

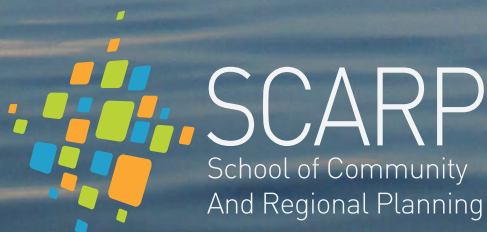
# City of Malolos

## Towards a Local Climate Change Action Plan

Prepared for:  
City Government of Malolos

Prepared by:  
Zoë Greig, Leanna Leib-Milburn, Victor D. Ngo, and Meika S. Taylor  
The University of British Columbia, School of Community and Regional Planning

August 15, 2014



a place of mind  
THE UNIVERSITY OF BRITISH COLUMBIA  
**Faculty of Applied Science**

## **CITY OF MALOLOS: TOWARDS A LOCAL CLIMATE CHANGE ACTION PLAN**

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Research Supervisor: Dr. Lenora Angeles  
Cover Photo: Meika S. Taylor

The opinions and recommendations in this report, and any errors, are those of the authors, and do not necessarily reflect the views of The University of British Columbia, the School of Community and Regional Planning, Bulacan State University, the City Government of Malolos, or the Provincial Government of Bulacan.

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## **EXECUTIVE SUMMARY**

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### **Introduction**

The adverse impacts of climate change are becoming increasingly more prevalent in the Philippines. Climate change-related impacts in the Philippines include extreme weather events, precipitation variability, sea level rise, flooding, and droughts. These are all noticeable, local manifestations of global climate change. In response, rigorous local and global action is required to mitigate, respond, and adapt to climate change.

At the national level, the Government of the Philippines has responded to climate change through the National Climate Change Action Plan 2011-2028 (NCCAP). In 2009, the Philippine Government passed the Climate Change Act (Republic Act 9729), which mandated all Local Government Units (LGUs) to prepare Local Climate Change Action Plans (LCCAPs) within their respective jurisdictions. The LCCAPs are an essential framework to guide local government's strategic response and action for climate change adaptation and mitigation.

The purpose of this study is to provide background research support and a set of recommendations to assist the City Government of Malolos in capacity building and action planning for climate change.

### **Methodology**

The research is a result of a collaboration between the City Government of Malolos and the School of Community and Regional Planning (SCARP) at the University of British Columbia (UBC) in Vancouver, Canada. The City retained four graduate planning students (henceforth referred to as the Research Team) for the purposes of the study as part of a community-based service learning studio course supervised by Dr. Lenora Angeles at UBC.

The Research Team employed a mixed methods research methodology consisting of primary and secondary data collection. Specifically, the Research Team conducted the following:

- Interviews and focus group discussions with residents of Malolos, community groups, elected officials (Sangguniang Panlungsod and Sangguniang Barangay councillors), and City staff;
- Administration of a survey questionnaire of City staff;
- Review of planning-related documents by the City;
- Review of climate change planning-related documents by the Provincial Government of Bulacan;
- Review of the Philippine National Climate Change Action Plan;
- Review of academic literature pertaining to climate change planning.

### **Exposure Analysis and Climate Projections**

A preliminary vulnerability assessment was prepared for Malolos. Specifically, an exposure analysis was conducted that was based on the methodology by the UN-Habitat's Cities and Climate Change Initiative (CCCI). Climate change projections were sourced for the province of Bulacan for the year 2020 and 2050 to be used as a proxy for Malolos. Projections are based on the IPCC medium-range emissions scenario and are relative to the 1971 to 2000 baseline climate.

Projections show Malolos will experience more extremes—the dry seasons will become drier and the wet seasons will be wetter. Sea level will continue to rise. Major climate change impacts for Malolos include:

- Flooding (Tidal) / Sea Level Rise;
- Flooding (Rainfall);
- Flooding (Coastal Storm Surge);
- Drought;
- Sea Temperature Rise.

## **Planning and Policy Analysis**

Addressing climate change means recognizing how *existing* planning activities can lead, support, and/or complement climate change planning. There is considerable overlap with climate change adaptation and mitigation requirements within the traditional areas of government planning responsibility (e.g. land use, transportation, solid waste management).

Effective climate change planning should be mainstreamed and integrated with all aspects of local government planning and decision-making. This helps to coordinate and improve the likelihood of project implementation, avoid policy conflict, ensure climate change planning is sustained within government activities, and leverage the necessary resources and tools to realize a climate-smart city.

In order to identify opportunities for mainstreaming, a planning and policy analysis is conducted using a climate change frame/lens on the City's Vision and Mission and the following planning documents as required by all LGUs to prepare:

- Comprehensive Land Use Plan (CLUP);
- Comprehensive Development Plan (CDP);
- Executive Legislative Agenda (ELA).

The section is intended for City staff and elected officials to understand how specific issues, goals, objectives, policy, and programs outlined in these documents relate to and align with climate change planning.

In addition, other relevant plans are analyzed using a climate change frame/lens to identify opportunities for mainstreaming.

## **City Staff Capacity Survey**

A city staff capacity survey was administered to various City Offices to determine the City's capacity for climate change planning and identify opportunities for improvement. Key findings include that:

- Majority of staff (74%) reported that climate change was very important for LGUs to plan for.
- Majority of staff reported that climate change was a regular occurrence in their work. 65% reported climate change "Often" comes into their work and 14% reported "Very Often."

In addition, staff was asked to rank where they saw the most opportunity for growth in relation to climate change planning internal/within their office and external/outside their office. Overall, the following were consistently ranked highest for both internal and external opportunities:

- Improved knowledge and expertise about climate change planning;
- Prioritizing climate change planning at the City Government overall and within individual offices;
- More clearly identified role and function of individual offices for climate change planning;
- Improved inter-departmental/office communications, co-operation, and coordination.

In contrast, the following were ranked lowest on the importance scale:

- Improved data and adequate data collection;
- Increased financial resources (e.g. budget) and human resources (e.g. staff);
- Increased provincial and national support;
- Improved public awareness and support for climate change planning.



## Climate Change Action Recommendations

Recommendations for the City were broken down into six sections:

- **5.1 Quick Starts and General Recommendations**
  - Support City staff professional development and training for climate change planning;
  - Establish a Climate Change Working Group;
  - Demonstrate corporate climate leadership and lead by example;
  - Improve data collection to support climate change planning.
  
- **5.2 Environment and Natural Resources**
  - Support local organic farming;
  - Reduce reliance on groundwater resources;
  - Address saltwater intrusion to groundwater resources;
  - Improve treatment of stormwater runoff and sewage to reduce the pollution of waterways;
  - Improve resilience of the city's ecological health.
  
- **5.3 Infrastructure, Land Use, and the Built Environment**
  - Improve stormwater management practices;
  - Improve maintenance of the existing drainage system;
  - Seek opportunities for renewable energy sources;
  - Ensure land use planning are aligned with long-term climate adaptation goals;
  - Ensure building and construction practices are aligned with long-term climate adaptation goals;
  - Enhance walkability and pedestrian-oriented urban design;
  - Make cycling more accessible and convenient;
  - Reduce traffic congestion.
  
- **5.4 Economy and Industry**
  - Focus on developing the capacity of local industries;
  - Support climate-proofing of industries;
  - Improve capacity of local industry to practice sustainable, low-impact production;
  - Expand green industry and green job opportunities;
  - Increase the prevalence of local purchasing practices among consumers;
  - Seek opportunities for local capacity building initiatives.
  
- **5.5 Health and Human Security**
  - Prioritize improved air quality;
  - Improve access to safe and affordable drinking water;
  - Ensure vulnerable populations are provided access to foods containing nutrients for climate-related diseases;
  - Safeguard the lives of informal settlers living in high-risk areas.
  
- **5.6 Education and Capacity Building**
  - Lead by example on climate change action to educate and inspire the public;
  - Improve public climate change literacy and understanding;
  - Utilize multiple platforms for communications and information dissemination;
  - Support water conservation practices;
  - Provide positive reinforcement for participation in waste segregation;
  - Increase access to proper waste disposal and segregation;
  - Increase capacity for composting at the barangay and household level.

### **Toolkits and Resource Guides for Climate Change Action**

The report concludes with a series of toolkits that are designed to be used by the City to assist with their climate change planning efforts. Five toolkits are available:

- **Rainwater harvesting** (household, community, and commercial and institutional rainwater harvesting options);
- **Stormwater management** (permeable surfaces and paving, rain gardens, and bioswales);
- **Economic development, assistance, and capacity building** (microcredit, Philippine Climate Adaptation Support Service, cooperatives, and public-private partnerships);
- **Youth engagement and education** (educational curriculum, participatory gaming, digital and social media, graphic communications);
- **Behaviour change and community-based social marketing** (reducing barriers to sustainable and climate-smart behaviour change).

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## ACRONYMS LIST

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ARI	Acute Respiratory Infection
AURI	Acute Upper Respiratory Infection
CASS	Climate Adaptation Support Service
CCCI	Cities and Climate Change Initiative
CDP	Comprehensive Development Plan
CLUP	Comprehensive Land Use Plan
DJF	December, January, February
ELA	Executive Legislative Agenda
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
JJA	June, July, August
KPM	Kabataan Progresibong Malolenyo
LCCAP	Local Climate Change Action Plan
LEED	Leadership in Energy and Environmental Design
LGU	Local Government Unit
MAM	March, April, May
NCCAP	National Climate Change Action Plan
NSCB	National Statistics Coordination Board
NFSCC	National Framework Strategy on Climate Change
NGO	Non-Governmental Organization
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
RA	Republic Act
SCARP	School of Community and Regional Planning
SK	Sangguniang Kabataan
SON	September, October, November
UBC	The University of British Columbia
UN	United Nations
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
WHO	World Health Organization

## MESSAGE FROM THE AUTHORS

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We want to take a moment to reflect on our experiences working in the Philippines and acknowledge the help and support we received during the course of our international community-service learning experience.

As students studying at a Western academic institution in British Columbia, Canada, we acknowledge the privilege we embody as we work within a collaborative research context in the Philippines. Our goal was to learn from the lived experiences of the residents of Malolos. We conducted our research using an asset-based approach to climate change planning to highlight the many strengths already present within the city of Malolos.

During our time in the Philippines, we were astounded by the generosity and hospitality of Filipinos. We express a heartfelt *salamat po* for welcoming us into your beautiful country, communities, homes, and hearts. The relationships we developed during our time in Malolos will stick with us for a lifetime. We will carry your stories and insights into our future roles as planners. We are immensely grateful to all of those who have assisted us in our research and experiential learning process.

We hope that we can give you the gift of learning something about your own city through our eyes in this report since we have learned so much from you.

## ACKNOWLEDGEMENTS

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We would like to thank the City Government of Malolos for being so welcoming to the students from the School of Community and Regional Planning at the University of British Columbia, particularly the SCARP Malolos research team.

Specifically, this project would not have been possible without the support of:

- Honorable Mayor Atty. Christian D. Natividad;
- Honorable Vice-Mayor Engr. Gilbert T. Gatchalian;
- City Administrator Atty. Rizaldy L. Mendoza.

We would especially like to thank Mr. Jun Bautista and the staff at the City Planning & Development Office (including Mr. Matt Jayson S. Villanueva and Mr. Felipe B. Moratillo) for connecting us with barangays and key interview contacts and providing interview support, translation, and data. We would also like to thank Mr. Romeo Surio Bartolo at the City Agriculture Office for assisting us with our visit of the coastal barangays.

We are grateful to the barangay captains and the residents of Malolos for sharing their stories, histories, and realities with us. You were our *bayanihan* and the heart and soul of our project.

For translation support of ordinances and other key documents, we would like to thank Ms. Linda Torio.

Lastly, we would like to thank Mom Nora Angeles for her unwavering support of Team Malolos. She was our fearless leader, funding coordinator, translator, counselor, tour guide, transportation manager, and so many other things. *Maraming salamat po!*

— Zoë Greig, Leanna Leib-Milburn, Victor D. Ngo, and Meika S. Taylor

## AUTHOR BIOGRAPHIES

**Zoë Greig** is a second year Master's student at the University of British Columbia in the School of Community and Regional Planning where she specializes in Social Planning and Community Development. She completed a BA (Honours) in Geography at the University of Victoria with a specialization in Urban and Development Studies. She is particularly interested in social, environmental, and transformative justice. Her research interests, which catalyze these philosophies, include: indigenous community development, informal waste management, capacity building, disaster and risk management, participatory problem-solving, sustainability, and gender studies.

**Leanna Leib-Millburn** is a second year Master's student at the University of British Columbia in the School of Community and Regional Planning. She completed a Bachelor's in communications and sociology where she explored the uses of technology for community development and grassroots mobilization. Her current research interests include grassroots water management, collaborative watershed governance, asset-based community planning, and indigenous community planning. She currently works in Policy Development and Community Planning at Kwikwetlem First Nation, an indigenous community in Canada.

**Victor D. Ngo** is a second year Master's student at the University of British Columbia in the School of Community and Regional Planning. He completed a BA in Geography specializing in Urban Studies at UBC. Victor's interdisciplinary research focuses on climate change and sustainability planning, examining land use, transportation, urban design, and public engagement issues. His current work investigates municipal climate change planning, policy, and governance; sustainable transportation decision-making and public engagement; youth engagement in climate change and sustainability; and innovative applications of civic technology and digital & social media for public engagement and civic participation.

**Meika S. Taylor** is a Métis woman from Fort McMurray, Alberta, Canada. She is currently a second year Master's student at the University of British Columbia in the School of Community and Regional Planning where she is also the recipient of an Aboriginal Graduate Fellowship. Her research specialization is in Indigenous Community Planning. She is interested in the role social media plays in public engagement within Indigenous community planning. Meika received a Bachelor of Arts degree in Anthropology and Sociology with Distinction from the University of Alberta in 2006. Her background is in applied research and information management within an Indigenous context.



From left to right: Victor D. Ngo, Zoë Greig, Dr. Leonora Angeles, Meika S. Taylor, Leanna Leib-Millburn.

## **1.0 INTRODUCTION**

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### **1.1 STUDY PURPOSE**

The adverse impacts of climate change are becoming increasingly more prevalent in the Philippines. Climate change-related impacts in the Philippines include extreme weather events, precipitation variability, sea level rise, flooding, and droughts. These are all noticeable, local manifestations of global climate change. In response, rigorous local and global action is required to mitigate, respond, and adapt to climate change.

At the national level, the Government of the Philippines has responded to climate change through the National Climate Change Action Plan 2011-2028 (NCCAP). In 2009, the Philippine Government passed the Climate Change Act (Republic Act 9729), which mandated all Local Government Units (LGUs) to prepare Local Climate Change Action Plans (LCCAPs) within their respective jurisdictions. The LCCAPs are an essential framework to guide local government's strategic response and action for climate change adaptation and mitigation.

The purpose of this study is to provide background research support and a set of recommendations to assist the City Government of Malolos in capacity building and action planning for climate change.

### **1.2 METHODOLOGY**

The research is a result of a collaboration between the City Government of Malolos and the School of Community and Regional Planning (SCARP) at the University of British Columbia (UBC) in Vancouver, Canada. The City retained four graduate planning students (henceforth referred to as the Research Team) for the purposes of the study as part of a community-based service learning studio course supervised by Dr. Lenora Angeles at UBC. The course is a component of a larger research project led by Dr. Lenora Angeles investigating urbanizing watershed governance in the Angat River Basin Region.

The Research Team employed a mixed methods research methodology consisting of primary and secondary data collection. Specifically, the Research Team conducted the following:

- Interviews and focus group discussions with residents of Malolos, community groups, elected officials (Sangguniang Panlungsod and Sangguniang Barangay councillors), and City staff;
- Administration of a survey questionnaire of City staff;
- Review of planning-related documents by the City;
- Review of climate change planning-related documents by the Provincial Government of Bulacan;
- Review of the Philippine National Climate Change Action Plan;
- Review of academic literature pertaining to climate change planning.

See Appendix A for the full list of stakeholders interviewed.

The study adopts an asset-based approach in framing climate change planning and serves as the conceptual basis of the research. Utilizing an asset-based, positive framework helps to shift planning and community development from a deficit-based, problem identification approach to considering the potential opportunities for improvement based on existing assets within the community.

Strengths and opportunities within the City and the general community have been identified for determining how strategic goals and objectives can be achieved for climate change action as the planning process moves forward.

### **1.3 PHILIPPINES PLANNING CONTEXT**

Like the rest of the world, the Philippines are not immune to the impacts of climate change. Rather, the Philippines is highly vulnerable to the effects of a changing climate. The country is experiencing climate change-

related impacts in more pronounced ways than other areas due to its geography. Due to the Philippines' location, 50% of the country's total land area and 81% of its population are vulnerable to natural disasters.<sup>1</sup>

In response to the growing concern around climate change vulnerability in the Philippines, the Philippine Government passed the Climate Change Act (Republic Act 9729) in 2009. The Climate Change Act serves as a legal directive requiring all LGUs to design and implement LCCAPs. In 2010, the National Framework Strategy on Climate Change (NFSCC) was adopted that provided a series of guiding principles to steer national mitigation and adaptation strategies.

In 2011, the Philippine Government prepared the National Climate Change Action Plan 2011-2028. The plan outlines a set of strategic actions to be employed for climate change adaptation and mitigation and sustainable development within the Philippines. Broken down into seven priority areas, the NCCAP provides a comprehensive overview of key areas for adaptation and mitigation:

- Food Security;
- Water Sufficiency;
- Ecological and Environmental Stability;
- Human Security;
- Climate Smart Industries and Services;
- Knowledge and Capacity Development.

#### 1.4 PROFILE OF THE CITY OF MALOLOS

The city of Malolos is located in the southwestern region of the Bulacan province in Central Luzon, Philippines and north of Manila Bay. As the capital city of the Bulacan, the city of Malolos is comprised of 51 barangays, including five coastal islands.



**Figure 1. Map of the city of Malolos. Source: Wikipedia.**

The following data is sourced from the Malolos Ecological Profile 2012 (unless otherwise noted), the most readily available source of information at the LGU level for planning-related data.<sup>2</sup>

<sup>1</sup> Philippine Climate Change Commission, *National Climate Change Action Plan 2011-2028* (Republic of the Philippines, 2011), 7.

## Topography

With a total land area of 6,725 hectares, the city has a diverse topography with an elevation ranging from approximately 0.5 meters below sea level to 6.0 meters above sea level. The terrain is fairly flat varying from a 0.81% to 2.17% incline. Malolos sits within the Pampanga River Basin. The natural water system of the area includes a network of creeks and rivers, which deposit themselves in the intertidal areas of Manila Bay.

## Climate

Malolos has two distinct seasons referred to as the wet season (June to November) and dry season (December to May). Variations in rainfall paired with seasonal variations in air currents bring in strong winds, storm surges, and typhoons particularly in the wet season from June to September. The temperature in Malolos varies annually with the lowest temperature occurring in January at 20.4 °C to the highest at 34.9 °C in April.

## Population

As of the 2010 Census, the city of Malolos' population was 234,945.<sup>3</sup> The annual growth rate of Malolos was 4.31% from 2007 to 2010. The city's growth is largely attributed to an influx of migrants paired with natural growth patterns. Due to Malolos' close proximity to Manila (42 kilometers), the city has become a popular destination for migrants from around the province.

## Land Use

Over 60% of Malolos' land area is used for agriculture and fishponds (see Table 1). Due to the heavy reliance on the agricultural and aqua cultural sector, the city is extremely vulnerable to climate change-related events, which disproportionately affect these sectors.

**Table 1. Malolos Land Use Area, 2003.**

Classification	Area (ha)	Percent of Total (%)
Agricultural Areas	2,157.38	32.08
Fishponds	1,900.48	28.26
Built-up Areas	1,621.40	24.11
Grassland	351.72	5.23
Other Plantation	338.94	5.04
Water Bodies	191.66	2.85
Bare/Rocky Land	122.40	1.82
Mangrove Forest	41.02	0.61

## Socio-economic

According to poverty estimates presented by the National Statistics Coordination Board, the rate of poverty incidence<sup>4</sup> in Malolos is 5.2%.<sup>5</sup> While this number sits well below the national averages of poverty incidence among families (20.5%) and poverty incidence among the entire population (26.3%)<sup>6</sup>, it is still imperative that the City recognizes any rates of poverty to be a major source of vulnerability in relation to climate change.

<sup>2</sup> Malolos City Planning & Development Office, *City of Malolos Ecological Profile 2012* (City Government of Malolos, 2012).

<sup>3</sup> Philippine National Statistics Office, *2010 Census of Population and Housing: Population Counts - Central Luzon* (Republic of the Philippines, 2010).

<sup>4</sup> **Poverty incidence** is defined as the "proportion of families/individuals with per capita income/expenditure less than the per capita poverty threshold to the total number of families/individuals" and **poverty threshold** is defined as "the minimum income/expenditure required for a family/individual to meet the basic food and non-food requirements." Philippine National Statistics Coordination Board, *Official Concepts and Definitions for Statistical Purposes*, (Republic of the Philippines, 2007), <http://www.nscb.gov.ph/poverty/Glossary.asp>.

<sup>5</sup> Philippine National Statistics Coordination Board, *City and Municipal-level Small Area Poverty Estimates* (Republic of the Philippines, 2009), [http://www.nscb.gov.ph/poverty/2009\\_SAE/2009\\_sae\\_final.pdf](http://www.nscb.gov.ph/poverty/2009_SAE/2009_sae_final.pdf).

<sup>6</sup> Philippine National Statistics Coordination Board, *Poverty Incidence, Magnitude of Poor Families and Share to Total Poor Families in Luzon, Visayas and Mindanao: 2006, 2009 and 2012* (Republic of the Philippines, 2013), [www.nscb.gov.ph/poverty/data/fullterm2012/tab13-14.xls](http://www.nscb.gov.ph/poverty/data/fullterm2012/tab13-14.xls).

## 2.0 OVERVIEW OF CLIMATE CHANGE

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This section's overview of climate change and climate change-related definitions are based on the Climate Change Act of 2009 in order for any planning to be consistent with the Philippine National Climate Change Action Plan.

### 2.1 WHAT IS CLIMATE CHANGE?

Climate change should be understood as the long-term, persisting changes in the climate of an area. These changes can happen because of natural causes such as volcanic and solar activity, but can also be expedited by human activity through the emissions of carbon dioxide and other greenhouse gases into the Earth's atmosphere

Global climate change is felt locally in the Philippines through impacts that include extreme weather events, precipitation variability, sea level rise, flooding, and droughts. As a result, climate change is and will be affecting daily life for all Filipinos both today and in the future.

#### **Climate Change**

Changes in the mean and/or variability of its properties and that persists for an extended period typically decades or longer, whether due to natural variability or as a result of human activity.

### 2.2 CLIMATE CHANGE ADAPTATION AND MITIGATION

**Climate change adaptation** is adjustments made in natural systems or in human activities to respond to the changing climate. Climate change adaptation is a necessary part of the global population's continued survival. The ability of Filipinos to seek new methods of adaptation is demonstrative of their climate resiliency.

Some examples of adaptation include:

- Farmers changing their crops to better align with a new cropping schedule;
- Farmers planting new crops in response to the changing climate;
- Relocation of informal settlements from flood prone areas.

#### **Climate Resilience**

Resilience is best used to define two specific attributes of a system or a community:<sup>7</sup>

- The amount of disturbance a system or community can absorb and still remain within the same state;
- The degree to which a system or community is capable of self-organization.

**Climate change mitigation** is when human intervention takes place to address the role of human beings in accelerating climate change. The ultimate objective of mitigation is to lessen the effects of climate change. Mitigation measures include strategies to decrease greenhouse gas emissions such as the implementation of solid waste management programs or better land use and transportation planning.

#### **Adaptive Mitigation**

Using mitigation measures as an integral part of adaptation that integrates adaptation and mitigation into core business policies and operations. The NCCAP recommends seeking out opportunities for adaptive mitigation whenever possible.

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<sup>7</sup> Elian Levina and Dennis Tirpak, *Adaptation to Climate Change: Key Terms* (Organisation for Economic Co-operation and Development, 2006), 15-16, [www.oecd.org/env/cc/36736773.pdf](http://www.oecd.org/env/cc/36736773.pdf).



### Adaptation vs. Coping

**Adaptation** and **coping** are often used interchangeably in disaster management; however, in climate change planning, it is important to distinguish between the two:

- **Coping strategies** are short-term and associated with managing or enduring stressful conditions.
- **Adaptation strategies** are long-term adjustments to change. Adaptation strategies offer strategic and proactive approaches in planning for climate change. Without a clear understanding of how these concepts differ, opportunities for adaptation may be compromised by short-term, unplanned, coping tactics.

### 2.3 REMOVING THE POLITICS FROM CLIMATE CHANGE ACTION

The responsibility of planning for climate change often falls with the government. In the case of the Philippines, the National Government and the LGUs can play a key role in climate change action. Mainstreaming climate change planning where climate change planning is a part of regular local government planning is essential for successful climate change action and the implementation of plans, policies, and actions.

Having climate change purely tied to political agendas can be problematic for a number of reasons:

- Short-term nature of political terms;
- Decision-making being influenced by popularity;
- Political leaders want to show progress during their time in office, and may find it impossible to run on a “no growth” agenda;

Climate change planning should focus predominantly on the future of the city of Malolos and its residents. Effective climate change planning should:

- Be based on long-term visions of the future;
- Be participatory and involve citizens in every step of the planning process;
- Be holistic in nature and seek the connections between all sectors;
- Focus on building the capacity of civil society to respond to climate change.

Indeed, the benefits associated with climate change planning go well beyond protecting the environment. Strategic climate change planning offers a host of advantages in a variety of different sectors for sustainable development.

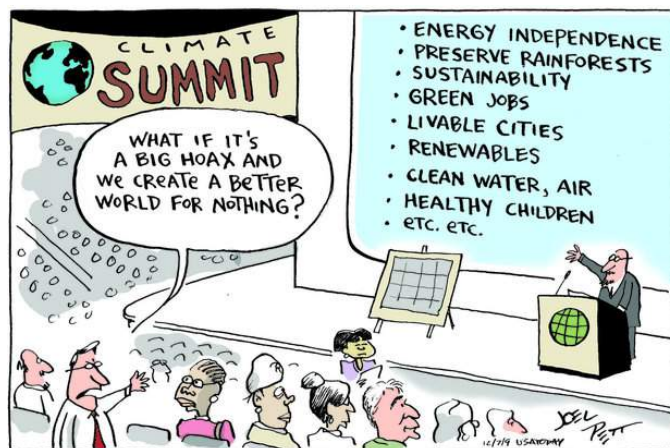


Figure 2. Climate Change Action Benefits. Source: Joel Pett.

### 3.0 VULNERABILITY ASSESSMENT

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#### 3.1 OVERVIEW OF VULNERABILITY ASSESSMENT

This report follows the National Framework Strategy on Climate Change's direction towards adaptation and mitigation of climate change, with an emphasis on adaptation. The particular emphasis on adaptation is because of the Philippines' high vulnerability to climate change and the country's status of being an insignificant emitter of global GHG emissions.

Nonetheless, GHG emissions in the Philippines and Malolos will be expected to grow as industrialization, urbanization, and population growth continues. As such, opportunities for adaptive mitigation (climate-smart) strategies should be emphasized whenever possible, whereby mitigation measures are an integral part of adaptation for "win-win" climate action strategies.

With the NCCAP's emphasis on adaptation, current and future climate change planning in Malolos should follow standard methodology for adaptation. One common approach in climate change planning is conducting a vulnerability assessment. This section loosely follows the vulnerability assessment methodology outlined in the UN-Habitat *Planning for Climate Change: A Strategic, Values-Based Approach for Urban Planners* guide.<sup>8</sup> The guide is particularly designed for communities appropriate to the Malolos context.

A vulnerability assessment allows planners to prioritize climate change planning activities and focus on the key sectors, places, and people that are most susceptible to climate change impacts in a community. Key questions that a vulnerability assessment asks are:

- How is your city exposed to climate change today and in the future?
- How sensitive are your city's people, places and institutions to this exposure?
- Who is most vulnerable and least able to adapt?
- What sectors are most impacted?

For the purposes of this report, only a preliminary exposure analysis is conducted based on the scientific data available and stakeholder observations conducted by the research team. This will build upon existing vulnerability assessment work conducted by the City.

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<sup>8</sup> United Nations Human Settlements Programme, *Planning for Climate Change: A Strategic, Values-Based Approach for Urban Planners* (UN-Habitat, 2014), <http://unhabitat.org/publications/planning-for-climate-change-a-strategic-values-based-approach-for-urban-planners-cities-and-climate-change-initiative>.

**Vulnerability =  
Exposure x Sensitivity x Adaptive Capacity**

<b>Exposure</b>	How a community is exposed to changes in the climate: what changes can already be observed, what will the climate be like in the future? Exposure considers both current and projected changes based on a review of historic and current climate information (e.g. temperature, precipitation) and projected climate scenarios. It also identifies the climate change hazards associated with the change (e.g. flooding, sea level rise), their biophysical outcomes (e.g. groundwater depletion, coastal erosion), including their current and future magnitude and frequency.
<b>Sensitivity</b>	The degree to which exposed people, places, institutions, and sectors are impacted, either positively or negatively, by climate change today and the degree to which they could be impacted in the future. As with exposure, sensitivity may be immediately related to a change in climate (e.g. a change in water supply due to decrease in precipitation during the dry season) or less direct (e.g. farmers depending on adequate water supply lose their livelihoods). The sensitivity analysis is based on the socio-economic and physical realities, which represent the underlying causes for a climate change impact (e.g. residence in an informal settlement, poor drainage system, poverty situation).
<b>Adaptive Capacity</b>	The degree to which people, places, institutions, and sectors are able to adapt to climate change impacts. Adaptive capacity typically is indicated by socio-economic and environmental factors and local realities that enable a city or community to adjust its system in view of current and future risks. It may also include factors and conditions that leverage new climate conditions to become new opportunities (i.e. more precipitation may lead to new opportunities in rain water harvesting).

Adapted from: UN-Habitat's *Planning for Climate Change: A Strategic, Values-Based Approach for Urban Planners* (2014).

### 3.2 EXPOSURE ANALYSIS

#### 3.2.1 WEATHER AND CLIMATE PROFILE

The first step in the exposure analysis is to create a weather and climate profile using historical weather/climate data and future climate change projections and scenarios.

Figures are provided for the city of Malolos when possible in the report. Provincial-level data are used as a proxy for Malolos. Data pertaining to climate change projections and scenarios including baseline figures are available for the Province of Bulacan and sourced from the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA).

Climate models presented here are based on the medium-range emissions scenario developed by the Intergovernmental Panel on Climate Change in its Special Report on Emission Scenarios (IPCC SRES).

Weather/climate records are divided into the following seasonal variations based on months:

DJF	December, January, February (dry)
MAM	March, April, May (dry)
JJA	June, July, August (wet)
SON	September, October, November (wet)

### 3.2.1.1 TEMPERATURE

Malolos' climate falls under the Type I category based on the modified Corona's Philippine Climate Classification (1951-2003), which is characterized by two pronounced dry and wet seasons. The months of June to November fall under the wet/rainy season and the months of December to May are the dry/cool season.

As of 2000, the annual temperature varies from 20.4 °C to 34.9 °C (see Table 2). The highest registered temperature occurs during the month of April at 34.9 °C, while the lowest registered temperature occurs during the month of January at 20.4 °C. The annual mean temperature is 27.5 °C.

**Table 2. Observed Temperature Record for Malolos (Science Garden Station), 2000.**

Month	Temperature (°C)		Number of Rainy Days
	Max	Min	
January	30.4	20.4	4
February	31.6	20.6	2
March	33.2	21.6	3
April	34.9	23.3	4
May	34.6	24.4	12
June	32.9	24.3	18
July	31.6	23.9	22
August	31.1	23.9	24
September	31.5	23.7	22
October	31.3	23.2	19
November	31.1	22.4	14
December	30.3	21.3	9
<b>Annual</b>	<b>32.1</b>	<b>22.8</b>	<b>153</b>

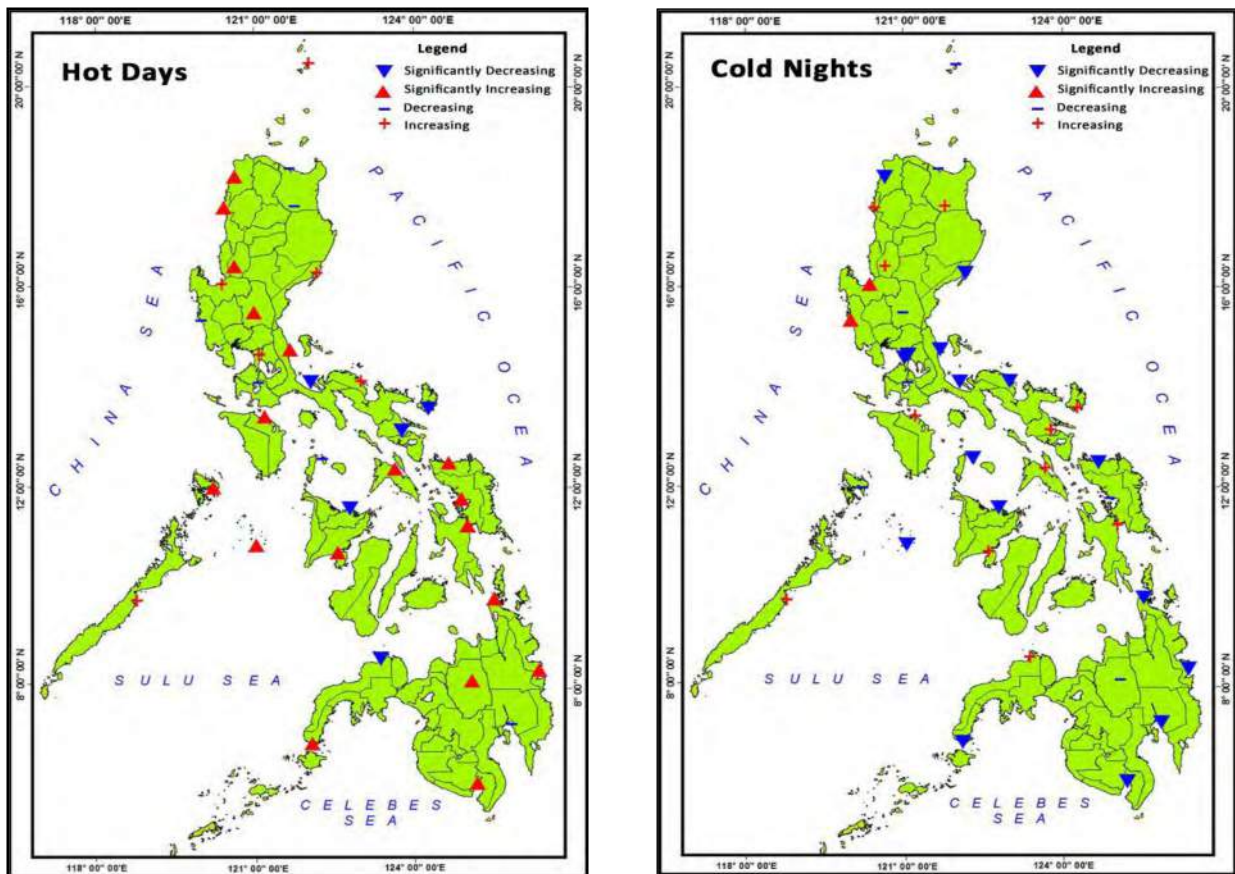
Source: PAGASA.

For the province, Bulacan's baseline temperature is 26 °C. Table 3 shows the observed baseline historical temperature for Bulacan from 1971 to 2000. There has been a statistically significant positive trend in the number of hot days and a decreasing number of cool nights in Bulacan (see Figure 3).

**Table 3. Observed Baseline Historical Temperature for Bulacan, 1971-2000.**

Season	Baseline Temperature (°C)
DJF	25.6
MAM	27.9
JJA	27.1
SON	26.7

Source: PAGASA.



**Figure 3. Trend in the frequency of days with maximum and minimum temperatures above and below the 1971-2000 mean. Source: PAGASA.**

### 3.2.1.2 RAINFALL

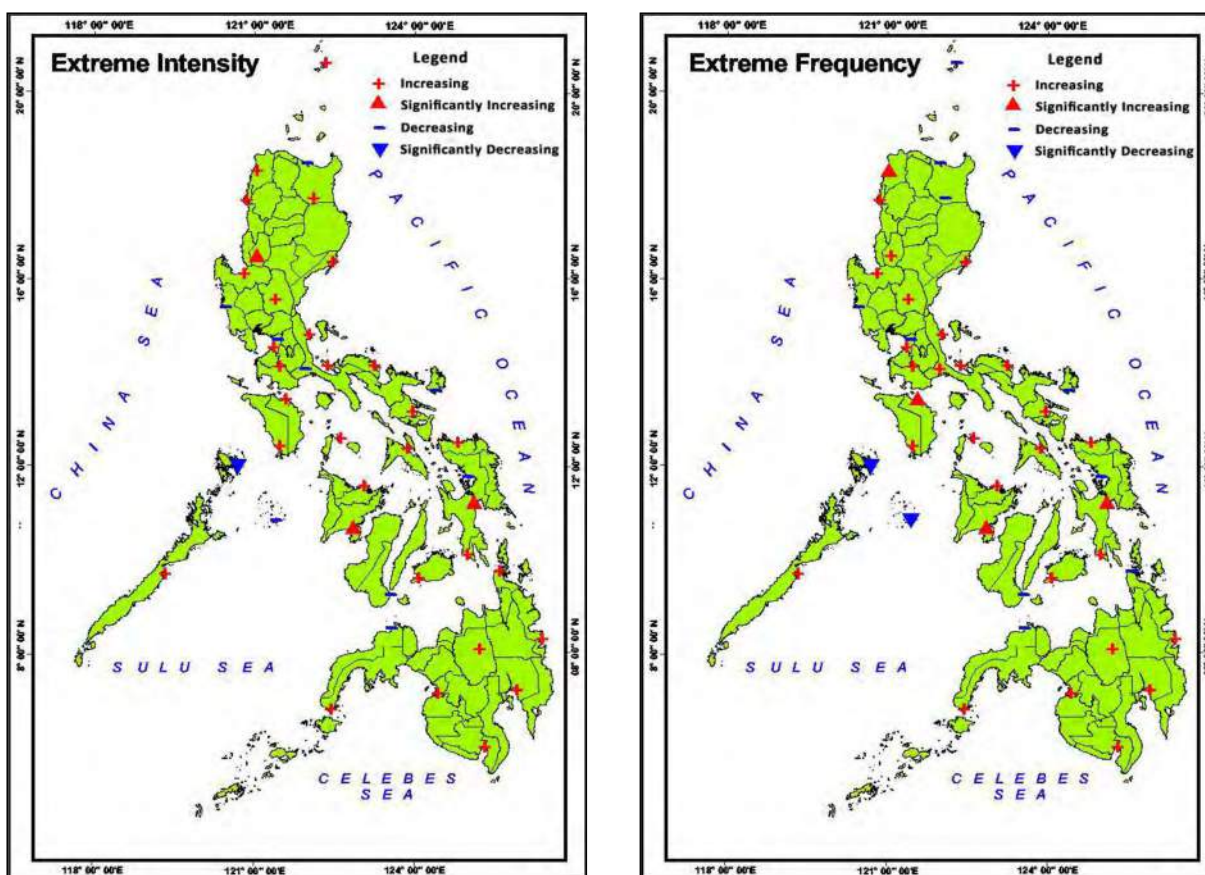
As of 1980, the highest amount of rainfall in Malolos occurs during the month of August at 464.90 mm while the least amount of volume occurs during the month of February at 9.4 mm (see Table 2 for the number of rainy days in a year). The annual average total rainfall is 2071.4 mm. The months of July, August, and September see the highest number of rainy days in the year.

In Malolos, there has been a positive trend towards increases in the intensity and frequency of extreme rainfall, although it is not statistically significant (see Figure 4). For the province, the annual average total rainfall is 2384.8 m. Table 4 shows the observed baseline historical rainfall for Bulacan from 1971 to 2000.

**Table 4. Observed Baseline Historical Rainfall for Bulacan, 1971-2000.**

Season	Baseline Rainfall (mm)
DJF	212.4
MAM	288.9
JJA	1041.4
SON	842.1

Source: PAGASA.



**Figure 4. Trend in the intensity and frequency of extreme daily rainfall (1951-2008) compared to the 1971-2000 mean. Source: PAGASA.**

### 3.2.1.3 TYPHOONS

There has been no indication of increasing frequency of typhoons in the Philippines from 1948 to 2000. However, there has been a very slight increase in the number of extreme typhoons (winds 150 kph and above) from 1971 to 2010 during El Niño years. Table 5 shows the number of typhoons that have crossed the province of Bulacan 50 km from its boundaries from 1948 to 2009. The months of September, October, and November see the highest number of cyclones crossing the boundaries of Bulacan.

**Table 5. Number of Tropical Cyclones Crossed Bulacan 50 km from Boundaries, 1948-2009.**

Month	Number of Tropical Cyclones
January	0
February	0
March	0
April	0
May	4
June	8
July	9
August	4
September	11
October	23
November	16
December	2
<b>Total</b>	<b>77</b>

Source: PAGASA.

### 3.2.2 CLIMATE PROJECTIONS

All projections are calculated for the province of Bulacan for the year 2020 and 2050. Projections are used as a proxy for Malolos for the purposes of this analysis. City-level specific climate projections will need to be developed in the future to support planning requirements. Projections are based on the IPCC medium-range emissions scenario and are relative to the 1971 to 2000 baseline climate.

In summary, the projections show Malolos will experience more extremes—the dry seasons will become drier and the wet seasons will be wetter.

#### 3.2.2.1 YEAR 2020 AND 2050 TEMPERATURE PROJECTIONS

Overall, Bulacan is projected to experience hotter temperatures throughout the year with the biggest increase of 1.9 °C in December, January, and February (DJF) by the year 2050. March, April, and May (MAM) is projected to continue to be the hottest season at 30.0 °C by the year 2050. Table 6 shows the projected seasonal mean temperature change for the year 2020 and 2050.

**Table 6. Projected Seasonal Mean Temperature under Medium-range Emission Scenario for Bulacan, 2020 and 2050.**

Season	Baseline (°C)	Projected Mean Temperature (°C)		Projected Temperature Increase from Baseline (°C)	
	1971-2000	2020	2050	2020	2050
DJF	25.6	26.5	27.5	0.9	1.9
MAM	27.9	29.0	30.0	1.1	1.8
JJA	27.1	28.0	28.8	0.9	1.7
SON	26.7	27.7	28.6	1.0	1.7
<b>Mean</b>	<b>26.8</b>	<b>27.8</b>	<b>28.7</b>	<b>1.0</b>	<b>1.8</b>

Source: PAGASA.

#### 3.2.2.2 YEAR 2020 AND 2050 RAINFALL PROJECTION

Projected changes in rainfall differ depending on the season. March, April, and May (MAM) is projected to experience the biggest drop in rainfall of 36.4%, a decrease of 105.16 mm by the year 2050. June, July, and August (JJA) is projected to see a significant increase in rainfall of 23.6%, an increase of 245.77 mm by the year 2050. Table 7 shows the projected seasonal mean rainfall volume change for the year 2020 and 2050.

**Table 7. Projected Seasonal Mean Rainfall Volume under Medium-range Emission Scenario for Bulacan, 2020 and 2050.**

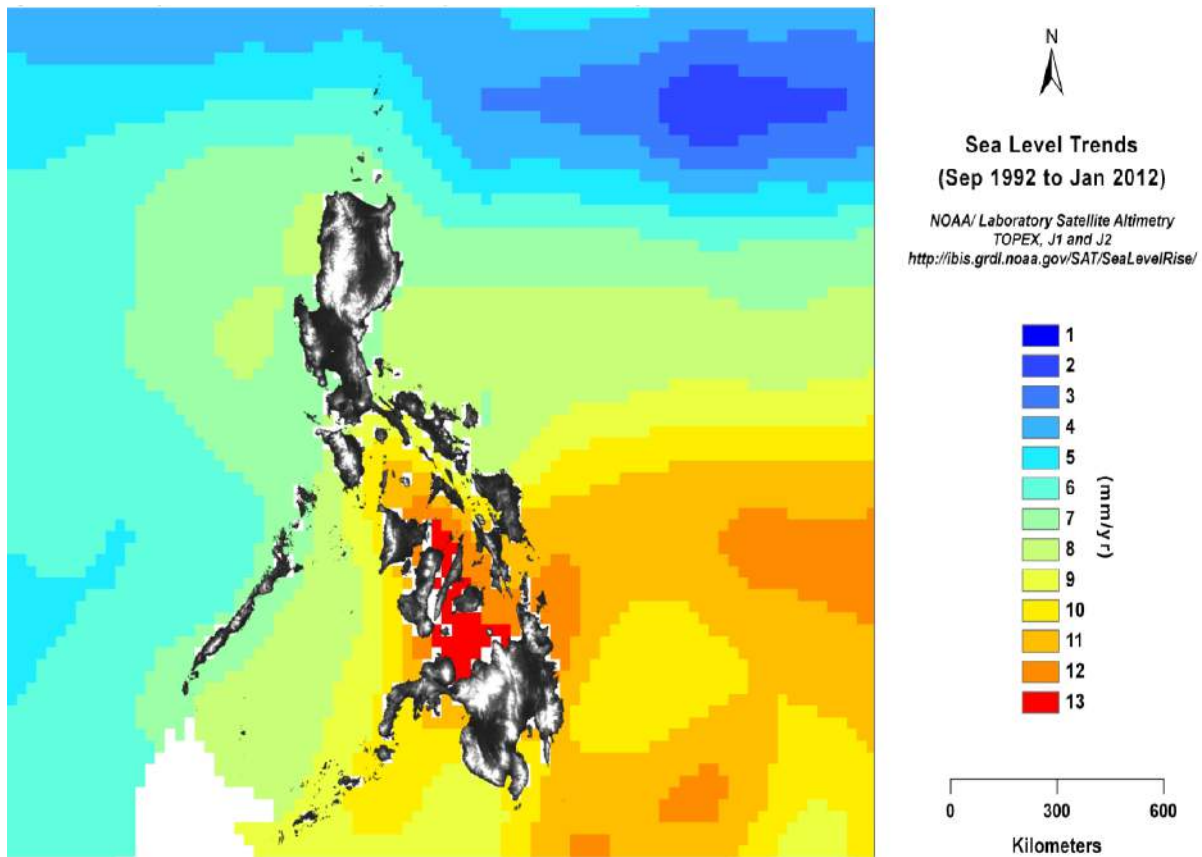
Season	Baseline (mm)	Projected Mean Rainfall (mm)		Projected Rainfall Change from Baseline (%)	
	1971-2000	2020	2050	2020	2050
DJF	212.4	221.3	184.36	4.2	-13.2
MAM	288.9	222.5	183.74	-23.0	-36.4
JJA	1041.4	1174.7	1287.17	12.8	23.6
SON	842.1	817.7	814.31	-2.9	-3.3
<b>Total</b>	<b>2384.8</b>	<b>2436.2</b>	<b>2469.58</b>	<b>2.1</b>	<b>3.4</b>

Source: PAGASA.

#### 3.2.2.3 YEAR 2020 AND 2050 SEA LEVEL RISE PROJECTION

The US National Oceanic and Atmospheric Administration estimates that from 1992 to 2012, Bulacan has experienced a 7 mm rise in sea level, particularly along the communities facing Manila Bay (see Figure 5). Sea level rise is contributing to longer tidal flooding in Malolos. By 2050, the sea level is projected to increase by 25.9 cm in Manila Bay and will contribute to more flooding hazards in Malolos.





**Figure 5. Trend in sea level rise in the Philippines, 1992-2012.**

### 3.2.3 WEATHER AND CLIMATE SUMMARY

Table 8 shows a summary of the identified climate change hazards, historical trends in weather and climate, climate change projections, and exposure of climate change impacts. Data was sourced from primary data collection (stakeholder interviews; the list of stakeholders can be found in Appendix A) the existing City of Malolos Climate Change Action Plan, and the Bulacan Disaster Risk and Climate Change Vulnerability Assessment Report (BDRACCVA).<sup>9</sup>

Flooding is identified as the largest climate change hazard in Malolos with the highest exposure to the number of barangays.

<sup>9</sup> Bulacan Provincial and Development Office, *Province of Bulacan Disaster Risk and Climate Change Vulnerability Assessment Report: Integrating Disaster Risk Reduction and Climate Change Adaptation in Local Development Planning and Decision-making Processes* (Provincial Government of Bulacan, 2013).

**Table 8. Exposure Analysis of Malolos.**

Climate Change Hazard		Historical Trends			Climate Change Projections		Exposure
Climate Change Hazard	Hazard Type	Local/Regional Weather Data	BDRACCVA Review	Community Stakeholder Observations	Climate Model Scenario Projections	Summary of Projected Future Change	Barangays
Flooding (Tidal)/Sea Level Rise	Change to Average	- Sea level rise (7 mm increase).	- Tidal sea level rise in Manila Bay and along rivers banks. - Land subsidence due to groundwater extraction.	- Every high tide brings flood. - Sea level has been rising even when factoring high tide and winds/storms; land subsidence is a contributing factor.	- Continued sea level rise (25.9 mm increase).	- Sea level will rise with high degree of confidence; effect will be further exacerbated due to land subsidence.	Panasahan, Calero, Matimbo, Mambog, Bangkal, Babatnin, Masile, Namayan, Caliligawan, Pamarawan, Santiago, Liang, San Gabriel, Catmon, Balayong, Bagna, Atlag, Liang
Flooding (Rainfall)	Change to Average/Extreme Event	- Increase of intensity and frequency of extreme rainfall. - Increase in intensity of typhoons.	- Extensive heavy rainfall and/or extreme weather conditions (e.g. typhoons, monsoons).	- Monsoons have increased in intensity.	- Increase in overall rainfall volume. - Increase in intensity and frequency of extreme rainfall. - Increase in rainfall volume (JJA). - Decrease in rainfall volume (DJF, MAM, SON).	- Increase of intensity and frequency of extreme weather events during the wet season; decrease during the dry season.	Look I, Lugam, Longos, Bulihan, Anilao, Canalate, San Juan, Dakila, Balite, Taal, Santor, San Pablo, Bagong Bayan, Ligas, Sumapang Bata, Bungahan, Guinhawa, Mojon, Sumapang Matanda, Pinagbakahan, Santisima Trinidad, Tikay, Niugan, Cofradia, Mabolo, Caniogan Sto. Rosario, San Agustin, Sto. Cristo
Flooding (Costal Storm Surge)	Extreme Event	- Increase in intensity of typhoons. - Sea level rise (7 mm increase).	- Extreme weather conditions (typhoon).	- Typhoons have increased in intensity. - Height of tides and waves are unpredictable.	- Unknown regarding frequency of typhoons. - Continued sea level rise (25.9 mm increase).	- Increase of intensity of typhoons during the wet season.	Coastal barangays

Drought	Extreme Event	<ul style="list-style-type: none"> <li>- Increasing number of hot days.</li> <li>- Decreasing number of cool days.</li> </ul>		<ul style="list-style-type: none"> <li>- Aquifer levels during dry season prior to 1987 were higher than they currently are.</li> <li>- Changing weather patterns have resulted in droughts in agricultural areas during both dry and wet season.</li> </ul>	<p>Dry season will become drier:</p> <ul style="list-style-type: none"> <li>- Increase in temperature.</li> <li>- Decrease in rainfall.</li> </ul> <p>Wet season will become wetter:</p> <ul style="list-style-type: none"> <li>- Increase in temperature.</li> <li>- Increase in rainfall.</li> </ul>	<ul style="list-style-type: none"> <li>- Dry season will become drier and the wet season will become wetter.</li> </ul>	City-wide; barangays most affected unknown
Sea Temperature Rise	Change to Average			<ul style="list-style-type: none"> <li>- Temperature of water has been rising; evident in fishing activities.</li> </ul>	N/A; global projections forecast rising sea-surface temperature.	<ul style="list-style-type: none"> <li>- Increase in sea temperature.</li> </ul>	Coastal barangays

### **3.3 CLIMATE CHANGE IMPACTS**

Based on the identified climate change hazards from the vulnerability assessment, the following impacts were identified based on stakeholder interviews. The assessment is not intended to be comprehensive of all impacts. Impacts are not listed in any particular order.

#### **Flooding (Tidal) / Sea Level Rise**

- Transportation network unable to function due to flooded roads affecting commute and livelihoods; impacts are expected to be felt most acutely by low income and blue collar workers (e.g. construction, driving);
- Increase in incidences of water-born diseases (e.g. dengue);
- Saltwater intrusion affecting water quality and livelihoods (e.g. crop damage);
- Deposited waste collects after water recedes, particularly in areas with poor solid waste management practices.

#### **Flooding (Rainfall)**

- Increased stormwater runoff, particularly in (new) subdivisions that do not comply with standard drainage sizes and/or in subdivisions with high levels of impervious surfaces and maximized lot coverage;
- Lower yields of agricultural products (e.g. palay) and higher incidences of damage products;
- Residents are forced to change livelihood options such as fishing, particularly when fishponds overflow;
- School facilities are flooded, disrupting classes for students.

#### **Flooding (Coastal Storm Surge)**

- Damage to mangrove forests along the coast.

#### **Drought**

- Reduced water supply of underground aquifers from water (over)-extraction;
- Increased water stress resulting in more severe incidents of low aquifer levels during the dry season; impacts felt acutely in agricultural areas;
- Future vulnerability of the water supplies for coastal barangays that are not connected to the Water District.

#### **Sea Temperature Rise**

- Changes in water temperature resulting in lower fishing productivity.

## **4.0 MALOLOS CLIMATE CHANGE PLANNING REVIEW**

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### **4.1 OVERVIEW OF MALOLOS' LOCAL CLIMATE CHANGE ACTION PLAN**

The City Government of Malolos prepared and submitted a LCCAP to the National Government in late 2013 in response to the Climate Change Act of 2009 (RA 9729) covering the year 2014 to 2019. The LCCAP's goal is to:

Enhance transformative framework of resiliency in local communities through a capacity development program for empowerment to mitigate, prepare, respond, recover and adapt to climate change and related disasters.

The LCCAP covers five core development areas:

- Coastal;
- Health;
- Agriculture;
- Water and Water Resources;
- Environment.

Each area has a corresponding identification of its climate change vulnerability, key actions, adaptation measures and targets, implementing partners, indicative budgetary requirement, and a timeframe:

The plan is accompanied by a Climate Change Vulnerability Assessment (Anticipatory Adaptation Management) report that identifies the climate change vulnerability for the five areas and the associated socio-economic impact. Actions outlined in the LCCAP identify new climate change-specific actions and the need for continued and/or improved implementation of existing policies and ordinances. Significant inter-departmental coordination will be necessary for the successful implementation of the plan given the numerous partners required for each action.

The submission of the LCCAP is a testament to the commitment of the City, as well as the current Mayor and Sangguniang Panlungsod, to climate change action in Malolos. To reiterate, the purpose of this report is supplement the current LCCAP and to provide further research to build upon the existing climate change-related policies and actions in the City Government of Malolos for a longer term climate action strategy.

### **4.2 PLANNING AND POLICY ANALYSIS**

Cities must plan for multiple challenges, including traditional planning areas such as land use, transportation, and solid waste management. Taking action on climate change may initially appear as an additional burden for local governments. Coupled with inadequate resources and budget constraints, the enormity and complexity of climate change can make it seemingly impossible to address.

However, addressing climate change means recognizing how *existing* planning activities can lead, support, and/or complement climate change planning. There is considerable overlap with climate change adaptation and mitigation requirements within the traditional areas of government planning responsibility.

Effective climate change planning should be mainstreamed and integrated with all aspects of local government planning and decision-making. This helps to coordinate and improve the likelihood of project implementation, avoid policy conflict, ensure climate change planning is sustained within government activities, and leverage the necessary resources and tools to realize a climate-smart city.

Specifically, the Climate Change Act of 2009 (Republic Act 9729) defines mainstreaming as the “integration of policies and measures that address climate change into development planning and sectoral decision-making.”

### **Mainstreaming Climate Change Planning**

“Climate change planning can, and should, augment and be **integrated and mainstreamed with existing city plans, planning processes and development activities across all sectors**. Climate change is simply another piece of information that should be considered during every planning process, or when existing plans are modified and updated.

Fundamentally, **good city planning practices are, by their nature, also climate smart planning practices**. This is because most climate change planning actions are consistent with planners’ responsibilities, including:

- **Minimizing risk** and improving land development activities that occur in or near flood, slope or coastal hazard areas.
- **Improving infrastructure** for stormwater management, solid and liquid waste management, access to safe drinking water, and the movement of goods and people.
- **Protecting ecosystems** and environmentally sensitive areas in and around towns and cities.
- **Improving disaster risk reduction**, including the improvement of response capacities for disasters (particularly weather and climate-related events).
- **Supporting local economic development** to reduce poverty and improve quality of life.”

Source: UN-Habitat’s *Planning for Climate Change: A Strategic, Values-Based Approach for Urban Planners* (2014).

In order to identify opportunities for mainstreaming, a planning and policy analysis is conducted using a climate change frame/lens on the City Government of Malolos’ Vision and Mission and the following planning documents as required by all LGUs to prepare:

- Comprehensive Land Use Plan (CLUP);
- Comprehensive Development Plan (CDP);
- Executive Legislative Agenda (ELA).

This section is intended for City staff and elected officials to understand how specific issues, goals, objectives, policy, and programs outlined in these documents relate to climate change planning.

Specifically, an asset-based approach is used to highlight the strengths of the various planning documents as they relate to climate change and how these existing plans and policies can be integrated into climate change planning to strengthen inter-departmental coordination. Specific climate change recommendations to improve the planning areas covered by the scope of these documents can be found in Section 5 of the report.

Additional analysis is conducted on other relevant plans prepared by the City Government of Malolos. Detailed analysis of the CLUP, CDP, and ELA can be found in matrix form in Appendix B.

## 4.2.1 CITY VISION AND MISSION

### **Vision**

Unique historical city in Central Luzon and leader in the field of education, culture, art and livelihood with efficient (or effective) and accountable government in union with a pro-God (or God-loving) society that gives importance to health, nature and the environment.

- Malolos' vision is holistic and directly aligns with the goals and requirements of climate change planning and sustainable development.
- Upholding the ideals of an efficient, effective, and accountable government will help build Malolos' resiliency to climate change and allows the City to plan and respond to the impacts of climate change.
- A pro-God and God-loving society is a strong and connected society. Being resilient to climate change requires a connected society that has capacity to plan for the effects of climate change and be able to provide hope and support in times of crisis.

### **Mission**

To provide the highest form of service for the greater development of programs that will raise the standard of living, education, arts, culture and health focusing on the people of Malolos, through simple (or low-cost or simplified) but effective in meeting (or adapting to) current and future needs. Promote the rights and welfare of poor citizens, families and communities to lift them from poverty and boost social service delivery through policies and initiatives in programs and services development.

- Malolos is already thinking about the present and the future, which directly aligns with the goals and requirements of climate change planning and sustainable development.
- *Bayanihan*, the spirit of community cooperation and connectedness, is demonstrated in the mission statement through the promotion of rights and social welfare for all citizens. Together, this builds capacity and in turn builds resiliency to climate change.
- Focusing on vulnerable populations is important in securing climate justice as they are the least able to adapt to climate change.
- Climate change planning is not necessarily always simple or low-cost and will require dedicated effort in planning, decision-making, and financing of implementation—it is an investment for *now* and the future.



#### **4.2.2 COMPREHENSIVE LAND USE PLAN**

A Comprehensive Land Use Plan (CLUP) is a multi-sectoral planning document containing a city's long-term management plan and vision. The CLUP outlines a basic framework for the city's physical development and identifies particular areas for development as well as areas for preservation. An additional function of a CLUP is to direct investments as they correspond to the development framework.

The City of Malolos' Comprehensive Land Use Plan 1996-2001 provides a detailed sectoral analysis of 13 key sectors. The overview of each sector includes a goal, a set of objectives, and a set of targets for the city's development. The City is currently in the process of updating the CLUP.

The following analysis is intended to inform the creation of an updated CLUP with clear connections made between each respective sector and climate change.

##### **Agricultural**

The economic resiliency of Malolos' agricultural and aquacultural sectors is a focus of the existing CLUP. This is an important factor in ensuring a strong economic base for resiliency in climate change adaptation as well as in the times of climate crisis, particularly in relation to socio-economic resiliency. Beyond the economic considerations, it is also important to take into account a variety of other factors in making the link to climate change, including:

- Ensuring sustainable farming practices when increasing yield;
- Increasing food security for the city of Malolos;
- Pursuing organic agriculture and aquaculture practices.

##### **Commerce**

The promotion of a solid economic foundation is a crucial point in planning for climate resiliency. The CLUP's focus on development is a realistic objective to ensure the economic sustainability of Malolos. In furthering this vision, it is advised that the City consider:

- Focus on green options for growth and development;
- Support businesses in sourcing locally produced goods and services;
- Enhance the pedestrian environment in high growth areas.

##### **Industrial**

Local economic development is integral for the promotion of sustainable livelihoods for the residents of Malolos. The CLUP's prioritization of small and medium enterprises is commendable as it can better support livelihoods in Malolos. In supporting the expansion of industry, it is important to:

- Have a balance of land uses to ensure that all sectors prosper (e.g. continued preservation of agriculture for food security);
- Industry should be located in places that are low risk to hazards;
- Recognize the climate-smart industry as outlined in the NCCAP as an important sector in moving forward.

## **Education and Culture**

The City's emphasis on education as a priority is a strong, proactive approach to ensuring improved socio-economic status for its citizens. The CLUP focuses on expanding the availability of educational facilities within the city. These structures should:

- Be designed so that they consider climate related hazards and be potential sites for gathering during calamities;
- Consider green building design and construction of new facilities.

## **Health and Nutrition**

There is a direct link between climate change and health, therefore the City's emphasis on health and nutrition is a vital step towards ensuring an overall resiliency. Furthermore, there is a strong correlation between health and all other sectors. In order to guarantee a healthy Malolos, it is important that:

- Nutrition programs source local, organic foods and foods that contain the nutrients that combat climate-related diseases such as dengue;
- Construction of hospitals and health-related infrastructure in low-risk areas and consideration of climate-proofing strategies;
- Educate health workers and the public on climate-related diseases and illnesses.

## **Social Welfare Services**

The recognition of social welfare services and the need to uplift the marginalized has direct ties to climate change planning. The heaviest burden of climate change most often falls on the most marginalized populations.<sup>10</sup> Therefore, livelihood improvement is necessary in creating resilient communities. In order to plan for climate change, connections need to be made between the existing objectives and:

- Social elevation for the marginalized citizens of Malolos;
- Access to basic human rights such as clean water, clean air, proper sanitation, etc.

## **Housing**

The City identifies increased housing as a goal in the CLUP and prioritizes the use of indigenous materials for their construction. Sourcing local, indigenous materials is a smart and important step towards achieving climate-smart building practices. Additionally, when developing or refurbishing housing stock, it is important to consider:

- Development of all new housing is constructed in low-risk areas;
- Exploring climate adaptive housing and climate-proofing options for housing.

## **Environmental Management**

The CLUP draws the connection between improved living conditions and proper environmental management. The difficulty is finding a balance between cultural, social, economic, and environmental benefits. In order to achieve this balance, the City should strive for:

- Optimization of environmental and social development without favouring a particular sector at the expense the other;
- Sustainability should be at the core of all decisions.

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<sup>10</sup> B. Wisner, P. Blaikie, T. Cannon, and I. Davis, *At Risk: Natural Hazards, People's Vulnerability and Disasters* (London, Routledge, 2003).

### **Sports and Recreation**

Sports and Recreation plays a vital part building healthy communities and is an important part of strengthening social capital and community ties. Therefore, any development should be constructed in a sustainable way to ensure that these recreational facilities will remain a part of the community in the long-term. In the development of Sports and Recreation, the City should:

- Ensure climate-resilient design in all new developments;
- Continue to draw the link between healthy environment and healthy communities.

### **Protective Services**

Safe communities rely on strong protective services. In times of calamities, the City relies on these services for the protection of its citizens. Climate change has the potential to exacerbate risks. Therefore, the City should take a proactive approach by:

- Educating and enforcing non-incineration policies;
- Incorporating systems of early detection of any threats (e.g. fire).

### **Transportation**

The emissions produced from transportation contribute to climate change. The City's goal of reducing vehicular pollution is fundamental for a sustainable future. In order to promote sustainable transport, the City should consider:

- Promoting non-vehicular travel (e.g. walking and cycling);
- Drawing connections between transportation and health;
- Ensure that the transportation system continues to support livelihoods by guaranteeing that roads remain passable in times of flood and high tide.

### **Telecommunication**

Telecommunication is an important feature of the 21st century, both on a daily basis and in times of crisis. It is important for the City to ensure that:

- Telecommunications infrastructure is climate-proofed.

### **Water**

Access to water is a fundamental human right. Therefore, the City's aim to continue with the potable water initiatives is essential. The impacts of climate change will reduce the accessibility to clean and safe drinking water in Malolos. It is crucial that not only water conservation and potable water initiatives are continued, but also that:

- Alternative sources for water are explored (e.g. surface water and rainwater harvesting);
- Water quality continues to be monitored.

### **Power**

Emissions from the power sector are projected to increase according to the Philippine Climate Change Commission. Conservation and demand management is an important step in reducing the effects of climate change. Given the trend of increased emissions:

- Alternative and renewable power sources should be sourced wherever possible.

### **4.2.3 COMPREHENSIVE DEVELOPMENT PLAN**

A Comprehensive Development Plan (CDP) is a medium-term action plan used by LGUs for the development and implementation of priority projects and programs. The sectoral and cross-sectoral programs and projects found in the CDP are guided by the land use policies outlined in the CLUP. While CLUP provides a basic framework for long-term development, the CDP is tasked with adding the substance and detail for achieving the plans and visions outlined in the CLUP.

The City of Malolos' Comprehensive Development Plan 2005-2007 provides a detailed analysis of 10 key sectors. The comprehensive overview of each sector includes a goal, a set of objectives, and a set of targets for the city's development.

#### **Health**

Community resiliency to health-related effects resulting from calamities is a focus in the CDP. Both prevention and mitigation are covered in this sector. It is important to:

- Consider climate-proofing new buildings that will be constructed to house health-related infrastructure such as stations and hospitals.

#### **Social Welfare**

The CDP highlights the need to build more daycares and to create a government department dedicated to vulnerable groups such as indigent families, delinquent children, and battered women. It also focuses on relocating informal settlers of barangay Balayong. From a climate change perspective, it is important to:

- Seek options for sustainable building materials and consider climate-proofing new buildings.
- Relocate informal settlers that are prone to climate change hazards such as extreme flooding, sea level rise, and storm surge.

#### **Education**

The CDP focuses on providing library access to the coastal barangays. Encouraging the donation of books helps to reduce the environmental impacts associated with the production of new goods. It is important to:

- Consider eco-friendly options for vehicles that will be used to house and transport the "library on wheels." Hybrid vehicles, alternatives to leaded fuels, and vehicles that meet the emissions requirements will all help to lessen the environmental impacts that contribute to climate change.

#### **Housing**

The CDP focuses on the disparities between residential areas in their access to clean drinking water. Developing sufficient and sustainable access to drinking water for all residents and providing educational programs on the dangers of unsustainable water extraction processes are important features of the CDP.

- Water extraction alternatives need to be considered for the diversification of drinking water provisions;
- Rainwater harvesting may help to alleviate some of the groundwater extraction and provide an alternative to aquifer supply if a cost-effective harvesting and treatment solution can be delivered to the residents that are currently lacking access to water.

## **Sports and Recreation**

Providing increased access to sports and recreation facilities is important for overall population health. Construction of these facilities should:

- Take into account the long-term effects of climate change by considering the use of sustainable building materials for the project;
- Climate-proofing facilities, which would include construction at higher levels of elevation to avoid flooding and using materials that can withstand extremes in weather.

## **Public Order and Safety**

Safe communities rely on strong protective services. In times of calamities, the City relies on these services for the protection of its citizens. The CDP focuses on increased visibility of police officers and increasing the fireman to citizen ratio. From a climate change perspective, the City should be commended on its recommendation to increase police visibility using bicycles, rather than other motorized modes of transportation.

## **Agriculture**

The CDP is focused on producing high yield crops, increasing the demand for local livestock, and supporting healthy aquaculture environments by implementing appropriate waste management techniques. Preserving agricultural lands is vital for climate change planning as these lands help to reduce runoff and flooding in areas. Preserving agricultural lands also contributes to increased food security.

- Effective irrigation systems can incorporate the use of rainwater harvesting systems;
- Increased rainfall in the area due to climate change could be captured to increase crop production.

## **Industry and Services**

The CDP notes that transient employees flock to Malolos for work due to widely available public transportation. From a climate change perspective, these transportation options should be:

- Evaluated to ensure a reduction of emissions in order to mitigate deterioration of air quality in Malolos;
- Alternatives to leaded fuels should be considered, as well as the adopting the use of hybrid vehicles.

It would be beneficial in the development of Malolos' tourism industry that the City considers the effects of climate change.

- Eco-tourism tourism options should be assessed to minimize environmental impacts and provide financial resources for conservation efforts;
- Ecosystem tourism should also be considered as an option for a long term sustainable ecotourism program.<sup>11</sup>

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<sup>11</sup> D. Tyler and J.M. Dangerfield, "Ecosystem Tourism: A Resource-based Philosophy for Ecotourism," *Journal of Sustainable Tourism* 7, no. 2 (1999): 146-158.

## **Physical/Infrastructure**

The CDP focuses on numerous interconnected goals regarding physical infrastructure. Improving water transportation systems and waterways by rehabilitating river systems is a strong focus in the CDP.

- Water transportation network improvements must consider impacts from sea level rise, storm surge, and typhoons;
- In the creation of a wastewater/sewage disposal system, ensure untreated sewage will not end up in waterways that are already vulnerable due to climate change impacts.

Another strength of the CDP is the goal of turning the Malolos into a walkable city. Creating a walkable city reduces the need for motorized transportation that contributes to climate change.

- Sidewalks should be constructed at higher elevations or in areas that are not prone to flood.

## **Environment**

The CDP highlights a range of key issues including solid waste management, wastewater facilities, increasing rainwater catchment basins, regulation of groundwater extraction, and increasing mangrove forest coverage. Numerous assets are identified in this section of the plan:

- Encouraging recycling activities in every household and industry helps to conserve raw materials and energy, lessening the amount of greenhouse gas emissions produced from factories in the creation of consumer goods;
- Implementing community monitoring systems for industrial wastewater outputs should increase industry accountability by personalizing the effects of wastewater generation. Proper treatment of wastewater is essential for climate change planning to avoid worsening the effects of climate hazards on the water table;
- Increasing rainwater catchment basins is a renewable water provision solution that has the potential to decrease the overall water extraction rates from aquifers;
- Providing information and education regarding the hazards of over extraction of groundwater should help to preserve continued supply access;
- Planting mangroves along the coastal barangays increases the health of the aquaculture environment by providing a juvenile habitat for fish species. Mangroves also serve as a natural dyke helping to protect the coastal barangays from subsidence.

#### **4.2.4 EXECUTIVE LEGISLATIVE AGENDA**

The Executive Legislative Agenda (ELA) is a three-year planning document that corresponds to the term of the Sangguniang Panlungsod. The ELA identifies priority issues for the LGU's executive and legislative branches to pursue. The Agenda is complementary to and supports the implementation of the longer-term CLUP and the medium-term CDP.

In order to respond to the urgent priorities of climate change planning, the ELA can place climate change at the forefront of the City's planning priorities. This will guide successful implementation of quick-start policies and actions to deliver immediate community benefits and lay a strong framework for a climate risk-resilient Malolos.

The City of Malolos' Executive Legislative Agenda 2014-2016 is split into four clusters, containing mission statements, goals, and objectives for each cluster.

#### **Environment**

The City has an ambitious mission of making Malolos the "cleanest and greenest city in Central Luzon." Planning for climate change will play a central role in making Malolos a clean and green city given the host of benefits and co-benefits that addressing climate change provides.

For the air pollution goal:

- The location, and not simply the quantity, of new green infrastructure such as trees should be targeted particularly in urbanized areas with highly paved areas and near major motorized transportation routes;
- Make explicit the link between air pollution and transportation, particularly when considering transportation planning demands in future growth areas targeted for higher density development

For the land (solid waste management) goal:

- Make explicit the link on how organic waste diversion reduces GHG emissions at landfills;
- Emphasize how reduction and recycling can reduce emissions through lowered energy consumption;
- Consider how strict enforcement of the "no segregation, no collection" policy may have unintended consequences in producing a significant amount of waste that is uncollected and pollute environmentally sensitive areas and/or clog drainage systems.

For the water goal:

- A clear connection should be drawn between ensuring a clean, safe, and accessible water supply and how climate change impacts this, whether through increased usage during hotter weather or changing livelihood activities as a result of climate change.
- Water treatment facilities need to be climate proofed to ensure clean water for all.

#### **Social**

Climate change is not simply a physical phenomenon with physical impacts on the environment, but it also produces significant socio-economic impacts on communities and livelihoods. Vulnerable populations are disproportionately affected by the effects of climate due to their limited adaptive capacity, limited resources, higher exposure to risks, and since many often live in or near particularly sensitive areas such as informal settlements. As a result, the maximum utilization of resources and adequate service provision may be jeopardized by climate change. The City should consider how:

- Climate change will impede the ability to promote healthy lifestyles through increased mortality during higher temperatures, decreased access to healthy food, and increased rates of water-borne preventable diseases.
- Health-related facilities need to be climate-proofed, particularly during times of calamities;

- Expansion of facilities may need to be considered as climate change worsens and more of the population are affected by related impacts;
- Social welfare services may be additionally burdened (financial, etc.). This happens because the vulnerable sectors of society are disproportionately impacted by climate change.

### **Economic**

Climate change has considerable potential to adversely impact the important economic sectors of Malolos, threaten traditionally sources of livelihood, and increase the burden of financial costs to the effective delivery of municipal services. This ultimately threatens the sustainability of the City and the residents of Malolos. Planning for climate change *now* is more cost effective than compared to the costs of inaction (e.g. damage to infrastructure and property, loss of livelihoods, etc.). In implementing the economic objectives, the City should consider:

- Longevity and life span of publicly-owned *and* privately-owned equipment and machines. Climate change impacts may result in the need for more frequent use of assets, potentially shortening their lifespan. Assets may be damaged during extreme weather events, which can be particularly devastating for people who rely on equipment and machines for livelihood purposes such as agriculture and fishing.
- Preservation of agricultural lands and slowing and/or preventing land conversion is crucial for making Malolos a climate risk-resilient city due agricultural land's importance, including food security, carbon sink, and green infrastructure. A successful climate change planning must go hand-in-hand with a well-developed CLUP to manage future growth.
- Tourism-related infrastructure and facilities should be climate-proofed to ensure their sustainability into the future and Malolos' important cultural assets are protected for future generations.

### **Administrative**

Preparing for climate change is good business practice for a local government to ensure administrative and financial efficiency and stability. Sound management of public resources can help the City achieve its vision and mission and deliver quality services to residents. However, climate change can significantly hinder the administrative abilities of the City.

- Climate change threatens traditional and business as usual practices, so the City must adapt and adopt new practices to manage public resources effectively. Climate change should be considered within all aspects of internal administrative planning.
- Efficient financial use of resources should be dedicated towards *low regret actions*, actions that benefit the community regardless of the extent of climate change. This address immediate community development issues while contributing to climate change planning. Analysis and prioritization of actions must be conducted in order to deliver the broadest community benefit.
- Climate change planning should be mainstreamed and integrated into existing city activities will promote more streamlined practices to guide successful implementation.

## **4.2.4 ADDITIONAL PLANS**

### **Solid Waste Management Plan**

The City of Malolos' Solid Waste Management Plan 2010-2020 is closely aligned with the City's ELA and incorporates many principles and actions supportive of climate change action, including:

- Sustainable, long-term, and clearly defined vision, mission, goals, and objectives;
- Drawing a clear connection between ecological health and the health of Malolos' citizens and livelihood improvements;
- Creation a zero waste management target;
- Identification of air pollution control strategies including an air quality action plan;



- Initiation of organic agriculture and vermicomposting activities;  
Strong plan targets for waste reduction rates;
- Encouragement of city-wide waste segregation program;
- Effective policies related to prohibiting waste incineration;
- Solid waste collection and transfer activities targeting recyclable and biodegradable materials.

An up-to-date ecological profile of the city and its residents is an important feature of the solid waste management planning, especially for the identification of areas that may require additional aid in waste management services, planning, and education. However, much of the demographic data utilized in the 2010 plan is outdated. As part of the CLUP update process, the Solid Waste Management Plan should be updated to reflect the newest ecological data.

### **Contingency Plans for Flood and Earthquake**

The City has engaged in contingency planning for flood and earthquake events. These plans successfully incorporate a number of factors vital to climate change action:

- Detailed analysis of the hazard areas;
- Overview of the populations that will be impacted during a calamity;
- Clear assessment of what would be needed in the case of a flood or an earthquake;
- Detailed assessment of the gaps that exist between the infrastructure needed in an incident of calamity and what the City has available;
- Link between incidents of crisis and health, social welfare, and poverty.

Both of these contingency plans also make a brief reference to the recovery from a crisis, which is an important part of thinking about long-term climate change planning. It would be beneficial for the City to expand this section on recovery in their contingency planning. In making reparations after a flood or an earthquake, it is imperative that these are done with climate change in mind in order to ensure climate resiliency in the future.

### **Local Shelter Plan**

The Local Shelter Plan accounts for the housing needs of those living in hazardous areas or areas where there is a likelihood of resettlement. It has been designed to include the needs of formal and informal settlers throughout the city. It successfully incorporates many features related to climate change action such as:

- Hazard mapping;
- Integration with disaster risk reduction management planning;
- Use of indigenous and alternative materials,

The plan also develops a profile of the vulnerable populations that the plan aims to address. However, much of the data used to build this section is out-of-date and may not reflect the current state of the vulnerable populations in Malolos.

In order to ensure that the Local Shelter Plan properly aligns with climate change planning in the city, it is essential to base the plan using the latest ecological data. It may be necessary to conduct a study of the vulnerable populations to build an up-to-date dataset.

### 4.3 CITY STAFF CAPACITY ANALYSIS

#### 4.3.1 OVERVIEW OF SURVEY

A city staff capacity survey was administered to various City Offices to determine the City’s capacity for climate change planning and identify opportunities for improvement. Specifically, the objectives of the survey were to determine and understand:

1. Perceptions and understanding of climate change;<sup>12</sup>
2. Perceptions about the importance and occurrence of climate change in the work of staff;
3. Areas for growth and improvement within Offices and the City Government in relation to climate change planning.

A total of 133 responses out of 210 surveys were received from City staff for a response rate of 63%.<sup>13</sup> One significant limitation to the survey is that not all offices could be surveyed due to time constraints. Nonetheless, the survey reflects the results of some of the key offices that would be involved in climate change planning-related work. Table 9 shows the number of surveys received from each office. Percentages are rounded up.

**Table 9. Survey Response by Office.**

Office/Department	Number of Responses	Percent of Responses
Sangguniang Panlungsod	6	5%
Office of the City Mayor	8	7%
Office of the City Vice Mayor	10	9%
Office of the City Administrator	12	11%
City Assessor Office	12	11%
City Budget Office	6	5%
City Planning & Department Office	11	10%
City Legal Office	4	4%
City Social Welfare & Development Office	10	9%
City Engineering Office	10	9%
City Health Office	9	8%
City Agriculture Office	8	7%
Business Permit and Licensing Division	5	4%
Department of the Interior Local Government	2	2%
<b>Total</b>	<b>113</b>	<b>100%</b>

The majority of staff who responded are medium to long-time employees, with 63% having worked at the City for at least 4 years (see Table 10). The average age of staff reported was between 35-39 and 40-44 (see Table 11).

**Table 10. Employment Length of Survey Respondents.**

Employment Length	Number of Responses	Percent of Responses
Less than 1 year	10	9%
1-3 years	31	28%
4-6 years	36	32%
More than 7 years	35	31%
<b>Total</b>	<b>112</b>	<b>100%</b>

<sup>12</sup> Results of staff perceptions and understanding of climate change will be reported in a separate report in the future.

<sup>13</sup> Results pertaining to the Department of the Interior Local Government are generally not discussed in the section due to the low response rate of only two responses, but are included in summary of the entire survey dataset.

**Table 11. Age of Survey Respondents.**

Age Range	Number of Responses	Percent of Responses
15-19	2	2%
20-24	10	9%
25-29	12	11%
30-34	16	14%
35-39	15	13%
40-44	18	16%
45-49	16	14%
50-54	15	13%
55-59	1	1%
60-64	6	5%
65-69	1	1%
<b>Total</b>	<b>112</b>	<b>100%</b>

#### 4.3.2 CLIMATE CHANGE PLANNING IMPORTANCE AND OCCURRENCE

The vast majority of staff (74%) reported that climate change planning was very important on a scale of 1 to 5, where 5 is the most important and 1 is the least important (see Table 12). Overall, this demonstrates City staff's commitment to climate change action and will prove to be a strong asset for the City.

When broken down by office, the Sangguniang Panlungsod and the City Budget Office had the highest scores with all respondents unanimously reporting "Most Important" (see Table 13). This is a welcome sign given that strong political leadership is often a strong predictor for successful implementation of climate change-related projects in local government, and the importance of financing climate change projects should not be understated. Regardless, all the offices were very similar in how important they thought climate change planning was.

**Table 12. Importance of Climate Change Planning.**

Importance	Number of Responses	Percent of Responses
1 = Least Important	0	0%
2	0	0%
3	6	6%
4	22	21%
5 = Most Important	78	74%
<b>Total</b>	<b>106</b>	<b>100%</b>

Note: Survey question: *How important is it for Local Government Units (LGUs) to plan for climate change with 1 being the least important and 5 being the most important?*

**Table 13. Importance of Climate Change Planning by Office.**

Office/Department	Mean	Standard Deviation	Min	Max	Number of Responses
Sangguniang Panlungsod	5	0	5	5	6
Office of the City Mayor	4.86	0.38	4	5	7
Office of the City Vice Mayor	4.67	0.71	3	5	9
Office of the City Administrator	4.67	0.49	4	5	12
City Assessor Office	4.42	0.79	3	5	12
City Budget Office	5	0	5	5	6
City Planning & Department Office	4.64	0.67	3	5	11
City Legal Office	4.67	0.58	4	5	3
City Social Welfare & Development Office	4.75	0.46	4	5	8
City Engineering Office	4.70	0.48	4	5	10
City Health Office	4.38	0.74	3	5	8
City Agriculture Office	4.88	0.35	4	5	8
Business Permit and Licensing Division	4.25	0.96	3	5	4
Department of the Interior Local Government	5	0	5	5	2

The majority of staff reported that climate change was a regular occurrence in their work. 65% reported climate change “Often” comes into their work and 14% reported “Very Often” (see Table 14). When broken down by office, there was more variation. The City Assessor Office had the lowest score while the Business Permit and Licensing Division had the highest score (see Table 15).

Some of the key planning-related offices (Mayor, Vice Mayor, Budget, Planning & Development, Social Welfare & Development, Engineering, Health, and Agriculture) reported similar scores that climate change “Often” comes into their work. These results indicate that City staff are making connections in their work to climate change. This is important given that climate change planning is a multi-sectoral effort.

**Table 14. Occurrence of Climate Change in Work.**

Importance	Number of Responses	Percent of Responses
Rarely	1	1%
Sometimes	20	19%
Often	68	65%
Very Often	15	14%
<b>Total</b>	<b>104</b>	<b>100%</b>

Note: Survey question: *How often do you see climate change come into your work?*

**Table 15. Importance of Climate Change Planning by Office.**

Office/Department	Mean	Standard Deviation	Min	Max	Number of Responses
Sangguniang Panlungsod	3.60	0.55	3	4	5
Office of the City Mayor	4	0	4	4	7
Office of the City Vice Mayor	4	0.71	3	5	9
Office of the City Administrator	3.75	0.45	3	4	12
City Assessor Office	3.22	0.67	2	4	9
City Budget Office	4	0	4	4	5
City Planning & Department Office	3.91	0.54	3	5	11
City Legal Office	4	0.82	3	5	4
City Social Welfare & Development Office	4.25	0.71	3	5	8
City Engineering Office	4	0.47	3	5	10
City Health Office	4	0.50	3	5	9
City Agriculture Office	4.13	0.35	4	5	8
Business Permit and Licensing Division	4.60	0.89	3	5	5
Department of the Interior Local Government	4	1.41	3	5	2

Further research needs to be conducted to understand the nature of various offices and their connection to climate change in terms of occurrence in order for the City to better able to support the office-specific needs. Nevertheless, the high ratings of importance and occurrence in the survey speaks positively to the City's capacity to plan for climate change in the future.

#### **4.3.3 CAPACITY OPPORTUNITIES FOR GROWTH AND IMPROVEMENT**

Respondents were asked to rank where they saw the most opportunity for growth in relation to climate change planning internal/within their office and external/outside their office on a scale of 1 to 6, where 6 is the most important and 1 is the least important (see Table 16 and 17). The mode is reported and not the mean here in order to show the most common value reported. Survey items were based on an extensive academic literature review of areas for improvement commonly identified by local governments.

Overall, the following were consistently ranked highest on the importance scale (4 to 6) across survey respondents for both internal and external opportunities:

- Improved knowledge and expertise about climate change planning;
- Prioritizing climate change planning at the City Government overall and within individual offices;
- More clearly identified role and function of individual offices for climate change planning;
- Improved inter-departmental/office communications, co-operation, and coordination.

In contrast, the following were ranked lowest on the importance scale (1-3):

- Improved data and adequate data collection;
- Increased financial resources (e.g. budget) and human resources (e.g. staff);
- Increased provincial and national support;
- Improved public awareness and support for climate change planning.

**Table 16. Opportunities for Growth and Improvement, Internal/Within Office.**

<b>Opportunity</b>	<b>Mode</b>	<b>Min</b>	<b>Max</b>
Improved knowledge and expertise about climate change planning	6	2	6
Prioritizing climate change planning in your department/office	5	1	6
More clearly identified role and function of your department/office for climate change planning	5	1	6
Improved data and adequate data collection	3	1	6
Increased financial resources (e.g. budget)	2	1	6
Increased human resources (e.g. staff)	1	1	6

Note: Survey question: *Rank where you see the most opportunity for growth INTERNAL/WITHIN to your department/office in doing climate change planning or supporting climate change planning-related activities. Use 6 as the most important and 1 being the least important. Number of responses = 77.*

**Table 17. Opportunities for Growth and Improvement, External/Outside Office.**

<b>Opportunity</b>	<b>Mode</b>	<b>Min</b>	<b>Max</b>
Prioritizing climate change planning at the City Government of Malolos	6	1	6
Improved knowledge and expertise about climate change planning of the City Government	5	1	6
Improved inter-departmental/office communications, co-operation, and coordination	4	1	6
Increased provincial government support	2	1	6
Increased national government support	2	1	6
Improved public awareness and support for climate change planning	1	1	6

Note: Survey question: *Rank where you see the most opportunity for growth EXTERNAL/OUTSIDE to your department/office in doing climate change planning or supporting climate change planning-related activities. Use 6 as the most important and 1 being the least important. Number of responses = 76.*

These responses are areas that the City has responsibility and influence over. As a result, the City can take a leadership position to build internal capacity and enable a better environment for successful climate change planning and implementation. Appendix D shows the full results broken down by individual office.

## 5.0 CLIMATE CHANGE ACTION RECOMMENDATIONS

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The following set of climate change action recommendations have been developed based on primary and secondary data collection in Malolos including stakeholder interviews. Each recommendation has been developed in response to a climate-related opportunity that was identified by key stakeholders or through the data collection process. Recommendations are numbered by each sector:

- General Recommendations;
- Environment and Natural Resources;
- Infrastructure, Land Use, and the Built Environment;
- Economy and Industry;
- Health and Human Security;
- Education and Capacity Building.

Corresponding to each overarching recommendation, a set of suggested actions have been provided. These actions have been developed to be implementable policies and projects. In the implementation of these policies and projects, the City should develop a set of indicators to ensure that each project can be monitored and evaluated for success.

The recommendations and actions presented not comprehensive. They are only a list of suggestions for implementation.

This section also aims to demonstrate how climate action can have a variety of cross-sectoral benefits. Consideration of these benefits and co-benefits can help the City better prioritize these projects. It will also help in the creation of collaborative partnerships between various offices to carry out the projects to completion. This will allow for a sharing of resources and expertise and will contribute to the overall success of the project.

### 5.1 QUICK STARTS AND GENERAL RECOMMENDATIONS

The following recommendations are quick start and general recommendations. Quick start projects are those that do not require significant and long-term financial resources, administrative reorganizing, or intensive amounts of labour to implement. In addition to being useful to climate change action, quick start projects can help to build and maintain momentum for plan implementation.

#### **Recommendation 1 (QUICK START): Support City staff professional development and training for climate change planning**

Staff identified that improved knowledge and expertise about climate change planning was one of the biggest priorities moving forward in climate change action. Building staff capacity through professional development and training opportunities will help individual offices and the City Government overall better plan for climate change. The following principles should be followed:

- The nature of planning-related work each City Office is responsible for is very different;
- Provide professional development and training opportunities that best meet the specific preferences and needs of City Offices;
- Consult each Office on what are the best and most meaningful methods to support professional development and training opportunities in order for the efficient use of resources;
- Do not assume traditional training and information seminars are the best method.

Furthermore, professional development and training materials can potentially be adapted for elected officials at the barangay level.

**Recommendation 2 (QUICK START): Establish a Climate Change Working Group**

The creation of an inter-departmental working group dedicated to climate change action at the City should be established to coordinate all climate change planning activities. It should have representation from all offices that support climate change work.

This recommendation would directly support the need for a clearer role and function of individual offices for climate change planning and improve inter-departmental coordination, communications, and co-operation for climate change planning as identified in the staff survey. A Climate Change Working Group or a similar structure is important given that climate change planning is a multi-sectoral effort and not the responsibility of any one City office. A Working Group would support mainstream climate change planning to avoid policy conflict and make better use of resources. Cities that take action on climate change typically have a dedicated department or group of staff to lead all climate change planning activities.

In addition, this Working Group can help lead professional development and training opportunities for climate change planning and build staff capacity.

**Recommendation 3 (QUICK START): Demonstrate corporate climate leadership**

For climate change planning to gain traction and support particularly among the public, the City must demonstrate strong leadership and be a role model for best practices. Positive role modeling is an effective way to influence behaviour. Actions speak louder than words and if the City can lead by example, the community will follow.

One example the City could showcase would be for all City staff to perform high-level waste segregation and recycling at City Hall and/or to avoid using non-recyclable products in City facilities (such as using biodegradable paper take-out containers for meals in place of styrofoam).

**Recommendation 4: Improve data collection to support climate change planning**

Improved data collection for the City such as more accurate and up-to-date demographic and ecological data would allow the City to better support more effective and efficient climate change planning. In addition to improving planning activity, improved data collection will also assist with monitoring in all sectors.

Monitoring specific to climate change could be collected and tracked at the barangay level similar to the Community-Based Monitoring System. This will help to develop a more accurate assessment of the impacts of climate change to communities over time.



## 5.2 ENVIRONMENT AND NATURAL RESOURCES

A healthy environment is essential to the long-term sustainability of Malolos. The following set of recommendations addresses some key opportunities related to climate change planning:

- 1.0 Support local organic farming;
- 2.0 Reduce reliance on groundwater resources;
- 3.0 Address saltwater intrusion to groundwater resources;
- 4.0 Improve treatment of stormwater runoff and sewage to reduce the pollution of waterways;
- 5.0 Improve resilience of the city's ecological health.

Agriculture and aquaculture are a primary livelihood in the City of Malolos. Agricultural land makes up 32% of the total land base and fishponds make up 28% (see Table 1). It is important to plan for the long-term sustainability of this industry. The expansion of organic farming in Malolos is an ongoing initiative of the City Agriculture office. The City supports vermicomposting projects and supplies seeds to farmers engaged in organic farming practices.<sup>14</sup> These projects should be further developed with a specific focus on supporting farmers as they transition over to organic farming practices.

Malolos falls within the Angat River Basin. The various municipalities situated within the watershed are facing similar challenges to Malolos including:

- Increased severity and frequency of flooding;
- Water scarcity;
- Sea level rise;
- Salt water intrusion;
- Land subsidence;
- Low ecosystem and watershed health.

Climate change has resulted in increasing intensity and frequency of extreme weather events such as typhoons and flooding. This coupled with the prevalence of grey infrastructure within the city has resulted in pooling water in the city streets after instances of heavy rain. Flooding is also occurring in the coastal Barangays with high tide due to the combined effects of sea level rise and land subsidence.

“Global climate change will profoundly affect hydrologic systems worldwide ... Unchecked, groundwater depletion can exacerbate the impacts of these changes; conversely, controlled management of groundwater depletion can contribute to their mitigation.”

Source: Leonard F. Konikow and Eloise Kendy<sup>15</sup>

Malolos relies on groundwater as the sole source of water for the city. This dependence on groundwater has a number of associated risks for the population, including contributing to land subsidence, increased likelihood of saltwater infiltration, and ease of contamination by surface pollutants.<sup>16</sup> Finding alternatives to groundwater should be a priority for the City in order to adapt to climate change. Doing so will help to combat issues of water scarcity, but will also assist in the challenges faced in relation to flooding. There is much that can be done at the local level in order to address environment and natural resources challenges. However, in order to restore the Angat River and ensure the long-term health of the watershed, collaboration across municipalities is imperative.

<sup>14</sup> City Agriculture Office, personal communication, July 14, 2014.

<sup>15</sup> L.F. Konikow and E. Kendy, “Groundwater Depletion: A Global Problem,” *Journal of Hydrogeology* 3 (2005): 318.

<sup>16</sup> Ibid.

<b>5.2 Environment and Natural Resources</b>			
<b>Impact/Opportunity</b>	<b>Recommendation</b>	<b>Action</b>	<b>Associated Benefits</b>
Long-term sustainable farming practices	<b>1.0 Support local organic farming.</b>	1.1 Promote organic consumption through information and education campaigns.	<ul style="list-style-type: none"> <li>- Decreased water pollution.</li> <li>- Increased food security.</li> <li>- Improved soil formation.</li> <li>- Supporting the local economy.</li> <li>- Creation of green jobs.</li> </ul>
		1.2 Continue to explore options for vermicomposting and organic farming practices (including agriculture, fisheries, and livestock).	<ul style="list-style-type: none"> <li>- See above.</li> </ul>
		1.3 Provide support for farmers transitioning into organic farming practices to help offset the initial drop in revenue.	<ul style="list-style-type: none"> <li>- Increased food security.</li> <li>- Reduced pollution of agricultural lands.</li> <li>- Increased health of consumers.</li> <li>- Creation of green jobs.</li> </ul>
Water scarcity	<b>2.0 Reduce reliance on groundwater resources.</b>	2.1 Explore opportunities for the use of surface water as an alternative.	<ul style="list-style-type: none"> <li>- Reduced land subsidence.</li> <li>- Improved access to drinking water.</li> </ul>
		2.3 Conduct analysis on areas in the city that are suitable for rainwater harvesting at the household level.	
		2.2 Implement rainwater harvesting pilot projects at the household, commercial, and institutional building level.	<ul style="list-style-type: none"> <li>- Reduced land subsidence.</li> <li>- Improved access to drinking water.</li> <li>- Reduced impact on groundwater supplies.</li> <li>- Reduced impact of rainwater on drainage system.</li> <li>- Creation of green jobs.</li> </ul>
		2.4 Conduct feasibility assessment for a central rainwater harvesting facility in barangay Bangkal to identify financial viability and specific community priorities.	<ul style="list-style-type: none"> <li>- Improved water security.</li> <li>- Reduced impact on groundwater supplies.</li> <li>- Reduced impact of rainwater on drainage system.</li> <li>- Reduced incidences of waterborne illnesses.</li> </ul>
		2.5 Explore rainwater harvesting as an option to supplement water use in commercial and major institutional buildings (e.g. using rainwater to flush toilets at new City Hall).	<ul style="list-style-type: none"> <li>- Improved water security.</li> <li>- Reduced impact on groundwater supplies.</li> <li>- Reduced impact of rainwater on drainage system.</li> <li>- Increased green infrastructure.</li> </ul>

Sea level rise	<b>3.0 Address saltwater intrusion to groundwater resources.</b>	3.1 Study different options for desalination of drinking water to determine most appropriate solution for the city.	<ul style="list-style-type: none"> <li>- Improved access to drinking water.</li> <li>- Improved water security.</li> </ul>
		3.2 Study the impacts sea level rise is having on existing flora and fauna in Malolos in order to determine which breeds can serve as a replacement in riparian zones to any loss species from increased salinity.	<ul style="list-style-type: none"> <li>- Increased biodiversity.</li> <li>- Increased ecosystem health and resilience.</li> <li>- Creation of green jobs.</li> </ul>
Ecosystem health	<b>4.0 Improve treatment of stormwater runoff and sewage to reduce pollution of waterways.</b>	4.1 Study and identify the most significant pollution sources in the Angat River and waterways within the jurisdiction of the City.	<ul style="list-style-type: none"> <li>- Decreased water pollution.</li> <li>- Improved ecosystem health.</li> <li>- Improved community health.</li> </ul>
		4.2 Build partnerships with municipalities within the Angat River Basin to develop a collaborative watershed management approach.	<ul style="list-style-type: none"> <li>- Increased leadership capacity.</li> <li>- Improved government collaboration.</li> </ul>
		4.3 Develop a long-term action plan to eradicate pollution and restore the Angat River and waterways within Malolos to proper functioning condition.	<ul style="list-style-type: none"> <li>- Improved community health.</li> <li>- Improved ecosystem health.</li> <li>- Improved access to drinking water.</li> <li>- Improved opportunities for ecotourism.</li> </ul>
	<b>5.0 Improve the resilience of the city's ecological health.</b>	5.1 Continue to support the existing mangrove restoration program and identify options for program expansion.	<ul style="list-style-type: none"> <li>- Increased biodiversity.</li> <li>- Reduced soil erosion.</li> <li>- Increased breeding ground for fish species.</li> <li>- Creation of green jobs.</li> </ul>

### 5.3 INFRASTRUCTURE, LAND USE, AND THE BUILT ENVIRONMENT

How land is developed and managed has significant implications for climate change adaptation and mitigation. The following set of recommendations addresses some key opportunities related to climate change planning:

- 1.0 Improve stormwater management practices;
- 2.0 Improve maintenance of the existing drainage system;
- 3.0 Seek opportunities for renewable energy sources;
- 4.0 Ensure land use planning are aligned with long-term climate change adaptation goals;
- 5.0 Ensure building and construction practices are aligned with long-term climate change adaptation goals;
- 6.0 Enhance walkability and pedestrian-oriented urban design;
- 7.0 Make cycling more accessible and convenient;
- 8.0 Reduce traffic congestion.

#### Renewable Energy

Renewable energy resources offer an approach for reducing GHG emissions. The City's plan to incorporate solar panels in the new City Hall building should be supported. Continuing with this trend whether it be geothermal, hydroelectric, wind, wave, biomass, or solar power will also build resilience to energy insecurity in the region. Furthermore, harnessing renewable forms of energy reduce the strain on the environment to produce non-renewable natural resources.

#### Land Use Planning and Regulations

Incorporating long-term adaptation visions into all building codes and land use plans will help to strategically align the current development processes with future plans. A direct result of insecure land tenure is limited to no regulation of land use and an absence of building codes and minimum standards for constructed objects.<sup>17</sup> Unregulated construction significantly affects risk in two ways:<sup>18</sup>

- Lack of regulation results in building construction occurring in hazardous locations, such as along high-risk flood zones along riversides, which would otherwise be considered uninhabitable by disaster and risk management standards;
- Unregulated structures being erected can be flimsy and unsound, composed of scrap materials collected as a strategy for survival.

Therefore, strict enforcement of building codes and zoning that, for example, restricts development in high-risk areas and building standards that are fit to stand up against intense climate patterns will protect local citizens and help to avoid catastrophes. A strong sense of foresight is necessary for ensuring that lasting climate change adaptation plans are integrated into present day developments. This will help Malolos build a climate-smart city of tomorrow.

#### Green Infrastructure

If constructed appropriately, infrastructure can be built in a way that lessens the impact of flooding in Malolos. Permeable surfaces and rain gardens have the potential to reduce the amount of pooling water and flooding in certain areas. Flooding can also be exacerbated by inefficient drainage systems. Maintenance and upgrading of existing drainage systems can help to reduce the pressure and alleviate heavy floodwaters. Green building practices and development will not only help to alleviate the current effects of climate change, but will also help to strengthen Malolos for the future.

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<sup>17</sup> B. Wisner, P. Blaikie, T. Cannon, and I. Davis, *At Risk: Natural Hazards, People's Vulnerability and Disasters* (London, Routledge, 2003).

<sup>18</sup> United Nations Human Settlements Programme, *Enhancing Urban Safety and Security: Global Report on Human Settlements* (UN-Habitat, 2007), <http://www.unhabitat.org/downloads/docs/GRHS.2007.0.pdf>.

<b>5.3 Infrastructure, Land Use, and the Built Environment</b>			
<b>Impact/Opportunity</b>	<b>Recommendation</b>	<b>Action</b>	<b>Associated Benefits</b>
Flooding	<b>1.0 Improve stormwater management practices.</b>	1.1 Develop pilot projects for permeable surfaces on low traffic side-streets that are prone to flooding.	<ul style="list-style-type: none"> <li>- Reduced flooding.</li> <li>- Reduced infrastructure maintenance costs.</li> <li>- Reduced impact on drainage system.</li> <li>- Reduced breeding grounds of waterborne illnesses.</li> </ul>
		1.2 Study other suitable areas in the city for permeable surface pilot projects in a variety of streets.	
		1.3 Study locations suitable for rain gardens and street bioswale pilot projects.	
	<b>2.0 Improve maintenance of the existing drainage system.</b>	2.1 Conduct an assessment of priority locations in the drainage system that require maintenance and upgrades.	
		2.2 Determine methods to reduce impact of solid waste on the drainage system.	
		2.3 Evaluate existing drainage standards to anticipate extreme weather events and heavier rainfall volumes.	
Ecosystem health and long-term sustainability	<b>3.0 Seek opportunities for renewable energy sources.</b>	3.1 Continue to explore opportunities to implement renewable energy sources as an alternative (e.g. geothermal, hydroelectric, wind wave, biomass, solar power).	<ul style="list-style-type: none"> <li>- Reduced GHG emissions.</li> <li>- Creation of green jobs.</li> </ul>
	<b>4.0 Ensure land use planning are aligned with long-term climate change adaptation goals.</b>	4.1 Ensure that high-risk areas are identified in the zoning ordinance and the CLUP update.	<ul style="list-style-type: none"> <li>- Improved public safety.</li> </ul>
		4.2 Strictly enforce “no-build” zoning regulations.	
	<b>5.0 Ensure building and construction practices are aligned with long-term climate change adaptation goals.</b>	5.1 Safe engineering standards should be strictly enforced for the protection of structures and building occupants.	
		5.2 Prioritize retrofitting of existing structures to be climate-proofed.	
	Walking and cycling	<b>6.0 Enhance walkability and pedestrian-oriented urban design.</b>	6.1 Increase minimum sidewalk width standards beyond 1.5 m, particularly in commercial and mixed-use areas.
6.2 Increase sidewalk widths within the City’s right-of-way, particularly in high-growth areas (e.g. McArthur Highway) and institutional buildings (e.g. new City Hall).			

		6.3 Develop a corridor plan of McArthur Highway with detailed design guidelines to manage and shape land use, development, and design outcomes in order to prioritize a pedestrian-friendly streetscape and public realm through adequate pedestrian facilities.	
	<b>7.0 Make cycling more accessible and convenient.</b>	7.1 Require all new commercial and mixed-use development to provide minimum on-site bicycle storage.	
		7.2 Identify opportunities for retrofitting existing development to add bicycle storage.	
		7.3 Develop a cycling map for the public to know which streets can safely accommodate bicycles.	
	<b>8.0 Reduce traffic congestion.</b>	8.1 Work with the Bulacan Department of Public Works and Highways to ensure all traffic lights within the city are properly working.	

## 5.4 ECONOMY AND INDUSTRY

Establishing a healthy and robust green economy is vital for creating climate smart communities. Economic resilience and development strategies are fundamental for improving the adaptive capacity of Malolos. Identifying and supporting green programs and income generating activities will help to strengthen local resilience to climate change and improve the lives of the most vulnerable. The following set of recommendations to promote the green economy are provided:

- 1.0 Focus on developing the capacity of local industries;
- 2.0 Support climate-proofing of industries;
- 3.0 Improve capacity of local industry to practice sustainable, low-impact production;
- 4.0 Expand green industry and green job opportunities;
- 5.0 Increase the prevalence of local purchasing practices among consumers;
- 6.0 Seek opportunities for local capacity building initiatives.

“Green jobs as work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high- efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution.”

Source: United Nations Environment Programme.<sup>19</sup>

In order to incorporate green jobs and green industry into the planning framework, it is advised that the City adopt definitions so they might help to inform decision-making and policy development.

The City has prioritized small and medium scale enterprises in the City’s CLUP. In order to further this plan, it is recommended that the City not only to continue to support local initiatives, but assist in the greening of enterprises and industries as well. The NCCAP recommends supporting local business as a key strategy for improving economic vitality and resilience. For example, sourcing foods locally contributes to reducing GHG emissions while supporting the local economy.<sup>20</sup> Furthermore, community members are more likely to feel inclined to buy locally sourced goods if it is a priority in their community.<sup>21</sup> Public leadership can support this trend through educational campaigns, tax breaks, or incentives.

Local authorities can further play a role in the promotion of climate-proofing initiatives and sustainable goods production. Related to this, Malolos can support green employment opportunities that benefit the environment and the economy.

As a result of lower catch yields, many fisher-folk in the coastal areas have to resort to alternative labour practices in order to support their livelihoods. Given their vulnerable positions (both socio-economically and geographically), capacity building initiatives are essentially for building resilience. Local economic development and livelihood support programs offer unique opportunities for Malolos to support the most vulnerable. See Section 7.3 for a more in-depth overview of economic assistance supporting livelihoods.

<sup>19</sup> United Nations Environment Programme, *Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World* (UNEP, 2008), [http://www.unep.org/PDF/UNEPGreenjobs\\_report08.pdf](http://www.unep.org/PDF/UNEPGreenjobs_report08.pdf).

<sup>20</sup> C.L. Weber and H.S. Matthews, “Food-Miles and the Relative Climate Impacts of Food Choices in the United States,” *Environment, Science and Technology* 42 (2008): 3508–3513.

<sup>21</sup> G. Seyfang, “Ecological Citizenship and Sustainable Consumption: Examining Local Organic Food Networks,” *Journal of Rural Studies* 22 (2006): 383–395.

<b>5.4 Economy and Industry</b>				
<b>Impact/Opportunity</b>	<b>Recommendation</b>	<b>Action</b>	<b>Associated Benefits</b>	
Economic resilience	<b>1.0 Focus on developing the capacity of local industries</b>	1.1 Continue to support small and medium enterprises.	- Creation of green jobs. - Increased economic resilience. - Increased local capacity.	
	<b>2.0 Support climate-proofing of enterprises.</b>	2.1 Provide incentives and tax breaks for new developments that incorporate climate-proofing and green design.	- See above. - Reduced industrial impact on the environment.	
	<b>3.0 Improve capacity of local industry to practice sustainable, low-impact production.</b>	3.1 Educate industry on how to reduce impacts of production on the environment.	3.2 Provide incentives for green production.  3.3 Increased enforcement of violations related to environmental degradation.	- Creation of green jobs. - Increased economic resilience. - Increased local capacity.
	<b>4.0 Expand green industry and green job opportunities.</b>	4.1 Explore and support multi-sectoral green employment opportunities.		
	<b>5.0 Increase the prevalence of local purchasing practices among consumers.</b>	5.1 Educate residents on the importance of supporting the local economy through the purchase of locally-produced goods and services.		
	<b>6.0 Seek opportunities for local capacity building.</b>	6.1 Explore secure policy frameworks and regulatory options to encourage micro-financing opportunities for vulnerable populations.	6.2 Explore the options for the delivery of credit-related support services (e.g. workshops for skills development and entrepreneurial trainings; technology transfer; and livelihood development programs) to promote micro-financing programs in Malolos.  6.3 Investigate potential donor and/or partner organizations for micro-lending opportunities.  6.4 Explore local opportunities where financial assistance from the Climate Change Commission's Climate Adaptation Support Service program may be applicable.  6.5 Help facilitate the potential benefactor's application process and provide additional assistance where needed if potential Climate Adaptation Support Service program recipients are identified.	



## 5.5 HEALTH AND HUMAN SECURITY

Ensuring the health and quality of life of the residents of Malolos is essential in building climate change resilience. This section looks at a set of recommendations relating to the health and security of citizens with a specific focus on health, nutrition, food security, and housing. Key recommendations include:

- 1.0 Prioritize improved air quality;
- 2.0 Improve access to safe and affordable drinking water;
- 3.0 Ensure vulnerable populations are provided access to foods containing nutrients for climate-related diseases;
- 4.0 Safeguard the lives of informal settlers living in high-risk areas.

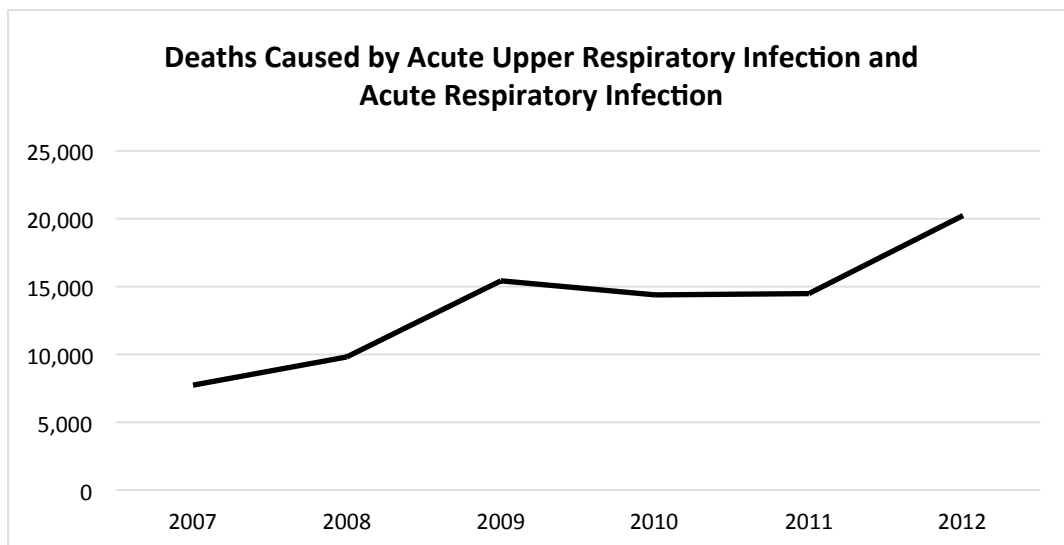
### Disease

According to the 2012 Ecological Profile, the top five causes of morbidity in Malolos include:

- Acute Upper Respiratory Infection (AURI) / Acute Respiratory Infection (ARI);
- Skin Disease;
- Diarrhea;
- Urinary Tract Infection;
- Gastrointestinal Tract Infection.

As demonstrated below, a strong correlation can be made between climate change and incidences of these diseases. As such, climate change action will help to combat these diseases.

ARIs are the number one cause of morbidity in Malolos and cases have been on the rise for the past five years (see Figure 6). High occurrence of ARIs is known to be associated with areas that have poor air quality. ARIs can also be worsened by air pollution and is often more prevalent among children.<sup>22</sup> The NCCAP recognizes the need for enhanced air quality at the national level in the Philippines and has devised long-term action strategies based on the Philippine Clean Air Act of 1999.



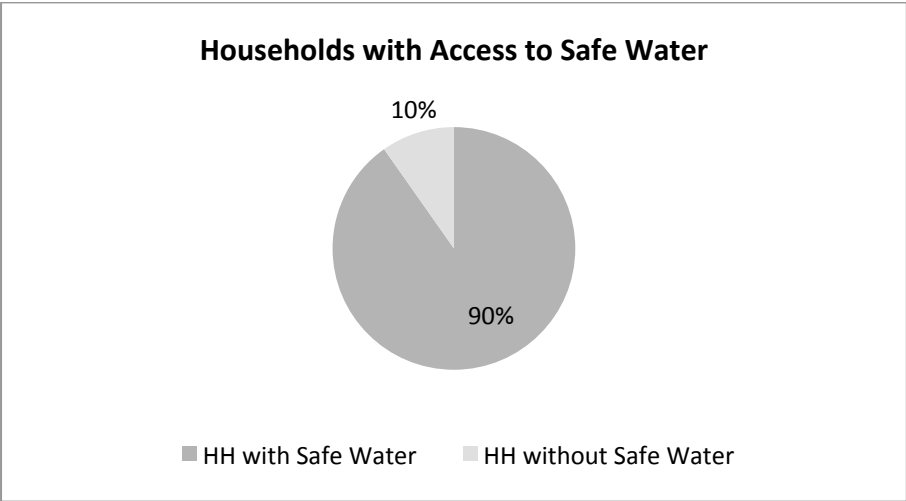
**Figure 6. Deaths caused by Acute Upper Respiratory Infection and Acute Respiratory Infection, 2007-2012. Source: City of Malolos Ecological Profile 2012.**

<sup>22</sup> World Health Organization, "Children's Environmental Health: Air Pollution," WHO, 2014, <http://www.who.int/ceh/risks/cehair/en/>.

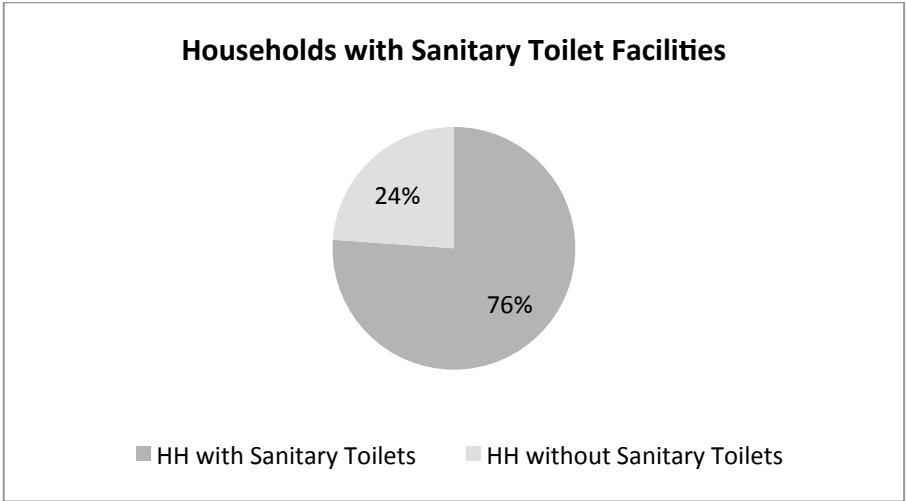
At the local level, the City is pushing for the reduction of motorized vehicle emissions. The City’s Traffic Management Division recognizes the need to address traffic congestion in order to reduce emissions caused by automobiles, jeepneys, and tricycles. For example, the Traffic Management Division is currently working to collect a dataset to determine the highest vehicle emitters in the city.<sup>23</sup> However, it is important that Malolos works to address all sectors contributing to GHGs, including industry. This will require a collaborative effort and data sharing to collect the necessary transportation and industrial emissions before a strategy can be devised.

**Water**

Diarrhea, urinary tract infections, and gastrointestinal tract infections can all be associated with limited access to safe drinking water and poor levels of sanitation.<sup>24</sup> The City of Malolos has a relatively high rate of access to water as 90% of households are connected to the water system (see Figure 7). However, only 76% of households have access to sanitary toilet facilities (see Figure 8).



**Figure 7. Households in Malolos with access to safe water.**



**Figure 8. Households in Malolos with access to sanitary toilet facilities.**

<sup>23</sup> Malolos Traffic Management Division, personal communication, July 8, 2014.  
<sup>24</sup> United Nations Children’s Fund, “Water, Sanitation and Hygiene: Common Water and Sanitation-related Diseases,” UNICEF, 2003, [http://www.unicef.org/wash/index\\_wes\\_related.html](http://www.unicef.org/wash/index_wes_related.html).

The City of Malolos Water District is working to address water shortages by seeking alternatives to the current groundwater system. With this arrangement, there is the concern that access to surface water may result in a significant increase in the concessionaire cost, which may make it challenging for some residents to access safe water in their homes.<sup>25</sup> Continued access to safe and affordable drinking water is an essential part of ensuring the health and resilience of the residents of Malolos.

See Section 7.1 for a toolkit on rainwater harvesting.

### **Nutrition**

In addition to water resources, food and nutrition play an essential role in human health. Malnutrition is recognized as a contributor to diarrhea and gastrointestinal diseases. The consumption of nutrient rich foods can help to combat these diseases.<sup>26</sup> In one of the most vulnerable areas of Malolos, malnutrition is an issue particularly among children.<sup>27</sup> Addressing this issue will help to improve the overall health of residents and strengthen their resilience to climate change.

“For the poor, understanding what the city can and cannot provide and what its constraints are is a first step ... For local governments, this means recognizing the contribution that the urban poor make to a city’s economy and society and involving them in discussions about needs and priorities. Local participation is crucial to ensure that the approach taken suits the needs of residents, and in ensuring quality standards.”

Source: The World Bank<sup>28</sup>

### **Housing**

As the sea level continues to rise, it will be important for the City to plan for the long-term safety and security of the most vulnerable populations particularly those living in high risk areas along the waterways. The 2012 Ecological Profile identifies 550 households as being informal settlers.

As the City works to provide stable housing for these citizens in the future, it will be important to engage in a collaborative and participatory process. This will ensure that the relocation is done in such a way that is respectful and meets the needs of those being resettled, while also working within the bounds of what the City is able to offer them.

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<sup>25</sup> City of Malolos Water District, personal communication, July 8, 2014.

<sup>26</sup> World Health Organization, “Diarrhoeal disease,” WHO, 2013, <http://www.who.int/mediacentre/factsheets/fs330/en/>.

<sup>27</sup> Barangay Captain of Bangkal, personal communication, July 15, 2014.

<sup>28</sup> The World Bank, *Climate Change, Disaster Risk, and the Urban Poor: Cities Building Resilience for a Changing World* (The World Bank, 2011), <http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1306291319853/Summary.pdf>.

<b>5.5 Health and Human Security</b>			
<b>Impact/Opportunity</b>	<b>Recommendation</b>	<b>Action</b>	<b>Associated Benefits</b>
Prevalence of diseases and health conditions related to climate change	<b>1.0 Prioritize improved air quality.</b>	1.1 Conduct a study to identify the primary emitters of greenhouse gases within Malolos, including transportation and industry.	- Improved air quality. - Reduced respiratory illness.
		1.2 Develop a mitigation action plan to reduce greenhouse gas emissions; consider using an incentive-based system.	- See above.
		1.3 Increase the amount of roadside trees and vegetation throughout the city.	- Improved air quality. - Reduced respiratory illness. - Improved soil formation. - Increase in permeable surface area. - Creation of green jobs.
	<b>2.0 Improve access to safe and affordable drinking water.</b>	2.1 Continue to seek alternatives to groundwater supplies to diversify water resources.	- Reduced instances of waterborne diseases. - Improved water security. - Increased sanitation.
	<b>3.0 Ensure vulnerable populations are provided access to foods containing nutrients for climate-related diseases.</b>	3.1 Create an information and education campaign on the importance of obtaining a diverse range of nutrients.	- Improved food security. - Increased community capacity. - Increased overall health of residents.
		3.2 Develop a toolkit for residents on how to obtain a diverse range of nutrients.	- See above.
		3.3 Develop a city-wide home gardening/community gardening program to encourage sustenance farming.	- Increase in permeable surface area. - Improved food security. - Improved soil formation.
	<b>4.0 Safeguard the lives of informal settlers living in high-risk areas.</b>	4.1 Establish a participatory process to develop a long-term plan for resettlement, including the transition period after resettlement.	- Increased human security. - Increased resiliency and improved capacity building.

## 5.6 EDUCATION AND CAPACITY BUILDING

Education and capacity building are key mechanisms for providing a solid foundation for a citizenry that is engaged and active in climate change action. With an increased understanding of the causes of climate change and a personal connection positive attitudinal and behavioral change, the public should feel an increased sense of empowerment in making a positive difference in their city. The following recommendations are made:

- 1.0 Lead by example on climate change action to educate and inspire the public;
- 2.0 Improve climate change literacy and understanding on youth and adults;
- 3.0 Utilize multiple platforms for communications and information dissemination;
- 4.0 Support water conservation practices;
- 5.0 Provide positive reinforcement for participation in waste segregation;
- 6.0 Increase access to proper waste disposal and segregation;
- 7.0 Increase capacity for composting at the barangay and household level.

The City is already providing strong leadership for citizens through the passage of innovative green legislation that demonstrate knowledge of climate change impacts on the city and aims to build capacity. Citizen capacity building can be increased through information and educational campaigns for all age levels. Section 7.4 outlines some options for increasing the effectiveness of public outreach campaigns and incorporating hands-on opportunities for learning while participating in climate change action.

An example of best practice is barangay Canarate's household-level gardening program where seeds are given to every household to encourage local vegetable gardens. Programs like this could be expanded to other barangays within the city to help increase food security and reduce solid waste from purchasing vegetables in disposable plastic wrap.

Other quick start projects that can be implemented to engage the public in climate change action are increasing the amount of waste disposal and recycling bins throughout the city to encourage waste segregation and proper disposal and implementing household level and/or barangay level composting programs. Waste bins should be easy to use and accommodate a variety of waste (see Figure 9).



**Figure 9. Example of a waste bin that accommodate a variety of waste such as bottles.**

Improving waste segregation in the city may be encouraged through a positive reinforcement program. Implementing a household-level incentive program for promoting waste segregation may increase compliance with the ordinance. For example, the Municipality of Calumpit has created a successful waste segregation competition, which could be potentially effective in Malolos.

In borrowing this idea, the establishment of a city-wide waste segregation competition between barangays where the barangay captains are challenged to see who can have the highest segregation rates per household could spark friendly competition around waste segregation. This would:

- Boost barangay moral and community spirit;
- Keep the city clean and beautiful;
- Protect the environment.

Appropriate prizes could be determined through consultation with the barangays.

<b>5.6 Education and Capacity Building</b>			
<b>Impact/Opportunity</b>	<b>Recommendation</b>	<b>Action</b>	<b>Associated Benefits</b>
Public climate-smart behavior	<b>1.0 Lead by example on climate change action to educate and inspire the public.</b>	1.1 Implement waste segregation bins in all City Offices and government-related facilities.	<ul style="list-style-type: none"> <li>- Removal of recyclables from waste stream.</li> <li>- Increase culture of recycling.</li> <li>- Demonstrate leadership.</li> </ul>
		1.2 Implement policy to only purchase food served in eco-containers (e.g. recycled paper products, reusable plastic containers) for city-related activities (e.g. <i>marina</i> ).	<ul style="list-style-type: none"> <li>- Reduction of non-recyclable solid waste.</li> <li>- Demonstrate leadership.</li> </ul>
		1.3 Seek opportunities for green building design and infrastructure in institutional buildings (e.g. solar panels and rainwater harvesting in new City Hall).	<ul style="list-style-type: none"> <li>- Increased green infrastructure.</li> <li>- Demonstrate leadership.</li> </ul>
Community capacity building	<b>2.0 Improve public climate change literacy and understanding.</b>	2.1 Implement information and education campaigns showing link between personal behaviour and climate change.	<ul style="list-style-type: none"> <li>- Increased community support for climate action.</li> <li>- Increased community capacity.</li> </ul>
	<b>3.0 Utilize multiple platforms for communications and information dissemination.</b>	3.1 Develop a communications strategy using social media platforms (e.g. Facebook) to complement and support existing information dissemination.	<ul style="list-style-type: none"> <li>- Larger audience receiving communications.</li> <li>- Increased community capacity.</li> </ul>
Water scarcity	<b>4.0 Support water conservation practices.</b>	4.1 Develop an education campaign to encourage residents to conserve water at the household level.	<ul style="list-style-type: none"> <li>- Reduced impact on groundwater resources.</li> <li>- Reduced impact on drainage system.</li> <li>- Increased community capacity.</li> </ul>
		4.2 Offer rewards and/or incentives to encourage businesses to implement water conservation practices.	<ul style="list-style-type: none"> <li>- See above.</li> </ul>
Waste segregation compliance	<b>5.0 Provide positive reinforcement for participation in waste segregation.</b>	5.1 Create a household-level incentive program for promoting waste segregation.	<ul style="list-style-type: none"> <li>- Removed of recyclables from waste stream.</li> <li>- Reduced environmental risks to marine habitats.</li> <li>- Improved sanitation.</li> <li>- Reduced GHG emissions.</li> </ul>
		5.2 Establish a city-wide competition for barangays to compete for highest segregation rates per household.	
		5.3 Implement education campaign to increase public awareness on environmental, health, and safety issues regarding waste.	

		5.4 Provide increased and convenient for residents to sell their recyclable waste.	
	<b>6.0 Increase access to proper waste disposal and segregation.</b>	6.1 Increase the amount of waste disposal and recycling bins throughout the city to encourage waste segregation and proper disposal.	
	<b>7.0 Increase capacity for composting at the barangay and household level.</b>	7.1 Implement education campaign and workshops related to household level composting (potentially in conjunction with Health and Human Security Recommendation 3.3).	<ul style="list-style-type: none"> <li>- Enrichment of local soils.</li> <li>- Prevention of pollution.</li> <li>- Removal of organic matter from waste stream.</li> </ul>



## 6.0 PLAN IMPLEMENTATION

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In order to address climate change, it is imperative that concrete actions towards climate change adaptation and mitigation are taken now. Local climate change action plans are only effective if they are implemented and championed by strong authority and leadership.

The City is well positioned to build on the foundational work of their LCCAP that was submitted in late 2013 (covering the years 2014 to 2019) to create a more robust, long-term plan for the future. The following key principles should be incorporated within the planning process as the City moves forward.

### 6.1 CORPORATE LEADERSHIP: CITY GOVERNMENT OF MALOLOS LEADING BY EXAMPLE

No plan can be successful without strong corporate leadership at the local government. A commitment from the City Government to act as a role model to the citizens of Malolos is required to educate and inspire the public on best practices.

The City is poised to affect positive city-wide change in climate change action through strong corporate leadership. Political leadership and support was reflected positively in the City staff survey and it will help drive sustainable action within the City. This will ultimately trickle down to the barangay and household level.

One action the City can implement immediately is the use of sustainable packaging for all catering used for City-related functions. Choosing food vendors that provide catering using bamboo and banana leaves (see Figure 10) rather than styrofoam is a relatively simple change that can drastically reduce the amount of non-recyclable solid waste generated by the City.



Figure 10. Banana leaf.

## **6.2 COMMUNITY LEADERSHIP: ROLE OF THE PUBLIC IN CLIMATE CHANGE ACTION**

Active public participation and engagement is vital for true sustainable development. Community and citizen leadership takes time and requires government support for development. Fostering climate leadership occurs through the strengthening of skills, competencies, and knowledge of individuals and communities. The government's role in empowering its citizens will also directly contribute to increasing community resiliency.

Once citizen capacity is built, participatory efforts by the public will support climate planning through:

- Building mutual accountability for both the public and elected officials in climate change action;
- Assisting climate change planning by providing information related to the public's lived and local experience of climate change, particularly important for monitoring;
- Decreasing local vulnerability to climate-related hazards;
- Generating increased public support for adaptation and mitigation efforts through mainstreaming climate change issues into public consciousness.

## **6.3 COLLABORATION**

Collaboration is a key part of planning for climate change and it should be taking place in a variety of ways. Not only should the City seek opportunities for collaboration within City Offices, it should also seek opportunities to pool resources with other governmental, non-governmental, and civic organizations.

### **Intra-governmental Collaboration**

There is the misconception that the responsibility of climate change action planning falls solely with those sectors dealing with environmental or disaster-related issues. However, at the end of the day, it is important to remember that every sector will be impacted by climate change.

All City offices need to be brought into the conversation on climate change action and they should each have input into the long-term planning process. Different Offices may take a different approach to climate change action and there is much to be learned through the process of sharing solutions.

Collaboration between areas within the City Government allows for:

- Knowledge and experience sharing;
- Interdisciplinary solutions;
- Pooled financial and capital resources.

### **Inter-governmental Collaboration**

Climate change is an issue that is addressed by all levels of government given that the impacts span across all geographic areas and areas. In developing solutions to climate-related issues, it is beneficial to take a more comprehensive or regional approach, as opposed to working within the boundaries of local jurisdictions. This allows for solutions to be developed that will address the issues present in an entire system, rather than a select portion of it.

For example, the City is situated within in the Angat River Basin, and as a result faces similar challenges as the other municipalities sharing the watershed. All LGUs located within the Angat River Basin would benefit from a collaborative approach to climate change planning.

The pooling of knowledge and resources would allow for:

- Asset, resource, and knowledge sharing across local governments;
- Strengthened voice in advocating for support from senior levels of government;
- Projects that could be developed and executed at a regional scale.

#### **Extra-governmental Collaboration**

Not only should local governments seek to collaborate with other governmental actors in their region, they should also create opportunities to collaborate with non-governmental actors. This includes non-profit organizations, civic organizations, and the public in general. Benefits include:

- Knowledge of the local context;
- Vested interest in long-term conditions;
- Flexibility to act without direct political implications.

#### **6.4 MONITORING AND EVALUATION**

Monitoring and evaluation are essential, yet often overlooked, features of the planning process. Without effective systems in place for the monitoring and evaluation of plans, no matter how excellent the plan may be, it risks failing to achieve desired goals and outcomes. It is useful to view monitoring and evaluation as central tools for plan implementation:

- **Monitoring** involves the gathering of information and applying indicators to measure the progression and results of the action;
- **Evaluation** involves an assessment of the monitored objectives to evaluate where any enhancements and/or changes can be made for better and more effective results.

Tracking performance provides:

- Evidence of progress and achievement of actions and targets;
- Transparency and communication of results with stakeholders;
- Establishes government accountability;
- Identification of actions that are not progressing well in order to alter and modify them in order to achieve more successful outcomes.

Indicators should be developed for each action in order to track and measure progress. Establish baseline data and identify expected results and indicators for measurement.

The results of monitoring and evaluation can be shared with stakeholders and the public in an easily accessible report on an annual basis.

## 7.0 TOOLKITS AND RESOURCE GUIDES FOR CLIMATE CHANGE ACTION

### 7.1 RAINWATER HARVESTING

#### Why use rainwater harvesting in Malolos?

Rainwater harvesting is a useful tool in supplementing water supply. It can also be seen as a tool to mitigate the impacts of flooding. Malolos is dependent on groundwater as the primary source of water for all of its residents. This dependency carries with it a number of challenges:

- Depletion of groundwater aquifers;
- Saltwater intrusion of groundwater resources;
- Land subsidence.

The City of Malolos Water District is currently exploring options for surface water as a supplementary source of water for the municipality.

“Rising population and urbanisation coupled with climate change may reduce urban water supply in developing countries.”

Source: Unalike Olowoia Aladenola and Omotayo B. Adeboye<sup>29</sup>

Rainwater harvesting addresses issues of water scarcity by serving as a supplementary source of water. However, it also has the potential to capture excess rainwater and reduce the impacts of stormwater on a city’s drainage system. Malolos is located in a watershed that is highly prone to flooding and the City must seek solutions to address excess stormwater. Rainwater harvesting will allow the City to turn rainwater into a useable asset as opposed to a burden.

#### How can rainwater be used?

##### Household Level

Rainwater harvesting is most often used to provide water resources to individual homes in areas where there are water shortages or where water provision is a challenge. This is generally done through the use of rooftop catchment facilities and a cistern located adjacent to the home. Each home is equipped with its own unique filtration system to ensure that the water being collected is potable and is free of debris, particles, and pollutants. These systems must be inspected and maintained regularly to ensure they are providing access to high quality water.

Pros	Cons
<ul style="list-style-type: none"><li>• Low cost maintenance;</li><li>• Easy to monitor and maintain;</li><li>• Flexibility to develop a system that adapts to the site context.</li></ul>	<ul style="list-style-type: none"><li>• High risk of contamination from rooftop gathering;</li><li>• Costly to implement.</li></ul>

<sup>29</sup> O.O. Aadenola and O.B. Adeboye, “Assessing the Potential for Rainwater Harvesting,” *Water Resource Management* 24 (2010): 2129-2137.

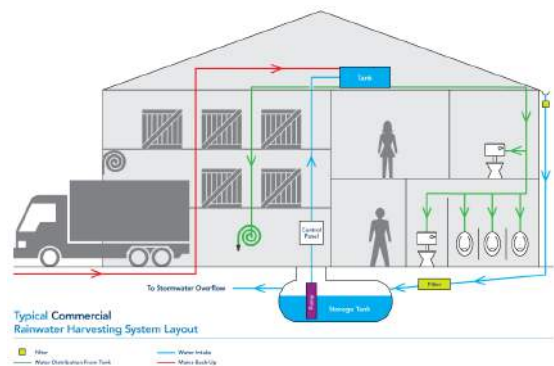
### Community Facility

Some communities choose to build a central rainwater harvesting facility to supply water. In this case, there is a central rainwater gathering site and a distribution system that runs to each of the homes. Filtration takes place at a central location before water is delivered to the homes on the network.

Pros	Cons
<ul style="list-style-type: none"> <li>Useful in context where access to space between residential structures are limited;</li> <li>Beneficial if a central authority or local government oversees the operation and management.</li> </ul>	<ul style="list-style-type: none"> <li>High upfront costs for installation and maintenance;</li> <li>Challenging to maintain and/or add to the water distribution system;</li> <li>Central collection of water can result in high risk of contamination for a large number of users.</li> </ul>

### Commercial and Institutional Buildings

Sometimes financing is not available to collect rainwater and treat it to the extent that it can be used for drinking or cleaning. There are a number of facilities that are implementing rainwater harvesting to reduce their usage of potable water where possible. One of the common uses of rainwater harvesting in major institutional buildings is to gather water for flushing toilets (see Figure 11). Rainwater is also used by many buildings to water gardens or lawns located on site.<sup>30</sup>



**Figure 11. Commercial Rainwater Harvesting System Layout. Source: Rain Catchers Water Harvesting, [http://raincatchers.ie/wp-content/uploads/2011/08/Raincatchers\\_Commercial\\_Schematic.png](http://raincatchers.ie/wp-content/uploads/2011/08/Raincatchers_Commercial_Schematic.png).**

Pros	Cons
<ul style="list-style-type: none"> <li>Minimal filtration needed for non-potable water;</li> <li>Decreases cost of water in the long-term;</li> <li>Reducing water consumption of large buildings has a more significant impact.</li> </ul>	<ul style="list-style-type: none"> <li>High upfront costs;</li> <li>Water may appear dirty as it is not generally treated.</li> </ul>

### Mini Case Study: Hillcrest Community Centre, Vancouver, B.C., Canada

The Hillcrest Community Centre received major retrofitting and renovations leading up to the Vancouver 2010 Winter Olympics. It was designed to incorporate aspects of Leadership in Energy and Environmental Design (LEED) design, including features of water efficiency.

The building is outfitted with low-flush, water efficient toilets. It also has an onsite rainwater harvesting system and the water gathered is used to flush the toilets. By implementing this feature, potable water usage has decreased in the building by about 30%.

Source: [http://greenbuildingbrain.org/buildings/hillcrest\\_centre](http://greenbuildingbrain.org/buildings/hillcrest_centre)

<sup>30</sup> C. Kloss, *Managing Wet Weather with Green Infrastructure: Municipal Handbook Rainwater Harvesting Policies* (US Environmental Protection Agency, 2008), [http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi\\_municipalhandbook\\_harvesting.pdf](http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi_municipalhandbook_harvesting.pdf).

## Additional Resources

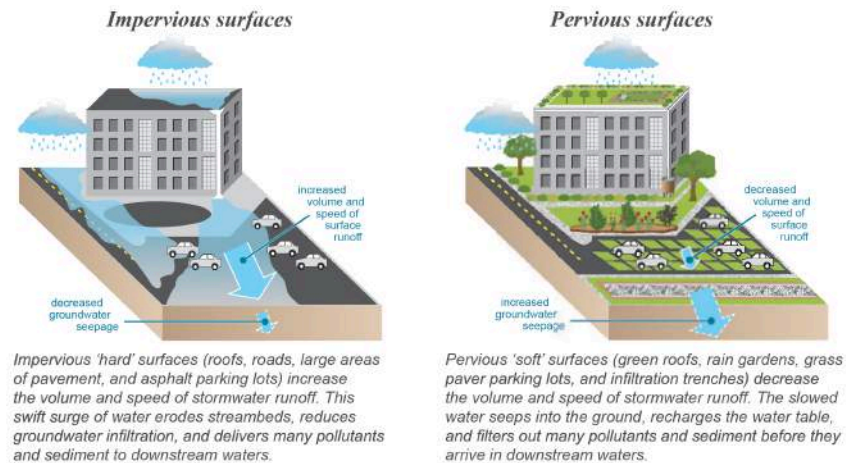
- **Water Aid** has prepared a technical brief that discusses the use of rainwater harvesting at the household level. This document provides an overview of how roof catchment can be implemented as a source of safe drinking water.  
Source: <http://www.wateraid.org/~media/Publications/Rainwater-harvesting.pdf>
- **World Health Organization (WHO)** has prepared a fact sheet with some useful information about the planning of rainwater harvesting facilities. This document provides an overview of different types of rainwater harvesting and the technical considerations involved.  
Source: [www.who.int/water\\_sanitation\\_health/hygiene/emergencies/fs2\\_6.pdf](http://www.who.int/water_sanitation_health/hygiene/emergencies/fs2_6.pdf)
- **United States Environmental Protection Agency (US EPA)** has prepared a guide that discusses the various levels of rainwater harvesting (household, commercial, and institutional). It provides insight into some of the benefits of rainwater harvesting with case studies.  
Source: [http://www.water.epa.gov/infrastructure/greeninfrastructure/upload/gi\\_munichandbook\\_harvesting.pdf](http://www.water.epa.gov/infrastructure/greeninfrastructure/upload/gi_munichandbook_harvesting.pdf)
- **United Nations Environment Program (UNEP)** has compiled a list of case studies of rainwater harvesting from around the world. This list is predominantly focused on household level rainwater harvesting and the use of rainwater as a supplemental source of drinking water.  
Source: <http://www.unep.or.jp/ietc/publications/urban/urbanenv-2/9.asp>
- **United Nations Environment Program (UNEP)** prepared this document with a look at the technical considerations and costs associated with implementing harvesting in South Asia.  
Source: <http://www.unep.or.jp/ietc/publications/techpublications/techpub-8e/rainwater2.asp>
- **Organization of American States (OAS)** has developed a guide that outlines some of the necessary technical considerations that need to be made when implementing rainwater harvesting. It also includes a number of case studies to showcase various harvesting systems.  
Source: <https://www.oas.org/dsd/publications/Unit/oea59e/ch10.htm>
- **Rainwater for Food Security** is an NGO that is exploring the many uses of rainwater harvesting projects around the world. They serve as a facilitator of a network of organizations working on rainwater harvesting and they work to connect potential funders with projects.  
Source: <http://www.rain4food.net/>
- **International Federation of Red Cross and Red Crescent Societies** has been involved in the installation of many rainwater harvesting projects worldwide. Through the collaboration of regional Red Cross organizations and international Red Cross partners, many projects have been developed to support the provision of clean drinking water in areas where water is scarce.  
Source: <http://www.ifrc.org/en/news-and-media/news-stories/asia-pacific/cambodia/a-gift-from-the-skies-rainwater-harvesting-in-rural-cambodia/>
- **International Rainwater Harvesting Alliance** is an NGO serving as a facilitator for leading rainwater harvesting organizations. Their primary activities include lobbying and advocacy for the expansion of rainwater harvesting initiatives. They have also compiled an array of tools to assist with the planning and implementation of rainwater harvesting initiatives.  
Source: [http://www.irha-h2o.org/?page\\_id=19](http://www.irha-h2o.org/?page_id=19)
- **Rain Catchers: Water Harvesting** is a firm located in Ireland that specializes in rainwater harvesting design and installation. Their website has a number of resources related to rainwater harvesting at a variety of scales. This following weblink reviews the basics of a commercial water harvesting system, focusing on the use of rainwater for toilets and on-site irrigation.  
Source: <http://raincatchers.ie/rain-harvesting-systems/commercial/>



## 7.2 STORMWATER MANAGEMENT

### Overview of Permeable Surfaces

Grey infrastructure such as concrete and pavement tend to dominate urbanized and industrial cities. This can lead to flooding or pools of standing water along transportation facilities that interfere with vehicle traffic and pedestrians. In order to address this, many urbanized cities are seeking ways to incorporate permeable surfaces into their infrastructure. These cities are opting to replace impermeable pavement throughout the city with permeable alternatives while others are finding ways to incorporate green infrastructure to help offset flooding (see Figure 12).



**Figure 12. Impervious surfaces vs. pervious surfaces. Source: University of Maryland, [http://ian.umces.edu/press/newsletters/publication/420/stormwater\\_management](http://ian.umces.edu/press/newsletters/publication/420/stormwater_management).**

Many cities in North America are working to replace solid pavement with permeable surfaces. The City of Chicago has numerous ongoing projects testing permeable pavement throughout the city (see Figure 13). They are also converting many of their flood prone alleyways into green alley pilot projects with the use of permeable materials and green design. They have seen favorable results and are expanding these projects across the city.



**Figure 13. Alley incorporating green alley principles. Source: American Society of Landscape Architects, [http://www.asla.org/2011awards/images/largescale/080\\_10.jpg](http://www.asla.org/2011awards/images/largescale/080_10.jpg).**

Portland is another North American city that has been incorporating green infrastructure to combat the pooling water in their streets. Their projects have been heavily based in the construction of rain gardens and swales along city streets to capture rainwater. These pieces of green infrastructure provide a place for built up rainwater to pass into the ground and make its way into the aquifer (see Figure 14).



**Figure 14. Bioswale. Source: City of Portland,**  
<http://www.portlandoregon.gov/bes/50716>.

### Stormwater Management in Malolos

Pooling water and flooded streets occur regularly in the streets of Malolos. This is largely as a result of the prevalence of impermeable surfaces where the water gathers and does not have the opportunity to escape. This prevents it water from passing through the natural filtration system of the soil and making its way back into the water table. Instead, it pools on the surface and creates a breeding ground for waterborne illnesses. It also makes it challenging for pedestrians to pass through the city.



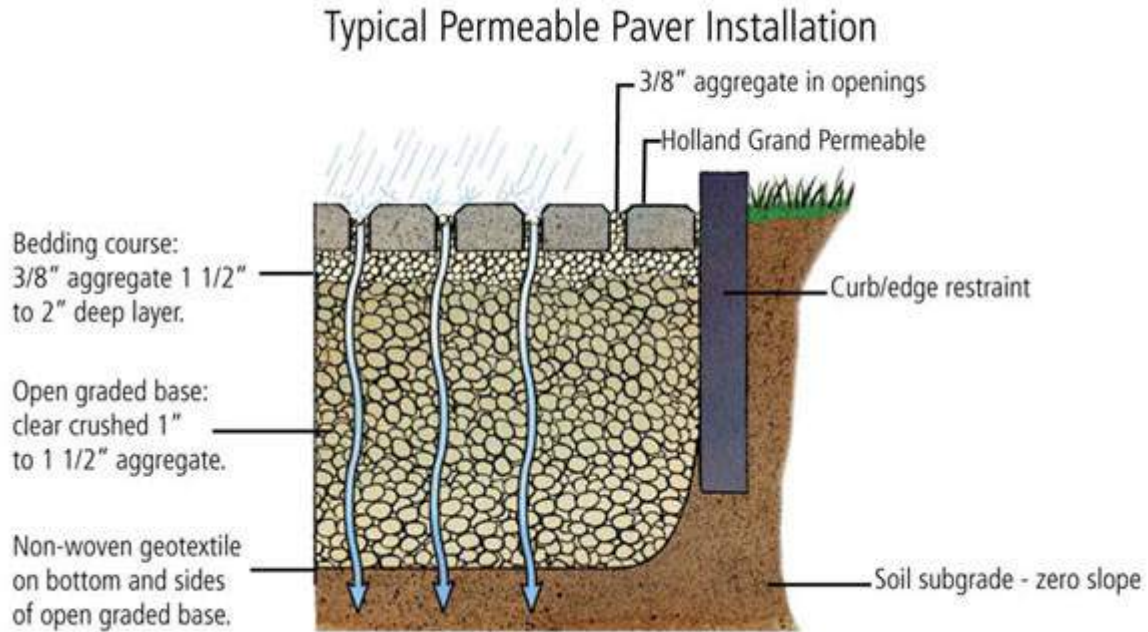
**Figure 15. Pooling water and flooded streets in Malolos. Source: Leanna Leib-Milburn.**

A possible solution to this problem is the use of permeable materials in urban infrastructure. This will help to reduce instances of flooding, preserve and protect infrastructure, improve walkability, and help to beautify Malolos.



## Permeable Paving

Roads, sidewalks, and parking lots are quick to flood in instances of heavy rain. This is because their design tends to be based on solid pavement without space for rainwater to pass through. As pavement deteriorates, it can also result in low points in the infrastructure. This is where water can collect and result in unattractive pools of water.

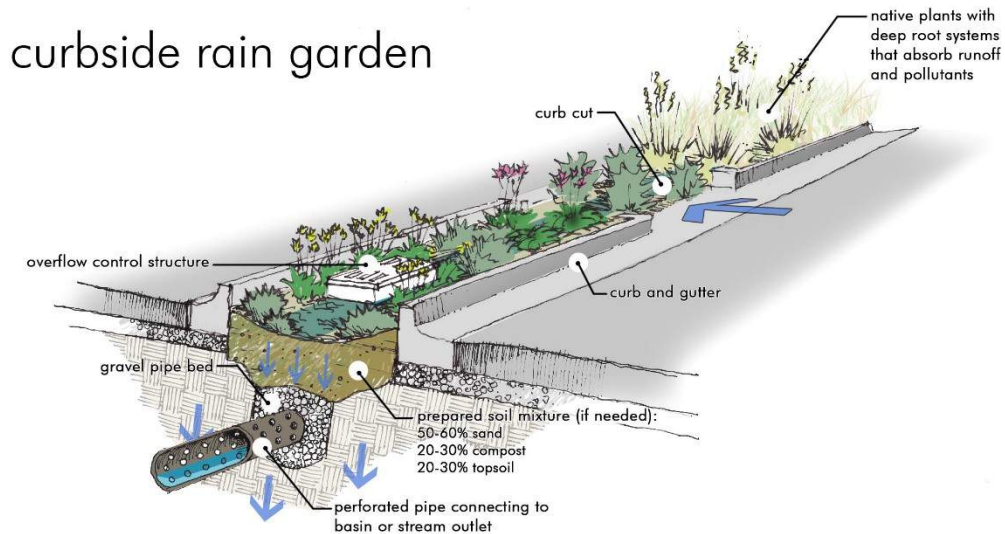


**Figure 16. Permeable paver installation.** Source: Charlestown Community Garden, <http://charlestowncommunitygardensheds.blogspot.com/2011/10/storage-shed-relocation-diagram.html>

Although permeable paving designs can be more expensive at the time of installation, they can reduce long-term maintenance costs (see Figure 16). They can also offset the costs associated with flood-related repairs such as potholes, cracked pavement, and damage to adjacent property.

## Rain Gardens and Bioswales

Rain gardens and bioswales are often used to capture excess water that pools alongside streets. They create a catchment area for rainwater that mimics those that would have occurred naturally.



**Figure 17. Curbside rain garden. Source: Big Walnut Creek Watershed Alliance, <http://bigwalnutwatershed.org/images/bioswale%20enlargement.jpg>.**

Rain gardens have a number of benefits. Not only do they allow excess water to flow into ground water aquifers, they also reduce mosquito-breeding habitat to reduce prevalence of waterborne illnesses.

### Implementing of Permeable Surfaces in Malolos

There are numerous types of permeable surface possibilities and it is important for the City to select the designs that will work best for Malolos. This will require the City to research what options are feasible and then run various pilot projects in different parts of the city. In exploring alternative options, considerations should be made for:

- Design that will complement existing drainage and/or storm sewer infrastructure,
- Materials that are best suited to local conditions;
- Projects that fit within the City's budget.

It must also determine which locations are best suited to pilot these designs through the consideration of:

- Areas that are highly prone to flooding or pooling water;
- Parts of the city with varying levels of vehicular and pedestrian traffic.

**Additional Resources:**

- Information on pervious pavement.  
Source: <http://www.perviouspavement.org/>
- Reviews of alternative types of permeable surfaces including porous concrete, permeable surfaces, and pervious pavement.  
Link: [http://www.concretenetwork.com/concrete/porous\\_concrete\\_pavers/](http://www.concretenetwork.com/concrete/porous_concrete_pavers/)
- Number of helpful resources including an overview of the different types of permeable surfaces that can be used at the household, industrial, and municipal level.  
Link: <http://www.icpi.org/>
- Reviews of different types of stormwater management solutions including permeable pavement and rain gardens.  
Link: <http://www.lakesuperiorstreams.org/stormwater/toolkit/tools.html>
- Lists of a variety of permeable surfaces as well as the associated benefits with installing permeable surfaces.  
Link: <https://www.crd.bc.ca/education/at-home/low-impact-development/permeable-paving>

### 7.3 ECONOMIC DEVELOPMENT, FINANCING, AND CAPACITY BUILDING

Since 1991, decentralization has placed a great deal of pressure on local governments to support their communities. Due to constricted budgets and limited resources, local authorities often find it difficult on how to provide assistance to competing interests.

For example in the vulnerable coastal areas of Malolos, the local fishing community is already feeling the effects of climate change. In a stakeholder interview, a local fisherman reported observed changes in marine temperatures as the water temperatures increase. Due to lower catch yields (which may be attributable to warming waters and ocean acidification<sup>31</sup>), the fisherman revealed the fishing community is resorting to alternative labour practices such as building dikes and sea walls for fishponds.

The fisherman identified a locally and cooperatively owned fish processing plant on Namayan and assistance in developing the entrepreneurial skills needed for embarking on this business endeavor as a major resource in climate change adaptation. They reported the City has been particularly supportive in supplying the local fishing community with fishing nets required for their livelihood. However, gaining access to the financial capital to support starting a Namayan fish processing plant is a significant barrier.

Local economic development and livelihood support programs are essential components of capacity building. Specifically, the NCCAP states that:

The [LCCAP] implementation strategy, therefore, follows the precautionary principle and assumes a pro-active stance by building the adaptive capacity of men and women in historically high risk areas. Because the poor are generally less able to cope and recover from shocks, be it climate-related or economic, then increasing the adaptive capacity of the poor should be a priority.<sup>32</sup>

In supporting the economic development of the most vulnerable, the City can play a strategic role in building resiliency for the most marginalized. Supporting economic development does not necessarily have to occur through direct welfare and funding. A variety of opportunities exist for helping to build a sturdy economic base for the city's most vulnerable.

#### Microcredit

Microcredit schemes create opportunities for poor and disadvantaged groups to gain access to financial lending support that is not otherwise available. The aim of microcredit programs is to improve livelihoods and increase income for marginalized groups, particularly those in the agricultural and fishery sectors located in rural areas.

- While governments are strongly *discouraged* from participating in micro-financing programs, they do play an important role in creating a hospitable atmosphere for micro-lending to occur. Through secure policy frameworks and **the creation of legal and regulatory environments that encourage micro-financing**, governments can improve the operational settings for donors to work within.
- The **delivery of public support services and initiatives that build capacity help potential micro-credit recipients** in accessing micro-credit programs and in managing credit funded projects. More specifically, the delivery of credit-related support services, such as workshops related to skills development and entrepreneurial trainings, technology transfer, and livelihood development programs, are significant mechanisms for LGUs to promote micro-financing programs locally.

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<sup>31</sup> The World Bank, *Turn Down The Heat: Climate Extremes, Regional Impacts, and the Case for Resilience* (The World Bank, 2013), [http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/06/14/000445729\\_20130614145941/Rendered/PDF/784240WPOFull00D0CONF0to0June19090L.pdf](http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/06/14/000445729_20130614145941/Rendered/PDF/784240WPOFull00D0CONF0to0June19090L.pdf).

<sup>32</sup> Philippine Climate Change Commission, *National Climate Change Action Plan 2011-2028* (Republic of the Philippines, 2011), 43.

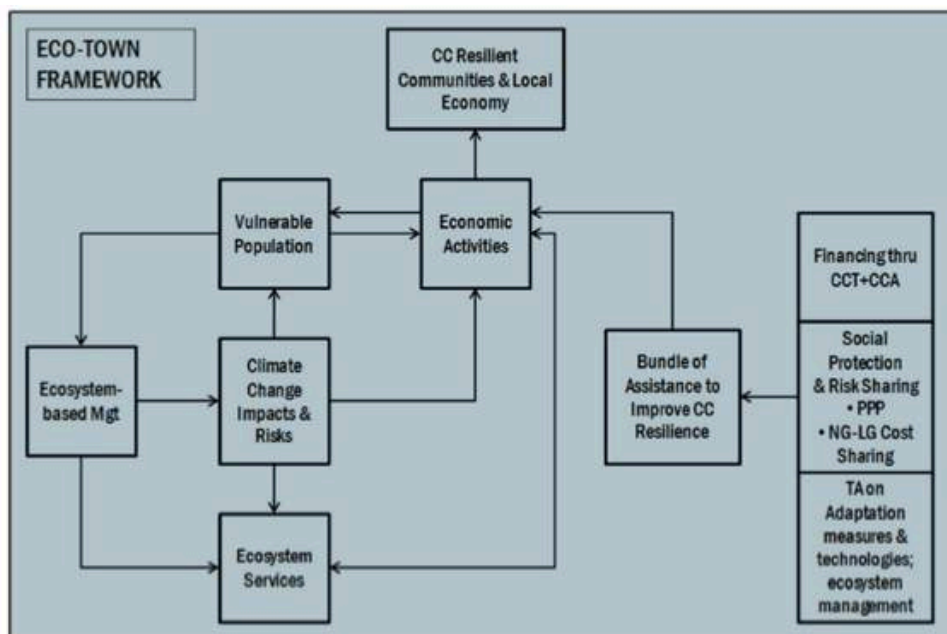
- Governments also play **an important managerial role in ensuring that the appropriate stakeholders are involved** in the microcredit process. Additionally, good governance can help to identify administrative capabilities of potential donor or partner organizations.

### Climate Adaptation Support Service (CASS)

The Philippine Climate Change Commission has been actively involved in the development of Climate Adaptation Support Service (CASS), a financial assistance program with the specific intent of supporting communities in becoming resilient to the effects of climate change, alternatively referred to as ecotowns.<sup>33</sup>

CASS is modeled after conventional conditional cash transfer programs, which aim to reduce poverty through providing financial assistance to persons who meet conditions and requirements set by the bestowing agency. The conditions set in the CASS system include a demonstration of financial need—individuals or families living below the poverty line at risk of climate change related impacts and a requirement to ecosystem preservation and/or rehabilitation. An example of this would be that CASS recipients living in at-risk coastal areas may be required to follow through with and participate in household-level waste management.

The CASS falls into the NCCAP’s Ecotown Framework that seeks to build environmentally and economically sustainable communities through poverty alleviation and ecological protection.



**Figure 18. Philippine Ecotown Framework.**

[The framework] also illustrates that climate change poses risks to the population, some of whom are more vulnerable to the risks than others. Climate change can also affect the goods and services provided by ecosystems. Degraded ecosystems will be less resilient to climate change and extreme events. Conversely, healthy and stable ecosystems can lessen the impacts of climate change. The ecotown therefore, targets assistance to vulnerable men and women in communities, ensure that a package of

<sup>33</sup> “At the local level, implementation of the [local climate change] action plan will be packaged using the concept of ecologically stable and economically resilient towns or ecotowns. An ecotown is a planning unit composed of municipalities or a group of municipalities located within and in the boundaries of critical key biodiversity areas (forest, coastal/marine and fishery, or watersheds), highly vulnerable to climate change risks due to its geography, geographic location, and poverty situation” Ibid, 42.

assistance is provided for sustainable livelihood activities, ecosystems (such as forests, coastal areas, fisheries, and urban/built up systems) are protected.<sup>34</sup>

### **Cooperatives**

Cooperatives are autonomous organizations composed of individuals who voluntarily cooperate for their mutual social, economic, and cultural benefits. Cooperatives run on a people-centered business model.

Due to the self-governing nature of cooperatives, governments are discouraged from managing and controlling these types of organizations. Local authorities can, however, be effective participants in providing assistance to help stimulate cooperative enterprises and create enabling conditions for developments to thrive. Providing adequate support to mobilize involvement and enable inclusion can be difficult. The challenge leaders face in enabling participation is providing adequate support, be it “material, moral and political,” without “taking-over” or “tutoring.”<sup>35</sup>

Governments can also play a vital role in supporting cooperative development through providing strong legal environments that protect the self-governing nature of these organizations. Voluntary membership, participant control, and autonomy can all be fostered through practical regulation. Furthermore, LGUs can be of assistance by nurturing coordination between stakeholders. Adopting policies and legislation that support the development of fair and equitable relationships, institutional connections, and formal frameworks for facilitating cooperation are essential.

### **Public-Private Partnerships**

Public-Private Partnerships (PPPs) are a form of business venture jointly established between government and private sector offering advantages to the public sector. PPPs work as key strategies in securing sustainable local development. The Philippines Public-Private Partnership Centre define PPPs as a:

Contractual agreement between the Government and a private firm targeted towards financing, designing, implementing and operating infrastructure facilities and services that were traditionally provided by the public sector. It embodies optimal risk allocation between the parties – minimizing cost while realizing project developmental objectives. Thus, the project is to be structured in such a way that the private sector gets a reasonable rate of return on its investment.<sup>36</sup>

Key elements of PPPs include:

- A contractual agreement between the public sector and the private sector;
- Shared risks and resources;
- Value for Money;
- Outcome orientation;
- Acceleration of the infrastructure provision and faster implementation.

Whatever the chosen mechanism for providing avenues for economic development, financial support, and capacity building, it is vital that Malolos is conscious of the most vulnerable sectors of their population. Understanding *who* and *what* is at risk will help to inform Malolos how to best provide support. Planning for climate change includes building a strong and economically healthy local economy. As Malolos strives to adapt to a changing climate, a reduction in socio-economic vulnerability is necessary.

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<sup>34</sup> Ibid, 43.

<sup>35</sup> A. Cornwall, “Unpacking ‘Participation’: Models, Meanings and Practices,” *Community Development Journal* 43, no. 3 (2008): 282.

<sup>36</sup> Philippine Public-Private Partnership Center, *Developing Public-Private Partnerships in Local Infrastructure and Development Projects* (Republic of the Philippines, 2010), [http://ppp.gov.ph/?page\\_id=5779](http://ppp.gov.ph/?page_id=5779).

## 7.4 YOUTH ENGAGEMENT AND EDUCATION

Youth make up approximately thirty percent of the world's population. As a result, youth engagement and education surrounding climate change is key to sustainable development.

In Central Luzon, of which the city of Malolos is included, the rates of youth aged 0-14 years have remained between 32% and 35% from 2000 to 2010 according to the Census.<sup>37</sup> Creating learning resources on climate change and sustainability that can be shared and implemented by educators, government agencies, and youth is an important step moving forward.

Strategies for youth engagement in climate change and educational curriculum and pedagogy regarding climate change were identified through stakeholder interviews and focus groups with:

- Kabataan Progresibong Malolenyo (KPM);
- Sangguniang Kabataan (SK) Youth Council;
- Canalate Elementary School;
- Namayan Elementary School.

The Kabataan Progresibong Malolenyo have 300+ members between the ages of 17 and 25. Currently, they have 38 appointed officers for individual barangays in Malolos. They are a non-governmental youth organization that is pro-environment and works towards implementing programs and projects for the welfare of the youth and general citizens of Malolos.

The Sangguniang Kabataan is not officially operating in Malolos at this time. The organization was put on hold prior to the 2013 barangay elections. When active, the SK represented youth aged 15 to 17 with an elected representative for each barangay.

Youth representatives identified that youth in Malolos get the majority of their information on climate change through their school, mass media, and social media. Filipino culture dictates that youth show their educators a high degree of respect. When educators speak, students will listen as a sign of reverence. It is imperative that educators have up-to-date information on climate change that can be delivered in a relatable way to youth in all levels of the educational system.

Youth representatives also reported that they learn best when they are engaged in active learning methods such as activities instead of traditional lectures. Activities should be practical and related to lived experience. Teachers in Malolos have adapted their teaching styles to include project-based learning where youth can practice hands-on skills while learning about climate change through a personal connection with the environment. Projects include:

- Collecting plastic recyclables and turning them into reusable shopping bags;
- Planting small gardens at the school that can be harvested to provide snacks for the students;
- Planting gardens in the trash to model the impact that solid waste has on crops;
- Reusing glass bottles in art projects to create decorative vases.

In addition to educational activities focused on climate change, other participatory options for engagement include games, role-playing scenarios, and challenges/competitions. Games can be used for youth of all ages from elementary to university. For example, the Red Cross Climate Centre has created a number of climate

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<sup>37</sup> Philippine National Statistics Office, *Region III Quickstat for June 2014* (Republic of the Philippines, 2014), [http://www.census.gov.ph/sites/default/files/attachments/ird/quickstat/region%2003\\_7.xls](http://www.census.gov.ph/sites/default/files/attachments/ird/quickstat/region%2003_7.xls).



change games for all ages that are free to the public and easily accessible online (<http://www.climatecentre.org/site/games>).

Utilizing games as a means of engaging youth has a number of benefits:

- Participatory games speed up learning by generating dialogue around climate change by forcing players to take action;
- Conversations that take place during games can be easily related to real world events and occurrences;
- “Game play itself can accelerate learning about common errors; this can help people link early warnings with early action in the real world.”<sup>38</sup>

Research has found that participatory games accelerate learning, dialogue, and action surrounding climate change action.<sup>39</sup> Games have the ability to translate abstract, complex concepts in a tangible way. Connecting climate change risk to real world scenarios that youth can connect with is vital for relevant and meaningful engagement for youth.

In an analysis of 52 climate change games, research found that most games deal with local and global mitigation issues and not adaptation.<sup>40</sup> If the goal is to increase youth educational capacity surrounding both climate change adaptation and mitigation, then the City may want to consider creating participatory games for youth that incorporate adaptation planning components. See Table 18 for steps in participatory game design.

**Table 18. Six steps for participatory game design.**<sup>41</sup>

Steps	Implementation
1. Define the communications challenge.	Purpose of game is to stimulate climate change dialogue.
2. Define the key elements.	Ensure each game element has both potential benefit and consequence.
3. Define the emotional triggers of the narrative.	Design game to stimulate dialogue between players on how they can work together to achieve the best possible outcomes as a team.
4. Refine game dynamics or process.	Design the game to played for several rounds without the effects of climate change. When climate change is added, increase the consequences for actions.
5. Develop rules.	Create rules that have the potential to affect individual and collective decision making strategies to simulate real world climate change scenarios
6. Play!	Encourage fun during the game but also ask reflective questions to encourage dialogue surrounding climate change education.

Role-playing scenarios offer another avenue for engaging with youth in a participatory manner. Giving younger generations the opportunity to play the role of decision-makers and think through the possible outcomes of their decisions can help them to empathize with the challenges faced by real world decision-makers.

<sup>38</sup> Carina Bachofen, Pablo Suarez, Margot Steenbergen, and Natasha Grist, *Can Games Help People Manage the Climate Risks They Face? The Participatory Design of Educational Games* (Red Cross/Red Crescent Climate Centre), <http://www.climatecentre.org/downloads/File/Games/AW-wps-games-v5.pdf>.

<sup>39</sup> Ibid.

<sup>40</sup> D. Reckien and K. Eisenack, "Climate Change Gaming on Board and Screen: A Review," *Simulation & Gaming* 44, no. 2-3 (2013): 253-271.

<sup>41</sup> Ibid.



A study on the participatory simulation of land-use changes in the northern mountains of Vietnam through role-playing found that:<sup>42</sup>

- Role-playing simulations served as effective ice breakers;
- Allowed the researchers to build trust between groups easily;
- Allowed game players to go beyond typical responses and contribute their own points of view.

In addition to games and roleplaying, personal challenges may foster the same kind of competitive spirit and make climate change action fun and experiential for youth. For example, the *Extreme Lifestyle Change: The 20% Challenge* challenges participants to consume 20% less in their lives.<sup>43</sup> Strategies include spending less money, saving electricity, and increasing volunteer time in the community. Many of the suggestions can be implemented by youth and if they challenge their friends to compete, this role modeling behaviour can spread throughout their social networks.

The youth respondents also commented on how youth tend to focus on technology and not climate change, so the challenge is to connect the two topics. Social media and video game technologies provide opportunities for collaboration. Youth respondents identified that one effective way of reaching youth is through social media platforms such as Facebook, YouTube, and Instagram. Many youth in the Philippines have access to cellphones and/or smartphones where they can access the internet and receive event invitations and news information online.

Research shows that, “young people’s preferences for more interactive Web-based features echo previous research in the field of civic education, which indicates that traditional, passive learning techniques such as memorization and recitation tend to be ineffective in the classroom.”<sup>44</sup>

There are already a number of resources available online to engage with youth. YouTube hosts a number of educational videos related to climate change. There are also songs and music videos surrounding climate change. One unique way the City can engage Filipino youth regarding climate change is to create a Tagalog climate change karaoke song and post it on YouTube. English climate change songs with lyrics already exist online and may serve as a template (<http://youtu.be/C78KE5iGtg4>).

Another possibility for engagement is getting youth to make documentaries and videos about topics they are passionate about. A climate change video competition hosted at school may create the drive for youth to learn more about climate change while producing an electronic teaching tool that can be shared through online networks to reach large numbers of youth.

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<sup>42</sup> J.C. Castella, T.N. Trung, and S. Boissau, “Participatory Simulation of Land-use Changes in the Northern Mountains of Vietnam: The Combined Use of an Agent-based Model, a Role-playing Game, and a Geographic Information System,” *Ecology and Society* 10, no. 1 (2005): 27.

<sup>43</sup> Mark Apel, Lauren McDonell, Jay Moynihan, Darien Simon, and Viviane Simon-Brown, *Climate Change Handbook: A Citizen’s Guide to Thoughtful Action* (Oregon State University, 2010), <https://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20080/CEO4bClimateGuide.pdf?sequence=4>.

<sup>44</sup> C. Bachen, K-M Raphael, K.M. Lynn, and J. Philippi, “Civic Engagement, Pedagogy, and Information Technology on Web Sites for Youth,” *Political Communication* 25, no. 3 (2008): 290-310.

“To change things, you must first start with yourself. ... I believe that I can make a difference and create change. I can be a better member of society.”

— Youth member of Kabataan Progresibong Malolenyo

Other creative means to communicate with the public can be through infographics. Infogr.am (<http://infogr.am>) is a website that allows users to create simple, but highly engaging graphics. They also offer data visualization webinars online.



**Figure 19. Example of an infographic.**

For public planning events, Poll Everywhere (<http://www.polleverywhere.com>) is an engagement tool that can be used to both see if your audience is understanding the material and increase active participation.

Poll Everywhere has the ability to create a question that the audience can respond to during an event by either text message (international text numbers are available), tweets via Twitter, or signing in to the web interface and posting a message online. The responses show up live on a screen and can be displayed as:

- Ticker tape response with the messages scrolling along the screen;
- Dialogue box format in which speech bubbles pop up with responses in the order they are received;
- Word cloud format in which identical responses are grouped together and shown as larger words on the screen.

All three display methods are highly effective at engaging the audience and encouraging participation in a discussion.

### **Additional Resources**

- Red Cross Climate Centre, <http://www.climatecentre.org/site/games>
- Climate Interactive, <http://www.climateinteractive.org>
- “Transforming Climate Change Education through Serious Games and Participatory Approaches,” [http://systemdynamics.org/PhD\\_Colloquium/26th/s/juliette.pdf](http://systemdynamics.org/PhD_Colloquium/26th/s/juliette.pdf)

### **7.5 BEHAVIOUR CHANGE AND COMMUNITY-BASED SOCIAL MARKETING**

Traditional approaches to climate change engagement and education are based on a deficit model that assumes the public has a gap in understanding climate change concepts. As a result, interventions to promote sustainable behavior are often based on the assumption that by improving the knowledge of an issue through programs such as mass media campaigns, behavior will change.

In practice, information-based campaigns are often not effective. This is because they do not target barriers preventing people in making more sustainable and climate-smart choices. Community-based social marketing is a method to promote behaviour change by identifying barriers (perceived or real) and addressing those barriers.

### **Additional Resources**

- **Fostering Sustainable Behaviour: Community-Based Social Marketing** contains the online version of the book by Doug McKenzie-Mohr and resources appropriate for local government to use.  
Source: <http://www.cbsm.com/public/world.lasso>

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## **APPENDIX A: STAKEHOLDER INTERVIEW LIST**

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Formal stakeholder interviews and focus groups are presented below chronologically by area.

### **City Government of Malolos**

- Mayor, Vice Mayor, and City Administrator with staff representatives from City Engineering Office, City Agriculture Office, City Social Welfare & Development Office, Traffic Management Division (July 2, 2014)
- City Administrator (July 7, 2014)
- City Planning & Development Office (July 7, 2014)
- Traffic Management Division (July 7, 2014)
- City Health Office (July 7, 2014)
- City Economic and Enterprise Development Office (July 7, 2014)
- City Vice Mayor Office (July 8, 2014)
- City of Malolos Water District (July 8, 2014)
- City Agriculture Office (July 11 and 14, 2014)
- Vice Mayor (July 14, 2014)

### **Barangay Captains and Council Members**

- Canalate (July 9, 2014)
- Longos (July 9, 2014)
- Pamarawan (July 11, 2014)
- Namayan (July 11, 2014)
- Bangkal (July 15, 2014)

### **Community and Civic Society**

- Namayan Elementary School (July 11, 2014)
- Fishermen from Namayan (July 11, 2014)
- Kabataan Progresibong Malolenyo (July 15, 2014)
- Sangguniang Kabataan Youth Council (July 21, 2014)
- Canalate Elementary School (July 21, 2014)

Data was also collected through informal conversations with residents of Malolos and other government officials in the City Government of Malolos and the Provincial Government of Bulacan.

## APPENDIX B: STAKEHOLDER INTERVIEW QUESTIONS

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### Vulnerability Assessment:

- **What climate-related weather changes have you observed?**  
Anu-ano pong pagbabago-bago ng klima o panahon ang inyong napapansin?
- **How are those changes affecting your daily life?**  
Anu-ano po ang mga epekto ng pagbabago-bago ng klima o panahon sa inyong pang-araw-araw na buhay?
- **How are you adapting to those changes?**  
Ano po ang inyong mga ginagawa para maging matatag sa mga nararanasan ninyong pagbabago-bagong ito?

### Adaptation Responses:

- **Tell us about your experience during the most recent “calamity” in your community?**  
Paki-lahad po ang inyong karanasan tuwing may kalamidad sa inyong komunidad?
  - **How did your community respond?**  
Papaano po tumugon ang inyong komunidad kung may kalamidad?
  - **What went well?**  
Anu-ano po ang mga nangyaring magaganda?
  - **What did not go well?**  
Anu-ano naman po ang mga nangyaring hindi maganda?
  - **What would have been useful to have had in place?**  
Ano po sana ang mayroon kayo o nagawa ninyo para kayo ay mas nakatugon nang mahusay sa kalamidad?
  - **What did you learn from your experience?**  
Anu-ano po ang inyong mga natutunan or leksiyon mula sa inyong karanasan?

### Gaps for Adaptation

- **What is missing in your community that you would like or need to help you adapt?**  
Anu-ano pa po ang kulang o maari pong gawin pa ng inyong komunidad para matulungan kayong maging matibay laban sa pagbabago-bago ng klima?

### Assets for Adaptation:

- **Where are the valuable places in your community?**  
Anu-ano po ang mga lugar na natatangi o mahahalalaga sa inyong komunidad?
- **Who are the important people in your community?**  
Sino-sino po ang mahahalagang tao sa inyong komunidad?
  - **Who are the local champions in your community?**  
Sino-sino po png mga lokal na kampion, mga taong masisigasig sa pagtulong na inyong pinagtitiwalaan sa inyong komunidad?
- **What else is important to your community?**  
Anu-ano pa po ang mahahalaga sa inyong komunidad?
- **What does your community do well/what are your strengths in terms of climate change adaptation?**  
Anu-ano po ang magagandang ginagawa ng inyong komunidad para maging matibay laban sa pagbabago-bago ng klima?
- **When there isn’t an impending disaster such as flooding or drought, are you thinking about climate change? If so, then how or what are you thinking about?**  
Kung wala pong nagbabatang sakuna tulad ng pagbaha o tagtuyot, iniisip ninyo po ba ang Climate Change o kakaibang pagbabago ng panahon. Kung oo po ang inyong sagot, papaano po ninyo iniisip ninyo; ano po ang naiisip ninyo?

## APPENDIX C: PLANNING AND POLICY ANALYSIS – COMPREHENSIVE LAND USE PLAN

Cluster	Goal	Objective	Target	Connection to Climate Change
Agricultural Sector (Farming, Livestock and Poultry, and Fishing)	Improve the economic conditions of farmers	-	-	<ul style="list-style-type: none"> <li>- Establish economic resiliency of farmers</li> <li>- Farmers livelihoods dependent on healthy agricultural sector, which is heavily influenced by climate change</li> </ul>
		Optimize utilization of crop lands through multiple cropping and intercropping	-	<ul style="list-style-type: none"> <li>- Biodiversity is essential to prevent crop devastation that may come as a result of diseases or dramatic changes in climate</li> </ul>
		To increase livestock and poultry production	-	<ul style="list-style-type: none"> <li>- Economic resiliency of farmers</li> </ul>
		To expand fishpond production and attain self-sufficiency in fish	-	-
			Increase yield in agricultural crops from 85 cavans to 100 cavan for the period of 1996-2001.	<ul style="list-style-type: none"> <li>- Could place stresses on the environment (i.e. excessive use of water, land use, etc.)</li> <li>- May also provide increased food security</li> <li>- Importance of diversity of crops yielded, so not dependent on one singular crop</li> </ul>
			Increase vegetable production from backyard to semi-commercial scale.	<ul style="list-style-type: none"> <li>- Should have a variety of ways to access vegetables, whether through backyard production and commercial scale</li> <li>- Having sustenance farming taking place can tie into food security</li> </ul>
			Increase livestock production by at least 10% a year.	<ul style="list-style-type: none"> <li>- Increased economic resiliency of farmers</li> <li>- Type of livestock is important because some livestock's are high stress on the environment (i.e. cattle farming uses a lot of water)</li> </ul>
			Increase fish production through development of swamps and marshes.	<ul style="list-style-type: none"> <li>- Creation of green space and permeable surfaces</li> <li>- Organic fish production should be made a priority to reduce stresses on the environment, as well as to prevent damaging the health of those consuming fish.</li> <li>- Ensure that the community is not dependent on only fishing as a source of livelihood - economic diversity</li> </ul>
Commerce	To increased the level of trading and commercial activities in the municipality through improvement of business district.	-	-	<ul style="list-style-type: none"> <li>- Any growth and development has to take into account their external impacts on the environment - green growth should be promoted - pollution, foot print, etc.</li> <li>- Locally sourced trading and commercial activities should be prioritized over external to develop local economic capacity.</li> </ul>
	To promote and cleanliness measure for the market to effectuate available and wholesome commercial area for everyone.			<ul style="list-style-type: none"> <li>- Continue promoting locally produced goods and services</li> <li>- Green development/Green growth</li> <li>- Areas of foot traffic only in CBD</li> </ul>



			To construct/repair existing provincial roads for immediate transport of goods from adjacent municipalities to encourage prospective inventors	<ul style="list-style-type: none"> <li>- Consider the infrastructure in the upgrade - seek permeable options (i.e. permeable concrete, etc.)</li> <li>- In the encouragement of investment, ensure that the environment is made a priority in all developments for long-term, social-economic and sustainable growth</li> </ul>
Industry	To develop and carry out an efficient and comprehensive program to stimulate support and develop small and medium scale industries in the municipality.	-	-	<ul style="list-style-type: none"> <li>- Climate friendly industries should be prioritized over non-climate friendly industries</li> <li>- SMEs build local economic strength for resiliency</li> <li>- Industry should be placed in locations that are low-risk for flooding/disaster</li> <li>- Should embed industrial zoning in the land use plan</li> </ul>
		Promote and develop cottage, small and medium scale industries which make use of available local materials.	-	-
		Encourage private and government agencies to invest in cottage, small and medium scale industries in the municipality.	-	-
			To increase the number so industrial establishment within five years.	- Industrial growth is beneficial to an urbanizing city. However, other forms of land use need to be taken into consideration (i.e. it is important to continue supporting agricultural development to ensure local food security, etc.)
Educational and Culture	To establish a fine physical environment for the municipality's educational system that will give equal opportunity to everyone to attain intellectual excellence.	-	-	- The building should be constructed with climate change in mind (i.e. built on high ground to resist flooding, resistant to disaster, etc.)
		To make the educational system an effective agent of agent of change to develop mentally fit and morally health citizenry.	-	-
		To improve the curriculum and instructions.	-	<ul style="list-style-type: none"> <li>- Expand school programs to teach children how to live sustainably (i.e. backyard gardening, recycling, etc.)</li> <li>- If possible, include programs teaching children about climate change and how to reduce their impacts</li> </ul>
			To reduce the number of out-of-school-youth.	
			To acquire through donation additional instructional materials and textbook within the next five (5) year.	
			Improvement/repair of identified dilapidated school building within the next five (5) year.	- Any building renovations should be done so in a 'green' manner (i.e. non-toxic building materials and paints)
	To sponsor seminar workshop for school teacher every year.	- Yes, including climate-related seminars		

Health and Nutrition	To improve and safeguard the general health condition of town's population.	To set up more nutrition program to generally improve nutrition especially among children	-	<ul style="list-style-type: none"> <li>- Could promote locally-sourced organic food; educate on the impacts of fast-food and food from international markets</li> <li>- Include lessons on food security</li> <li>- Promotion of foods that contain the nutrients that combat climate-related diseases (i.e. Vitamin A deficiency)</li> <li>- Education on how food consumption behaviour impacts the environment (i.e. beef - high water use)</li> </ul>	
		To inform the sanitation of the environment especially the water supply and waste disposal system.	-	<ul style="list-style-type: none"> <li>- Education on where waste goes (all waste goes somewhere)</li> <li>- Inform how health is impacted by unsound environmental behaviour (i.e. educate on water cycle and how toxic waste can affect your health)</li> </ul>	
		To develop and construct health infrastructure needs and to upgrade the equipment needs of the rural health units and hospitals.	-	<ul style="list-style-type: none"> <li>- Connection between health and socio-economic status (inextricably linked with health risks associated through the environment; improving health services will improve the health of all, including the most marginalized).</li> <li>- Construct hospitals in a safe location</li> <li>- Ensure hospital is participating in proper waste disposal</li> </ul>	
			To continue maternal and child care services rendered.	-	- Combatting child mortality through climate-related illnesses
			To continue the nutrition program.	-	- See above
			Establishment of day-care centers.	-	- Sounds locations and sustainable infrastructure
			Conduct barangay health workers training programs. Acquire more medicine for the needy.	-	- Educate health workers on climate-related illnesses and diseases
Social Welfare Services	To serve fully the families/individuals belonging to the bottom poor of the populace thereby uplifting the living condition.	-	-	<ul style="list-style-type: none"> <li>- Serving marginalized populations should include providing a healthy environment</li> <li>- Living conditions include: access to clean water, clean air, etc.</li> </ul>	
		To promote social and economic advancement of the needy youth who are mostly out-of-school.	-	-	
		To intensify services rendered by the welfare organization of the municipality.	-	-	
			Provide supplemental feeding to all malnourished children in every barangay.	-	- In feeding the malnourished, ensure that the food being provided is not only good for the children's' health, but also for the environment
			Provide employment to at least 60% of the out-of-school youth and disabled persons.	-	- Continue with CT program

Housing/Shelter	To improve housing needs of the municipality.			<ul style="list-style-type: none"> <li>- Ensure all new housing is constructed in a safe area, away from sea level rise, etc.; be conscious of climate impacts in all new developments</li> <li>- Be conscious of materials being used; sustainable materials in housing construction</li> </ul>
		To provide credit assistance for housing with low amortization rate and longer repayment period		<ul style="list-style-type: none"> <li>- Also, provide support/credit assistance for sustainable building practices.</li> </ul>
			Improvement of 150 dilapidated housing within 1996-2001.	<ul style="list-style-type: none"> <li>- With the improvement of houses: sources sustainable building materials, non-toxic paints, etc.</li> </ul>
Environmental Management	To upgrade the living condition of the people through proper environmental management in the community.	-		-
	To maximize cultural, social and economic benefits through an orderly and controlled development of environmental resources.	-	-	<ul style="list-style-type: none"> <li>- Do so without exhausting existing environmental resources; be conscious of the impacts of benefitting from environmental resources</li> </ul>
		Optimize the use of surrounding resources for the welfare of the resident.		<ul style="list-style-type: none"> <li>- Social, economic and environmental development should be balanced to promote sustainability</li> <li>- Poetizing the welfare of the residents while at the same time optimizing the welfare of the environment</li> </ul>
			Maintenance of beautification and cleanliness drive in all barangays the whole year round.	<ul style="list-style-type: none"> <li>- Beautification, cleanliness, and environmental health</li> </ul>
			Construction of more sophisticated toilet facilities especially in remote areas	<ul style="list-style-type: none"> <li>- Should incorporate proper waste management/sewage treatment; low impact on environment</li> </ul>
Sports and Recreation	Promote physical fitness and sports as a part of the residents up lift men	-	-	-
	To improve all sports facilities and encouragement of other sports than the common favorite ones.	-	-	<ul style="list-style-type: none"> <li>- Developed in an eco-friendly way</li> </ul>
		To encourage continuous sports programs annually in the municipality.	-	-
			To construct at the three (3) sports facilities especially in the remote barangays.	<ul style="list-style-type: none"> <li>- Facilities need to developed in an eco-friendly way; with climate change in mind</li> </ul>

			To renovate and improve all dilapidated sports and recreational facilities.	- Outdoor sports facilities should be designed to incorporate permeable surfaces
Protective Services	Maintain a safe, peaceful and orderly of the community and minimize it not totally avoid accidents of crime and fire.	-	-	-
		To increase the awareness of community residents with regards to fire prevention techniques/measures.	-	- Connection between wildfires - continually educate and enforce non-incineration policies - Preventative measures of early detection and reporting of wildfires *
			To organize a fire fighting unit by hiring at least 50% firemen for the period 1992-1998. To conduct a regular fire drills/lectures on the prevention of fire in places of public assembly.	- Incorporate education on how humans can have negative impacts on the environment through incineration or the starting of wildfires
Transportation	Design comprehensive circulation system necessary to support all other development activities.	-	-	- Goal should include references to low to zero emission transportation (i.e. active transport such as walkability) - Improved circulation should be explored hand-in-hand with reduced emission - Should include not just development, but citizen safety and health
		To lessen if not totally eliminate congestion, increase safety, provide greater service and reduce pollution.	-	- Reduce emissions as well
			Improve the inter-barangay, linkages to enhance a better relationship and communication among the residents of Malolos as well as in trade and commerce.	- Should also look at ways to improve environmental health and sustainable - As well as the enhancement of more sustainable transportation options - Ensure that transportation system continues supporting livelihoods (i.e. roads resistant to flooding)
Telecommunications	Provide all means of communication facilities and services.	-	-	-
		Improve postal services by expansion of post office staff and provision of adequate service facilities.		- Ensure that telecommunications system is "climate proof"
Water	Provide adequate and potable water supply in all barangays of the municipality.	-	-	- Continue working on potable water options
		Construct water facilities in priority depressed barangays as a means to improve the health and economic conditions of the populace.	-	- Important to do this through the exploration of alternative sources of water (i.e. rainwater harvesting)

Power	Improve the electrical services to enhance development in the social and economic aspects of the municipality.	-	-	- Ensure to seek sustainable sources of electricity (i.e. renewable resources such as solar power, etc.)
		Served all households without electricity and eventually provide all amenities derived from it.	-	- See above

## APPENDIX D: PLANNING AND POLICY ANALYSIS – COMPREHENSIVE DEVELOPMENT PLAN

Cluster	Mission	Issue	Goal	Action	Connection to Climate Change
Health	Social Development Plan	Lack of health stations (BUHL)	One health station per barangay	-Build 4 new BHU	Climate change is causing rising levels of communicable diseases. More health clinics and licensed doctors are required to help mitigate the effects of climate related and disaster related diseases.
		Lack of doctors and medical equipment		-Employ 10 doctors and obtain medical equipment	
		Lack of public hospital in Poblacion area and Industrial Area		-Build Public General Hospital (long-term plan to build two hospitals)	
Social Welfare	Social Development Plan	Lack of daycare centers and dedicated staff	-Compliance with the Early Childhood and Care Development Law -Dedicated Budget line for social services	-Build 4 new daycare centers and employ at least 1 permanent teacher	-Ensure buildings are climate proof. Seek options for sustainable development. -Incorporate environmental education into curriculum at daycare.
		Lack of social housing	-Relocate the informal settlers in Barangay Balayong	-Provide social housing for homeless.	-Ensure buildings are climate proof. Seek options for sustainable development.
Education	Social Development Plan	Insufficient library services	-Library on wheels program for coastal barangays	-More books for all educational levels	-Ensure vehicle used for library on wheels meets emissions standards
Housing	Social Development Plan	Some residential areas do not have access to clean drinking water	Sufficient and sustainable access to clean and safe water by all residents	-Centralize provision of water supply (promote connections to a centralized water distribution center) -Information and Educational campaigns of the danger of unsustainable water extraction practices	Unregulated groundwater extraction is not a sustainable practice and will cause a depletion of the available water. If too much water is extracted for too long, the source could collapse on itself.
Sports and Recreation	Social Development Plan	Lack of recreational facilities	Provision of recreational facilities	-Enter into partnerships with private institutions	-Ensure recreational facilities are climate proof. Seek options for sustainable development.
Public Order and Safety	Social Development Plan	Limited police force and stations	More police visibility	-Use Barangay security force to augment police force -provision of vehicles (such as bicycles) to facilitate increased mobility of officers	Using bicycles rather than fossil fuel burning vehicles reduces harmful emissions and the carbon footprint.

Agriculture	Economic Development Plan	<p>1) Declining productive areas for parlay (rice) due to:  a) absence of CLUP  b) poor enforcement of zoning ordinance  c) private investments = indiscriminate business structures</p>	<p>1) High production of crops, livestock, poultry and fishery  2) Utilization of organic feeds and other farm inputs by farmers  3) Elevate the quality and distinctive taste of local sweets and delicacies</p>	<p>1) Modernization of the agricultural sector: a) Preserve lands according to crop suitability; b) Production support and post harvest facilities; c) Production support for livestock and poultry; d) Organize farmers and fishermen into economic interest groups  2) Update land inventory  3) Rehabilitation of irrigation facilities  4) Provide modern farm inputs  5) Provide post harvest facilities</p>	<p>"Fertile lands were forced to become idle due to the installation of infrastructures that resulted to the difficulty if not total absence to the access of water supply due to the disconnection of the land from the irrigation system." Effective irrigation systems can incorporate the use of rainwater harvesting systems. Increased rainfall in the area due to climate change could be captured to increase crop production. Preserving agricultural lands is also vital to climate change planning as these lands help to reduce runoff and flooding in areas. Preserving agricultural lands also contributes to increased food security.</p>
		<p>3) Fragile and vulnerable fishing due to:  a) absence of appropriate waste management system (especially on the coast)  b) indiscriminate dumping of garbage and waste into the river from commercial and residential sources</p>			<p>Improper waste management is exacerbated by climate change with extreme weather conditions causing flooding. Solid waste ends up polluting the fisheries.</p>
		<p>Marginalized labour force of Malolos City due to the competition of employment opportunities by non-residents</p>			<p>Transient employees flocked the City due to available public transportation thus making Malolos highly accessible even to non-resident. This transportation should be</p>

					looked at with a climate change lens (monitoring emissions, leaded vs. unleaded fuel).
			Tourism		Eco-tourism options
Interconnected	Physical/Infrastructure Development Plan	Inefficient water transport system	Improve water transportation system	Maximize the use of rivers as alternative routes. Implementation of river rehabilitation.	Storm surge, sea level rise, and typhoons all affect water transportation systems. These environmental factors should be considered when planning to improve water transport systems.
		The current public transport system within the poblacion is dispersed and often inaccessible		Offer incentives for PUV's to locate in a common area via increased travel management personnel	The current public transportation system employs the use of leaded vehicles with high emissions. Future transportation planning should explore the use of hybrid vehicles, unleaded fuel products, and controlled emissions.
		Unwalkable streets due to vehicular/pedestrian conflicts	Walkable City	Strict implementation of the building code for easements, setbacks and sidewalks	Walkable cities reduce the need for fossil fuel powered vehicles that contribute to climate change.
		Decay of historic and cultural treasures in Malolos	Implement urban conservation plan	Implementation of preservation of old historical facades.	Establishing development controls to guide/regulate/revitalize the built up area of public utilities should consider climate change to ensure areas are climate proof.
		Numerous traffic choke points	Efficient vehicular traffic; sufficient and efficient drainage, utility, and sewer system	-Implementation of easement law -Creation and implementation of traffic flow plan -Develop road hierarchy	Increased vehicular traffic contributes to increased emissions and consumption of non-renewable fossil fuels that affects climate change. Reducing emissions and the number of fossil fuel burning vehicles should be considered in



					planning.
		Absence of sewage/waste water disposal system		-Strict implementation of DENR requirements for subdivision sewerage treatment facility -Provision of wastewater treatment facility for highly populated buildings and for the community	Ensuring a continued adequate supply of water requires the implementation of effective solid waste management plan. This also ensures that untreated sewage will not end up in waterways that are already vulnerable due to climate change impacts. Untreated sewage also produces emissions that contribute to climate change.
		Absence of a comprehensive traffic system	Better Traffic Flow	-Develop comprehensive traffic management program	Improvement of the road network should consider low-lying areas that are vulnerable to climate change in the plan (i.e.: avoiding floodplains).
		Haphazard location of land uses	Proper Zoning	-Formulate a city open space plan -Identify and develop in-city resettlement sites	- Determine an urban expansion area to accommodate future growth should consider the preservation of green space that will prevent runoff, flooding and potentially provide food security in the end if the green space is agricultural in nature. - Resettlement sites should be climate proof.
Environment	Environment Development Plan	High garbage generation without MRF in place	One MRF in each cluster	-Information and education on recycling	Recycling helps to conserve raw materials and energy. Since it takes less energy to recycle a product than to create a new one green house gas emissions from factories can be reduced.

		Absence of waste water facilities for some industries and lack of monitoring skills for waste generation	Industry equipped with waste water facilities	-Community monitoring system for industry wastewater pollution	Proper treatment of wastewater is essential to avoid exacerbating the effects of climate change on the water table
		Insufficient catchment facilities for rainwater runoff	Rainwater facilities per community	-Dredging of creeks along flashflood prone areas	Utilizing rainwater catchments can decrease water extraction from the aquifers.
		Lack of trees along river and creek easements to serve as erosion control	Abundance of trees to serve as a natural absorber	-Plant a tree project -Clean and Green Contest for communities	Trees reduce soil erosion, absorb runoff, and purify air by converting CO2 into oxygen.
		Unregulated groundwater extraction	Regulation of groundwater extraction for individual residents and establishments	-Information and education campaign -Strict enforcement of groundwater extraction regulations	Unregulated groundwater extraction is not a sustainable practice and will cause a depletion of the available water. If too much water is extracted for too long, the source could collapse on itself.
		Minimal presence of mangroves	Restore mangrove areas	-Mangrove planting for communities within coastal barangays	Planting mangroves along the coastal barangays increases the health of the aquaculture environment (juvenile habitat for fish species), improves air quality, and serve as a natural dyke.

**APPENDIX E: PLANNING AND POLICY ANALYSIS – EXECUTIVE LEGISLATIVE AGENDA**

Cluster	Mission	Issue	Goal	Objective	Connection to Climate Change
Environment	To make Malolos the cleanest and greenest city in Central Luzon	-	-	-	Being resilient to climate change is an integral part of becoming a green city; Planning for climate change provides a host of numerous benefits and co-benefits that supports making a city clean and green
		Air: Continuing air pollution	Controlled air pollution	-	Air pollution often consists of GHG emissions, which contributes to climate change
				To plant at least 100 trees per month	Trees help reduce stormwater runoff and flooding; Trees absorb carbon and help clean the air; Trees provide shade reducing the need for air conditioning and help reduce the urban heat island effect
				To minimize air pollutant generators	Air pollution often consists of GHG emissions, which contributes to climate change
				To apprehend smoke belchers	Air pollution often consists of GHG emissions, which contributes to climate change; Smoke belchers, particularly along transportation routes from motor vehicles, reduce air quality and health outcomes and increase the onset of respiratory-related illnesses
				Set industry standard (ISO) on environment	See above
		Land: Low compliance on waste management	To fully comply with RA 9003 (Solid Waste Management Act)	-	Effective solid waste management supports climate change mitigation by reducing emissions at waste sites; Effective collection diverts waste from ending up in environmentally sensitive areas
				To effect an effective household based segregation system	Effective segregation supports improved waste recycling or reuse, reducing potential GHG emissions at landfills; Waste that is collected means waste that does not end up in environmentally sensitive areas such as streams and rivers, potentially contaminating water supplies
				For all barangays to have functional MRFs	See above
				Effective collection system	See above

				To deputize volunteer eco-police in all barangays	See above
		Water: Continuing water pollution	Clean water for all	-	
				To implement septage and sewerage policies	Effective seepage and sewerage policies ensures high water quality in order to continue to provide safe and accessible water supply resilient to impacts from climate change
				To control aquaculture	The viability of aquaculture may be threatened due to the impacts of climate change, so climate change should be factored into decision-making for aquaculture planning
				To improve irrigation management	Effective irrigation management should be conscious of ensuring the sustainability and integrity of water supplies that does not jeopardize providing a safe and accessible water supply
				To mandate water treatment facilities in all subdivisions and industries	Water treatment ensures high water quality in order to continue to provide safe and accessible water supply resilient to impacts from climate change
Social	To empower the citizenry through economic self-sufficiency by providing global standard and employable technical education and skills development trainings	-	-	-	Exploring opportunities for "green jobs" can support technical education to enable economic self-sufficiency while protecting the environment
	Promote healthy lifestyle and sports development increase preventable diseases, prevent premature death through effective and efficient health services	-	-	-	Contributors to climate change (e.g. air pollution-related GHG emissions) impede healthy lifestyles; Climate change impacts can significantly affect the health of residents such as reduced air quality from higher temperatures, reduced water supply, an increase in the spread of diseases
	To promote social welfare services by providing prompt and appropriate assistance to vulnerable sectors of society	-	-	-	Vulnerable sectors of society experience the greatest socio-economic impact from climate change and are traditionally least able to adapt and underrepresented in climate change planning

		To maximize utilization of available resources	To provide quality services to five vulnerable populations (Senior Citizen; Persons with Disability; Indigent Family; Solo Parent; Out of School Youth)	-	Vulnerable sectors of society experience the greatest socio-economic impact from climate change and are traditionally least able to adapt and underrepresented in climate change planning
				To provide global standard and employable technical education and skills development planning	See above
				To decrease preventable diseases	See above
				To fully computerization	-
				To provide appropriate assistance to vulnerable sectors of the society	See above
				Implementation of laws and continuous services	Climate change planning requires successful and effective implementation of laws, particularly environmental standards to be upheld; Municipal service provision will adversely impacted due to climate change and will require considerations of the impacts of climate change on how services will need to be modified and/or adapted
Economic	To ensure quality infrastructure, sustainable agriculture and fishery, tourism, arts and culture, and employment	-	-	-	Climate change has considerable potential to negatively and severely impact economic sectors, particularly vulnerable sectors, that have not been climate proofed; many sectors have high potential to adopt more sustainable practices to support climate change mitigation

	To maximize income generation through proper management of logistics both human and material resources, well-defined urban planning and the formulation of programs and policies that will ensure the effective delivery of services	-	-	-	Fundamentally, smart practices of climate change planning are also by nature smart practices for urban planning in general; The costs of climate change-related impacts greatly outweigh the costs and resources of climate change adaptation
		Low performance of equipment's and machine used (particularly in the dredging of rivers and creeks) due to prolong lifespan	To improve the performance of equipments and machines	-	Equipments and machines may have to be used more frequently due to climate change-related impacts, for example climate change will increase flooding events causing more sedimentation, thus exacerbating the need for more frequent dredging shortening lifespans of equipments and machines and adding to procurement costs
				To procure new equipments and machine	See above
		Unstoppable development of agricultural lands to residential and commercial uses	To preserve highly productive agricultural lands which are not yet reclassified	-	Loss of agricultural land jeopardizes food security which is further exacerbated by climate change impacts that are affecting current food supply such as aquaculture and livelihood opportunities; Agricultural land help reduce runoff and flooding and act as carbon sinks -- preserving agricultural lands is crucial for climate change planning
				To formulate Comprehensive Land Use Plan (CLUP)/Zoning Ordinance	An up-to-date, strong, and implementable CLUP should provide clarity on good land use practices that support climate change planning such as retention of agricultural lands and promotion of compact, mixed-use urban form
	Rampant illegal fishing operation	To stop illegal fishing operation	-	Minimizing illegal fishing operations is important for maintaining fish stock integrity, however climate change can severely impact ecosystem health and introduce a significant amount of risk regarding the sustainability of fish stocks if collapsed, would have severe social and economic impacts	

		Low tourists arrival; Lacks tourism destinations amenities; Below standard tourism	To generate and increase revenues on culture and tourism	-	Climate change has considerable potential to negatively and severely impact features of the city that contribute to tourism, which would impede the ability of the government to generate revenue; There is significant opportunity to pursue sustainable ecotourism in order to support climate change planning and local economic development
				To develop and provide facilities and renovate tourist destinations - shrines, landmarks and heritage houses	Climate change can severely impact or render inaccessible tourist facilities and destinations, so climate proofing facilities and destinations needs to be considered in ensuring the integrity of these cultural assets
				To institute yearly cultural activities to entice tourists	See above
				To legislate tourism code of the city	
				To aggressively promote Malolos in the local and international settings	See above
		Lack of inter-department coordination	To have a regular monthly meeting with all departments.	-	Climate change planning is a multi-sectoral effort requiring sustained, strong, and effective coordination across multiple municipal departments in order to achieve positive climate change planning outcomes
				To come up with an Executive Order and/or ordinance that will define the parameter of responsibility of every department concern	Each department should be able to explicitly identity their contribution to climate change planning and/or climate change planning-related efforts
		Low revenue from income generating facilities	To maximize revenue of income generating facilities	-	Income generating facilities can be severely impacted by climate change and should be climate proofed in order to ensure sustainability of income generation
				To pass ordinances relating to revenue generation	See above

Administrative			To be one of the best economic and financial managers in the country by promoting sound management of public resources in its entirety	-	Climate change has significant economic and financial implications whether from the costs of climate change adaptation or recovering from climate change-related impacts -- sound management of public resources must necessarily consider climate change in planning and decision-making processes
				Lead the government in attaining its goals	Climate change should be a principal planning goal for the government given the city's vulnerability to the effects of climate change
				Excellent expenditure management	See above
				Maintain fiscal health and stability	See above
				Put public resources to its most financial use	Many climate change planning actions can be considered "low regrets" action -- actions that enhance a city's adaptive capacity, reduce its vulnerabilities, and deliver broad community benefits regardless of climate change impacts -- low regret actions address immediate community development issues while contributing to climate change planning to create win-win situations
				Persons entrusted with public funds are held accountable	Persons entrusted with public funds ultimately serve the needs of the people and thus should consider the impacts of climate change in planning and decision-making processes
				Non-performing employees due to partisan politics	To establish and maintain exemplary performance in providing the best services to Malolenyos



				To prioritize services on transportation sector, elderly sector, farmers and fisheries sector, business sector, youth and women sector	Vulnerable sectors of society experience the greatest socio-economic impact from climate change and are traditionally least able to adapt and underrepresented in climate change planning
				Maintain and institutionalize Internal Audit within the City Government of Malolos	
				Regular monitoring of productivity and accomplishments of employees and officials	Successful climate change planning should be inspirational and be positive -- monitoring and celebration of accomplishments is good practice for promoting the benefits of climate change planning
		Apathetic attitude of the community non-performing barangay officials	-	-	Effective climate change planning is sensitive to local knowledge, so well-performing barangay officials should be empowered in order to contribute to successful climate change planning
				Regularly coordinate w/ Barangay Officials and empower the community in the execution and implementation of PPAs	See above
				Institutionalized and regularly implement the Bayanihan sa Barangay Program	
				To have close coordination to the community in the implementation of ZWM	
				Establish more effective and sustainable Livelihood Programs and Projects which can alleviate poverty among the different sectors of the community	Climate change will adversely impacts sources of livelihoods for residents and prevent poverty alleviation; Livelihood Programs and Projects must consider the impacts of climate change in assessing their sustainability and viability
				Employ more skilled and competent employees to provide well-balance real property appraisal and realistic property valuation	More accurate data can feed into climate change planning such as mapping potential property losses from climate related hazards

		Less-productive employees (issues on reliability, lack of cooperation and passive attitude of employees)	Instill integrity in the performance of duties and functions Integrate responsiveness and being pro-active of every employee Inculcate collaboration and synergy in the work process of the CHM	-	-
				Provide employees with appropriate training programs/seminars	Lack of knowledge about climate change planning practices is often cited as a barrier to successful climate change planning and implementation

## APPENDIX F: CITY STAFF CAPACITY SURVEY

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**PANIMULA:** Ang mga mag-aaral mula sa University of British Columbia sa Vancouver, Canada, kasama si Dr. Nora Angeles, ay nagsasagawa ng pananaliksik sa mga pagpapalano para sa *climate change* sa Lungsod ng Malolos. Ang paglahok sa pagsusuring ito ay tanging boluntaryo lamang at ang pagkakakilanlan ng mga tugon ay ganap na mananatiling lihim. Ang pagkumpleto ng pagsusuring ito ay mangangailangan ng humigit-kumulang na 5-15 minuto ng inyong oras. Mangyaring ipaalam sa mga mag-aaral kung mayroon kayong mga katanungan o mga bagay na kinakailangan ng paglinaw.

Ang mga resulta ng pagsusuring ito ay makakatulong sa Pamahalaan ng Lungsod ng Malolos sa mabisang pagpapalano nito laban sa mga masamang epekto ng *Climate Change* at sa pagtupad nito sa pambansang kautusan na maglaan ng isang *Local Climate Change Action Plan*.

Kokolektahin ng mga mag-aaral ang mga papeles na ginamit sa pagsusuri mula sa inyong departamento/tanggapan sa susunod na araw. Maraming salamat po!

1. Saang Department/Office po kayo nagtrabaho sa City Government ng Malolos?

2. Gaano na kayo katagal nagtrabaho sa City Government ng Malolos? Paki-check po ang tamang sagot.

Kulang ng 1 taon                       4-6 taon                       Mahigit 10 taon  
 1-3 taon                               7-9 taon

3. Ilang taon napo kayo? Paki-check po ang tamang range ng inyong gulang.

Kulang ng 15                       25-29                       40-44                       55-59  
 15-19                               30-34                       45-49                       60-64  
 20-24                               35-39                       50-54                       65-69

4. Ano po ang inyong Kasarian?

5. Saang Lungsod o Munisipyo po kayo nakatira?

6. Saang Barangay ng inyong Lungsod o Munisipyo po kayo nakatira?

7. Ano po ang inyong pagkakaunawa o depinasyon ng *climate change* (o kakaibang pagbabago-bago ng ating klima o panahon)?

8. Magbigay po kayo ng LIMANG SALITA na inyong nauunawaan bilang kasama o kaakibat ng *climate change*? (Pwede pong English o Tagalog.)

9. Gaano po kahalaga para sa inyo na ang inyong Local Government Units (LGUs) ay magpatupad ng mga plano para sa *climate change*. Bilugan po ang inyong sagot: 1 bilang HINDI GAANONG IMPORTANTE hanggang 5 bilang PINAKA-IMPORTANTE.

1                      2                      3                      4                      5

10. Gaano kadalal ninyo nakikita ang epekto ng *climate change* sa inyong trabaho? Bilugan po ang inyong sagot.

Sobrang Dalas                      Madalas                      Paminsan-minsan                      Bihira                      Hindi Kailanman

11. Ranggo kung saan mas may pagkakataon na maisulong sa loob ng inyong sariling departamento/tanggapan ang pagpapalano para sa *climate change* o pagsuporta sa mga gawain na may kaugnayan sa pagpapalano para sa *climate change*? Gamitin po ang numerong 1 bilang PINAKA-IMPORTANTENG larangan pataas hanggang 6 bilang HINDI GAANONG IMPORTANTE.

- Karagdagang pananalapi (halimbawa, pagba-budget)
- Karagdagang mga tauhan (halimbawa, mga empleyado)
- Pinahusay na mga datos at sapat na pagkolekta ng mga ito
- Pinahusay na kaalaman at kadalubhasaan sa pagpapalano para sa *climate change*

- Pagbibigay importansiya ng inyong departamento/tanggapan sa pagpapalano para sa *climate change*
- Mas malinaw na pagtukoy sa mga tungkulin ng inyong departamento/tanggapan sa pagpapalano para sa *climate change*

**12. Ranggo kung saan mas may pagkakataon na maisulong sa labas ng inyong departamento/tanggapan ang pagpapalano para sa *climate change* o pagsuporta sa mga gawain na may kaugnayan sa pagpapalano para sa *climate change*? Gamitin po ang numerong 1 bilang PINAKA-IMPORTANTENG larangan pataas hanggang 6 bilang HINDI GAANONG IMPORTANTE.**

- Karagdagang suporta mula sa pamahalaang panlalawigan
- Karagdagang suporta mula sa pambansang pamahalaan
- Pinahusay na komunikasyon, pakikipagtulungan at koordinasyon sa pagitan ng iba't ibang departamento/tanggapan
- Pinahusay na kaalaman at kadalubhasaan ng pamahalaang panlungsod sa pagpapalano para sa *climate change*
- Pagbibigay importansiya ng Pamahalaan ng Lungsod ng Malolos sa pagpapalano para sa *climate change*
- Pinahusay na kamalayan at suporta ng publiko sa pagpapalano para sa *climate change*

## APPENDIX E: CITY STAFF CAPACITY SURVEY RESULTS

The mode is reported and not the mean here in order to show the most common value reported. If a “-” is reported, there was no mode available.

*Rank where you see the most opportunity for growth INTERNAL/WITHIN to your department/office in doing climate change planning or supporting climate change planning-related activities. Use 6 as the most important and 1 being the least important.*

Office/Department	Increased financial resources (e.g. budget)	Increased human resources (e.g. staff)	Improved data and adequate data collection	Improved knowledge and expertise about climate change planning	Prioritizing climate change planning in your department/office	More clearly identified role and function of your department/office for climate change planning
Sangguniang Panlungsod	5	-	2	4	-	-
Office of the City Mayor	2	1	3	-	6	-
Office of the City Vice Mayor	2	1	3	6	6	5
Office of the City Administrator	3	1	2	6	5	4
City Assessor Office	2	1	4	6	3	3
City Budget Office	2	1	3	6	2	4
City Planning & Department Office	2	1	4	6	5	4
City Legal Office	-	1	-	6	-	-
City Social Welfare & Development Office	5	1	3	4	5	6
City Engineering Office	2	1	3	5	1	3
City Health Office	4	1	2	6	5	6
City Agriculture Office	2	1	3	4	6	5
Business Permit and Licensing Division	6	1	2	3	4	5
Department of the Interior Local Government	-	1	-	-	-	-

*Rank where you see the most opportunity for growth EXTERNAL/OUTSIDE to your department/office in doing climate change planning or supporting climate change planning-related activities. Use 6 as the most important and 1 being the least important.*

<b>Office/Department</b>	<b>Increased provincial government support</b>	<b>Increased national government support</b>	<b>Improved inter-department/office communications, co-operation, and coordination</b>	<b>Improved knowledge and expertise about climate change planning of the City Government</b>	<b>Prioritizing climate change planning at the City Government of Malolos</b>	<b>Improved public awareness and support for climate change planning</b>
Sangguniang Panlungsod	-	-	3	3	2	4
Office of the City Mayor	2	-	-	5	6	-
Office of the City Vice Mayor	2	1	3	5	6	4
Office of the City Administrator	6	2	3	5	4	1
City Assessor Office	4	5	1	2	5	6
City Budget Office	5	1	4	3	6	5
City Planning & Department Office	5	6	4	3	3	1
City Legal Office	-	-	-	6	-	5
City Social Welfare & Development Office	5	-	2	3	4	6
City Engineering Office	3	4	4	5	6	1
City Health Office	1	3	-	4	5	3
City Agriculture Office	2	1	6	5	6	3
Business Permit and Licensing Division	1	2	3	6	5	4
Department of the Interior Local Government	-	-	-	-	-	-