Guidelines for Integrating Disaster Risk Information into Urban Land Use Planning in Myanmar

with special reference to Mandalay City

Australian Aid

adpc

Ministry of Construction
Department of Human Settlements and Housing Development (DHSHD)

Ministry of Social Welfare, Relief and Resettlement
Relief and Resettlement Department (RRD)

General Administration Department of Mandalay City

Fire Service Department of Mandalay City

Mandalay City Development Committee (MCDC)

Of

Republic of the Union of Myanmar

And

Australian Agency for International Development (AusAID)

Asian Disaster Preparedness Center (ADPC), Thailand

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CONTENTS

ACRONYMS

ADPC	Asian Disaster Preparedness Center
AusAID	Australian Agency for International Development
BSD	Building and Stores Department
CDC	City Development Committee
DADP	Detailed Area Development Plan
DHSHD	Department of Human Settlements and Housing Development
DRI	Disaster Risk Information
DRR	Disaster Risk Reduction
GAD	General Administration Department
GIS	Geographic Information Systems
LDC	Land Development Committee
MAPDRR	Myanmar Action Plan for Disaster Risk Reduction
MCDC	Mandalay City Development Committee
MOC	Ministry of Construction
NDC	Nay Pyi Taw Development Committee
NSDP	National Spatial Development Plan
NSDPA	National Spatial Development Planning Act
PLMD	Planning and Land Management Department
PWD	Public Works Department
RRD	Relief and Resettlement Department
SP	Structure Plan
TDC	Township Development Committee
TWG	Technical Working Group
UAP	Urban Area Plan
ULUP	Urban Land Use Planning
YCDC	Yangon City Development Committee

FOREWORD NOTE

The global urbanization process has great influence on the role hazards play in urban areas and Myanmar is no exception. New urban development is increasingly more likely to occur on hazard prone land, namely in floodplains and other low-lying areas, along fault lines or steep slopes, or in areas with no natural or artificial barriers to withstand high winds. Additionally, because migration and city growth is occurring rapidly throughout the country, much of this urban expansion is unplanned and unregulated, placing more people and infrastructure at increased risk.

Compared to rural areas, the impact of disasters can affect urban areas in different ways. Much depends on the type of disaster and the scale, but because urban areas are typically associated with economic growth and development, local, regional, and even global supply chains can be disrupted if businesses are not allowed to function normally as a result of the disaster. Therefore, it is crucial for local and national governments to integrate sound, disaster risk reduction efforts into the urban land use planning process to insure that investments, population, and livelihoods are better protected.

The project, Developing Guidelines for Integrating Disaster Risk Information in Urban Land Use Planning in Myanmar is the next step in the progression of Disaster Risk Reduction (DRR) work in the country conducted by Asian Disaster Preparedness Center (ADPC). Through support from the Australian Agency for International Development (AusAID), the goal of this project is to develop a feasible and implementable set of guidelines that integrate DRI into the land use planning process in urban areas throughout Myanmar. These guidelines will help to ensure that hazard resiliency is considered when future land use decisions are made.

ACKNOWLEDGMENTS

This guidelines document continues ADPC's work in the field of disaster risk reduction in Myanmar. As Myanmar moves forward with their economic transition, it is important to include valued work in disaster risk reduction in order to protect investment decisions, future planning, and the wellbeing of citizens.

The research team is grateful to all of the officials in the Ministry of Construction and representatives of the Department of Human Settlements and Housing Development and the Relief and Resettlement Department for their contributions to Technical Working Group and informal meetings. Collecting data and gaining an understanding of the regulatory and institutional structure of the Union of Myanmar would not have been possible without their dedicated involvement.

Likewise, all of the officials throughout the departments of the Mandalay City Development Committee were vital in the production of this document. Their participation in and contribution to technical training sessions, Technical Working Group Meetings, and informal meetings allowed the research team to gain insight about urban land use planning practices firsthand, from practitioners in the city. ADPC also truly appreciates Mandalay City Development Committee, the Ministry of Construction, and the Ministry of Social Welfare, Relief and Resettlement's gracious hospitality that was offered throughout the duration of the project.

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CHAPTER 01

INTRODUCTION

OBJECTIVE OF THE STUDY

Urban Land Use Planning (ULUP) is a significant tool that can be used to increase resiliency to natural disasters. ULUP enables municipalities and communities to make knowledgeable decisions about how to use its land in ways that are beneficial to current and future residents, along with buildings and infrastructure. Integrating Disaster Risk Information (DRI) into ULUP allows for considerations of potential hazards when developing plans and regulations and for planners and policy makers to make choices to protect population, property, and other assets from risk. Using DRI to inform planning decisions is one of the most cost-effective strategies for reducing disaster risk especially when compared to rebuilding or relocating buildings and infrastructure (World Bank 2013).

The project, Developing Guidelines for Integrating Disaster Risk Information in Urban Land Use Planning in Myanmar is the next step in the progression of Disaster Risk Reduction (DRR) work in the country conducted by Asian Disaster Preparedness Center (ADPC). The goal of this project is to develop a feasible and implementable set of guidelines that integrate DRI into the land use planning process in urban areas throughout Myanmar. These guidelines will help to ensure that hazard resiliency is considered when future land use decisions are made.

Mandalay City was chosen as a pilot site in order to understand how the current context of local land use planning can implement DRI due to its size, location, history with disasters, and projected future growth. In addition to providing local context for the project, ADPC aims to provide local officials in Mandalay City with the technical skills needed to build a comprehensive database with DRI in order to provide guidance towards responsible and resilient future land use decisions. The Situational Analysis report (completed April 2014) provided understanding of the current state of the land use planning process and initiatives throughout Myanmar at a national, regional, and local level.

SCOPE OF THE REPORT

The report, Developing Guidelines for Integrating Disaster Risk Information in Urban Land Use Planning in Myanmar has been organized into the following sections:

SECTION 02

This section, entitled The Urban Land Use Planning Procedure in Myanmar provides background description of the urban land use planning process in Myanmar. Descriptions of national, regional, and local level processes are described. In addition to describing the general process for these planning processes, there is discussion about how current practices relate to disaster risk reduction throughout the country. In order to provide context for the local level, there is also a more detailed description of the planning process and disaster risk reduction methods used in Mandalay City. The information used in this section was derived from the Situational Analysis developed by ADPC in May 2014. The goal of this section is not to repeat what was presented in the Situational Analysis but to provide context to the reader to understand the current situation of urban land use planning in Myanmar. The information is similar because this document is seen as independent of the Situational Analysis and can be used as a stand-alone tool for disaster risk management practitioners.

SECTION 03

This section, Characteristics of Urban Disasters within Myanmar provides a short description of the various hazards that affect urban areas throughout Myanmar. This is not a hazard assessment, and due to the objective of this report, Section 3 will only provide basic information about drought, cyclone, landslide, tsunami, earthquake, fire, and flood. The section also explores the effect that these hazards can have in urban areas and on urban development.

SECTION 04

The previous sections provided context for the overall objective of the report. The section, Integrating DRI into Urban Land Use Planning identifies the gaps that are currently missing involving disaster risk information and urban land use plans in Myanmar. In addition to identifying the gaps, section 4 will also provide steps and recommendations for the process of collecting, integrating, and implementing disaster risk information into the urban land use planning process.

SECTION 05

Integrating disaster risk information into the planning process is integral, however, once this step has been completed, it is also critical to highlight and analyze the different types of interventions government can implement to reduce risk in urban areas throughout the country. Section 5, Risk Sensitive Urban Land Use Planning Tools describes different types of planning interventions and provides tools of how disaster risk information can be used to ensure their effective implementation.

TARGET AUDIENCE

These guidelines are to be delivered to the Ministry of Construction, specifically the Relief and Resettlement Department (RDD) and the Department of Human Settlement and Housing Development (DHSHD), but there are a number of other individuals and groups who could utilize this report:

- Urban and regional planners
- Physical planning and development specialists and consultants for local and national governments
- Local and national level leaders and decision makers
- International donor agencies and partners
- Professionals in technical fields like architecture and engineering
- Disaster risk management and assessment professionals
- Geographers, geologists, hydrologists, and environmentalists
- Students and academics in the fields of planning, development, geography, other social sciences, and engineering

GUIDELINE PREPARATION

For preparing the guidelines, the following steps were followed:

- Formation of Technical Working Group and project scope
- Literary review of existing planning process and projects in Myanmar
- Situational Analysis of the existing planning process in Myanmar with special attention to Mandalay City.
- Identification of specific steps to integrate DRI into the urban land use planning process

CHAPTER 02

THE URBAN LAND USE PLANNING PROCEDURE IN MYANMAR

AN OVERVIEW OF LAND USE PLANS PREPARED IN MYANMAR

Over the past several years, Myanmar has taken many steps to craft new plans and policies related to spatial planning and economic development. This background places Myanmar in a unique opportunity for government officials to craft policies that are best in line with Myanmar's promising future and the safety of its people. Many plans and policies such as the National Building Code are currently being drafted. Integrating DRI into their content is crucial for Myanmar to aid in reducing the impact of hazards throughout the country.

NATIONAL LEVEL PLANNING

The Ministry of Construction (MOC), having jurisdiction over older acts for physical plans in Myanmar drafted a new National Spatial Development Planning Act (NSDPA) in 2012, which serves as the planning system for national policy. Two plans were enacted under the NSDPA: The National Comprehensive Development Plan and the National Spatial Development Plan (NSDP). The National Comprehensive Development Plan established the Ministry of National Planning and Economic Planning to be the authority on providing short and long-term development goals. This plan is not directly related to physical planning in Myanmar.

Physical and Land Use Planning

The second plan, the National Spatial Development Plan (NSDP), which is governed by the MOC is responsible for physical planning within the country and is the key component to strengthening DRM in Myanmar. The contents of the newly drafted plan, as of December 2012 include spatial planning policy at three levels (national, regional, township), land use regulations, and development permission criteria. The MOC also has a vision of integrating a spatial planning system into the National Comprehensive Development Plan but at present, this is still in the development process.

The MOC formed two main organizations to undertake the role of housing construction, buildings, and infrastructure. They are the Public Works Department (PWD) and the Department of Human Settlements and Housing Development (DHSHD). DHSHD, which is based in Nay Pyi Taw, has responsibilities that include urban and regional planning, provision of adequate housing, and planning for water supply and sanitation.

Town plans are prepared by the staff of the DHSHD but must be approved by the State Assembly and Cabinet, and then at the central level by the MOC, the Minister of Home Affairs and the Minister of Agriculture in the Cabinet, as the land use typically involves some change of designated agricultural land.

National Building Code

Currently, building codes are part of Union law and mayors or local officials establish bylaws. As part of the "Myanmar Project for Safer Settlements and Urban Research Program", the Ministry of Construction and UN-Habitat launched a collaborative project to develop land use planning guidelines on a national level. The guidelines will take special consideration of human settlements and communities that are vulnerable to hazards, along with preparedness and mitigation strategies as they relate to disasters. One component of this project is UN-Habitat's work with the Myanmar Engineering Society to formulate a National Building Code. Started in 2012, current drafts of the plan indicate that hazards such as fires, flood, earthquakes, and high winds are considered in several regulations relating to building placement, building materials, and other design elements. The plan is currently being finalized at the release of this document.

Disaster Risk Reduction

According to the Myanmar Action Plan for Disaster Risk Reduction (MAPDRR) of 2012 put out by the Ministry of Social Welfare, Relief and Resettlement with support from ADPC, the seven major components of the MAPDRR are as follows:

- Policy, institutional arrangements and further institutional development
- Hazard, vulnerability, and risk assessment
- Multi-hazard early warning systems
- Preparedness and response programs at national, regional, district, town, and village level
- Mainstreaming of DRR into development and mitigation
- Community based disaster preparedness and risk reduction
- Public awareness, education, and training

Technical training sessions of staff across the country provide necessary skills to implement regional and national plans for Myanmar with integrated DRI. The trained personnel will then provide multiple trainings to other staff members who will compile and analyze to be utilized for mapping township risk and vulnerability scenarios.

The State and Regional Level Planning Department is expected to draft a plan of expansion to cover the remaining Townships within their jurisdiction. Due to the requirements of the MAPDRR, Mandalay Region did prepare a Disaster Risk Management Working Plan that covers the institutional arrangements and communications, administration, availability of vehicles, and actions to be taken in the case of disasters, namely floods, fires, and storms. The plan focuses primarily on Mandalay City through the MCDC.

LOCAL LEVEL URBAN PLANNING

Local level planning is managed in different ways throughout Myanmar depending on the size of town or city. The three largest cities in Myanmar: Yangon, Nay Pyi Taw, and Mandalay all have City Development Committees that are responsible for all land allocation, management and planning, along with distribution of basic services.

According to DHSHD, local implementing regulations empower a Land Development Committee that is responsible for the allocation of land within a city. This committee is comprised of a Mayor, Secretary of the Regional Government, Secretary of the City Development Committee, Joint Secretary, and the Head of Land Management Department. They allocate land based on the following classifications:

- Government Land: this is further divided into government-leased land, which is typically leased for a 20 or 40-year basis. Government owned land that is not leased is typically used for public housing and administrative uses.
- Freehold Land: this is also known as family, or clan land that was leased during the colonial period or earlier.
- All land, weather through grant or lease can be sold by the owner.

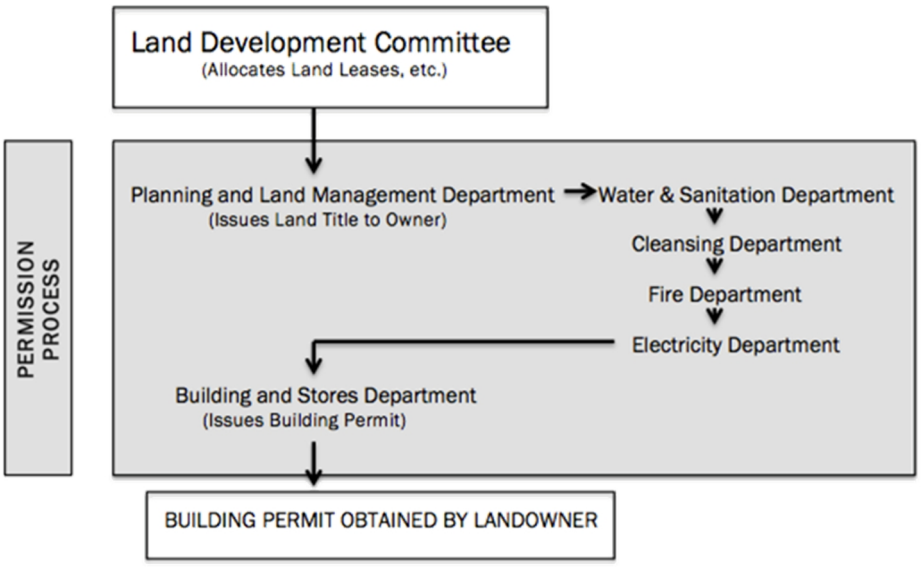
Other responsibilities of the City Development Committee (CDC) include local level planning decisions like permission for building construction and building use. The Development Committee's Building and Stores Department (BSD) and Planning and Land Management Department (PLMD) are the designated entities responsible for these permissions respectively. As urban planning positions are either limited or non-existent within the City Development Committee, there are few resources available to develop a comprehensive land use plan at the local level. Despite these lack of resources, the Land Development Committee (LDC) does have the authority to determine land use at a basic level.

Any construction of new buildings, repair of the old buildings and fencing of property requires permission from the Land Development Committee. After approval of the titling and location map from the PLMD, the detailed design plans for the structure are submitted for approval to the BSD. The BSD is responsible for inspecting the site and confirming the findings. The landowner has the responsibility to receive approval from all the necessary departments. The owner will put together all the permissions and will take it to the city office (BSD) to receive the application and the application fees. Each township has an engineer who accepts the application and forwards it to the BSD for processing. Figure 1 provides an outline of the process for land title and obtaining a construction permit:

Figure 1

Process of Obtaining Building Permit for cities in Myanmar

Source: DHSHD



All other townships in Myanmar are governed by a Township Development Committee (TDC), which contains a General Administrative Department (GAD). The GAD, which operates under the Ministry of Human Affairs issues land titles and the Development Department grants building construction approval.

Table 1

Township Development Committee Permissions Structure

Source: DHSHD

Township Development Committee	Permission Type
General Administration Department	Building Use Permit/Land Title
Development Department	Building Construction Approval

Myanmar is in a period of transition in regards to its regulatory structure. Within the next few years, as new institutions and multi-level decision-making frameworks are established, there will be greater understanding of how departments can coordinate and plan for effective urban land use decisions informed by DRI. However, as they currently exist, there is a foundation at all levels for DRI implementation into the planning process.

LOCAL LEVEL DEVELOPMENT: THE CASE OF MANDALAY CITY

The Situational Analysis, released in May 2014 by ADPC served as an introductory and exploratory component of this project and details the history of Mandalay City along with future development plans and goals for the city and region. The report also describes the current process of land use planning in Mandalay City. The analysis was conducted in order to provide context to the local level planning process in Myanmar.

The Mandalay City Development Committee (MCDC) oversees land use planning, development, and disaster preparedness within Mandalay City. The committee is divided into 14 departments and participated in the training sessions put on by ADPC regarding GIS and ULUP. The planning process for land development and building construction in Mandalay City follows the same guidelines (Figure 1- pg. 09) provided for all city development committees in the country. The City Planning and Land Management Department (PLMD) at the MCDC issues land titles. The permission is typically granted based on the designated use filed by the applicant during the process. Once a land title is obtained, The BSD of MCDC issues building permits within Mandalay City. Building construction permission is issued based on the application by the individual or firm.

Currently, the PLMD at the MCDC is only limited to land administration and there are no urban planners or architects in this department at the local level. Due to this, much of the development that occurs within the city is largely unregulated and unplanned because the approval process is so limited in scope, but MCDC does have the right to draft plans for land use on leasehold land. The Land Use Policy of September 2012 is the first step in this direction. By law, to implement an urban plan, the MCDC can draw plans, establish zoning ordinances and examine existing land uses.

Mandalay City is expected to experience great economic growth in the next several decades and development opportunities are already taking place throughout the 6 townships. While there is not a comprehensive land use plan for the city, DHSHD developed a 30 Year Prospective Plan that aims to guide development as it takes place in the city. Because DRI is only beginning to be considered as an important component of the development process, it is imperative to update development plans as valid data are collected.

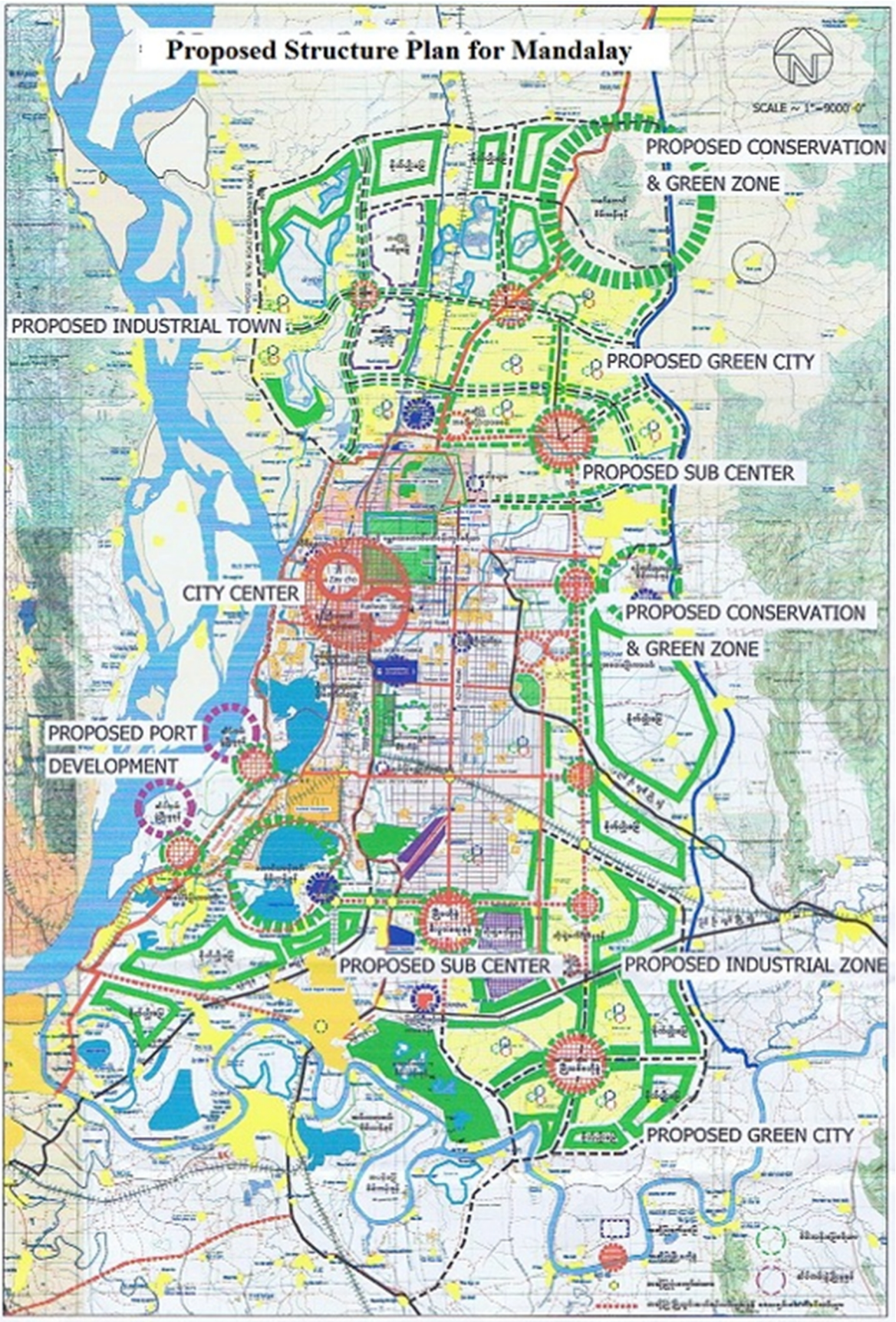


Figure 2

Mandalay City 30-Year Prospective Plan

Source: DHSHD 2013

MCDC does not have a requirement for structural drawings for buildings under three stories. Only buildings four stories and above are subject to permits and approvals including structural calculations and drawings. Earthquakes and fires are two hazards that Mandalay City has a history with and this lack of regulation provides many challenges to ensuring that structures are adequately prepared to withstand these hazards.

Mandalay City is at risk from various hazards, most notably, earthquake, fire, and flood. The city has taken several steps to address these various hazards. The Disaster Mitigation Plan for Mandalay City, which was prepared as part of the MAPDRR, addresses several disasters that affect specific areas of the city, but is still quite limited in its scope. The following regulations have been implemented based on the plan:

- Building Code that has seismic loading requirements for buildings upon the western side of the city. The code only applies to buildings of four or more stories.
- Relocation of several low cost housing areas to the eastern side of the city where there is lower risk of earthquake and flooding.
- Call for additional hazard maps (namely flood and fire) to be added to the building stock inventory.
- Provision of a budget for RRD to procure food and water in the case of a disaster, namely fire and flood.

While the Disaster Mitigation Plan is a positive progression, there are several steps that could be taken as the city moves to improve DRR including:

- Implement building code for all structures throughout the city regarding seismic loading requirements.
- Develop a comprehensive land use plan based on existing and future hazard maps.
- Utilize hazard maps to determine where flexible land use like parks and infrastructure to protect against flooding could be located.

Continue to conduct training sessions for both government officials and community groups in order to effectively manage disasters from preparedness, through response and recovery phases.

CONCLUSION

As the regulatory structure for physical planning in Myanmar continues to be dynamic and will keep developing over the next few years, there is already a framework in place that allows local authorities to make urban land use decisions and plans. Although disaster assessments, used to inform land use decisions are currently not often performed by local staff, there is a recognized need across the country to continue to develop local capacity in order to perform these assessment in the future. Cities like Mandalay have begun to make efforts to integrate DRR efforts into the overall ULUP process and although some building code regulations and zoning bylaws are not comprehensive throughout the entire city, these remain important steps to improving the overall resiliency of cities in Myanmar to withstand the challenges associated with hazards throughout the country.

CHAPTER 03

CHARACTERISTIC OF URBAN DISASTERS WITHIN MYANMAR

AN OVERVIEW OF DISASTERS IN MYANMAR

Myanmar is a country exposed to a number of hazards such as floods, cyclones, storm surge, earthquakes, landslides, fires, and tsunamis. Major parts of the country, notably the coastal region are affected by these hazards and currently there has been little capacity to prepare and respond to these events, which ultimately result in disaster. The most devastating recent disaster event, cyclone Nargis, hit the country in 2008 and resulted in significant damage to the lives and properties in the Ayeyarwady delta region. More than 80,000 people died, thousands of families were left homeless and basic infrastructure was damaged. The following provides a brief description of the hazards that effect Myanmar:

Cyclone

Myanmar is prone to the impacts of cyclones. The months of April, May and October to December are considered to be cyclone months according to historical records. In the last four decades alone, several major cyclones severely affected Myanmar, notably in 2008 with Cyclone Nargis

Storm Surge

Storm surge is defined as extraordinary flooding due to a storm. It generally occurs due to waves generated by the strong wind in tropical storms. The slope of the coastline is considered as one of the important factors controlling the intensity of storm surge. Myanmar, borders the Bay of Bengal and the Andaman Sea, and its 2400 km long coastline is potentially threatened by the waves, cyclones and associated weather.

Flood

In the past, floods have led to loss of life and property, damage to critical infrastructure, economic loss and health related problems such as outbreak of water borne diseases when lakes, ponds and reservoirs become contaminated. Myanmar receives practically all its rainfall between mid-May and October, during which flooding is common.

The riverine floods are common in the river delta while the flash floods and landslides are frequent in upper reaches of the river systems, which are normally in mountainous areas. In the cities and towns, localized floods occur from as a result of urbanization and deforestation combined with heavy rainfall.

Landslide

Myanmar has experienced many types of geologic hazards including earthquakes, landslides and subsidence in karst area. Among these, earthquakes and landslides are major hazards affecting the country. Geomorphologically, Myanmar has two mountainous provinces: namely the Western Ranges and the Eastern Highland which are the most at risk regions for these hazard events.

Fire

Although Myanmar is faced with forest fires throughout much of the country, these events typically occur in rural areas. Within urban areas of the country, fire is still a major hazard, mainly as a result of dense, unplanned and unregulated settlements that are constructed using unsafe, or flammable material. Fires are caused by a number of factors including: electricity misuse, electrical surges, and poorly managed wood fires and mosquito coils.

Earthquake

Myanmar is located on one of the two main earthquake belts of the world, known as the Alpide belts. It stretches from the northern part of the Mediterranean and extends eastward through Turkey, Iran, Afghanistan, and the Himalaya. Further it turns to the south and runs into Myanmar and finally ends in Indonesia. The country has witnessed several significant earthquakes in past. During the 20th Century alone, at least 18 large earthquakes have occured along the Central Lowland region where the well-known Sagaing Fault is present. The largest measured earthquake in Myanmar is a magnitude 8.0 event, which occurred on the northern segment of this fault on 23 May 1912.

Tsunami

Myanmar is earthquake-prone, as it lies in one of the two principal earthquake belts of the world-the Alpide Belt. The historical and seismic records show that in addition to some major historical earthquakes in the distant past, there had been at least 16 large earthquakes with magnitude 7.0 within the territory of Myanmar in the past 170 years.

There were also records of moderate Tsunami generated by two large magnitude earthquakes, which originated in the Andaman-Nicobar Islands. Thus, it is evident that Myanmar is vulnerable to hazards from moderate and large Tsunami along its long coastline. In view of these, it is necessary to assess the earthquake and tsunami hazard potential along the Myanmar coastal urbanized areas.

THE IMPACT OF URBAN DISASTERS

The urbanization process that occurs throughout the world can influence the role hazards play in urban areas globally, and Myanmar is no exception. As city populations grow as a result of high fertility rates, increased migration from rural-urban areas, and through administrative means, which claims rural land for the municipality, more land is needed to accommodate residents and infrastructure. This development is increasingly more likely to occur on hazard prone land, namely in floodplains and other low-lying areas, along fault lines or steep slopes, or in areas with no natural or artificial barriers to withstand high winds. Additionally, because migration and city growth is occurring rapidly throughout Myanmar and other developing countries in Asia, much of this urban expansion is unplanned and unregulated, placing more people and infrastructure at increased risk.

Compared to rural areas, the impact of disasters can affect urban areas in different ways. Much depends on the type of disaster and the scale, but because urban areas are typically associated with economic growth and development, local, regional, and even global supply chains can be disrupted if businesses are not allowed to function normally as a result of the disaster. Infrastructure used in cities is often in high concentration and a disaster affecting roads, public transit, electricity, telecommunication, and water/sanitation could greatly reduce the ability of a city to return to its normal functions for weeks, months, or even years (Shaw, 2009).

Mandalay City faces a multitude of hazards. A recent study on the risk (in terms of possible damage) from earthquake scenarios for Mandalay City (ADPC, 2012) has shown that the city would experience extensive damage to its critical infrastructure like roads, hospitals, educational facilities, and water pipelines from large earthquakes of 7.0 and 8.0 magnitude along different fault lines near the city, notably in the western section of the city. On 11 November 2012, an earthquake, registering a 6.8 magnitude, struck Sagaing and Mandalay regions. The earthquake damaged 400 houses, 65 schools, and 100 religious buildings. About 22 townships were affected across the Sagaing and Mandalay Regions with Singu and Thabeikkyin townships in Mandalay region and Kyaukmyaung sub-township in Sagaing region were most affected (OCHA, 2012).

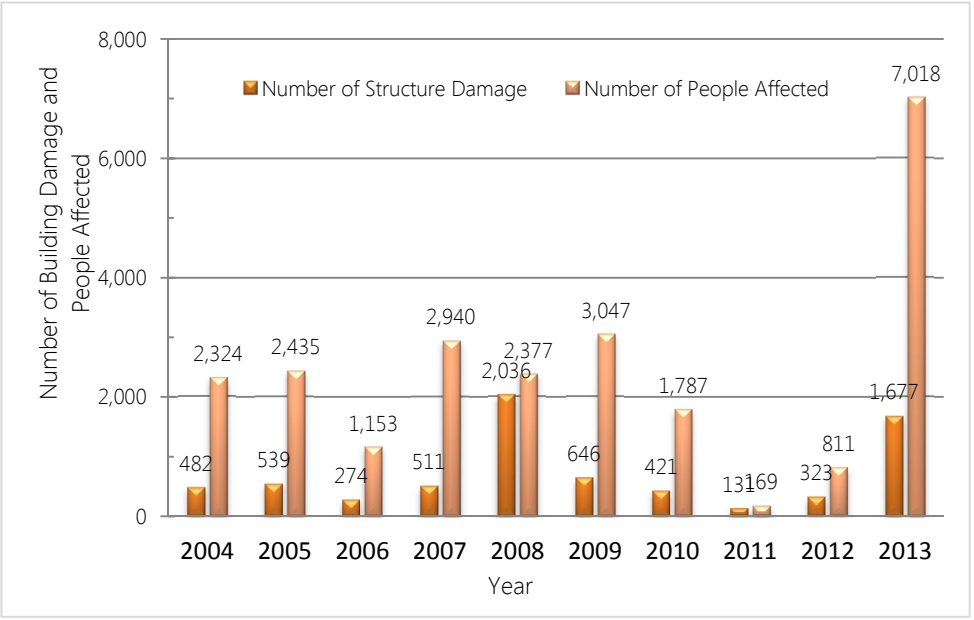
In terms of flood hazard, Mandalay City suffered from heavy flooding in 2010 after water levels in Aungpinlay, Aung Tharyar, Thamankone and New Yadanabon townships reached up to 1.8 meters after the highest amount of rainfall experienced in six decades period. Floodwater that flows into Mandalay City could come from a variety of sources including riverine flooding, external water from surrounding highland regions, diversion due to development in natural floodplains, and leakages in aging infrastructure.

Additionally, urban fire has caused problems to Mandalay City throughout the years. According to recent data, fires have affected both commercial and residential districts. There were about 1,685 fire incident records during 2004 to 2013 when about 7,040 building got damaged affecting 24,000 people with the economic losses estimated at 4.4 million USD (RRD, 2013). Figure 3 provides a view of the impact of fire hazard in Mandalay Division from 2004 to 2013.

Figure 3

Impact of Fire Hazard in Mandalay Division: 2004-2013

Source: Relief and Resettlement Department, RRD



CONCLUSION

Myanmar has a long history of experiencing hazards such as cyclones, earthquakes, fire, flood, landslide, and storm surge. As urban development continues in Myanmar, urban areas in the country will continue to be under increased risk of disasters. In addition, global climate change will place additional strain on natural systems as hazards are projected to increase in intensity and frequency. For Myanmar to adequately face these challenges, there is an increased need to develop a capacity to collect data and perform assessments, which can accurately inform decision makers on where the most hazard prone areas in the country are located.

CHAPTER 04

INTEGRATING DRI INTO URBAN LAND USE PLANNING

SUMMARY OF FINDINGS: IDENTIFYING GAPS IN THE EXISTING PROCEDURE

The Mandalay Regional Government and Development Committee has formulated a 30 year plan for the city of Mandalay known as the "Mandalay City Development Concept Plan Vision 2040". The main objective of the plan is to guide the city of Mandalay in long-term development. The following is a list of the specific objectives of the Mandalay City Development Concept Plan:

- To adopt a vision of future urban development in line with the changing situation of Mandalay through a systematic study on strengths, weakness and development potentials.
- To propose a Concept Plan, which will implement visions of future urban development described by the government.
- To identify and manage reserved urban land for future demand of living, job opportunities, and recreation of the increasing population.
- To prepare proposals for systematic planning of essential infrastructure, upgrade communication, and improve the living standards of residents.

The 30-year perspective plan describes the focus areas. However, the plan has not indicated phasing for its implementation. The initiative by the Ministry of Construction of the Union of Myanmar and ADPC is to figure out the integration of DRR into ULUP. Therefore, it is recommended that the perspective plan can be implemented in three broader frames. The following is a brief description of the recommended planning phases.

The Structure Plan (SP) aims to provide a long-term strategy to the year 2040 for the development of Mandalay and its environs. This plan to be composed of report and a map at 1:10,000 scale. The plan indicates the magnitude and direction of future growth of the city and sets forth recommendations for spatial and sectoral policies (the policies that have already been indicated in the Mandalay Urban Development Concept Plan).

The Urban Area Plan (UAP) is formulated to serve as a guide to development together with the control of land use of the urban areas in Mandalay. This plan is recommended for a period of 10 years, will be more elaborate than the Perspective / Structure Plan and shall contain a land use zoning map in the background of land ownership maps. The maps for this plan will be at 1:4000 scale supported by a written explanatory report. The Urban Area Plan will be subdivided into different zones.

The Detailed Area Development Plans (DADP) are a series of detailed spatial development plans of different types. DAPs include, apart from public sector initiated site and services plans and special development plans, the participatory land readjustment plans, guided land development plans and infrastructure led development plans and area improvement plans. The DAPs will be formulated for execution in a period of 3-5 years. The map scale of Detail area plan will be 1:1000 which will cover building level information detail.

PLANNING PHASES AND STEPS TO INTEGRATE DISASTER RISK INFORMATION

It is Important to understand the factors that determine hazard, vulnerability and risk, while at the same time, identify the phase of assessing risk and vulnerability to match with various phases of the planning process. There are various ways of defining disaster risk or vulnerability. However, it is important to identify the phase of calculating/ identify the vulnerability, risk and other relevant factors at different stages of the planning phase. This section of the guideline describes the planning steps to be followed and corresponding assessment requirements.

Disaster risk can be treated as a function of exposure, hazard and vulnerability and can be written as follows,

Disaster Risk = Function (Hazard, Exposure, Vulnerability)

As described in the earlier section, for the planning phases like Structure Plan, Urban Area Plan and Detailed Area Plan preparation, hazard, exposure, vulnerability has to be identified and to be analyzed for future planning. This will guide decision makers to more accurately identify risk prone areas. The following diagram identifies the three phases of the planning process, along with important DRR interventions to take place during each phase.

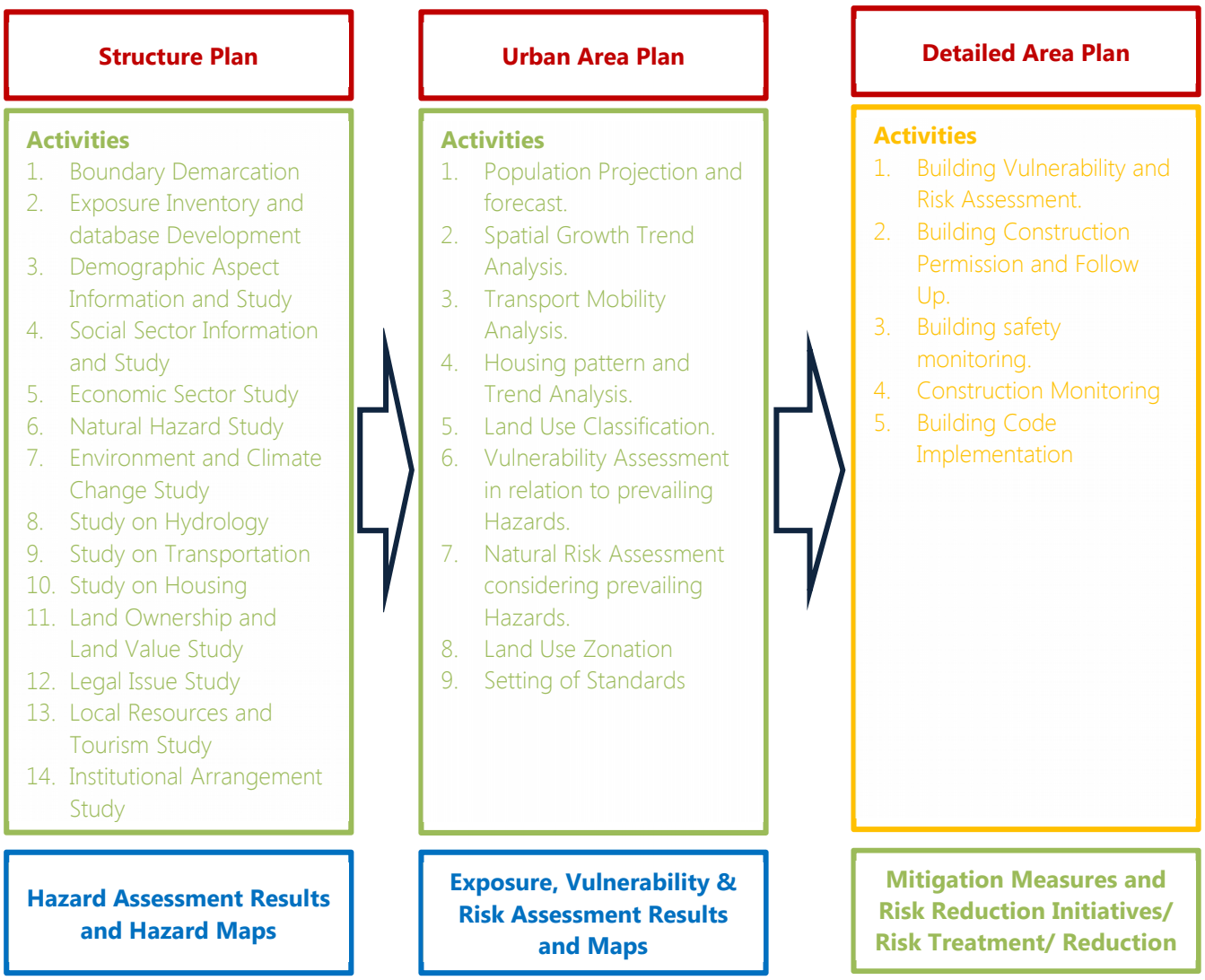


Figure 4

Recommended Planning Phases for Mandalay City Urban Development

While there are many gaps within the current procedure for urban land use planning in Myanmar, addressing these gaps requires a systematic process, which ensures all needs are met. The following steps have been highlighted, which provide guidance of how to progress with this process:

Step 1: Preparation and Collaboration

Goal: Ensuring that there is coordination amongst local level departments and national agencies is critical for this step. Once all the actors are involved, necessary personnel can be assigned to specific tasks. Tasks could include:

- Identify the goals and objectives of the project
- Prepared a timeline and methodology of the report
- Prepare a budget based on the timeline and methodology
- Undertake a literary review of all relevant plans and reports regarding the municipality or planning area. During this task, specific data should be identified to collect during Step 2 (see below)
- Initial data collection that is available on hand or during the literary review
- Reporting

Output: Situational Analysis or Inception Report, which describes the project objectives, the timeline, budget, and identifies the team members associated with the project.

Step 2: Data Collection and Reporting

Goal: Finding the data (spatial and non-spatial) amongst departments at local and national levels. Tasks could include:

- Prepare a GIS base map of the planning area and digitize any paper-based maps required.
- Establish agreements for data sharing among different agencies as required by the project
- Establish methods for data collection and storage
- Begin to assemble all collected data into a database of the planning area that can be updated when relevant changes occur
- Collect secondary data (usually sectoral) from different institutions such as the Relief and Resettlement Department (RRD), Department of Human Settlement and Housing Development (DHSHD), along with the Building and Stores Department (BSD) within municipalities that have a City Development Committee (CDC). For smaller towns, data can be obtained from the General Administration Department (GAD) and Development Department in municipalities that have a Township Development Committee (TDC)

- Collect primary data through surveys and field visits of the urban area. This may involve input from technical specialists for certain surveys. Ensure that hazard data is collected during relevant surveys (for example, waterways and hydrological surveys should consider rainfall, flood, and water drainage patterns for the areas)
- Collect additional specific hazard data (meteorological, seismic, soil stability etc.) as needed either from primary or secondary sources (such as a local risk assessment) depending on data availability
- Collect primary socio-economic data using participatory research methods and a socio-economic survey.

Output: Preliminary reports and maps based on data collection

Step 3: Analyzing Data and Assessing Needs

Goal: Analyze collected data and determine what gaps still exist. Tasks could include:

- Conduct GIS and DRR training sessions to ensure team members are equipped with the necessary skills for creating and updating the new urban risk database
- Analyze the socio-economic and demographic data and project future scenarios based on migration, urbanization, and population change
- Combine the socio-economic data with the environmental data to develop a disaster risk assessment
- Develop hazard and risk maps based on the data that has been collected
- Update the urban risk database with the results of the hazard and risk assessment
- Conduct a SWOT (Strength, Weakness, Opportunity, and Threat) analysis based on future development plans

Output: Report and maps that describe the social, environmental, and physical impact of disaster in urban areas and how it affects future development plans.

Note: Some data types might not be available. This is where building a disaster risk database is critical. The process is currently underway in Yangon and Mandalay but other urban areas need to acquire satellite images and begin highlighting building footprints. This is when the necessary information relating to building material, quality of building, building use, and occupancy can be added into the newly created database. Other towns and cities in Myanmar are behind in this process.

Step 4: Information Sharing

Goal: Ensure that regional and national governments, private sector interests, international donor agencies, and citizens have an understanding of the hazard risk and future development decisions. Tasks include:

- Conducting a technical working group (TWG) meeting with interested stakeholders
- Additional training sessions that engage other municipalities. This will allow for information to be shared but also for knowledge and understanding to be reinforced.
- Outreach campaign that engages community members and civil society groups

Output: Summary report that describes the outcome of technical working group meeting and the outreach campaign.

Step 5: Making Informed Planning Decisions

Goal: Utilize urban risk database and integrate risk assessment into planning, regulatory, and land use decisions. Task Include:

- For Yangon, Mandalay City, and Nay Pyi Taw - Land Development Committee enacts and develops comprehensive land use plan with the Department of Planning and Land Management (PLMD) and coordination of DHSHD.
- For Yangon, Mandalay City, and Nay Pyi Taw - Land Development Committee enacts and develops building codes with the Department of Planning and Land Management (PLMD) and the Building and Stores Department (BSD) and coordination of DHSHD.
- For towns with a Township Development Committee - Land Development Committee enacts and develops comprehensive land use plan with the General Administration Department (GAD) and coordination of DHSHD.
- For towns with a Township Development Committee - Land Development Committee enacts and develops building codes with the General Administration Department (GAD) and coordination of DHSHD.

Planning Guide 1: Level of Planning Phase and Related Assessments

Disaster Related Information/Assessment Required	Level of Planning Phase		
	Structure Plan (Scale 1:10,000)	Urban Area Plan (Scale 1:4,000)	Detailed Area Plan (Scale 1:1,000)
Hazard Assessment	Required for both built up and non-buildup areas	Required for zone based on landuse	Required at detailed level i.e; even at individual building level
Risk Assessment	Required at Gross Level	Required for zone based on landuse	Required at detailed level i.e; even at individual building level
Exposure Assessment	Required at Gross Level	Required at Detail Level	Required at Building Detail Level
Vulnerability Assessment	Required at Gross Level	Required at Detail Level	Required at Building Detail Level

Planning Guide 2: Exposure Data Requirement

Level of Planning Phase	Exposure Data Requirement		
	Land use	Infrastructure	Lifeline/ Utilities
Structure Plan (Scale 1:10,000)	Built Up and Non-Built up area demarcation	Major Communication lines like river, major roads, rail lines	Power Plant, Gas Field, Major Water Bodies
Urban Area Plan (Scale 1:4,000)	Categorization of existing infrastructure based on use	Categorization of infrastructures like major/ minor road;	Drainage Network, Major Gas line, Water Supply Network
Detailed Area Plan (Scale 1:1,000)	Individual structure use	Construction detail, type, category	Material type detail

Planning Guide 3: Hazard and Data Requirements

Types of Hazard	Level of Planning Phase and Hazard Information		
	Perspective Plan (Scale 1:10,000)	Urban Area Plan (Scale 1:4,000)	Detailed Area Plan (Scale 1:1,000)
Flood	Regional information and maps on flood prone areas Regional Drainage System Climate Change and Precipitation Maps Satellite Image	Historical Records on Flooding Topographic Maps (with spot height) Historical inundation maps Annual Rainfall Pattern	Detailed information on local level flooding and water logging Exposure inventory
Cyclone	Historical cyclone tract, damage	Wand and precipitation data and maps	Exposure inventory Local level wind and rainfall data
Landslide	Regional Maps of past landslide Geological Maps Regional slope map	Landslide inventory Slope stability maps Detail topographic map	Local level maps with the sub-soil information detail, ground water level detail Exposure inventory
Earthquake	Regional Fault Maps Regional Active Fault Study Geodynamic Modeling Study	Soil Liquefaction Study Micro Zonation Maps Geo-technical survey and studies Earthquake Catalog development	Exposure inventory and Assessment
Urban Fire	Development Pattern, built up/ non built up area identification	Building Density, accessibility, firefighting capacity	Exposure inventory and Assessment

DATA AND STUDY REQUIREMENTS

The city of Mandalay will be developed under the guidance of the Perspective Plan formulated for a period of 30 years. It requires a clear understanding about the data needed, along with the studies required in formulating sustainable development guidelines. This section describes the data requirements, assessments, and different studies required for policy formulation and an implementation mechanism for the Structure Plan, Urban Area Plan and Detailed Area Plan.

This section of the Guideline illustrates the major policy issues of the Structure Plan to be adopted during the development over the next thirty years. Anticipated policies have also been highlighted for major areas of development as may require. The Mandalay Structure Plan should be aimed to optimize the available urban land resources incorporating the strategy to create a more livable environment through emphasis on organized development. The land resource optimization strategy should be achieved under two sub-strategies, which are as follows:

- Existing Urban Area Densification: the strategy of densification in low-density areas within established urban areas through promotion/upgrading of infrastructure and services. This will help to utilize current vacant areas as well as underutilized areas within the built up areas.
- Accelerated Development at the Fringe: there is a slow process of rural-urban land use conversion in the urban periphery. However, though this process is adding to the urban space it does not make substantial contribution to urban population due to slow rate of population migration. This is due to low level of access to capital and low level of affordability of the people, lack of infrastructure and services, increasing land value lengthy land development cycle carried out mainly by the under-capitalized informal sector operating under infrastructure scarce investment.

Structure Plan Data Requirements

A number of information and studies are required for preparation of a Structure Plan for the City of Mandalay. The data/ information and related studies are also to be used for the second tier and third tier-planning phases respectively for the Urban Area Plan and Detailed Area Plan. Following is a list of data requirements and studies needed:

List of Major Sectors

1. Boundary Demarcation
2. Exposure Inventory and database Development
3. Demographic Aspect Information and Study
4. Social Sector Information and Study
5. Economic Sector Study
6. Natural Hazard Study
7. Environment and Climate Change Study
8. Study on Hydrology
9. Study on Transportation
10. Study on Housing
11. Land Ownership and Land Value Study
12. Legal Issue Study
13. Local Resources and Tourism Study

DR-SP - 01 (Data Requirement- Structure Plan)

Boundary Demarcation

Country Boundary, state boundary, province boundary, city boundary, perspective area boundary

Sources of Information

Burma Survey and General Administrative Division (GAD), Department of Land Records

DR-SP - 02

Exposure Inventory and Database Development

Major Infrastructure

Road Network, rail network, river network, Electricity network, Gas main network, Telecommunication network

Land Coverage

Built up area, water bodies, agriculture, forest, hilly areas, marshy areas

Sources of Information

Ministry of Construction (MOC), Ministry of Transport (MoT), Ministry of Railway (MoR), Ministry of Electricity (MoE), Ministry of Energy (MoE), Ministry of Communication and Technology (MoT)

DR-SP - 03

Demographic Aspect Information and Study

Population Characteristics and Dynamics

Trend in Population Size; Age Composition; Sex Composition; Ethnic Composition; Religious Composition; Fertility (Total fertility rate, Crude birth rates); Mortality (Infant mortality rate, expectation of life at birth, crude death rates); Migration (Proportion of in-migrants, reason for moving, length of continuous residence)

Sources of Information

Ministry of Immigration and Population, General Administrative Division (GAD), Ministry of Health (MoH)

DR-SP - 04

Social Sector Information and Study

Educational Service

Distribution of school by grade level; Trends of school enrollment by grade level; Distribution of students by origin, age and sex; School age population by grade level; Distribution of teachers by qualification; Number of repeaters and dropouts by grade level; Distribution of schools by ownership; Physical condition of schools and their facilities; Location and area occupied; Problems related to educational services; and Ongoing projects and future plans.

Sources of Information

Ministry of Education; Local Government

Health Service

Existing number of health institutions by type, health personnel; Health institutions by ownership; Ten top diseases and major causes of death; Origin of patients; Facilities in the health institutions; Physical condition of health institutions; Area and location of health institutions; Type of health services rendered by existing health institutions; Future plan and ongoing projects; and Problems related to health service.

Sources of Information

Ministry of Health (MoH); Local Government

Sport and Recreation

Number of playgrounds by neighborhood, sport fields and stadium; Availability of parks and zoo; Availability of Libraries; and Problems related to sport and recreational facilities

Sources of Information

Ministry of Sports (MoS);

DR-SP - 05

Economic Sector Survey and Study

Unemployment

Number of economically active population; number of unemployed population

Sources of Information

Ministry of Labor (MoL)

Business Sector

Number of business establishments by type, employment, and facilities; Spatial distribution of the establishments; Number of trade licenses issued, renewed or returned; Major source of item traded & major customers; Major challenges and opportunities of the sector.

Sources of Information

Ministry of Trade (MoT); Ministry of Planning (MoP)

Investment & Investment climate

Number of approved projects by sector (agriculture, industry, services etc.); Expected employment creation capacity of the projects; Capital of approved projects; Investment climate: availability of serviced land, infrastructure, support institutions, rules & regulations etc.; Opportunities and challenges of investment activities.

Sources of Information

Ministry of Trade (MoT)

Manufacturing Sector

Number of Manufacturing by type of employment and major products/outputs (time series); Spatial distribution of manufacturing activities; Major source of raw materials/inputs and market destination; Extent of inter-industrial linkage; Potentials and challenges of the sector.

Sources of Information

Ministry of Trade (MoT)

Micro and Small Enterprise (MSEs)

Number of persons engaged (separated by sex) in MSE operation by sector (cooperatively organized individuals)- time series data; Sources of raw materials; Major products/outputs; Extent of inter-sectional linkage; Available support institutions and types of support provided (credit and other technical supports); Potentials and challenges for MSE development.

Sources of Information

Ministry of Trade (MoT)

Informal sector

Type of informal activities being conducted in the town; Size of employment, amount of capital and sources of capital; Spatial distribution of the informal activities; Major sources of input and major customers; existing linkage with the formal sector;

Sources of Information

Ministry of Home Affairs

DR-SP - 06

Hazard Assessment
Identification of Major Hazard in and around the Planning Area
Flood
Historical Records of water level, damage, duration, period
Sources of Information: Department of Meteorology and Hydrology (DMH); General Administrative Division (GAD); Department of Waterways Development
Cyclone/ Storm
Historical Records of wind speed, storm surge level, inundation level, damage, duration, period
Sources of Information
Department of Meteorology and Hydrology (DMH); General Administrative Division (GAD);
Earthquake
Historical Records, magnitude, damage, fault lines, geological formation, general soil characteristics and type
Sources of Information
Department of Meteorology and Hydrology (DMH); General Administrative Division (GAD); Department of Social Affairs
Water Logging
Past records, affected areas,
Sources of Information
Department of Meteorology and Hydrology (DMH); General Administrative Division (GAD); Department of Irrigation
Landslide
Incident inventory, damage and casualties,
Sources of Information
Department of Meteorology and Hydrology (DMH); General Administrative Division (GAD; Department of Social Affairs
Urban Fire
Incidents, damage, sources
Sources of Information
Fire Department
General Administrative Division (GAD); Department of Social Affairs

DR-SP - 07

Environment and Climate Change Study

Solid waste

Institutional arrangement for solid waste management; Types and nature of solid waste generated; Role of different actors (NGOs, informal sector, government, MSEs); Recycling and reusing mechanisms; Budget allocated for solid waste management; Inter-municipal cooperation for solid waste management; Localized policy guidelines, strategies, rules and regulations related to solid waste management; Problems, opportunities and future plans.

Sources of Information

Mandalay City Development Committee (MCDC); General Administrative Division (GAD); Environmental Construction Department; Department of Health

Liquid Wastes

Number of toilet facilities by type; Mechanisms of collection, transportation, disposal, recycling, and treatment of liquid waste; Type and composition of liquid wastes generated from different sources; Public toilets and their spatial distribution; Budget allotted for liquid waste management; Inter-municipal cooperation on waste management; Condition of the existing waste disposal site, if available;

Sources of Information

Mandalay City Development Committee (MCDC); General Administrative Division (GAD); Environmental Construction Department; Department of Health

Air pollution

Identify major source of indoor and outdoor air pollution, Dust, Vehicles; Indoor Availability of kitchen facility, Type of energy source and use,

Sources of Information

Mandalay City Development Committee (MCDC); General Administrative Division (GAD); Environmental Construction Department; Department of Health

Temperature

Daily, Monthly and Yearly (maximum, minimum and average)

Sources of Information

Department of Meteorology and Hydrology (DMH); General Administrative Division (GAD);

Rainfall

Daily, Monthly and Yearly (maximum, minimum and average)

Sources of Information

Department of Meteorology and Hydrology (DMH); General Administrative Division (GAD); Department of Agriculture; Department of Irrigation

DR-SP - 08

Study on Hydrology and Drainage

Basin/ watershed characteristics

Basin size/area, slope, shape, length, width, drainage density; Surface and sub-surface geology; Depression storage information; Names of rivers, ridges, and other such physical features;

Sources of Information

Ministry of Agriculture and Irrigation (Irrigation Department and Department of Water Resource)

Ministry of Transport (Directorate of Water Resources and Improvement of River System; Department of Meteorology and Hydrology)

Open channel flow

Channel system layout; Channel shape, cross-section; Channel slope, flow direction, outlet type and protection; Channel type (natural channels- meandering, braided, straight); Flow resistance- vegetation, debris/ sedimentation, solid wastes, blockages etc.; Flow bypass information, damages, causes, maintenance and structural condition, ages of system; River bed and bank conditions, protection locations, dredging records, flow characteristics, backwater information from receiving stream, historical information on channel size, form or alignment changes,

Sources of Information

Ministry of Agriculture and Irrigation (Irrigation Department and Department of Water Resource)

Ministry of Transport (Directorate of Water Resources and Improvement of River System)

Hydro-meteorology

General rainfall characteristics, rainfall intensity records; Water level and velocity records; Stage-discharge rating curves

Sources of Information

Ministry of Transport (Department of Meteorology and Hydrology)

DR-SP - 09

Transport Survey and Study

Infrastructure Information & Facilities

Road Network and Types; number of lanes; Rail Network and Types; River network; airport, bus terminal, freight terminal, railway station, port, etc.

Sources of Information

Ministry of Construction (Public Works Department)

Ministry of Railway (Myanmar Railway; Department of Road and Transport)

Ministry of Transport (Civil Aviation; Inland Water Transport)

Survey and Studies

Traffic Count Survey; O-D Survey; Rail Passenger Survey & Inventory of Railway Station; Bus Passenger Survey;Truck Operation Survey; Inventory of Air Transport; Survey of River Ghats; Inventory of Car parking spaces ; Rural and Growth Centre Linkage Survey; Pedestrian Survey

Sources of Information

Ministry of Construction (Public Works Department)

Ministry of Railway (Myanmar Railway; Department of Road and Transport)

Ministry of Transport (Civil Aviation; Inland Water Transport)

YCDC, MCDC, NCD (Nay Pyi Taw City Development Council)

DR-SP - 10

Housing

Number of households and housing units; Housing units by tenure status (public, private, rented, etc.); Housing units by purpose (residential, business, etc.); Physical condition of housing units; Distribution of housing units by construction material; Bathing facilities, toilet facilities; Informal housing units; Problem related to housing; and, Ongoing projects and future housing plan.

Sources of Information

Ministry of Construction (Department of Human Settlement and Housing Development)

YCDC, MCDC, NCD

Ministry of Home Affairs (General Administrative Department)

DR-SP - 11

Land Ownership and Land Value Study

Identification of land ownership pattern, land value assessment (time series data)

Sources of Information

YCDC, MCDC, NDC

Ministry of Home Affairs (General Administrative Division)

Ministry of Finance (Internal Revenue Department)

DR-SP - 12

Legal Issue Study

Identify the acts, ordinance, rules related to all the studies being conducted under Perspective and Structure Plan

Sources of Information

Ministry of Construction (Department of Human Settlement and Housing Development)

YCDC, MCDC, NDC

Ministry of Home Affairs (General Administrative Division)

DR-SP - 13

Local Resources and Tourism Study

List of tourist attraction sites; Time series data on number of tourists; Tourist seasons; existing facilities at tourist attraction sites; Number and type of tourist oriented enterprises; Tourism promotion activities; Potential tourist attraction sites.

Sources of Information

Ministry of Hotel and Tourism (Tourism Department)

DR-SP - 14

Institutional Setting Study

Name, number, category of Government, Non-Government Agencies, NGOs operating in the commend area; existing capacities of the agencies; short comings; weakness; organizational settings

Sources of Information

Ministry of Home Affairs (General Administrative Division)

Policy Recommendations for Implementation of Perspective Plan

Areas of Conservation and Protection

Policy CP/1: Control Hazard Prone Areas from Development

Justification

As per Seismic Hazard and Risk Assessment by ADPC (2011), the south-western part of the city of Mandalay is susceptible to Liquefaction effect. Any type of important installation in the area will be at risk in case of earthquake event. Therefore, it is recommended to discourage development within this area.

Means of Implementation

This policy can be implemented through enacting new regulations, which call for protection of this area of the city. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

DMH, MCDC

Policy CP/2: Conservation of Rural- Agricultural Land

Justification

Rural and agriculture land play a vital role in producing food for urban areas and the overall region. Conservation of these areas can limit urban development onto key land resources.

Means of Implementation

This policy can be implemented through enacting new regulations, which call for protection of the rural-agriculture area. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

MCDC, MOC

Policy CP/3: Protection of Natural Water Courses
Justification Natural Water Bodies play a vital role for a city/ town. Therefore, it is important to protect natural water bodies in and around the city of Mandalay.
Means of Implementation This policy can be implemented through enacting new regulations, which call for protection all natural water bodies. The concerned agency/authority should take immediate steps in this regard.
Implementing Agency MCDC

Policy CP/4: Flood Control and Erosion
Justification Mandalay City continues to experience flooding throughout the 6 townships. Unplanned development has also contributed to erosion along riverbanks.
Means of Implementation This policy can be through enacting new regulations, which call for protection of the at hazard prone areas. The concerned agency/authority should take immediate steps in this regard.
Implementing Agency DMH

Urban Areas

Policy UA/1: Optimum use of Available Land Resources

Justification

Dense growth within the established urban area has not been promoted in Mandalay. There are still large amounts of land lying vacant amid all categories of land uses within Mandalay City area and beyond. Infilling of this land should be promoted and encouraged to optimize use of land. Keeping large land areas of vacant land within the existing built up area it is not logical to go for extension of physical boundary of the city.

Means of Implementation

This policy can be implemented through enacting new regulations, which calls for identification and process for development of the vacant land in urban areas. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

MCDC

Policy UA/2: Infrastructure Development in Spontaneous Areas

Justification

Infrastructure needs to be provided in order to allow spontaneous growth of existing and new urban areas by public sector development agencies. In many developing countries it is observed that haphazard development takes place along the urban fringe, which is beyond development control, by the city authority. Therefore, it requires development of roads and other infrastructures to guide the development in a systematic manner.

Means of Implementation

This policy can be implemented through enacting new regulations, which call for development planning along the urban fringe. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

MoC, MCDC, MoT

Policy UA/3: Initiatives for Urban Fringe Area Development
Justification Because development along the urban fringe often occurs in an unplanned fashion, it is necessary to conduct further disaster risk assessments and environmental impact studies to ensure that appropriate infrastructure planning is implemented to accommodate future growth along these areas.
Means of Implementation This policy can be implemented through enacting new regulations, which call for planning initiatives within this area. The concerned agency/authority should take immediate steps in this regard.
Implementing Agency MCDC

Housing

Policy HO/1: Promotion of Housing Area Development in New Urban Area

Justification

Mandalay City is projected to have rapid population growth over the next several decades. New residents of the city will require housing options in areas that are experiencing new development

Means of Implementation

This policy can be implemented through enacting new regulations, which calls for the location of housing in low risk areas of Mandalay City. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

MCDC, MOC, DHSHD

Policy HO/2: Promotion of Housing for the Low Income Groups and the Poor by Public Sector Housing Agencies

Justification

Many new migrants to the city are low-income and often result to informal means for their housing choices. Therefore, it is critical to provide affordable housing options in low risk areas throughout the city.

Means of Implementation

This policy can be implemented through enacting new regulations, which call for identification of low risk areas to provide affordable housing options. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

MCDC, MOC, DHSHD

Economy and Employment

Policy EC/1: Boosting of Regional Agriculture

Justification

Agriculture is critical to provide food and additional resources to urban areas and the surrounding rural environment.

Means of Implementation

This policy can be implemented through enacting new regulations, which call for protection of agricultural areas. Concerned agency/authority should take immediate steps in this regard.

Implementing Agency

Ministry of Agriculture

Policy EC/2: Promotion of Public-Private Joint Industrial Venture

Justification

Small and medium scale industry in and around the City of Mandalay can gain access to greater financial and knowledge based resources throughout active joint ventures and partnerships with public authorities.

Means of Implementation

This policy can be implemented through erecting new Act to strengthen public private partnerships and joint ventures in Mandalay City. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

Ministry of Industry

Infrastructure and Municipal Services

Policy INF/1: Development of Drainage System

Justification

The current drainage situation needs improvement to save the city from possible drainage congestion in the future.

Means of Implementation

This policy can be implemented through enacting new regulations, which call for improved drainage. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

MCDC

Policy INF/2: Development of Sustainable Water Supply System Based on Surface Sources

Justification

The current water supply situation needs to be improved to provide water to a growing number of urban residents in Mandalay City.

Means of Implementation

This policy can be implemented through enacting new regulations, which call for improving the water supply. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

MCDC

Infrastructure and Municipal Services

Policy TR/1: Incremental Road Network Development towards Achieving the Final Network

Justification

This section should justify the current traffic congestions and road development throughout Mandalay City in order to limit future traffic congestion.

Means of Implementation

This policy can be implemented through enacting new regulations, which call for road network and related transportation infrastructure development informed by disaster risk assessments. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

Ministry of Transportation

Policy TR/2: Development of Pedestrian Facilities Within the Urban Area

Justification

Pedestrian facilities such as sidewalks, crosswalks, and signals are needed to ensure pedestrian safety in future urban development

Means of Implementation

This policy can be implemented through enacting new regulations, which call for development of pedestrian facilities. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

MCDC, MoT

Tourism and Recreation

Policy TOUR/1: Promotion of Tourism through Infrastructure Development & Improvement

Justification

Facilities associated with current and future tourism should be enhanced to promote growth in the tourism industry.

Means of Implementation

This policy can be implemented through enacting new regulations, which call for protection of tourism facilities. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

Ministry of Tourism

Policy TOUR/2: Promotion of Local Heritage Based Tourism

Justification

Local heritage sites should be preserved and maintained in order to bolster tourism and enhance traditional culture and knowledge.

Means of Implementation

This policy can be implemented through enacting new regulations, which call for protection of heritage sites. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

Ministry of Tourism

Environment

Policy ENV/1: Promotion of Recreational Open/Green Space

Justification

Open spaces and playground facilities should be maintained and expanded in order to promote safety and public health within Mandalay City.

Means of Implementation

This policy can be implemented through enacting new regulations, which call for the protection of green space like parks and playgrounds. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

MCDC

Policy ENV/2: Prevention of Surface Water Pollution

Justification

Water Pollution in and around the City of Mandalay is currently a concern for public health and more purification and sanitation facilities should be provided in order to prevent contamination and outbreak of communicable disease.

Means of Implementation

This policy can be implemented through enacting new regulations, which call for additional water purification and sanitation facilities to be located on low risk land. The concerned agency/authority should take immediate steps in this regard.

Implementing Agency

MCDC, MoH

Data Requirements for Urban Area Plan

The Urban Area Plan will require more detailed information than that of Structure Plan. Apart from data required for UAP, a number of planning tools are to be used for decision implementation of Urban Area Plan. This stage of planning phase will analyze disaster issues more critically than the structure planning Phase.

Studies to Carry out

1. Population Projection and forecast.
2. Spatial Growth Trend Analysis.
3. Transport Mobility Analysis.
4. Housing pattern and Trend Analysis.
5. Vulnerability Assessment in relation to prevailing Hazards.
6. Natural Risk Assessment considering prevailing Hazards.

Exposure Inventory and Database Development

DR-UAP - 01 (Data Requirement-Urban Area Plan)

	BASIC INFORMATION AND CLASSES
A	Major Landuse Residential/ Homestead Agriculture Educational and Research Business and Mercantile Public Administration Institution Mixed Use Industrial and Storage Assembly
B	Transportation Road Alignment with width and ROW Rail Alignment with ROW Footpath with width Water Communication Location of Bus, Truck, Rail stand
C	Utility and Service Facilities Water Supply Network Gas Supply Network Electricity Supply network
D	Natural Features Water Body Pond River

DR-UAP - 02 (Standards for Different Facilities)

Urban Facilities	Planning Standard	Recommended Condition for Disaster Risk Mitigation
EDUCATION		
Primary School		
Secondary School		
College		
University		
HEALTH		
Hospital		
Clinic		
Diagnostic Center		
OPEN SPACE		
Park		
Play Ground		
SOCIAL SERVICES		
Market		
Post office		
Graveyard		
Social Centers		
Pagoda		
Temple		
COMMUNICATION		
Road		
Primary Road		
Secondary Road		
Main Road		
Footpath		

Currently, DR-UAP - 02 is left blank because national and local standards for the urban facilities do not exist. This table should serve as a template to highlight urban development in the future to ensure that appropriate disaster risk mitigation efforts are included in its implementation.

DR-UAP - 03 (Land Use Classification)

Residential/Homestead

Single structure (Private/ Government); Multi structure (Public/ Government); Apartment Housing (Private/ Government); Student Hostel, Mess, Rest House, Others (specify)

Educational and Research

Primary Schools; Secondary Schools (Boys/ Girls); Degree College; Technical Schools (Survey/ Polytechnic); Teachers Training College; Physical Training Institute; University; Civic and Social Organizations; Medical College; Libraries; Research Organization; Museum and Art Galleries; Kinder Garden; Vocational Institution; Others (specify)

Business and Mercantile (Commercial)

General Merchandise store (including groceries and stationeries); Food Market; Books and Office Supplies; Cloth and Garments store; Confectionary; Drugs, chemicals, and allied products (including paints and varnishes); Foot ware; Electrical & Electronics goods; Sports goods; Hardware and Building Materials; Furniture and Wood products; Wholesale Business; Laundries and dying; Tailors shops; Barber shops; Banking and Insurance; Repair Shops (Automobile, Electric goods, Watch, Cycle, Shoe and Leather goods etc.); Gold Smith, Black smith; Locksmith shops; Physician and Surgeons offices; Lawyers office; Dental and Medical Laboratories; Others (specify)

Public Administration

Government Office; Non-Government agency; police station; others (specify)

Institution

Social Welfare Organizations; Healthcare; Others (specify)

Mixed Use

Commerce/Residential/ Processing; Service Industries; Others (specify)

Urban RESERVE (Hazard Prone Area)

Areas demarcated as hazard prone areas in the Structure plan; surrounding areas of identified fault line; flood flow areas; natural water bodies; demarcated hills; others (specify)

Industrial Use and Storage

Food products (Sweet making etc.); Agro-processing Mills (Rice/Wheat/Oil seeds); Ice Plant; Tobacco manufacturing; Sugar Mills; Textile (Cotton/Silk); Wood products (Saw mill, furniture and other products); Pottery and related products; Leather and leather related products; Rubber and plastic products; Others (specify)

Open Space

Play ground (including stadium); Parks

Agriculture

Cropland; Orchard; Horticulture; Dairy Farm; Poultry Farm; Pisciculture (fish) Farm

Assembly

Clubs and Similar Buildings; Community Centre; Gynasium; Cinema; Theatres; Town Hall; religious building; others (specify)

Security/Defense

Army; Police; Jail; others (specify)

Public Utilities, Communications and Transport

Postal Services; Fire Services; Telephone Exchange Building; Sewerage system treatment/disposal Area; Waste Disposal Area; Water supply (treatment plant/intake point sets); Power Station; Radio Station; Rail way (include right of the way); Railway Station; Bus, Truck, Taxi, Terminals; Steamer Terminals; Airfields; Graveyard; Cremation; Others (specify)

Road

Metal; Non Metal; earthen Road

Railway

Water Bodies

Pond, Natural water flow, canal, river

Vacant Land

The lands which under no specific use for the time being; ownership of the land; others (specify)

Urban Area Plan Implementation Mechanism

Based on studies and analysis of the relevant sectors, conditions need to be set for implementation of an Urban Area Plan. At this stage, based on the land use, assessment results and trends analysis different zones to be demarcated for spatial development or land use control for further development. This part will determine the area specific policy to safeguard future development. The following is an outline of the zones to be demarcated with conditions of respective use:

Figure 5

Urban Land Use Planning Zones in Urban Area Plan

Zone	Permitted Use	Conditional Use	Restricted Use
Residential	Residence	Small business shops like confessionary	Commercial Activities; Any type of Industry; Polluting Activities
Commercial	General Merchandise store; Food Market; Books and Office Supplies etc.	Light industries with limited manpower/ types	Residence; academic like school/ college
Industrial	Heavy, medium and light industries	Commercial activities with limited categories	Residence; academic like school/ college
Educational	School; college; university	Student Dormitory	No urban use like commercial, industrial, residential
Agriculture	Agriculture, forestry; gardening	Fisheries; livestock	No urban use like commercial, industrial, residential
Open Space	Park; play ground; lake; zoo;	Temporary structure (to be specified) with light activities	No urban use like commercial, industrial, residential
Mixed Use	Combination of Residential, Commercial, offices etc.	Special type of activities (specify)	Any type of Industrial Use
No Development Zone (Hazard Prone Area)	Temporary use like Agriculture, gardening, forestry	Temporary structure (to be specified) with light activities	Power plant; heavy structure; industry;
Urban Reserve (Risk Prone Area)	Existing infrastructures without further extension	Improvement of existing infrastructures	Any type of new construction

Data Requirements for Detailed Area Plan

DR-DAP – 01

Figure 6

Data Requirements for Detailed Area Plan

List of Features	Information Requirement
Data Requirements for Urban Area Planning	
Building Information	Identification number, Accessibility, Utility services availability, Area of building footprint, Number of stories, Number of apartments, Structural type, Number of occupants, Age of the building.
Transportation	Type of road, construction material, width, footpath, number of lane, road divider, Railway line, railway track
Utility and Service facilities	Water supply network, material of pipeline, width, water main, pump station, water source, Gas Supply Network, , material of pipeline, width, gas, control station; Sewage network, alignment, alignment diameter; Electricity Supply Network, cable orientation, substation, electric main station.
Data Requirements for Earthquake Risk Assessment	
Building Information	Identification number, Accessibility, Utility services availability, Area of building footprint, Number of stories, Number of apartments, Structural type, Number of occupants, Age of the building. Presence of soft story, Presence of heavy overhangs, Shape of the building in plan view, Shape of the building in elevation view, Pounding possibility, Building in slope land, Visible ground settlement, Presence of short columns, Visible physical condition.
Transportation	Type of road, construction material, width, footpath, number of lane, road divider, Railway line, railway track
Utility and Service facilities	Water supply network, material of pipeline, width, water main, pump station, water source, Gas Supply Network, , material of pipeline, width, gas, control station; Sewage network, alignment, alignment diameter; Electricity Supply Network, cable orientation, substation, electric main station.
Data Requirements for Flood Risk Assessment	
Building Information	Identification number, Accessibility, Plinth height, Utility services availability, Area of building footprint, Number of stories, Number of apartments, Structural type, Number of occupants, Age of the building.
Transportation	Type of road, construction material, elevation, width, footpath, number of lane, road divider, Railway line, railway track and elevation
Utility and Service facilities	Water supply network, material of pipeline, width, water main, pump station, water source, Gas Supply Network, material of pipeline, width, gas, control station; Sewage network, alignment, alignment diameter; Electricity Supply Network, cable orientation, substation, electric main station., Location and Elevation of all supply stations

List of Features	Information Requirement
Data Requirements for Fire Risk Assessment	
Building Information	Identification number, Accessibility, Utility services availability, Area of building footprint, Number of stories, Number of apartments, construction material, Number of occupants, electric wiring of the building, distance from nearby house
Transportation	Type of road, width, footpath, number of lane, road divider
Utility and Service facilities	Water supply network, material of pipeline, width, water main, pump station, water source, Gas Supply Network, , material of pipeline, width, gas, control station; Sewage network, alignment, alignment diameter; Electricity Supply Network, cable orientation, substation, electric main station.
Data Requirements for Cyclone Risk Assessment	
Building Information	Identification number, Accessibility, Utility services availability, Area of building footprint, Number of stories, Number of apartments, Structural type, Number of occupants, Age of the building.
Transportation	Type of road, construction material, elevation, width, footpath, number of lane, road divider, Railway line, railway track and elevation
Utility and Service facilities	Water supply network, material of pipeline, width, water main, pump station, water source, Gas Supply Network, , material of pipeline, width, gas, control station; Sewage network, alignment, alignment diameter; Electricity Supply Network, cable orientation, substation, electric main station.
Data Requirements for Landslide Risk Assessment	
Building Information	Identification number, Accessibility, Utility services availability, Area of building footprint, Number of stories, Number of apartments, Structural type, Number of occupants, Elevation of the Building (slope in the hill /foot of the hill)
Transportation	Type of road, construction material, elevation, width
Utility and Service facilities	Water supply network, material of pipeline, width, water main, pump station, water source, Gas Supply Network, , material of pipeline, width, gas, control station; Sewage network, alignment, alignment diameter; Electricity Supply Network, cable orientation, substation, electric main station.

EXISTING STRUCTURE TO IMPLEMENT POLICY RECOMMENDATIONS

Figure 7

Existing Structure to Implement Policy Recommendations

Major Areas	Relevant Ministry and Departments
Boundary Demarcation	Survey Department & Forest Department under the ministry of Environmental Conservation and Forest Ministry of Defense GAD, Settlement and Land Record Department
Exposure Inventory and database Development	
Demographic Aspect Information and Study	Ministry of Immigration and Peoples' Power, GAD, Department of Health
Social Sector Information and Study	GAD, Planning Department, Sports and physical education department, Information and Public relation department, Department of Education, Social Welfare department, cooperative department,
Economic Sector Study	Ministry of National Planning and Economic Development, Ministry of Education, Central Bank of Myanmar, Ministry of Commerce, UMFCCI
Natural Hazard Study	Disaster Management Law 2013, DMH, DEC, GAD, MES, Myanmar Seismic Committee, Myanmar Geological Society,
Environment and Climate Change Study	Ministry of Environmental Conservation and forest, DMH
Study on Hydrology	Ministry of Agriculture and Irrigation, Ministry of Transport, Ministry of Electrical Energy
Study on Transportation	Ministry of Transport, Ministry of Railway, Ministry of Construction, City Development Committee
Study on Housing	MOC, DHSHD, City Development Committee, GAD,
Land Ownership and Land Value Study	GAD, Settlement and Land Record Department, Department of Internal Revenue
Legal Issue Study	
Local Resources and Tourism Study	Ministry of Hotel and Tourism, MOECF, Ministry of Culture, GAD, Immigration Department, City Development Committee
Building Development	Provincial Building Code 2012

CHAPTER 05

RISK SENSITIVE URBAN LAND USE PLANNING TOOLS

The previous section provided detailed information pertaining to the process of integrating DRI into specific urban land use planning measures in Myanmar, with case-by-case examples provided for Mandalay City. While Myanmar (and Mandalay City) have many institutions in place to strengthen DRR throughout urban areas in the country, this section will further detail broad planning tools which can also be integrated into planning practices throughout urban areas in Myanmar. This section should be used as a general reference to have a greater understanding of measures that can be taken, along with the necessary data needed to ensure that DRI is utilized.

Regulatory Tools

Regulatory measures like building codes and land use planning, when implemented with DRI can reduce risk in urban areas.

Building codes ensure that new development does not occur unless structures are designed and built to withstand the impact of hazards. Historical data relating to past disasters, along with future hazard projections and scenarios inform decision makers about the necessary restrictions to place on building construction material, seismic bearing loads, and intended use of the structure. This tool can be drafted at the local level, using National Building Codes as a model and shaped towards local conditions. The Development Committee, working with the PLMD or GAD would decide on the proper regulations of the code. Following approval, a building inspector or other appointed local government representative to ensure that a building can be safely used for its intended purpose. These codes can also ensure that old buildings are retrofitted properly in order to withstand reduce risk.

Data needed: historical disaster data, hazard scenario maps, and building database

- Land use can be regulated through the establishment of appropriate zoning measures within areas subject to or potentially subject to hazards. City Development Committees and districts (for smaller towns and urban areas) can now draft land use plans. DHSHD has assisted in the past in conducting prospective plans and could serve as an advisory role in this as well. Examples of land use regulations include:
    - Determine land use, density, building placement, and servicing standards
    - Designation of land as hazard prone, like identification of a floodplain establishes that development is limited, or will not occur in a hazardous location.
    - Minimum building elevations & setbacks for land in hazard prone areas.

Data needed: Map of urban area with current land use, hazard map, building database, and population data

Restriction Tools

Comprehensive land use plans are not the only way to change or restrict land use. A variety of ordinances aimed at specific hazard prone areas of a city or even a specific development site can be enacted to reduce risk.

- Land Acquisition is a process where government can gain ownership of land for the primary purpose of addressing public safety through purchase or expropriation. This has been done in other cases for means of economic development but here it is recommended for environmental preservation or protection. Land can be acquired for a variety of purposes including protection works (dike, mangrove/coral reef restoration, and no build zones). Land acquisition can also be done to prevent the development or to hold it in public ownership for exclusive public use like parks or other green space.

Data needed: Hazard map, infrastructure map, property ownership/land titles, and building database

- Transfer of Development Rights is a that tool refers to the transfer of a property's development potential under current zoning provisions from one site or property to another. If a parcel is considered at risk, the development potential can be relocated to another area of land or parcel not at risk. Density transfer is primarily a voluntary, market- concept in which the transfer of development potential is used to offer protection for sensitive coastal resources and remove it from hazardous areas. The tool is used to direct development away from the area at risk by designating the development ideas to an area where development or increased density can be safely accommodated.

Data needed: Map or urban area with current land use, Hazard map, building database, population data, development plans

- Conservation Easement is a legal agreement in which one property owner or leaser grants the use of some real property rights to a public or private entity for a specific purpose. It represents an interest in land but not the right of exclusive possession. The easement is typically used to preserve a particular portion of land on the property that is prone to hazards. Conservation easements are usually enacted to restrict development on fault lines, natural wildlife habitat, or low-lying areas including riverbanks and coastal areas.

Data needed: Map of urban area with current land use, Property maps with hazardous areas, Hazard maps.

Engineering Tools

- Property Specific design is a tool used to protect individual buildings that are found in hazard prone areas. This method of disaster risk reduction can be implemented in new development projects but is also advantageous because many existing structures can be retrofitted and updated with the necessary intervention. Approaches can include:
    - Reinforcing building foundations to withstand seismic activity, floodwater, or fire.
    - Structural elevation can be achieved in several ways including: raising the ground level below a building with the placement of fill; raising the habitable areas within a building; or raising the entire building by using stilts, foundation walls or similar elevating structures.
    - Wet flood proofing consists of providing protective measures against flooding and allows water to enter and exit a structure with minimum damage. This tool employs the use of flood resistant materials, the elevation of electrical and mechanical services and the use of openings for drainage.

Data needed: Historical disaster data, Map of urban area with current land use, building database, Hazard maps, Site survey, Engineering schematic

- Area wide hard protection like dikes can provide benefits to entire districts and urban areas. Dikes prevent the inundation of lowland area from storm surge, riverine flood, or high rainfall.

Data needed: Historical disaster data, Historic rainfall, Map of urban area with current land use, Hazard Maps, Site survey, Engineering schematic

Natural Protection Tools

- Coastal Wetland Creation or Restoration utilizes the natural functions of wetlands and mangroves to help create of a buffer to reduce wave energy, which can greatly reduce the impact of cyclones, storm surge, and flooding.

Data needed: Historic rainfall, historic disaster data, hazard maps, map of urban area with current land use, and ecological survey

- Dune Building or Rehabilitation Natural sand dunes provide an effective defense against coastal erosion and flooding by dissipating floodwaters from coastal or riverine sources. Dunes form a barrier similar in function to a seawall but are more dynamic, and can adjust in response to changes in wind and wave climate or sea level. Both natural and artificial dunes can be stabilized through vegetation planting; vegetation roots help stabilize the dune.

Data needed: Historic rainfall, historic disaster data, hazard maps, map of urban area with current land use, and ecological survey

- Natural Soil Nourishment refers to the addition of sand or other similar sediment material to satisfy the erosional forces in and around coastal and riverine areas. Soil nourishment reduces the detrimental effects of erosion by providing sediment to satisfy the natural forces of erosion.

Data needed: Historic rainfall, historic disaster data, hazard maps, map of urban area with current land use, and ecological survey

- Natural windbreaks like trees can withstand high-speed winds from cyclones and other storms. Planting and maintenance of urban green space can serve as a useful method to reduce the effect of high-speed winds on buildings and other infrastructure.

Data needed: Historic storm data with average wind speed, historic disaster data, hazard maps, map of urban area with current land use, and ecological survey

GLOSSARY

Building Code	A regulatory policy implemented by a governing authority that sets standards for minimum construction practices and building materials. These regulations are made to protect public health and safety.
Disaster	A serious disruption of the functioning of a community or society involving widespread human, material, economic or environmental losses exceeding the ability of the affected community or society to cope using its own resources.
Disaster Risk	The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period.
Disaster Risk Information	Data collected that pertains to disaster and hazard events. This can consist of data related to natural or man-made hazards and disasters. Historical disaster records, seasonal rainfall, and seismic recordings are common examples of these data types.
Disaster Risk Reduction	The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.
Exposure	People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.
Hazard	A dangerous phenomenon (such as a flood, storm, or earthquake) that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.
Hazard Mapping	The process of utilizing geospatial mapping technology and disaster risk information to represent the physical location of hazards such as cyclone, earthquakes, fire, flood, land slide, storm surge, and tsunami

Geographical Information Systems (GIS)	Computer software designed to capture, manage, analyze, and display multiple forms of geographically referenced information.
City Development Committee:	Administrative department found in the three largest cities in Myanmar: Yangon, Nay Pyi Taw, and Mandalay. These authorities are responsible for all land allocation, management and planning, along with distribution of basic services.
Myanmar Action Plan for Disaster Risk Reduction (MAPDRR)	An action plan drafted by the Ministry of Social Welfare, Relief and Resettlement and ADPC in 2012 that highlights seven components to strengthen disaster risk reduction policies and programs in the Republic of the Union of Myanmar.
National Spatial Development Plan (NSDP)	Drafted by the Ministry of Construction (MOC) in 2012, this plan states that MOC is responsible for physical planning within the country and is the key component to strengthening DRM in Myanmar. The contents of the newly drafted plan include spatial planning policy at three levels (national, regional, township), land use regulations, and development permission criteria.
Rural	Areas where agricultural practices dominate the economy and living densities are low in comparison to urban areas.
Township Development Committee (TDC)	All townships in Myanmar that are not considered cities are governed by this entity. Each authority contains a General Administrative Department (GAD). The GAD operates under the Ministry of Human Affairs issues land titles and the Development Department grants building construction approval within the TDC.
Urban	Areas where the majority of the population is employed in pursuits other than agriculture. Urban areas are typically characterized by high density living environments (compared to rural) and concentration of infrastructure.

Urban Land Use Planning	The systematic and iterative procedure carried out in order to create an enabling environment for sustainable development of land resources within an urban environment such as a city or town. It assesses the physical, socio-economic, institutional and legal potentials and constraints with respect to an optimal and sustainable use of land resources, and empowers people to make decisions about how to allocate those resources.
Vulnerability	The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.
Zoning Ordinance	A regulatory policy and tool utilized by a governing authority that sets physical standards or restrictions for building design features, land use, and other uses that occur within designated areas throughout a municipality or urban area.

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