

Guideline for Disaster Resilient Land Use Regulation / Development Standards

Project for Capacity Strengthening on Development of Non-Structural Measures for Landslide Risk Reduction in Sri Lanka

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**National Building Research Organisation
(NBRO)**



**Japan International Cooperation Agency
(JICA)**



**GUIDELINE
FOR
DISASTER RESILIENT LAND USE
REGULATION / DEVELOPMENT
STANDARDS**

PROJECT SABO

National Building Research Organization

Japan International Cooperation Agency

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ABBREVIATION

DMC	Disaster Management Centre
DS	Divisional Secretariat
GN	Grama Niladhari
HR	Hazard Risk
H & TI	Housing and Town Improvement
LUPPD	Land Use Policy Planning Department
LAB	Landslide Approval for Building
LAD	Landslide Approval for Development
LHM	Landslide Hazard Map
LA	Local Authority
MOD	Ministry of Defense
MLIT	Ministry of Land, Infrastructure, Transport and Tourism, Japan
MC	Municipal Council
NBRO	National Building Research Organisation
NCDM	National Council for Disaster Management
NNDIS	National Natural Disaster Insurance Scheme
NPPD	National Physical Planning Department
PS	Pradeshiya Sabha
SDRRP	Sediment Disaster Risk Reduction Plan
UC	Urban Council
UDA	Urban Development Authority
Y/R	Yellow/Red

CHAPTER 1 INTRODUCTION

1.1 Background

Sediment Disaster is one of the most serious natural disasters in Sri Lanka. In the central and southern mountainous areas, sediment disasters such as slope failures, landslides, and debris flow frequently occur in the monsoon period because of the fragile geology and steep topography. In recent years, sediment disasters caused by heavy rainfall in the spring monsoon season become severer. It is still fresh memory that the large-scale landslide in Aranayake, Kegalle district killed 130 lives in May 2016. In addition, increasing exposure to the hazards due to rapid reclamation and development has been raising sediment disaster risks in urban and rural areas. The Establishment and improvement of the early warning system and legal arrangement for land use planning and development standards are urgent issues in Sri Lanka.

National Building Research Organization (NBRO) under the Ministry of Defense (MOD) with the assistance of the Government of Japan has made efforts to improve the early warning system and legal arrangement for land use planning and development standards. However, to further mitigate sediment disaster risks in Sri Lanka, accurate risk assessment, early warning mechanism, and land use planning based on the assessment are required.

1.2 Objective

The main objective of this guideline is for advocating the practitioners to reduce the sediment disasters risks in Sri Lanka through reducing the exposure and vulnerability to sediment disasters by land use regulation and development standards.

1.3 Scope of the Guideline

1.3.1 Main Target Users of Guideline

The main target users of the guideline are the practitioners of land use planning and development control of both the national government and local government. The officials of Local Authorities (LA), Urban Development Authority (UDA), National Physical Planning Department (NPPD), Land Use Policy Planning Department (LUPPD), and NBRO are assumed as the target users of national and local government.

1.3.2 Composition of Guideline

The guideline consists of five chapters: “Chapter 1: Introduction”, “Chapter 2: Sediment Disaster and Countermeasures in Sri Lanka”, “Chapter 3: Land Use Classification and Regulation”, “Chapter 4: Development Standards” and “Chapter 5: Implementation of Land Use Zoning and Development Standards”.

“Chapter 1: Introduction” addresses the background, objectives, and scope of the guideline as an introductory part of the guideline.

“Chapter 2: Sediment Disaster and Countermeasures in Sri Lanka” shows the tendency of the sediment disasters in Sri Lanka and the outline of countermeasures to the disasters. The tendency of the sediment disaster covers increasing exposure to the hazards due to development in hilly and

mountain areas, and the source and the extent of the impact in the recent sediment disasters. For the countermeasures to the sediment disasters, hazard risk mapping and measures including both structural measures and non-structural measures are also introduced.

“Chapter 3: Land Use Classification and Regulation” shows basic ideas of land use regulation where sediment disaster risk is high, based on the recent tendency of increasing exposure to the hazards due to development in hilly and mountain areas as shown in Chapter 2. Chapter 3 also explains land use classification and regulations for the classified zones; the key points of the concerned laws and regulations; the idea of Yellow and Red zones as the extent of the disaster risks for each type of sediment disaster; four land use classifications based on Yellow and Red zones: Restricted Zone, Controlled Zone, Warning Zone, and Development Zone; possible land use activities at each zone.

“Chapter 4: Development Standards” states necessary development standards for the four land use classifications as explained in Chapter 3. Chapter 4 also addresses what measures including structural and non-structural are necessary for development activities in each zone.

“Chapter 5: Implementation of Land Use Zoning and Development Standards” explains a basic plan as Sediment Disaster Risk Reduction Plan (SDRRP) consisting of a land- use plan and other disaster reduction measures such as structural measures, early warning, evacuation, etc., which will be the basis to implement land use zoning and development standards. The SDRRP can be input to develop or update Development Plan to be prepared by UDA. This chapter also indicates the roles of the concerned stakeholders to implement the land use zoning of the Sediment Disaster Risk Reduction Plan.

CHAPTER 2 SEDIMENT DISASTERS AND COUNTERMEASURES IN SRI LANKA

2.1 Trend of Sediment Disasters

As of 2018, the NBRO inventory database has more than 3,000 documented sediment disasters. The sediment disasters have occurred in 12 districts and are especially concentrated in Kandy, Badulla, Ratnapura, and Kegalle districts, in the mountainous and hilly areas of Sri Lanka. The distribution of sediment disasters reflects regional geology, topography, and land use.

Sediment disasters are the most hazardous natural disasters in Sri Lanka, and the number of sediment disasters has been recently increasing nationwide (Figure 2-1). Many sediment disasters are associated with the cutting failure for house building and road construction. The recent increase in the number of sediment disasters is largely due to inappropriate land use planning and unplanned development onto sloping lands and previous landslide areas. Excavation at the base of slopes, particularly at the toes of potential and active landslides as well as colluvium slopes is the most common human trigger of sediment disasters.

In addition, almost all sediment disasters are associated with intense and/or prolonged periods of rainfalls, indicating that rainfalls are the main triggering factor of such disaster events. Improper planning and inappropriate maintenance of surface drainage systems also increase the potential for slope instabilities.

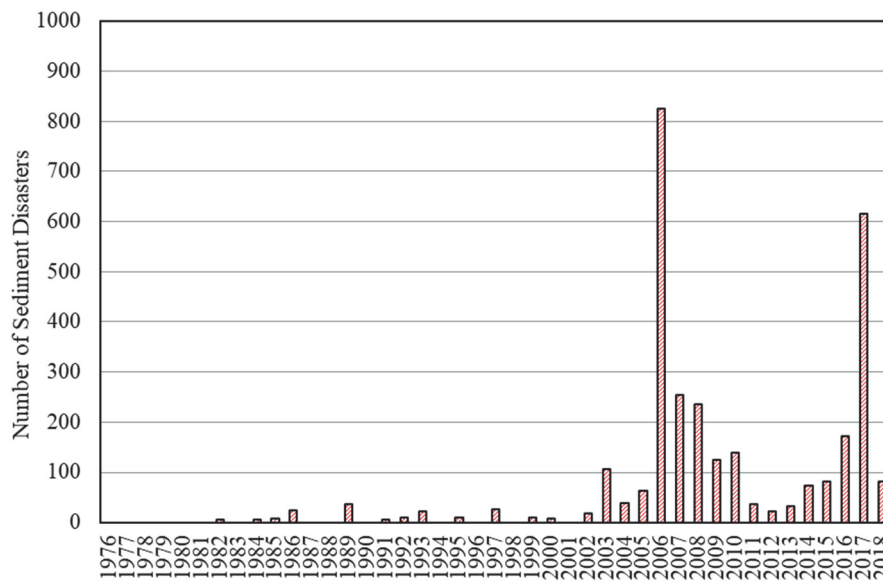


Figure 2-1: Yearly Occurrence of Sediment Disasters in Sri Lanka (1976 to 2018)

(※Systematic data collection was started after 2006)

2.1.1 Slides

Slides are used to describe a downward movement of slope materials along preexisting or potential rupture surfaces or zones according to MLIT, Japan (Figure 2-2). They are the major types of sediment disasters in Sri Lanka and are deep, rotational, or translational sliding caused by groundwater pressures within a gentle hillside. They normally move slowly and involve a relatively large volume of displaced mass, thereby causing significant damage to properties such as houses, roads, and other lifelines.

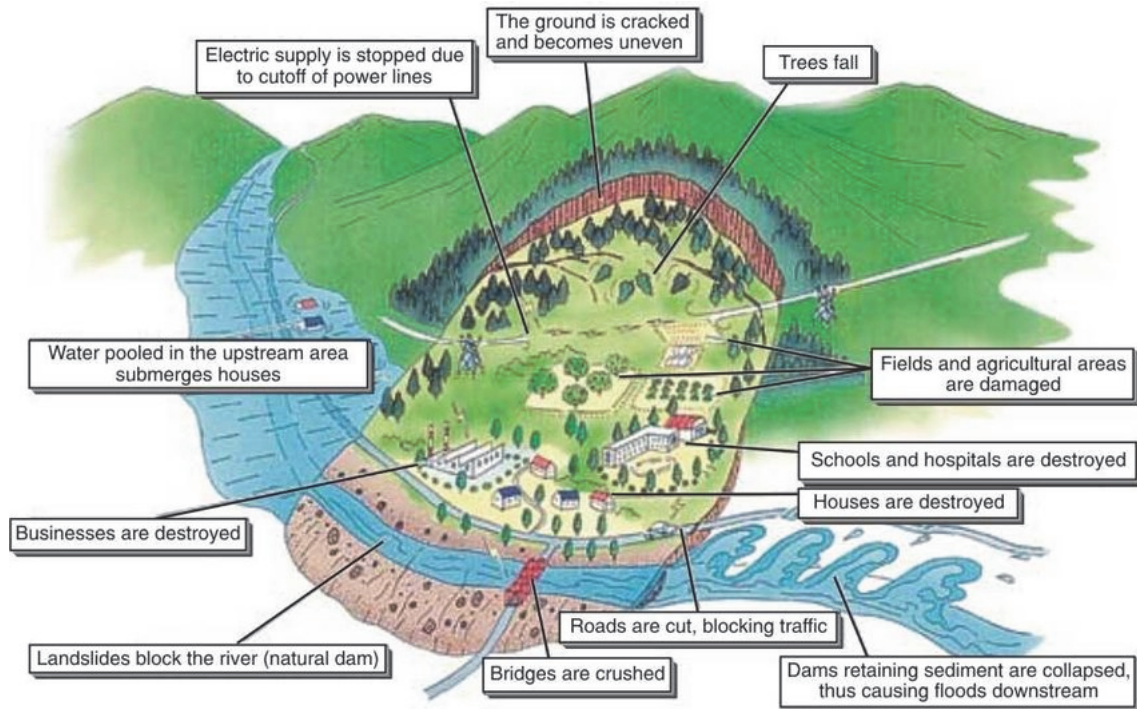


Figure 2-2: Damages by Slides

Source: MLIT, Japan

2.1.2 Slope Failures

Similar to slides, slope failures are also the major type of sediment disaster in Sri Lanka, but shallow, fast-moving on steep slopes, natural and artificial, with a relatively small volume of displaced mass. Slope failures, because of their fast-moving feature and without indication before movement, frequently result in serious injuries and fatalities even in the case of the small volume of displaced mass. Figure 2-3 illustrate the slope failure that occurred in Peradeniya (near Kandy) in 2011 which disrupted the transportation network and social life.



Figure 2-3: Slope failure occurred in Peradeniya

2.1.3 Debris Flows

Debris flows are also a common type of fast-moving sediment disaster in Sri Lanka. They usually start on upper steep hillsides mostly as shallow slope failures or occasionally as slides during intense rainfalls, then fast flow down hills and/or into channels, and finally spread widely on gently sloping grounds. Such sediment disasters, normally together with driftwoods, because of their fast-moving velocity and long-traveling distance, generally claim many lives in addition to the damage to roads, bridges, water supply lines, electricity, and so on along their traveling paths. Even small debris flows have a high potential to cause damage and loss of life.

In Sri Lanka, debris flows can be subdivided, from the viewpoint of hazard identification, into two subtypes, namely, channelized type and hillslope type. The hillslope type debris flows are generally unpredictable or difficult to identify prior to occurring because of no evidence or indication such as an alluvial fan or debris fan and therefore are also excluded from this guideline. Figure 2-4 shows the channelized type debris flow event that occurred in the 2017 Morawakkanda area, which was 3.1 km distance long between scarp to deposition area.



Figure 2-4: Debris Flow in Morawakkanda

2.1.4 Rock falls

Rockfalls are very rapid to extremely rapid fall-down of loosed and fractured rock blocks along steep rock slopes, natural, artificial or both. The fall-down movement takes place mainly through the air by free-fall, leaping, bounding or rolling. An inventory survey shows that rockfalls are



Figure 2-5: Image of Rockfall

common along many cut slopes for road constructions and house buildings, and therefore rockfalls threaten or damage transportation and residential areas. Figure 2-5 shows an image of a rockfall.

2.2 Overview of Countermeasures against Sediment Disasters

To reduce the risk of sediment disasters, there is no doubt that people should not live in sediment disaster-prone areas. However, since the land is limited, it is practically difficult to settle only in sediment disaster-free land such as flat plain apart from mountain hills. Therefore, it is important to 1) identify the existing risk, 2) reduce the risk to the level that people can tolerate, 3) strengthen the coping capacity of the people to the remaining risk, and 4) then, regulate land developments and settlements if the risk level is too high to live despite of the above efforts. Here introduces an outline of general countermeasures to reduce sediment disaster risk. The applicable measures are given in Chapter 4.

In the context of world trends on disaster risk reduction, all the stakeholders in Sri Lanka should follow Sendai Framework for Disaster Risk Reduction (2015-2030), which is the first major agreement of the post-2015 development agenda and provides the Member States including Sri Lanka with concrete actions to protect development gains from the risk of disaster. Its expected outcome is “The substantial reduction of disaster risk and losses in lives, livelihoods, and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries”. To achieve the outcome, it is pursued to “prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience”.

NBRO gives a concept of risk reduction measure for sediment disasters, which is consistent with the above outcome and goal of the Sendai Framework for Disaster Reduction, as shown in Figure 2-6. The risk reduction measures are divided into 1) risk identification, 2) risk communication and 3) risk mitigation. Risk communication includes early warning and education in which people obtain the right knowledge on sediment disasters and promptly receive real-time risk information. Risk mitigation includes development control and appropriate land use to establish disaster resilient society and measures to prevent the occurrence of sediment disasters.



Figure 2-6: Concept of Risk Reduction Measures against Landslides by NBRO (source: Jayathissa, 2015)

Moreover, the measures for sediment disaster risk reductions can be categories into 1) structural measures and 2) non-structural measures as shown in Figure 2-7.

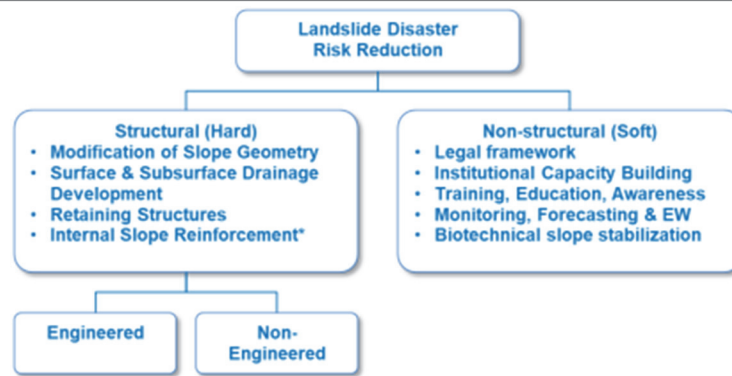


Figure 2-7: Structural and Non-structural Measures against Landslides (Source: Jayathissa, 2015)

Non-structural contains soft component measures such as legal framework; institutional capacity building; training, education, awareness; monitoring, forecasting, and early warning (EW); biotechnical slope stabilization, etc.

In addition to non-structural measures, there are two basic strategies by structural measures such as modification of slope geometry, surface, and subsurface drainage development, retaining structures, internal slope reinforcement, etc. to reduce landslide damages and losses due to landslide disasters:

- (1) Stabilization or Prevention Measures. Prevention measures, for potential landslides, such as slide and slope failure, are performed to directly improve their stabilities to the required levels. Typical prevention measures include grading the unstable portion of the slope to a lower or stable gradient, construction of rock buttresses and retaining walls, drainage improvements, and increase of force resisting sliding or failure. In general, prevention measures are typically moderate to high cost, but provide a long-term solution with low, long-term maintenance costs.
- (2) Protection Measures. Protection measures for potential landslides primarily focus on control, containment and/or diversion of the moving debris of landslide disaster, thereby protecting the involved residential houses and buildings as well as other infrastructures from landslide disasters. Such measures include retaining (containment) walls, embankments, and nets, sabo dams. Protection measures are generally low to moderate in cost compared to the above-mentioned prevention measures. However, considerable long-term maintenance costs are often associated with these measures to clean out and dispose of accumulated debris behind and inside these facilities (measures).

It should be also noted that stabilization measures seek to counter one or more key failure mechanisms and improve stability of the slope, thereby reducing the likelihood of landslide hazards; while protection measures allow landslide occurrence and seek to avoid, protect against, or limit the associated impacts, thereby reducing or controlling the consequence of landslide disasters.

CHAPTER 3 LAND USE CLASSIFICATION AND REGULATION

3.1 Overview

As seen in the tendency of the sediment disasters in Sri Lanka mentioned in Chapter 2, the development of mountainous areas in Sri Lanka has led to an increase in disasters. The causes of the increase in disasters are that residents and developers do not understand disaster risk, that land use plans taking into account disaster risk are not formulated, and that development has progressed at high disaster risk areas without obtaining development permission, and so on.

This chapter introduces how disaster risks are taken into consideration in the planning process of land use plans. Specifically, the relevant legal system related to land use planning in Sri Lanka will be reviewed, and the basic ideas on the method of setting Yellow and Red Zone to be applied in high disaster risk areas be addressed. The target disaster types for setting Yellow and Red Zone are steep slope (slope failure), landslide, and debris flow. Furthermore, this chapter explains the land use classification consists of four zones: Restricted Zone, Controlled Zone, Warning Zone, and Development Zone, which are set based on the Yellow and Red Zones. The basic ideas on possible land use activities for each zone and how to designate each zone are also covered in this chapter.

3.2 Legal Arrangement and Regulations Land Use and Development

Land use planning is the process of regulating the use of land to promote more required social and environmental outcomes and more efficient use of resources. In the Sri Lankan context, a large number of legislations has been enacted for the provision of powers necessary for planning the urban area as well as a rural area. Some of these legislations are intended to encourage people to the development of urban lands and others are designed for the control of development activities to avoid environmental and health problems, city beautifications, and any other social requirement initiated by the planning agencies.

The three (3) local government legislations and three (3) national level legislations have been identified as the key instruments for creating institutions, structures, and procedures for urban development in Sri Lanka. The concerned government officials need to follow these legislations at both the national government level and local government level for the planning and implementation of land use plans. The legislations are,

1. Local Government Legislations - highly oriented to govern some define boundary with political authority.
 - Municipal Council Ordinance – No 29 of 1947
 - Urban Council Ordinance – No 61 of 1939
 - Pradesiaya Sabha Act - No. 15 of 1987
2. National Level Legislations
 - Housing and Town Improvement Ordinance- No 19 of 1915 - enacted with the purpose of providing legal background for whole country
 - Town and Country Planning Ordinance- No 13 of 1946 - enacted with the purpose of providing legal background for whole country

- Urban Development Authority Act – No 41 of 1978 - valid to whole country after the declaration under the act.

3.2.1 Relevant Ordinance / Circular / Guidelines

(1) Issuing Landslide Clearance for construction in Landslide Prone areas

Since the majority of recent landslides are induced by human intervention, His Excellency the President, as the chairperson of the National Council for Disaster Management (NCDM), and the Ministry of Disaster Management have decided to make obtaining the concurrence of NBRO mandatory when construction activities are implemented in the identified landslide prone areas as specified in Circular 2011/01. The executors of the construction activities should obtain concurrence of NBRO when construction activities are implemented in the identified landslide prone areas.

The objectives of issuing NBRO's clearance for construction in landslide prone areas are to minimize the landslide disaster risk and to increase the safety of life and property from future slope instabilities. This objective is achieved by,

- evaluating the existing landslide susceptibility of the land selected for the intended construction based on the existing geological, geotechnical, and hydrological characteristics of the terrain enclosing the selected site.
- evaluating the possible changes in slope stability due to the required ground preparations and slope modifications for planned construction.
- evaluating the possible changes in slope stability due to the impact of planned construction on the hydrological characteristics of the terrain.
- recommending planned construction, with necessary conditions, when the potential for landslides/slope failures are minimal.
- studying the terrain in detail when there is a potential for landslides/slope failures, and if mitigation is viable, then recommending the introduction of remedial measures for the intended construction to minimize the susceptibility for any anticipated landslides/slope failures, and
- discouraging construction where there is a susceptibility to landslides/slope failures for which remedial measures are not feasible.

(2) Hazard Resilient Housing Construction Manual

The executors of the construction activities should refer to Hazard Resilient Housing Construction Manual when engineering design and construction activities are implemented in the identified landslide prone areas.

This Manual has been developed to promote the use of hazard resilient engineering design and construction practices when building houses in Sri Lanka. The Manual focuses on ensuring that housing environment is better prepared for potential disaster events through proper planning, siting, design and construction practices.

The primary aim of this Manual is to minimize the risk associated with individual houses built in natural hazard prone areas. Also, it aims to minimize the damage to at least some structural elements, if not all elements of the house during an extreme event, so that people can resume their day-to-day

activities without much interruption. It attempts to address specific issues associated with the construction of housing in areas prone to specific natural hazards, namely, landslides, high winds, floods, tsunamis, and earthquakes, or in areas exposed to inherent problematic ground conditions that could be hazardous to build therein. This Manual also aims at providing as much technical information as possible in a single reference material that brings together the relevant previously published disaster specific construction guidelines and additional engineering measures that have been adopted recently through research and practice.

3.3 Outline of Yellow/Red Zone

3.3.1 Concept of Yellow/Red Zone

Sediment Disaster Hazard Area (Yellow Zone) is defined as the area that is susceptible to landslide disaster, in which the resistance capacity of normal residential buildings is expected to be larger than the force acting on residential buildings due to the moving debris and earth of landslides. If an area is designated as a Yellow Zone: 1) early warning systems should be established, and 2) steps to raise the awareness of local people about sediment disasters shall be taken. On the other hand, Special Sediment Disaster Hazard Area (Red Zone) is designated as the area that is susceptible to landslide disaster, in which the force acting on residential buildings due to the moving debris and earth of landslides is expected to be larger than the resistance capacity of normal residential buildings. The detailed methodology of the Yellow/Red zone setting is given in the “Manual for Site-Specific Landslide Hazard Zoning”.

The risk level can be improved from Red Zone to Yellow Zone by the implementation of structural measures with technical judgment by NBRO. NBRO judges if or not the applied structural measures have positive effects from the viewpoints of mechanics between resistance capacity of normal residential buildings and force acting on the residential buildings. The concept and detail of the structural measures are illustrated in “Conceptual Planning of Structural Measures around the Designated Red Zone” which is the annex of the “Hazard and risk assessment manual” by NBRO.

3.3.2 Concept of Yellow/Red Zone for Slide

The extracted slide block by topographical and field survey is classified into three ranks, A, B and C, in terms of the clarity of slide topography and its activity based on the above-mentioned survey results. These ranks are defined and shown in Table 3-1.

Table 3-1: Classification of Ranks of a Slide Block

Classification of Ranks	Definition
Rank A	<ul style="list-style-type: none"> ▪ The slide is confirmed to be completely active at the field survey; and ▪ Its shape including its foot is clearly identifiable.
Rank B	<ul style="list-style-type: none"> ▪ The shape of the slide including its foot is clearly identifiable, but the slide is not confirmed to be active at the field survey; or ▪ The slide is confirmed to be locally active, and its shape is not clearly identifiable.
Rank C	<ul style="list-style-type: none"> ▪ The slide is not confirmed to be active at the field survey, and also its shape including its foot is not clearly identifiable.

Concept of setting the Yellow/Red Zone for slide is shown in Figure 3-1.

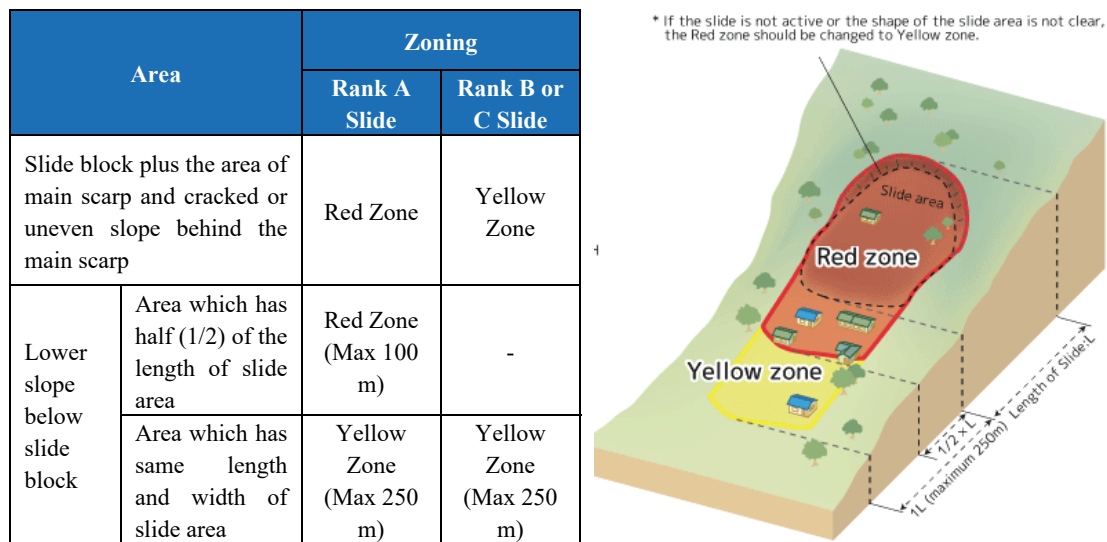


Figure 3-1: Conceptual Diagram of Yellow Zone and Red Zone for Slide

3.3.3 Concept of Yellow Zone and Red Zone for Slope Failures

Slope failures are related largely to slope steepness and slope height. Concept of setting the Yellow Zone or Red Zone for slope failure is Figure 3-2.

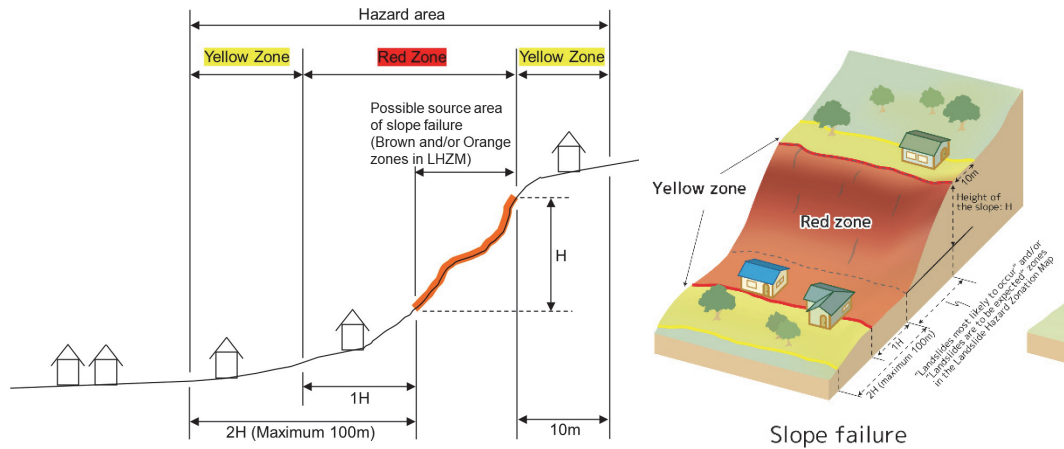


Figure 3-2: Conceptual Diagram of Yellow Zone and Red Zone for Slope Failure

3.3.4 Concept of Yellow Zone and Red Zone for Debris Flow

The lower ends of the Yellow Zone and Red Zone for debris flow shall be determined based on the ground gradient or inclination from the profile of the target area. In addition, the width of the zone shall be determined based on spreading angle such as 30 degrees for Yellow Zone or 15 degrees for Red Zone

Concept of setting the Yellow Zone or Red Zone for debris flow is Figure 3-3.

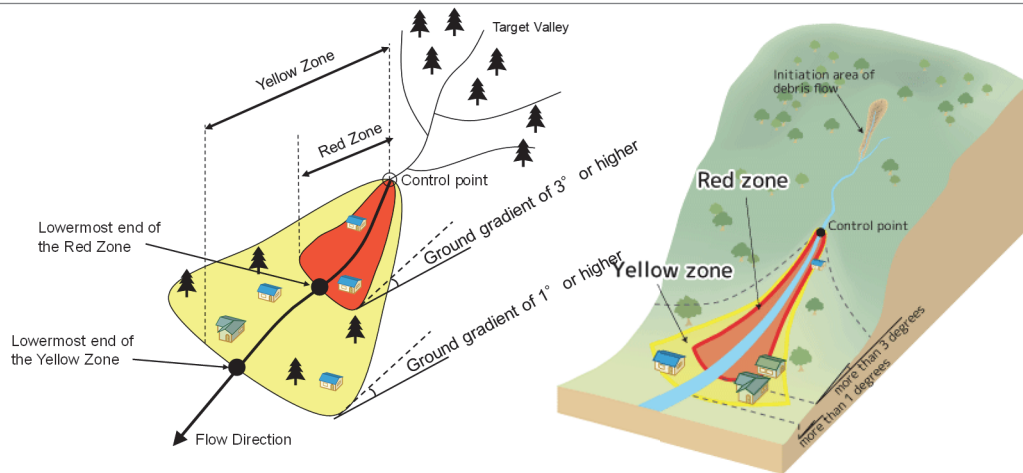


Figure 3-3: Conceptual Diagram of Yellow Zone and Red Zone for Debris Flow

3.4 Land Use Zoning Guide

3.4.1 Concept of Zoning base on Hazard/Risk Assessment

Land use planning is conducted by the planning agencies like UDA, NPPD, LUPPD, and Local authorities. The descriptive land use plan is developed to enhance the future benefits of the local authority area and maximize the land utilization in the local authority. However, disasters will affect the area, either from natural causes or man-made causes. Therefore, it is required to do planning activities by mitigating existing and future risk situations.

Landslide Hazard Map developed by NBRO has main four categories; “Landslide not likely to be occurred”, “Modest level landslide risk exists”, “Landslide risk might be existing” and “Landslide can be occurred”. Out of these four zones, development should be taken place only in the safe areas that were demarcated as “Landslide not likely to be occurred”. However, due to haphazard planning activities of the country, most of the landslide prone categories have settlements. Therefore, a proper zoning mechanism should be introduced to all categories to control the existing settlements and future developments.

For the above purpose, NBRO employed a new concept of Yellow/Red zoning in which more detailed and site-specific hazard risk levels can be indicated to promote appropriate land use on a community scale in the hilly area. The Yellow/Red zoning is also utilized for understanding the flow paths of each landslide types and identifying the possible land development type. Accordingly, the area was categorized into main four (4) zones; “Restricted Zone”, “Controlled Zone”, “Warning Zone” and “Development Zone”.

Where the new concept of Yellow/Red zoning is not applied, land use is to be tentatively examined based on the four categories of the Landslide Hazard Map by assuming that “Landslides most likely occur” is “Restricted Zone”, “Landslide are to be expected” is “Controlled Zone”, Modest level of landslide hazard exists” is “Warning Zone”, and “Landslide not likely occur” is “Development Zone” (see Table 3-2).

Table 3-2: Categorized Zoning based on Yellow/Red zoning and LHM

	Yellow/Red Zoning (Applied for the Y/R zoning prepared area)	Landslide Hazard Map (Applied for the remaining area)
Restricted Zone	Red Zone* (Sediment Disaster Hazard Area)	Landslides most likely to occur
Controlled Zone		Landslides are to be expected
Warning Zone	Yellow Zone (Special Sediment Disaster Hazard Area)	Modest level of landslide hazard exists
Development Zone	Else	Landslide not likely occur

Note: For debris flow, Restricted Zone is designated not only within Red Zone but also beyond Red Zone, that is section from initiation area to control point.

(1) Restricted Zone

The “Restricted Zone” is assigned for the lands identified as “Red Zone” and ranked in “Landslides most likely to occur (HR)” in LHM. The section from the initiation area to the control point beyond Red Zone is also assigned for debris flow. Any construction or any development shall be prohibited in the zone and this zone is a high probability of future landslide events. If any constructions are available in this zone should be relocated, with proper investigations. This land area should be kept as a natural area and required to monitor the environmental condition, water flow, and hazard situation in a detailed manner. In the future, this area shall be demarcated as a sensitive area and control all kinds of human impacts on the area. Landslide flow path area is also considered in this zone and considering the feasibility studies, the land should be converted into a green area for the entire community. It is required to have detailed investigations and proper early warning systems for upper catchments before converting the area a green area.

(2) Controlled Zone

The “Controlled Zone” is assigned for the lands identified as “Red Zone” or ranked in “Landslides are to be expected (HR)” in LHM. This zone is considered as a high-risk zone due to landslide events. Therefore, new developments such as residential, retail, office, and industry, should not be allowed in this zone. Existing developments are encouraged to resettle to Development Zone as the one in Restricted Zone. Where resettlement is difficult, the disaster risk reduction measures such as a proper early warning system should be applied.

Since both most of the Restricted Zone and Controlled Zone is set in Red Zone, how to divide between Restricted Zone and Controlled Zone should be considered. The boundaries of these two zones can be decided based on the situation of the exposure at the sites, mainly the distribution of the existing houses and the topography. Where the existing houses are distributed and the slope is mild, the Controlled Zone is to be designated. It is also possible to set a Buffer Zone between Restricted Zone and Controlled Zone to make a clear distinction between them depending on the site conditions as shown in (5) below. The Human Settlements Division of NBRO has a role to propose the division of the two zones as well as the Buffer Zone by conducting investigation.

(3) Warning Zone

The “Warning Zone” is assigned for the lands identified as the “Yellow Zone”. Development activities are allowed in this zone but need to follow the resilient construction guideline which was published by the NBRO. This zone can have different building densities depending on the risk levels. However, the entire zone should have a proper early warning system and continuous awareness programmes for the commuters and residents. Controlled land uses are allowed in the zone and the management plan of each land uses should be monitored by the respective institutes.

(4) Development Zone

The “Development Zone” is assigned for the lands which are not identified as either the Yellow zone or Red zone. This zone is demarcated by considering the importance of development and hazard levels. This zone can be used to develop any kind of constructions but it should have adhered to the guidelines which are provided by the planning agencies like UDA, NPPD, etc. No resilient construction techniques are mandated for the zone, unless if disaster management professionals were identified as disaster impacted areas. If so, the resilient construction guideline should have adhered to the constructions.

Based on this, the land area could be divided into main four sections and each section should be monitored by the institute. Furthermore, these main zones could be divided into subcategories by considering the hazard zones and development zone, which could be shown in Figure 3-.

(5) Buffer Zone

As mentioned in (3), it is also possible to set a Buffer Zone between Restricted Zone and the Controlled Zone. One of the land uses for a buffer zone is to introduce tree lines as a debris barrier as shown in Figure 3.. It may help to control debris to flow into the Controlled Zone to a certain extent and to make the boundaries of the Restricted Zone and Controlled Zone visible physically at sites.



Figure 3.4 Illustration of Tree Line Layout

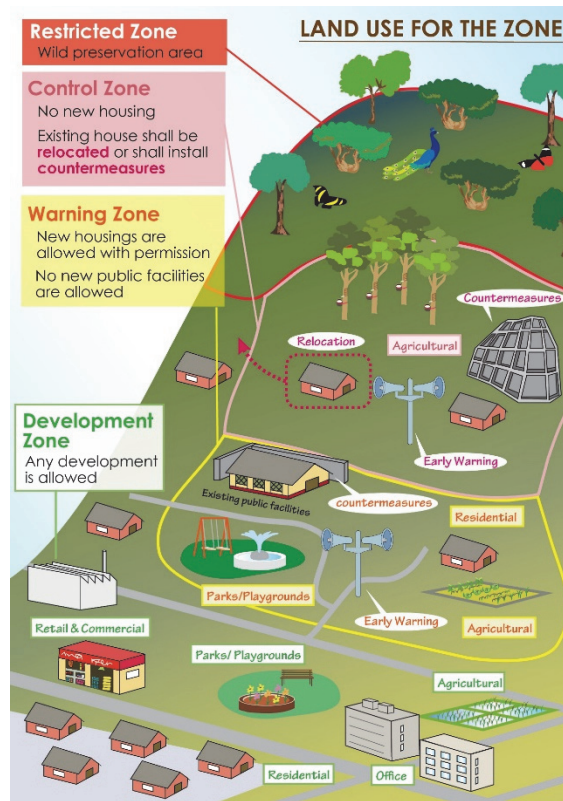


Figure 3-5: Conceptual Diagram of Land Use Zone based on Yellow/Red zoning

3.4.2 Possible Land Uses for the Zones

The possible land types for each zone are considered, and Table 3- shows the allowable and disallowable land use activities in each zone. Where judging if land use types are allowable or disallowable is necessary, a detailed investigation will be executed by NBRO. For example, agriculture use in the Restricted Zone requires detailed investigation for the judgment.

Table 3-3: Possible land uses for the zones

	Proposed Land use category			
	Development Zone	Warning Zone	Controlled Zone	Restricted Zone
Residential	Suitable for Use	Detailed Investigation	Not Suitable	Not Suitable
Retail & Commercial	Suitable for Use	Detailed Investigation	Not Suitable	Not Suitable
Office	Suitable for Use	Detailed Investigation	Not Suitable	Not Suitable
Industrial	Suitable for Use	Detailed Investigation	Not Suitable	Not Suitable
Parks/ Playgrounds	Suitable for Use	Suitable for Use	Detailed Investigation	Not Suitable
Agricultural	Suitable for Use	Suitable for Use	Suitable for Use	Detailed Investigation*

Note: Home gardening can be allowed depending on the situation.

NBRO will conduct detailed investigation through assessing the impact of hazard to target land use type. The following items are assessed in detailed investigation.

- impact of sediment disaster to be assumed (slope failure, slide, debris flow)
- current land use
- topography (slope, location of river/stream/channel,)
- geology
- vegetation
- location of nearest road, facilities for evacuation

CHAPTER 4 DEVELOPMENT STANDARD

4.1 Overview

Chapter 4 explains the development standard. Chapter 3 explained the four land use classifications: Restricted Zone, Controlled Zone, Warning Zone, and Development Zone. This chapter specifically explains what land use activities are allowed, and what measures are necessary for each zone.

All new development and housing construction are prohibited in Restricted Zone and the Controlled Zone. Existing housings in Restricted Zone should be resettled in a safe area such as Development Zone. Existing housings in Controlled Zone can remain with community-based disaster risk reduction measures and early warning system in Controlled Zone until the enactment of the relocation programme.

For Warning Zone, development with large-scale topographical changes is restricted. Development of a warning evacuation system and consideration for vulnerable people are required in the Warning Zone. The Development zone is designated for low disaster risk areas, so in principle, development is not restricted in the development zone.

4.2 Development and Countermeasures in “Restricted Zone”

“Restricted Zone” is designated where sediment disaster risk is extremely high in the “Red Zone”, such as the area where active landslide movements, cracks of houses, and land deformation are observed. In the Restricted Zone, any development and housing construction are restrictedly prohibited regardless of efforts of countermeasures. Agricultural use can be allowed depending on a detailed investigation by NBRO.

For existing houses in the “Restricted Zone”, the Local Authority and relevant authorities should consider promoting a resettlement programme to save lives from sediment disasters (detailed procedures and compensation application shall be given in section 4.2.1).

4.2.1 Resettlement and Compensation

Resettlement programmes for the existing high-risk houses should be encouraged. NBRO has prepared several plans for the ‘Implementation Framework’ that describes resettlement procedures and roles of relevant stakeholders.

NBRO will further provide technical assistance for the overall programme, providing recommendations for beneficiary selection, land selection, land development, designing the house plan and preparing the BOQ, providing technical advice for a land subdivision, layout planning and house plan selection, monitoring and providing necessary technical inputs for land development and house construction.

Apart from the resettlement programme, it has been introduced National Natural Disaster Insurance Scheme (NNDIS) as a pioneering initiative to use an insurance-based disaster risk financing solution at the country level. It is the first ever model in the world where the Government has obtained an insurance blanket cover against natural disasters to protect uninsured houses and small businesses in the entire country.

Figure 4-1 elaborates the government responses for disaster victims on resettlement and compensations.

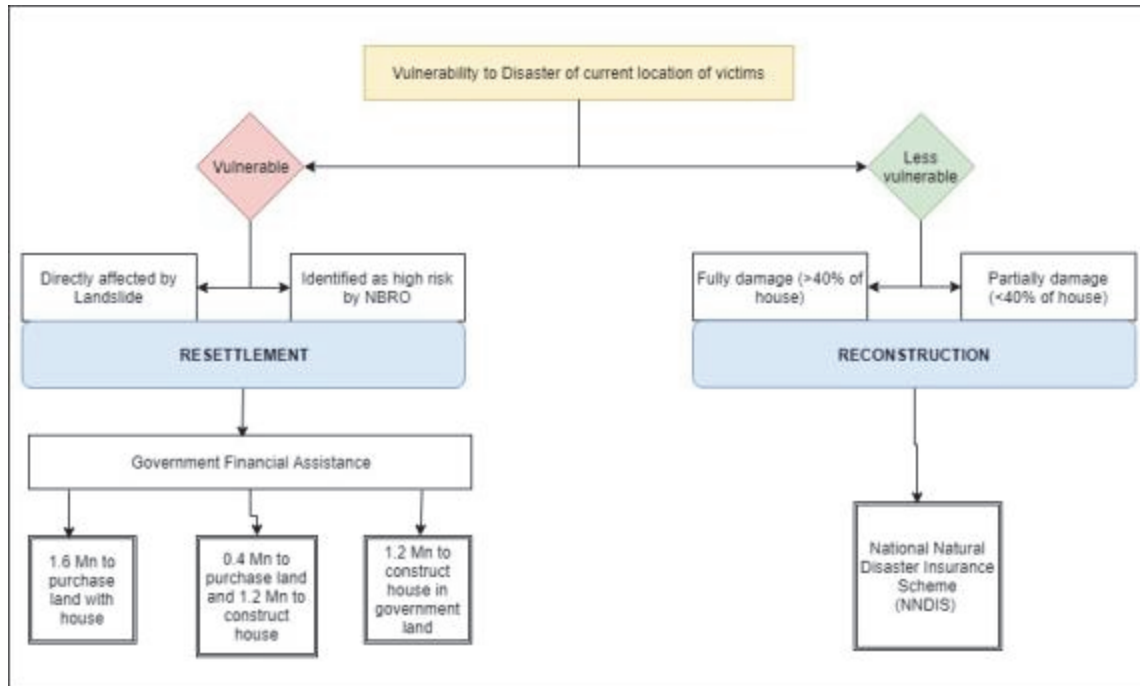


Figure 4-1: Options on Resettlement and Compensation

4.2.2 Effective Use of Restricted Zone

The land use in this zone should be a natural area including the preserving forest, with early warning systems. Agricultural use including home gardening can be allowed through a detailed investigation by NBRO. (Please see section 3.4.2)

In addition to the viewpoints of sediment disaster risk reduction, the land use in this zone as a natural area can be supported by the environmental aspects. Deforestation and loss of vegetation cover have been increasing after the industrial revolution and it is causing severe environmental problems now. The major issue of this is climate change and the greenhouse effect. Hence all the countries are now moving and seeking more environmentally friendly green solutions this concept can be applied to landslide areas too.

4.3 Development and Countermeasures in “Controlled Zone”

4.3.1 Development Regulation

“Controlled Zone” is a high-risk area for sediment disasters. Most area of Red Zone shall be designated as the Controlled Zone. In Controlled Zone, new developments for residential (including resettlement), retail and commercial, office, and industrial are not allowed even if appropriated countermeasures are implemented to prevent sediment disasters. Only agriculture is allowed, and using land as parks and playgrounds requires detail investigation by NBRO.

4.3.2 Structural Measures

In the case that the structural measures for sediment disaster are implemented at the target slope, the Red Zone shall be released, however, that these countermeasures are determined to exert an enough prevention effect of the sediment disaster. In addition, if the implemented countermeasures are considered not to completely mitigate the hazard, the designated Red Zone shall be changed into and remain as the Yellow Zone. Structural measure to be applied depends on the sediment disaster types at the target slope. The followings show the example of structural measures by sediment disaster type.

- slope failure: soil retaining work (Retaining wall), slope protection work, catching debris work
- slides: coupling with soil removal work, horizontal drainage boring, drainage well, channel works, drainage tunnel works, steel pipe pile works, and anchor works
- debris flow: Sabo dam, training channel

4.4 Development and Countermeasures in “Warning Zone”

4.4.1 Development Regulation

“Warning Zone” is regarded as a possible risk area for sediment disasters. Basically, Yellow zone shall be designated as the Warning Zone. In Warning Zone, Local Authorities shall ensure an early warning and evacuation system with the cooperation of central agencies such as DMC and NBRO. There is no restriction on private-use development and housing. However, development with large-scale topographical changes such as commercial housing land development, construction of large factories and motor roads with cutting and filling of the land is restricted. In addition, new construction of public facilities such as schools and hospitals are also prohibited.

For any land developments for housing and construction of building in the Warning Zone, the owners or developers are required to obtain Landslide Approval for Development (LAD) and/or Landslide Approval for Building (LAB) from NBRO before applying the development and construction to Local Authorities / UDA. It is because even if the land is located in the Warning Zone (Yellow Zone) on the zonation map, it might be highly hazardous for individual development on a micro-scale. Expert investigation and evaluation are needed.

4.4.2 Building Regulation

The buildings in this zone should be able to resist the followings

- minor ground movements without damage to the structure,
- moderate ground movements without structural damage but with some non-structural damage.
- larger movements without collapse, but with some structural damage and some nonstructural damage.

Although a certain degree of damage is acceptable in the house due to an unexpected event, loss of life is unacceptable. Accordingly, the structure of the house must be designed to ensure that it has

adequate strength, appropriate rigidity, and will remain as one integral unit, even while subjected to ground movements.

Flexible structures are most appropriate for hilly areas as these can accommodate movements without apparent significant distress. Steel or timber structures are generally used as the main material in them.

For more details in the design and construction of the buildings, the “Hazard Resilient Housing Construction Manual” should be referred.

4.4.3 Ensuring Early Warning and Evacuation System

In Waring Zone, heads of LAs and Divisional Secretariat (DS) Divisions should ensure early warning and evacuation system in cooperation with central agencies such as NBRO and DMC. This includes 1) dissemination of hazard maps and risk awareness, 2) identification of evacuation place and evacuation routes, 3) collecting early warning information, 4) delivering early warning and evacuation orders and 5) preparation and assistance for safe evacuation.

4.5 Development and Countermeasures in “Development Zone”

4.5.1 Development Regulation

This zone is free from landslide hazards and users can develop the land according to the existing building regulations such as Urban Development Authority Law and Housing & Town Improvement Ordinance.

The “Development zone” is set for the area out of the Yellow/Red zone, and is the free area from sediment disasters. Therefore, it is not necessary to regulate land development and building construction from the viewpoint of sediment disasters. The land owner and developer should follow appropriate procedures according to existing legal frameworks (such as UDA Law and Housing and Town Improvement (H & TI) Ordinance).

However, there are often sediment disaster risks due to insufficient accuracy of the topographic map that are essential information for Yellow/Red zone setting and due to local phenomenon, such as cutting failures. Therefore, even if the area is in a “Development zone”, it is required for the land owners and developers to comply with the followings;

- To obtain landslide certificate issued by NBRO (need to comply with 2011/1 circular)
- To comply with the “Disaster Resilient Housing Guideline”.

4.5.2 Securing Resettlement Site

There is no development restriction in the “Development zone”, where sediment disaster risk is low and regarded as a fairly safe area. Local Authorities are required to secure appropriate resettlement sites in this zone when resettlement is needed. For necessary processes and budget request related to the resettlement, please refer to Section 4.2.1. For resettlement site selection, the “Implementation Framework for the Resettlement of Landslide and Flood Victims” published by NBRO should be referred to.

CHAPTER 5 IMPLEMENTATION OF LAND USE ZONING AND DEVELOPMENT STANDARDS

5.1 Introduction

5.1.1 Objective of the Plan

To implement the land use zoning and development standards described in Chapters 3 and 4, local authorities are encouraged to develop the Sediment Disaster Risk Reduction Plans (SDRRP) with the cooperation of central and local agencies.

Therefore, it is required for local governments to refer to this guideline and to develop basic plans that promote the countermeasures such as land use planning, development regulation, structural measures, and strengthening of early warning and evacuation systems with the support of technical institutes, and approval those SDRRP plans in LA's planning committees. In addition, the roles and responsibilities of Local Authorities, DS Divisions, Districts, and the central governments for each countermeasure should be given in the basic plans. It aims to clarify budgets and financial resources for those measures and to facilitate budget allocation. Furthermore, having such plans by Local Authorities are also useful for accepting international investments. Based on the basic plans, investments for sediment disaster risk reduction will be evaluated and optimized at the national level.

The basic plans are expected to be developed as SDRRP by Local Authorities. However, it is difficult for them to develop SDRRP, especially in technical aspects. SDRRP should be developed through participatory workshops organized by the concerned central agencies such as NBRO, DMC and, UDA. SDRRP shall be integrated into the development plan to be prepared by LA or UDA for UDA declared area where the development plan has been prepared or will be newly prepared or updated.

5.2 SDRRP

SDRRP should be as simple as possible, and planning concepts should be visualized by using maps and schematic diagrams so that local residents can easily understand it. For technical aspects such as structural measures in Controlled Zone and early warning evacuation planning in Warning Zone, NBRO's field investigation, technical advises and visual materials should be provided. SDRRP is composed of the following six items.

- Introduction
- Sediment disasters in the area
- Basic policy for the hazard zones
- Land use plan
- Early warning and evacuation system
- Action plan

(1) Introduction

Firstly, general information about the target area such as population composition, living style, vulnerable public facilities (school, hospital, facilities for disabilities), current land use, industrial structure, etc. should be discussed. If there are specially designated areas that should be considered for land use planning, such as forest conservation areas, wildlife sanctuaries, and national parks, should also be mentioned in this section. In addition, existing issues to implementing the land use plan such as illegal development and settlement in the target area are also explained.

(2) Sediment Disasters in the Area

This section gives an overview of past disasters and damage situations in the target area. The Yellow/Red zoning map prepared by NBRO should be obtained and attached. The valuable public facilities and damaged areas of the past disasters will be added to the map as necessary. Since it may be difficult for the residents to identify the locations by looking at the map, it is recommended to put some landmarks that are easy to understand.

(3) Basic Policy for the Hazard Zones

Based on the Yellow/Red zoning map, “Restricted zone”, “Controlled zone”, “Warning zone” and “Development zone” will be designated according to the definition in Chapter 4. The Red zone will be divided into “Restricted zone” and “Controlled zone”. Local Authorities designated a “Restricted Zone” for the area with an especially high risk of sediment disasters and the development prohibits areas such as forest conservation areas.

In this section, basic policies for each zone should be explained. The recommended development standards are as given in Chapter 4. Especially for “Restricted zone” and “Controlled zone”, which may affect the market land prices in future, Local Authorities should explain and make consensus with residents. In case resettlement is needed, Local Authorities should consult with NBRO and other central agencies in advance regarding the appropriateness of the resettlement and suitable lands for resettlement in the target area.

The basic policy can be divided into two depending on the status of the current land use: one for existing residential areas and the other for the vacant area. If the residences exist in hazard zone such as “Restricted zone”, “Controlled zone”, and “Warning Zone”, it is ideal to relocate those existing residences to the “Development zone”. It is, however, difficult to apply land use regulations by relocating them and following possible and allowable land use activities as shown in Table 3.3 in reality. Options of disaster risk reduction measures other than land-use control should be taken into account for the existing residential area in the hazard zone. Land use regulations to prevent new development are to be promoted for the vacant area in the hazard zone.

Table 5-1 DRR measures for Existing Residential Area and Vacant Area in Hazard Zones

	Red Zone		Yellow Zone	
Possible Land Use	Restricted Zone Only for Natural Vegetation (Forest, bushes, etc.) (detailed investigation for agricultural)		Warning Zone Agriculture Parks and Playground/ non-residential activities Detailed investigation for Residential, Retail & Commercial, Office, Industrial	
	Controlled Zone Agricultural (detailed investigation for Human induces activities: Parks and Playground/non-residential activities)			
Current Land Use	Existing Residential Area -No special zoning regulations are in practice.	Vacant Area -No special zoning regulations are in practice.	Existing Residential Area -No special zoning regulations are in practice.	Vacant Area -No special zoning regulations are in practice.
DRR Measures	-Early Warning -Conduct a detailed investigation and select DRR measures - Land-use regulations (not to allow further development)	- Promote land-use regulations	-Early Warning -Structural Measures (Sabo, Retaining wall, etc.) - Other resilience constructions	- Promote land-use regulations

(4) Land Use Plan

Based on the above basic policies, a land-use plan for the target area will be developed. Since the objective of SDRRP is to show how to tackle the sediment disaster risks, it is not necessary to develop micro-scale land-use zoning maps. If larger-scale structural countermeasures for landslides and debris flows are needed, Local Authorities should consult with NBRO and other central agencies in advance, and attach the schematic layout plan of the facilities and estimated costs.

In case a development plan was already developed by UDA, Local Authorities should consider it carefully and make sure there are no discordances between each plan. When there is discordance between the land-use plan and the existing development plan, Local Authorities should make a standard By-law in consultation with relevant planning and technical agencies.

(5) Early Warning and Evacuation System

For the “Warning Zone”, a map that indicates necessary facilities for early warning, warning officers in the area, evacuation shelters/places, evacuation routes, capacities of the evacuation shelters and other necessary information for evacuation actions, will be developed. This map can be substituted with the above land use planning map.

In addition, the information communication protocol for early warning in the areas should be clarified in this section. If the construction of evacuation shelters and emergency equipment are required, those items should be shown.

(6) Action Plan

The action plan specifies the projects and the project budgets for implementation of the land use plan, countermeasure facilities and strengthening early warning and evacuation system in the target area. The target years of the implementation plan shall be about 1 year, 4 years and 10 years with consideration of the term of local councils. The projects that will be implemented by Local Authorities, supported by DS Divisions and/or Districts Secretaries and supported by the central agencies (NBRO, DMC, UDA etc.) should be classified in the action plan.

5.3 Development Plan and By-Law

UDA develops Development Plan for UDA declared area. The development Plan defines the policy framework and land-use proposals that will be used to guide development decisions within a specific area. Preparation of Development plans for declared areas is being vested with Urban Development Authority (UDA), after the declaration under section 03 of the UDA Law No. 41 of 1978 as an urban development area.

SDRRP as well as national, regional and local level plans, prepared by different agencies could be incorporated into the development plans, if there is DRR or land-use zoning plans and guidelines have been prepared during the time. Once gazetting the development plans, the implementation of the plans has to be implemented through provincial and local governments.

If there is any plans or guidelines that need to incorporate after gazetting the Development Plans, the provincial and local government have the authority to issue By-laws for implementation. Under Sec. 267 of the Municipal Council Ordinance, Urban Council Ordinance and Pradeshiya Sabha Act every local government may make By-laws following the stipulated procedure which is laid down in the Local Authorities (standard by-laws) Act NO.6 of 1952 and under Sec. 2 of the said Act, the Minister of Local Government made standard by-laws and published in the Government Gazette.

5.4 Implementation of Land Use Zoning for SDRRP

5.4.1 Role and Responsibilities of Concerned Agencies

(1) Roles of concerned organizations

Roles of the concerned organizations on land use zoning and development mentioned in SDRRP depend on the setting of the target area such as urban/rural, the declaration by UDA, with/without Development Plan etc. as shown in the following table. The concerned organizations are NBRO, UDA, Estate Company, Local Authority, and Grama Niladhari (GN). The Urban area is administered by either Municipal Council (MC) or Urban Council (UC). The Rural area is administered by Pradeshiya Sabha. Land in the urban area both MC and UC is designated by a UDA as UDA-declared area. Some rural areas are also designated as UDA-declared areas.

	Urban Area (MC, UC)		Rural Area (PS)	
	UDA Declared Area		Non UDA Declared Area	Estates
	Without Development Plan	With Development Plan		
NBRO	Prepare hazard map showing Yellow/Red zones Support UDA and/or LA in land use planning as a part of SDRRP Support and recommend to implement SDRRP (Early Warning and Evacuation / Structural Measures)			
UDA	Prepare land use plan based on hazard map	Update land use plan base on hazard map	-	-
Estate Company	-	-	-	Cooperate with LA
Local Authority	Give development permission based on UDA standards	Issue By-laws to implement the SDRRP Give development permission based on UDA standards and SDRRP	Prepare SDRRP for catchment area with disaster risk areas based no hazard map Give development permission	-
DS / GN	Provision of Data			

UDA has authority to develop land use plan for UDA declared area, but UDA has not yet developed land use plan for some parts of UDA declared area. Detail of land use planning in UDA declared area is explained in item (2).

Rural area has generally rural features and is out of UDA declared area. LA (PS) has authority to develop land use plan. Detail of land use planning out of UDA declared area is described in item (3).

A part of rural areas is called as Estates which land is used for tea plantations. Estate companies need to prepare land use plan, but there is no legal mandate in land use planning for the estates. Detail of land use planning in estates is explained in item (4).

LA provides development permission based on UDA standard for UDA declared area and prepares land use plan for catchment areas with disaster risks outside UDA declared area in rural areas. LA does not have any authorization in land use planning for estates. GN plays a role to provide data such as socio-economic data such as population, number of houses to UDA or LA.

As shown in table above, NBRO has a role to prepare hazard map showing Red/Yellow Zones, support UDA, LA, Estate Company in land use planning, and prepare development standard. The followings are consultation menu provided by NBRO.

- Prepare hazard map
- Prepare early warning system
- Prepare development standard

- Inspect land use plan in the aspect of hazard and risk management
- Prepare draft land use plan
- Prepare land use plan and regulation in special projected area
- Hold workshop, seminar, etc. for local residences' understanding of hazard map and regulation
- Prepare evacuation plan
- Hold disaster drill and disaster education program for local people

(2) Land Use Planning in UDA Declared Area

1) UDA Designated Area with Development Plan

The following figure shows interactions among NBRO, UDA, LA, and GN for UDA declared area with development plan. UDA will periodically revise existing land use plan with LA based on inputs such as disaster risk related information from NBRO and inputs such as community information from GN.

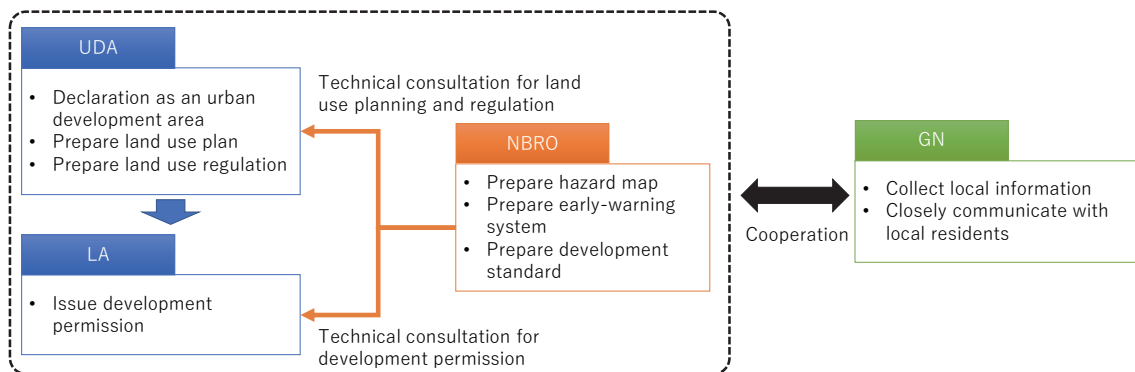


Figure 5-1: Interactions among NBRO, UDA, LA, and GN for UDA declared area with development plan

2) UDA Declared Area without Development Plan

The following figure shows interactions among NBRO, UDA, LA, and GN for UDA declared area without development plan. UDA will develop new land use plan with LA based on inputs such as disaster risk related information from NBRO and inputs such as community information from GN.

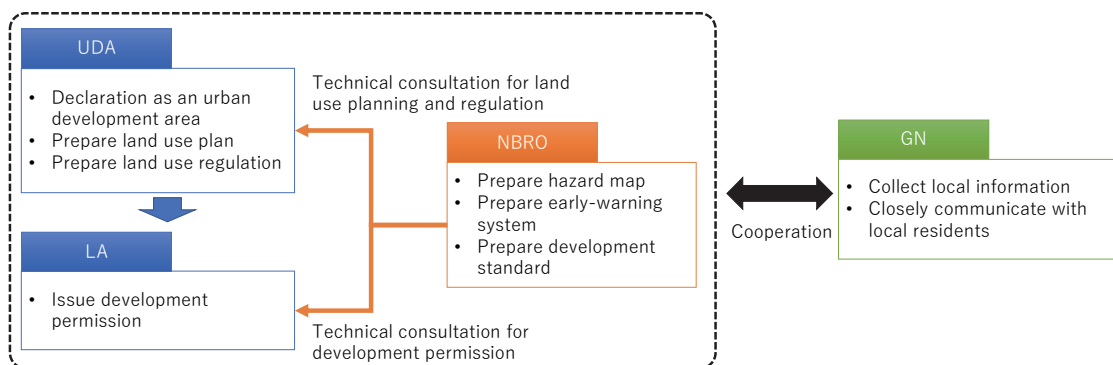


Figure 5-2: Interactions among NBRO, UDA, LA, and GN for UDA declared area without development plan

(3) Land Use Planning out of UDA Declared Area

The following figure shows interactions among NBRO, UDA, LA, and GN out of UDA declared area. LA will revise the existing land use plan where land use plan was already developed or develop new land use plan where land use plan is not yet developed. Inputs such as disaster risk related information from NBRO and inputs such as community information from GN are provided to LA.

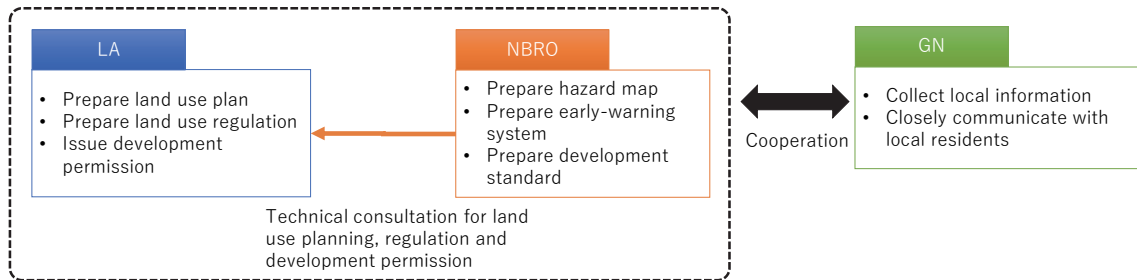


Figure 5-3: Interactions among NBRO, UDA, LA, and GN out of UDA declared area

(4) Estate

Estate will prepare land use plan, resettles residential houses into safer areas, and take necessary countermeasures through technical consultation by NBRO.

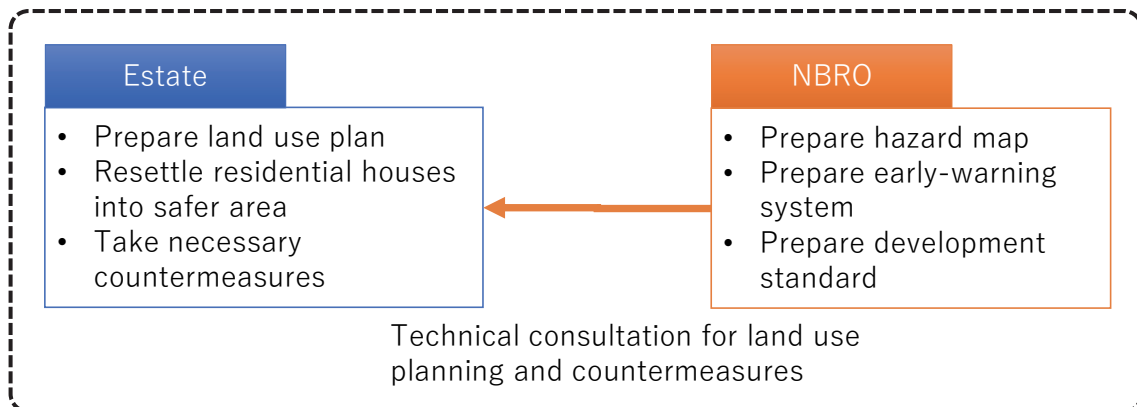


Figure 5-4: Interactions Estate with NBRO

5.4.2 Monitoring and Verification

The planning committee in the Local Authority shall monitor and verify the land use activity for each land use zoning if or not the land is used by following the land use direction in SDRRP. The frequency of the verification is basically one in a year at the same time to discuss the annual budget plan. The objective of the monitoring and verification is to capture the progress of the plan and modify the plan if necessary. The monitoring and verification of the land use activities are to be conducted in conjunction with the monitoring and verification of the action plan of SDRRP.



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