COMPREHENSIVE STUDY OF EXISTING LOOD MANAGEMENT SYSTEM

IN JAPAN AND SRI LANKA

FINAL RESEARCH REPORT
OF THE VISITING RESEARCHER PROGRAM- YEAR 2011
BY

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Dear Visiting Researchers,

As noted everywhere, there is new and arresting evidence on how and why disaster risk is increasing globally. Increasing urbanization, vulnerable rural livelihoods, and the decline of ecosystems are among the key "risk drivers" according to the 2009 Global Assessment Report on Disaster Risk Reduction by the United Nations.

About 40% of all natural disasters occur in Asia, but these account for more than 80% of the number of casualties attributed to natural disasters. Indeed, disaster risk is extremely high in Asia as compared to other regions. A series of catastrophes recently occurred in China, Indonesia, Vietnam or elsewhere again reminded us of the great importance of disaster risk reduction.

The Asian Disaster Reduction Center (ADRC), since its inception in 1998, has committed itself to promoting multilateral cooperation on disaster risk reduction in close cooperation with its twenty-nine member countries. In so doing, the ADRC is engaged in a wide range of activities, such as promoting dissemination and sharing of disaster-related knowledge. The ADRC also cooperates with its member countries in strengthening their capacity to cope with natural disasters at various levels of government. As one of such endeavours, we are very pleased to have welcomed Visiting Researchers from member countries again this year.

During their stay at the ADRC, the Visiting Researchers have visited many institutions, government and non-government alike. They have learned new knowledge and ideas through lectures and seminars and, most importantly, met many first-class professionals in Japan. I would like to take this opportunity to express my great appreciation to those who have spent their precious time and resources for our Visiting Researchers.

I congratulate the successful completion of the ADRC Visiting Researcher Program and hope that they will go back to their home countries safe and will maintain good collaboration with the ADRC in the future.

Atsushi KORESAWA
Executive Director
Asian Disaster Reduction Center

1. ACKNOWLEDGEMENT

We should be very much grateful to ADRC for giving an opportunity to Sri Lanka to nominate a participant at the workshop held in Japan. My sincere gratitude goes to Hon. Minister, Mahinda Amarweera (Minister of Disaster Management), Ms. S.M Mohamed (Secretary of Disaster Management Ministry), Major General Gamini Hettiarachchi (Director General of DMC) of Sri Lanka for giving me this opportunity which helped me to improve my disaster management skills and serve my country better.

I extend my special thanks to Dr. A. Koresawa (Executive Director of ADRC) for his kind cooperation and Ms. Miki Kodama (Senior Researcher) who guided me and coordinated several programs. , I also extend my heartiest thanks to my supervisor, Mr. Tetsuo Ibaraki and other staff members of ADRC and Japanese Teacher Mr. Shoji Kawahara, for the valuable information and encouragements given to me in many ways during my stay in Japan.

Further, I would like to offer my heartiest thanks and appreciation to all the staff members of the Disaster Management Centre of Sri Lanka for their immense help given to me to make this journey. Last but not the least, I would like to thank my husband, Mr. K.N. Bandara for his encouragements throughout the program in ADRC.

2. GENERAL INTRODUCTION

Sri Lanka is situated to the south of the Indian sub-continent between Latitudes 50.55'-90.55 N and Longitudes 790.42'-810.52' E. Total Land area of Sri Lanka is 65,525 sq km. It has a maximum length of 445 km (Devundara to Point Peduru) and maximum breadth is 224 km (Colombo - Sangamankanda) (Figure 1-1). The length of the Coastline is 1,340 km. The central and a bit of southern Sri Lanka is hilly. This region is surrounded by low flat plains extending to the sea. The highest Point is Mount Pidurutalagala, which is 8,281 feet in height (2,524 m). Another significant mountain is Sripada or Adam's Peak, also more than 2,000 meters high, which is considered as holiest mountain in Sri Lanka by the Buddhists, Hindus and Christians.

Figure 2.1: Map of Sri Lanka

Sri Lanka is generally a warm country having tropical climatic condition. It has warm climate is moderated by ocean winds and considerable moisture. Sri Lanka doesn't have significant changes with climatologically seasons. A special feature is that the hot and humid lowlands and the salubrious climate in the hill country. Both types of climates can be experienced by a few hours of motoring.

Average mean temperature along the coast is 26.70 C (80 F) and 19.70 C (66.50 F) in the hill country. Colombo, the commercial capital is situated on the west coast. The temperature varies from 26.4 C (79.5 F) to 27.8 C (82.12 F).

Relative Humidity varies from 70% during the day to 90% at night. In the lowlands the climate is typically tropical with an average temperature of 27ºC in Colombo. In the higher elevations it can be quite cool with temperatures dropping down to 16ºC at an altitude of nearly 2,000 meters. May, June and July are the hottest months of the year. Bright, sunny warm days are the rule and are common even during the height of the monsoon - climatically Sri Lanka has no off season. The main weather pattern is governed by two major monsoons known as North-East and South-West monsoons. The south west monsoon brings rain mainly from May to July, which affects western, southern and western slopes of central highlands of the island, while eastern slopes of central highlands and the Northern and Eastern regions are severely affected by North East monsoon. In addition, during the inter monsoon seasons of the year, the entire country receives heavy rain.

In ancient and medieval times merchants and sailors of other nations used these winds to sail to the coasts of Sri Lanka. Thus these winds have played a major role in the evolution of civilization in the country. Lifestyle of Sri Lankans is directly dependable on the rainfall caused by the monsoons.

3. SPECIFIC AIMS

Specific aims of this study:

(1) Study all available methods used in Japan for real-time information, information in advance and flood forecast.
(2) Study all available flood mitigation systems, procedures, flood early warning systems, early warning dissemination methodology, and quick response and evacuation procedures in Japan.
(3) Make a comparison between Japan and Sri Lanka in terms of flooding and early warning disseminations.
(4) Improve an early warning methodology with the help of Japanese methodology using available information such as rainfall and water level data. This can be done by improving better coordination between data collectors, vulnerable communities and those who are living in catchment areas selecting a specific stream network and its particular catchment area.
(5) Identify all the appropriate ways, which can be upgraded the existing early warning system with the help of Japanese methodology.
(6) Introduce new methodology, which can be adapted in Sri Lanka to disseminate real time early warning to vulnerable communities in flood prone areas with the help of high technologies that are currently used in Japan
(7) Conduct awareness programs for the communities within flood prone divisions on how to disseminate the early warning. This will be conducted during second part of research when I will be in Sri Lanka.

Long term objective of this proposed research is to establish the same methodology where possible through its outcomes to the other stream network within the district of Kegalle in Sri Lanka.

4. RESEARCH ACTIVITIES

(1) Data Acquisition :

Studied the water level data acquiring methods in Japan and the same was done for Sri Lanka

Studied the rainfall data acquiring methods in Japan and Sri Lanka.

Studied other types of data obtained for weather prediction in Japan.

Studied and interpreted the available research papers, articles and relevant documents.

(2) Data analysis

Did a comparative study of prediction methods to develop relationship between increases in river water level in accordance with rainfall pattern in the catchments in Japan and Sri Lanka.

Studied calculation methods used in calculating the time taken to flood the low land area due to critical rainfall received by the respective catchments.

(3) Establishment of flood early warning system

Studied the methodology used to disseminate real time early warning to the vulnerable communities and coordination among all stakeholders in Japan.

Studied the flood forecasting methods used in Japan.

(4) Evacuation programs

I studied the implementation of evacuation programs in Japan and compared them with Sri Lankan scenarios. Quality and effectiveness of the existing system in Sri Lanka could be improved accordingly.

5. ASIAN DISASTER REDUCTION CENTRE (ADRC)

ADRC is an International Organization which focuses reduction of disasters in Asia. Main objective of ADRC is to facilitate international cooperation for disaster reduction in the Asian region. Head office is located in the city of Kobe, Hyogo, Japan (Figure 6.1). There are 29 member countries and 5 advisory countries within the ADRC. Its mission is to enhance disaster resilience of the member countries, to build safe communities, and to create a society where sustainable development is possible. The Center works to build disaster resilient communities and to establish networks among countries through many programs including personnel exchanges in this field.

Figure 5.1: ADRC Office in Kobe

Main activities of the ADRC are categorized as follows;

- Information Sharing (Organizing International Meetings & Seminars, Disaster Information, Publications, Development of Tools, such as GLDE)
- Human Resource Development (Seminars &Trainings, VR Programs, Developments of Tools such as TDRM)
- Building Community Capabilities (Development of CBHM & Town Watching Method)

Other Activities

- Organizing International Meetings & Forums.
- Information Sharing through Publications.
- GLIDE (Global unique disaster Identifier).
- Visiting Researcher Program.
- Collaboration with Asian disaster Reduction and Response Network.
- Operations on International Recovery Platform (IRP).
- Field Survey of Tsunami Disasters in Indian Ocean Countries.
- Sentinel Asia Sentinel Asia–Disaster Management Support System in the Asia Disaster Asia--Pacific Region.

6. COMPARISON OF EXISTING FLOOD EARLY WARNING SYSTEMS OF JAPAN AND SRI LANKA

6.1. Overview of Disaster Situation in Japan and Sri Lanka

6.1.1 Overview of Natural Disasters in Japan

Japan is one of the countries often affected by unprecedented events of natural disasters such as Earthquakes, Tsunami, Typhoons, Floods and landslides. Since 1950, many large-scale typhoons and earthquakes have struck the country, which caused massive damages and great loss to its economy. Not only that, those events of disasters have killed tens of thousands of the people. As such Japan has been very serious in the development of disaster countermeasures and has been contributing to the development of sustainable disaster management systems especially advanced weather forecasting technology and disaster information communication systems.

The commonest natural disaster is Earthquakes. Japan can have up to 5000 earthquakes each year, which is about 10% out of total occurred on Earth. As a result of earthquakes, Tsunami can also develop to cause catastrophic damages to the coastal belt of the country. Tsunamis are large waves that crash up against the shore and wash away people, buildings, and bridges. Eg. Great Hanshin-Awaji Earthquake in 1995

Giant Volcanic eruptions are the next disaster that the country is facing with. There are many active volcanoes in Japan. A volcanic eruption can discharge ash and lava all over the surrounding area including populated areas. Sometimes the entire area goes under volcanic debris. Eg. Unzen-Fugendake volcanoe.

Typhoons in Japan occur mainly in August and September. Severe storms may cause many damages along with landslides and floods. Japan is hit by about 29 typhoons in a year. Some such recorded worst meteorological changes, have caused significant damage and loss of human life, eg. Typhoon Ise-wan in 1959.

6.1.2 Overview of Natural Disasters in Sri Lanka

Every year, different types of natural disasters affect Sri Lanka, like in other developing countries. Natural Disasters in Sri Lanka are mainly hydro-meteorological and geological phenomenal events such as floods, landslides, cyclones, tidal waves, droughts and Tsunamis. Following is an outline of the natural disasters that have occurred causing extensive damage to the people and property every year, disrupting social and economic development endeavors.

I. Floods
II. Landslides, slope failures and rock fall
III. Cyclones
IV. Drought
V. Coastal erosion
VI. Subsidence and erosion
VII. Ground settlements
VIII. Reservoir induced earth quakes
IX. Tsunami
X. Minor Earth quakes

Out of all these natural disasters, Landslides and floods are the dominants. Even when compared to all the other south Asian countries, flood and landslides are the most dominant natural disaster in Sri Lanka (Table 7.1)

Table 6.1: South Asia, Population, Urban Share and Natural Disasters caused

Country	Population (Millions)			Urban %	Natural Disasters faced
	1997	2010	2025		
1. Bangladesh	122.2	152.1	180.3	16	Cyclones, Flooding
2. Bhutan	0.8	1.1	1.5	15	Earthquake
3. India	969.7	1182.7	1384.6	26	Cyclones, Flooding, Earthquakes, Landslides
4. Maldives	0.3	0.4	0.6	26	Sea Erosion, Cyclones
5. Nepal	22.6	30.8	41.4	10	Landslides, Earthquakes
6. Pakistan	137.8	176.4	232.9	28	Earthquakes, Landslides, Droughts
7. Sri Lanka	18.7	22	23.4	23	Landslides, Flooding, Cyclones, Droughts, Tsunami

Source: Based on "Human Settlement in South Asia" and "Role of R & D institutions in Disaster Risk Mitigation", 1998

Historical evidences of Sri Lanka clearly show that, there had been a strong disaster management system especially to overcome severe water shortage during droughts. This was done by constructing massive irrigation systems, which includes reservoirs to provide much needed water for farming in the dry zone, which covers about 2/3 of the country's land area. Sri Lanka has an agriculture-based economy consisting of a plantation agriculture sector and subsistence agriculture sector. Even after the economic reforms from close economy to open economy since 1977, agriculture sector continued to play an important role in the economy. The agriculture sector still contributes about 21% to the Gross Domestic Product (GDP) of the country and provide livelihood for about 40% of the labor force. Wet zone of the country, where a large number of major rivers flow through, is prone to severe flooding frequently. Human settlements located on the river banks and low-lying areas are mainly subjected to flooding. Sometimes, settlements below the man made irrigation tanks are subjected to flooding mostly when tank bunds fail.

Coastal erosion and Indian Ocean tsunami are the other major disasters that Sri Lanka faces. Most of the communities that are affected by coastal erosion and tsunami are unauthorized dwellers along the coast.. Some parts of eastern province of the country are prone to cyclones. However, occurrences of cyclones are very less frequent when compared to the other disasters.

In the last 10 years period before 2003, Sri Lanka has experienced 30 major disaster events in which about 398 peoples were killed and 2.75 million people were affected. The total economic loss was estimated to be almost US$ 5.96 billion approximately. Flooding & Landslides in 2003 affected 137,221 families (720,500 persons), claimed 252 lives and also 37,227 houses were damaged. Tsunami in 2004 affected 260,967 families (1.3 million), claimed 31,225 lives, the missing people were around 41,000 and 108,467 houses were damaged. Total estimated economic loss from tsunami was around us$ 3.6 billion. Although 1,600km from the epicenter, the waves struck with huge force and swept inland up to 5 kilo meters. Waves as high as six meters had crashed into coastal villages, sweeping away people, houses, vehicles and even a fully packed train with 1700 passengers. It was the worst human disaster in Sri Lankan history.

6.2. Disaster Management Framework in Japan

6.2.1. Disaster Management Framework

Disaster Management of Japan is categorized into 3 levels. They are national, regional and municipal levels. The significance of each level is delineated as follows:

National Level:

Prime Minister is the National Commander of the National Disaster Management Council. This council is formulated by the designated government organizations (23 ministries and agencies) (Figure 7.1), and designated public cooperation (63 organizations including independent administrative agencies, Bank of Japan, Japanese Red Cross Society, NHK, electricity and gas companies). The National Disaster Management council is responsible for

formulation, promoting and implementation of the Basic Disaster Management Plan. Meanwhile, the other two designed agencies of government and public operations are responsible for formulation and implementation of the Disaster Management Operation Plan.

Prefectural Level:

The Governor is the commander ordering via the Prefectural Disaster Management Council, and the designed government organizations and public corporations locally. The prefectural council in collaboration with the mentioned designed agencies works to formulate and promote the implementation of Local Disaster Management Plan.

Municipal Level:

In this level, the Mayor of City, Town and Village is the commander, as the Governor in prefectural level, will t function through Municipal Disaster Management Council to formulate and promote the implementation of Local Disaster Management Plan.

6.2.2. Disaster Management Plan

To correlate with the three disaster management systems, Japan has made up the basic plans, operation plan, to respond effectively to various types of disasters in the relevant areas. The first is Basic Disaster Management Plan- the key plan for disaster reduction activities prepared by the Central Disaster Management Council based on the Disaster Countermeasures Basic Act, the second is Disaster Management Operation Plan made up by each designed government organization and designed public corporation, and the last one is Local Disaster Management Plan set up by each prefectural and municipal council. The last two plans are based on the Basic Disaster Management Plan.

Basic Disaster Management Plan is the plan to state on comprehensive and long- term disaster reduction issues such as disaster management related system, disaster reduction projects, early and appropriate disaster recovery and rehabilitation, as well is scientific and technical research. The structure of the plan consists of measures to be taken or followed for each type of disasters both natural disasters and accident disasters.

Tangible countermeasures will be taken promptly by each stakeholder in the event of a disaster. These stakeholders (such as the national and local governments, public corporations and other entities) will follow the phases of disaster prevention and preparedness, emergency response, as well as recovery and rehabilitation. In addition the conceptual formulation of the Basic Disaster Management Plan has emphasized on this important points.

- hazard and risk mapping,
- clarification of Jurisdiction,
- responsibilities and procedures on establishment of emergency response headquarters,
- evacuation guidance and instructions to citizens about evacuation area in advance,
- procedure to gather and disseminate disaster information , and public participation.

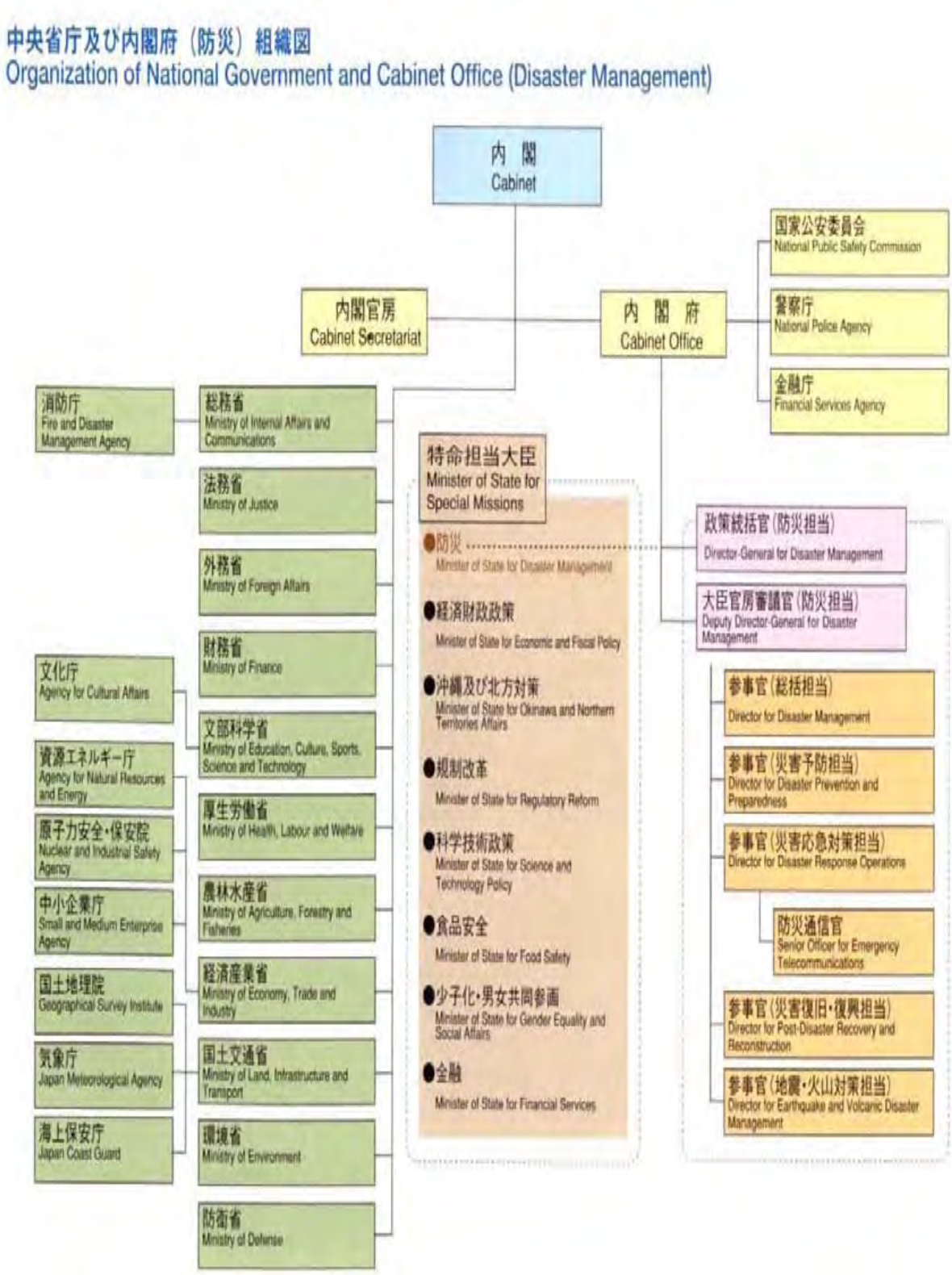


Figure 6.1: Disaster Management Structure of Japan

6.2.3. Basic Legal Framework of Disaster Management in Japan

Basic legal framework has been formulated in Japan for the implementation of the National Disaster Management Plan. Disaster Countermeasure Basic Act (1961) applies to all of the disaster phases of prevention, mitigation and preparedness, emergency response as well as recovery and rehabilitation. It was formulated in 1961, after the suffering of Typhoon Ise-wan in 1959 that caused more than 5,000 fatalities. Following acts are the other relevant acts associated with disaster countermeasures Basic Act (1961);

(i) Erosion Control Act (1897), Disaster Relief Act (1947), Building Standard Law (1950),

(ii) Landslide Prevention Act (1958), River Act (1964), and Act on Special Measures for Large-scale Earthquakes (1978).

(iii) Erosion Control Act 1897:

These Acts also clearly define the responsibilities of all stakeholders of the central government, local government and other public organizations in taking necessary measures for preventing sediment-related disaster from generation and discharge of unstable sediment due to natural events, such as heavy-rain induced landslides and river-bed erosion to ensure a sound environment and maintain the function of river in flood control and water use, and thus to provide safety for life and property

(iv) Disaster Relief Act 1947:

The purpose of this law is to allow the national government to take necessary emergency relief measures in case of disaster with the cooperation of local municipal governments, the Japan Red Cross, and other relevant organizations. Distribution of food and drinking water, supply of clothing, beddings, and other basic requirements, Medical and natal care, Rescue of disaster victims , Emergency repairs to houses subjected to disaster, providing financial assistance, providing equipment, and materials required to maintain livelihoods, Distribution of school supplies , Interment and other matters as specified by government regulations..

(v) Building Standard Law 1950:

In Article 39 of the law, the municipal government is allowed to designate the area with considerable risk due to tsunami, storm surge, and flood and so on as disaster prone area by its local ordinance. And it shall be determined in the above ordinance that necessary items for disaster Prevention in the disaster prone area such as prohibition against building a residence or restriction concerning ta building. Specific instructions in this regard have to be made by the authorities.

(vi) Land slide Control Act 1958:

This Act provides measures for preventing landslides or slag heap collapses to avoid or mitigate damage from those hazards, and thus to contribute to the conservation of the national land and the stability of the people‘s livelihood.

(vii) River Act 1896:

The law is to clearly define the responsibilities of the national and local governments and other public organizations to take necessary measures for comprehensive river management, through which disasters due to floods and storm

surges will be prevented, rivers will be in proper use, the regular functions of river water will be maintained, and river environment will be improved and conserved, which will contribute to the conservation and development of the national land, and thus ultimately to enhance public welfare. This law specifies the administration of rivers including classification of administrator.

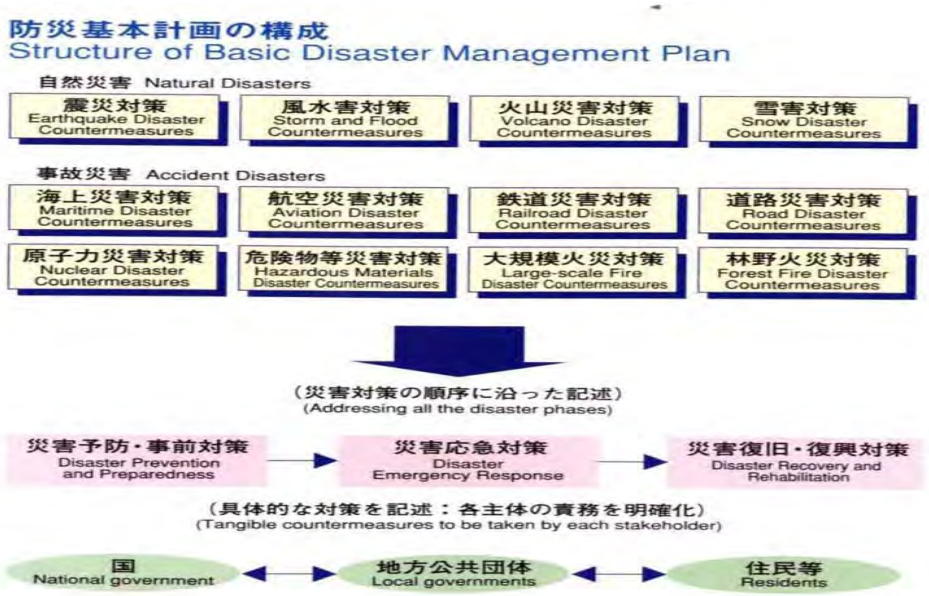


Figure 6.2: Structure of Basic Disaster Management Plan in Japan

6.2.4. Organization Responsibility and Response Mechanism

In addition to the Central Disaster Management Council, there are 23 designated ministries and 63 designated public corporations, prefectural Disaster Management Council, and Municipal Disaster Management Council. It also includes other main agencies namely Cabinet Secretariat, Cabinet Office, and Residents too (Figure 7.1 & 7.3).

The Cabinet Secretariat was established in 1995 to take into account the large-scale disasters and serious accidents including the Great Hanshin- Awaji Earthquake that occurred at that time. The Government had to handle a wide-range of issues regarding the planning of basic disaster management policies and supporting the Cabinet Secretariat to respond to large-scale disasters. The Central Disaster Management Council has been, dealing with the Basic Disaster Management Act, formed under the Cabinet Office, chaired by The Prime Minister, Ministers of State for Disaster Management, all 23 ministries, and heads of major public institutions and experts. The council has mainly taken task of formulation and promotion and implementation of the Basic Disaster Management Plan and Earthquake Countermeasure Plans. When there are large-scale disasters occurring in Japan, all agencies concerned will deal cooperatively with the situation.. The two main organizations, the Cabinet Office, and Prime Minister‘s Office, will be

directly responsible for this matters in line with national commanding. Firstly, the Cabinet will collect the information and dispatch the initial emergency survey team to the affected areas, coordinate and hold the inter-ministerial meeting, and then dispatch again to investigate the situations. Meanwhile, the Prime minister's Office will keep a close watch to the situation, analyze the damage and discuss, and establish the head quarter and dispatch the government investigation team gore.

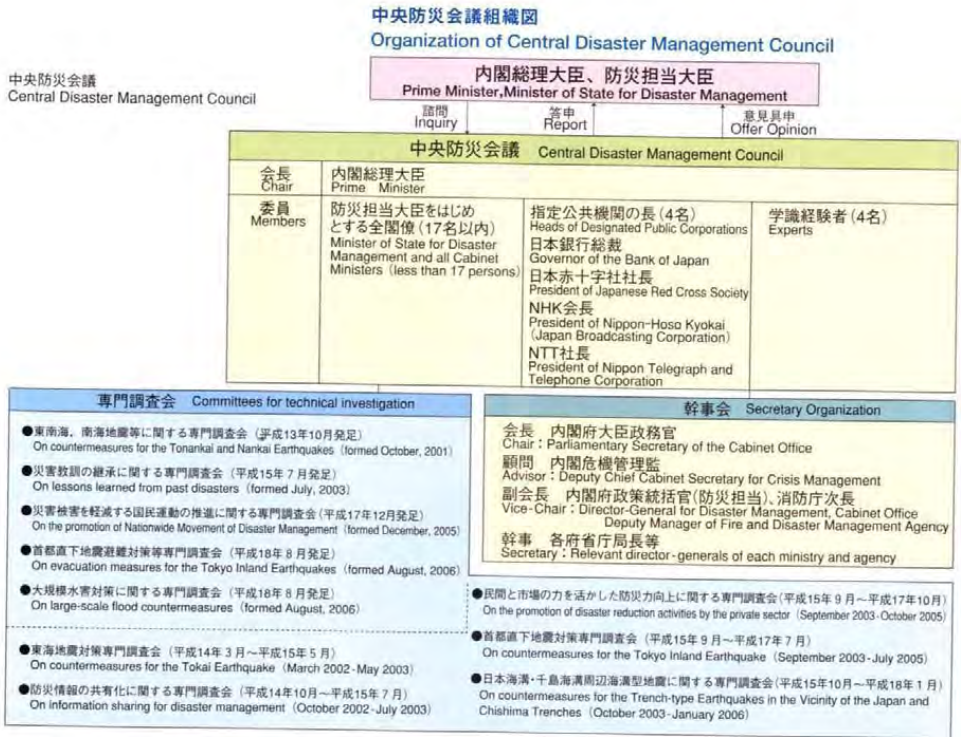


Figure 6.3: Organization of Central Disaster Management Council

6.3. Disaster Management Framework in Sri Lanka

There are 8 provinces and 25 districts in Sri Lanka. Each district is administered under a DISTRICT SECRETARY, who is appointed by the central government. The main tasks of the District Secretariat are to coordinate and communicate activities of the central government and Divisional Secretariats. The District Secretariat is also responsible for implementing and monitoring development projects at the district level and assisting lower-level subdivisions in their activities, as well as revenue collection and coordination of elections in the district. A district is divided into a number of Divisional Secretary Divisions (commonly known as DS divisions), which are in turn subdivided into Grama Niladari Divisions.

6.3.1. Legal System and Framework of Disaster Management

National Disaster Management Act (2005):

In July 2005, the Sri Lanka Disaster Management Act No.13 of 2005 was enacted, which provides the legal basis for instituting a disaster risk management system in the country. The National Council for Disaster Management (NCDM), is a high-level inter-ministerial body. The chairman and vice chairman of the NCDM is H.E. the President and Hon Prime Minister respectively. Other members are Leader of the Opposition, Ministers in charge of 20 selected subject areas, Provincial Council Chief Ministers and five members of the Opposition. The Act also provides for establishing the Disaster Management Centre (DMC) under the Council to be the apex body for the purpose of planning, co-coordinating and implementing of certain natural and other forms of disasters (Figure-7-4)

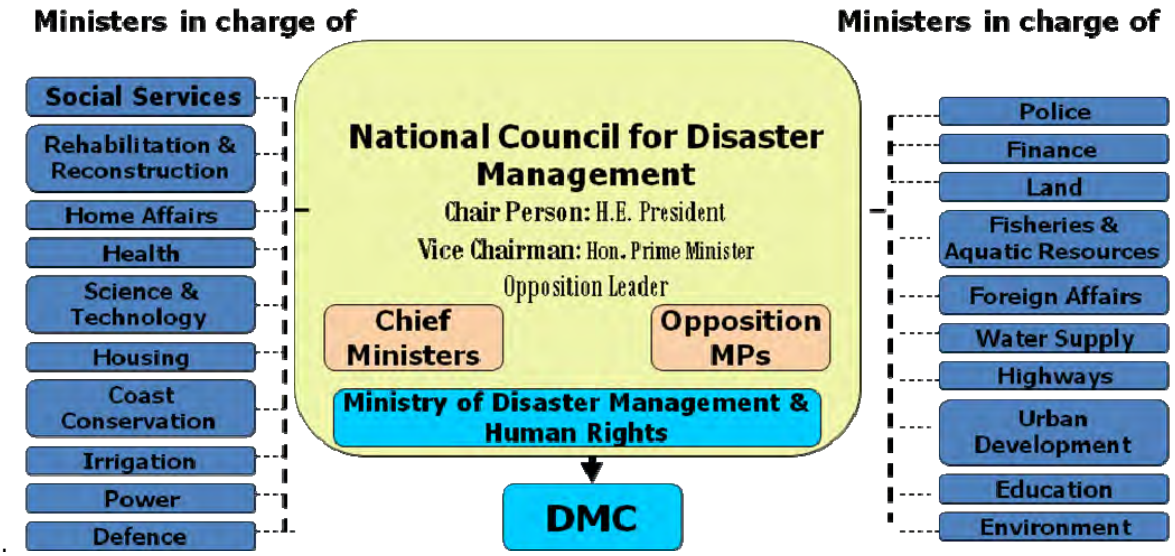


Figure 6.4: Flow chart showing the National Council for Disaster Management

The Principal Functions of the DMC as per the DM Act:

(1) Assisting the Council in the preparation of the National Disaster Management Plan and the National Emergency Operation Plan and proposals for upgrading the same when it becomes necessary

(2) Taking responsibility for the implementation of the National Disaster Management Plan and the National Emergency Operation Plan, and upon the declaration of a state of disaster to direct and coordinate the implementation of the National Emergency Operation plan

(3) Ensuring that the various Disaster Management Plans prepared by Ministries, Government Departments or public corporations conforms to the National Disaster Management Plan

(4) Based on Disaster Management Plans prepared by various Ministries, Government Departments and public corporations under section 10, preparing and implementing programs and plans for disaster preparedness, mitigation, prevention, relief, rehabilitation and reconstruction activities and coordinating of organizations which implement such programs and plans and obtain financial assistance from the Treasury for such activities and release the same to the relevant regions and monitor and evaluate these activities

(5) Issuing instructions and guidelines to appropriate organizations, non-governmental organizations, district secretaries and divisional secretaries on activities relating to disaster management and initiating and implementing work programs in co-ordination with such organizations and secretaries

(6) Promoting research and development programs in relation to disaster management and setting up and maintaining a data base on disaster management

(7) Submitting reports to the Council from time to time and whenever required by the Council in regard to its activities.

(8) This Act also provides for a framework for disaster risk management in Sri Lanka and addresses disaster management (DM) holistically, leading to a policy shift from response based mechanisms to a proactive approach towards Disaster Risk Management.

In terms of the Act following hazards come under the purview of Disaster Management:

Floods	Landslides	Tsunami (Seismic Wave)
Earthquakes	Air Hazards	Fire
Industrial Hazards	Epidemics	Explosions
Air Raids	Civil or Internal Strife	Chemical Accidents
Radiological Emergency	Oil Spills	Nuclear Disaster
Urban and Forest Fire	Coastal Erosion	Tornadoes, Lightening Strikes and Severe Thunder Storms

In July 2005 the Disaster Management Centre (DMC) was established under the National Council for Disaster Management (NCDM) to be functional under H.E. the President.

In December 2005, a separate Ministry for Disaster Management was established under the Hon. Prime Minister. In February 2006 the Ministry for Disaster Management and Human Rights (M/DM&HR) was established with the subject of Human Rights listed under its purview. As per the gazette notification of February 2006, National Disaster Management Council, Disaster Management Centre and Department of Meteorology and National Building Research Organization (NBRO) were placed within the purview of M/DM&HR. In 2010 the Ministry was renamed as Ministry of Disaster Management.

The DM functions implemented through the DMC according to this gazette notification are as follows:

(1) Initiate and coordinate foreign aided projects for disaster mitigation, response and recovery

(2) Liaising with Ministries, Government authorities and agencies, private sector agencies, NGOs and INGOs and all other relevant agencies to ensure timely execution of such responsibility.

(3) Coordination and Management of relief activities pertaining to natural and man-made disasters.

(4) Coordinating awareness programs on natural disasters and man-made disasters

(5) Early warning systems

(6) Supervision of the activities of non-governmental organizations and social welfare voluntary agencies in relation to disaster management, provisions of relief and promotion of human rights

(7) Facilitation of and assistance to non-governmental organizations and social welfare voluntary agencies, in the fields of disaster management and human rights

Through countrywide Ministries, Departments and Public Corporations, Provincial Council, Local Authority Administration; and District, Division and Grama Niladhari administration; to enforce coordinate and monitor activities related to;

(i) Hazard Mapping and Risk Assessment

(ii) Information Management

(iii) Disaster mitigation

(iv) Early warning dissemination

(v) Preparedness for effective response at disaster situations

(vi) Emergency Operations Management

(vii) Management of the post-disaster activities after a disaster

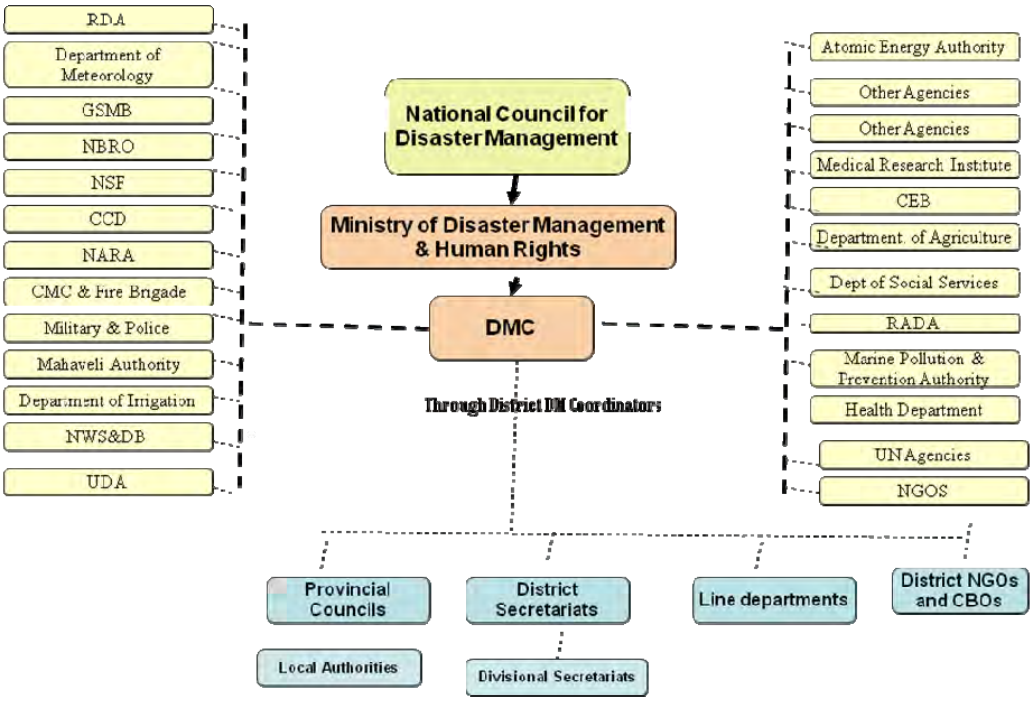


Figure 6.5: Coordination Mechanism in Disaster Management

6.3.2. Structure of Disaster Management

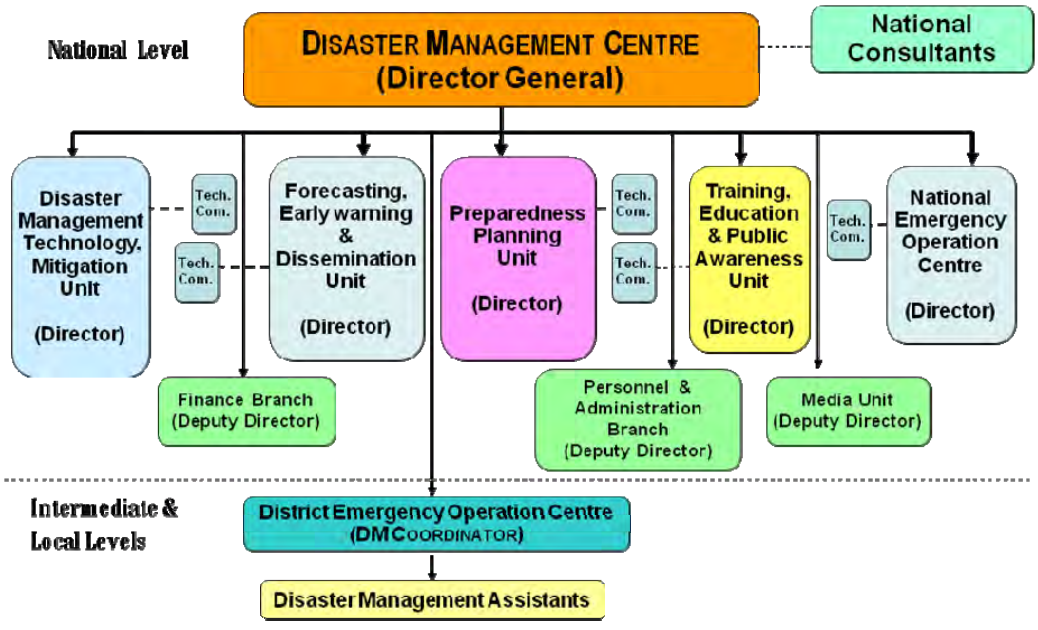


Figure 6.6: Organizational structure of Disaster Management (national level to district level)

National Platform for Disaster Risk Reduction

As shown in the following figure 6.5, there is a strong link among all stake holders concerned in disaster management. Disaster Management Centre operates all the DM related activities through District Disaster Management Coordinators.

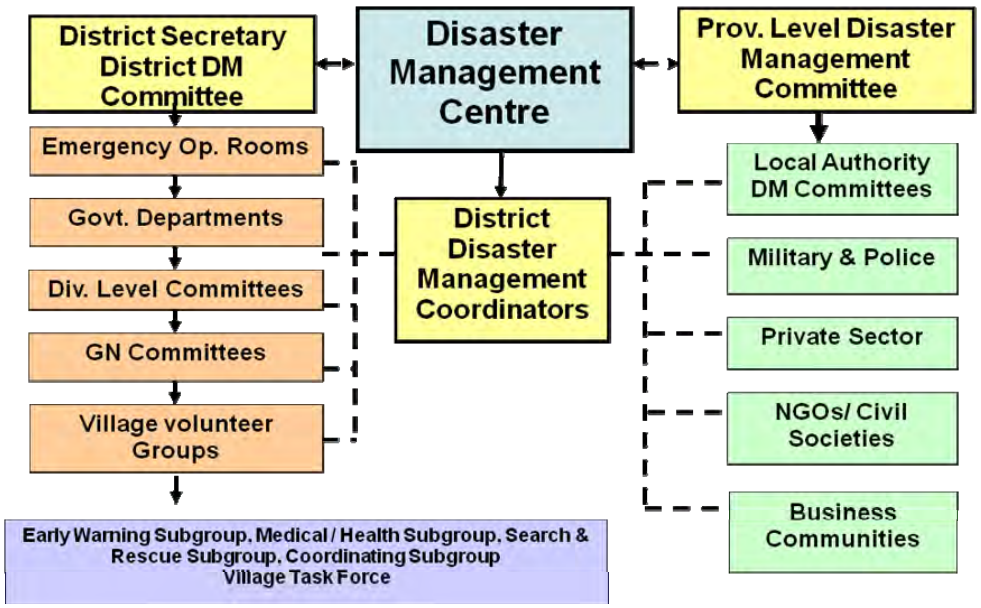


Figure-6.7: Disaster Risk Management Mechanism at Sub-National Level

The above mechanism addresses the disaster management activities to the grass root level (village level)

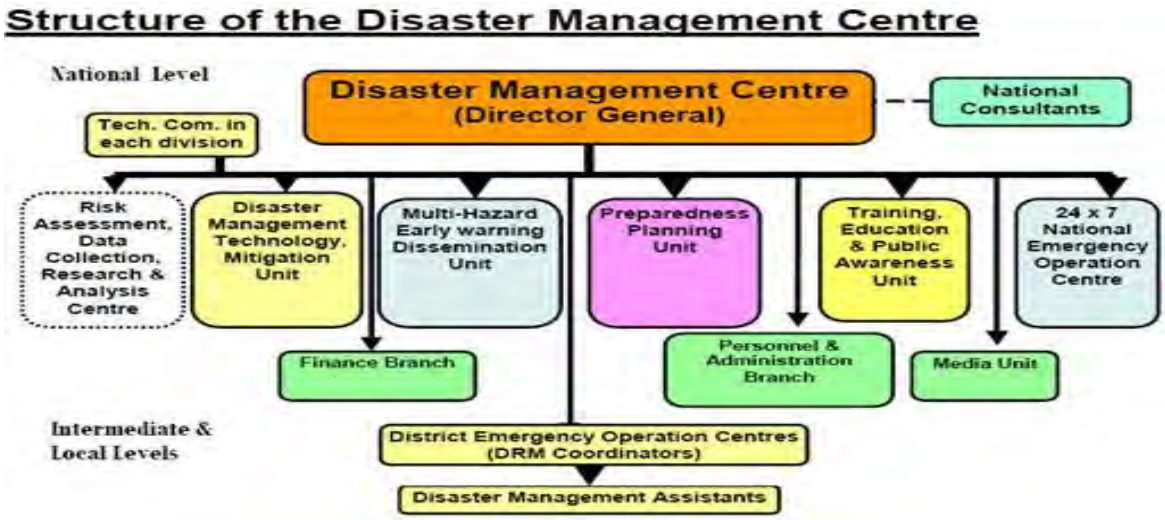


Figure 6.8: Structure of the Disaster Management Centre

Disaster Management Centre (DMC), which was established as per the Disaster Management Act of Sri Lanka consists of several subdivisions in order to function the DM activities properly (Figure 6.8). DMC will be directing, issuing guidelines, facilitating, coordinating, monitoring, where necessary directly implementing or enforcing activities related to:

(1) Disaster Management Technology, Long-term Mitigation & DRR

The DMC carries out a large number of activities on mitigation using its Technology. Some of them are s Hazard Mapping and Risk Assessment, Information and Data Collection, Research and Analysis, Building Technology, Development and maintenance of DMC Website, Long term Disaster Risk Reduction, Implementation of specific risk reduction projects to reduce specific identified risks that can cause future disasters, DRR integration in Development, long-term action planning.

(2) Early Warning

When a disaster has been predicted or forecast by a respective scientific organization, DMC has systems in place for receiving forecasting and early warning. DMC also does forecast impending disasters followed by early warning and dissemination procedures.

(3) Emergency Operations in case of a disaster

DMC has established a National Emergency Operation Centre, which is 24x7 in service. It is now under the process of establishment of emergency operation rooms at provincial, district and divisional levels in some districts, provincial and district level emergency operation centers have already been established. In addition, DMC is carrying out Emergency Operations, coordinating with armed forces, police and other related agencies at national and all sub levels.

(4) Preparedness Planning (National and other levels)

Preparation of National Disaster Management Plan and Emergency Operation Plans along with district level and divisional level preparedness plans are in progress. Under such preparedness plans, DMC is facilitating, issuing guidelines, coordinating, directing and monitoring of preparation of disaster preparedness and response plans at provincial, district, local authority, divisional and village levels. The major objective of the preparation of preparedness plans is to improve response on time and effective response, equitable relief distribution, speedy recovery, timely rehabilitation and reconstruction at national level and all sub levels such as District and Divisional levels.

(5) Training, Education & Public Awareness

In order to train aware all groups of the general public, school community, employees of government, private and all other organizations, training programs are conducted. Public Awareness Programs for officials at all levels, school children and community level are also conducted. Objective of these activities is to reduce disaster risks. Disaster management is being included in school curricula and in university curricula as appropriate.

7. OVERVIEW OF FLOOD DISASTER IN JAPAN

7.1. Overview of Flood Disaster in Japan

Japan is very vulnerable to the water-related disasters. Severe water-related disasters have been causing human losses every year. Floods and sediment related disasters have occurred in more than 90% of municipalities throughout Japan during the past ten years.(1994 to 2003) The risk of disaster is becoming greater due to global warming. Heavily concentrated rainfalls exceeding 50 mm or even 100 mm per hour are on the increasing trend.

Year	Dead or missing persons	No. of inundated houses	Reason
1953	1760		
1996(July)	48		
1996(September)			Flooding due to Typhoon)
2004	240	199,371	Concentrated rainfalls and landings by 10 typhoons
2005	41	32,581	Precipitation of over 100 mm per hour
2006	42	25,804	Heavy rainfall

Causes of flood:

(1) Many rivers are very steep with a short distance from the source to the sea, resulting in rapid flow. Furthermore, most of urban areas are located in low-lying areas that are lower than the water level during floods.

(2) Population and city functions are concentrated in areas below zero-meters level in coastal areas of three major bays. Catastrophic disasters are anticipated once the embankments are failed.

(3) Approximately half of the population and three-quarters of total assets are concentrated in low-lying areas. Major damage is anticipated when flooding occurs.

(4) Level of structural improvement is lower compared with other countries.(Compared with other industrialized nations , the level of safety secured by flood control measures is lower in Japan.

(5) Aggravation of flood damage by urbanization.

(6) Rapid urbanization has been in progress in many parts of the country, particularly in the Tokyo metropolitan area.
(7) Asphalt and concrete prevent natural permeation of storm water into the ground. As a result, storm water fills rivers and depressions more quickly in urban areas than in rural ones, increasing the risk of urban flood damage.
(8) Occurrence of urban –type floods
(9) Normally, the flow rate of rivers in urban areas is extremely low, but urban-type floods frequently occur when typhoons hit because the rain water falling in the catchment concentrates and outflows within a short period, paralyzing urban functions and flooding underground shopping malls.

7.2. Framework of river management in Japan

Rivers subject to the river law are classified into Class A and Class B rivers, depending on the importance of their roles. The roles for managing rivers are tasked to the Minister of Land, Infrastructure and Transport (Regional Directors of Maintenance Agencies), as well as the governors of prefectures.

Management of small-scale rivers that do not fall into the categories of Class A or Class B is delegated to municipal government mayors in accordance with the rules and regulations for class B rivers. (Law applicable rivers)

(i) Class A river (directly managed segment) system is managed by the National Government (Ministry of Land Infrastructure and Transport) and some designated segments of class A rivers are managed by the governor of the prefecture or mayor of a government ordinance designated city(specified segments)
(ii) Class B rivers are managed by the governor of the prefecture or mayor of a government ordinance designated city.

Rivers of Japan are characterized by their relatively short lengths and considerably steep gradients due to the narrow and mountainous topography of the country. In this regard, the Mogami, the Fuji and the Kuma are regarded as the three most rapid rivers of Japan. Typical rivers of Japan rise from mountainous forests and cut out deep V-shaped valleys in their upper reaches, and form alluvial plains in their lower reaches which enable the Japanese to cultivate rice fields and to set up cities. Most rivers are dammed to supply both water and electricity.

The longest river of Japan is the Shinano, which flows from Nagano to Niigata. The Tone has the largest watershed and serves water to more than 30 million inhabitants of Tokyo metropolitan area.

7.3. Flood management and sediment, erosion control in Japan

Various facilities and systems have been established to provide protection from flood damage.

(1) River information systems ensure successful river management.

Radar rain gauges and telemeter systems are used to measure water level, rainfall, etc. Information thus obtained is processed and provided to concerned governmental agencies and local residents so that timely and appropriate river management and flood defense measures can be taken.

(2) Widening of channels and embankments

Rise in water level is reduced by increasing the width. Levees are also used to prevent overtopping.

(3) Detention basins

Water is diverted from a swollen river, and the water is returned to the river after the threat of flooding has disappeared.

(4) Floodways

Canals are used to divert water from the middle or lower reaches of the river and directly channel the water to other rivers or the sea. This technique helps to reduce river flow.

(5) Dam

Dams store water in the event of flooding caused by heavy rain and Control River flows downstream to alleviate flood damage (Figure 8.1). Dams function both as a means to ensure stable water supply to downstream residents and as a means to generate power.

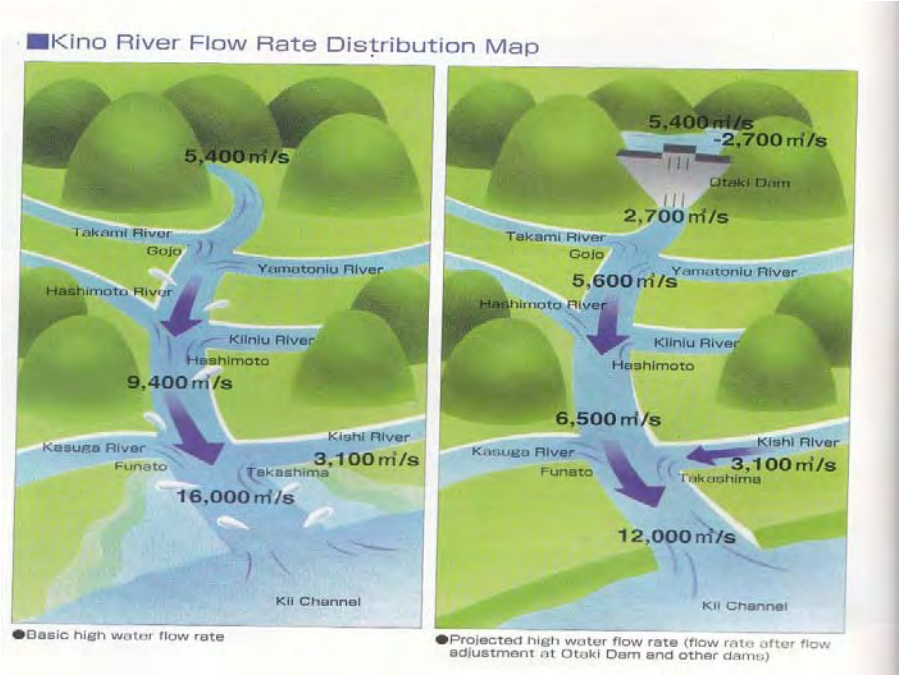


Figure 7.1: Flood control system of Kino River, Japan using a flood control Dam

7.4. Comprehensive flood control measures in Japan:

Japan is in need of comprehensive flood control measures to cope with rapid urbanization. Following are those comprehensive approaches.

(1) River basin measures such as the construction of facilities designed to preserve and enhance the retention and detention capabilities of river basins and the development of land uses and buildings that are highly resistant to floods

(2) Damage mitigation measures, such as the establishment of warning and evacuation systems (Figure 7.2).

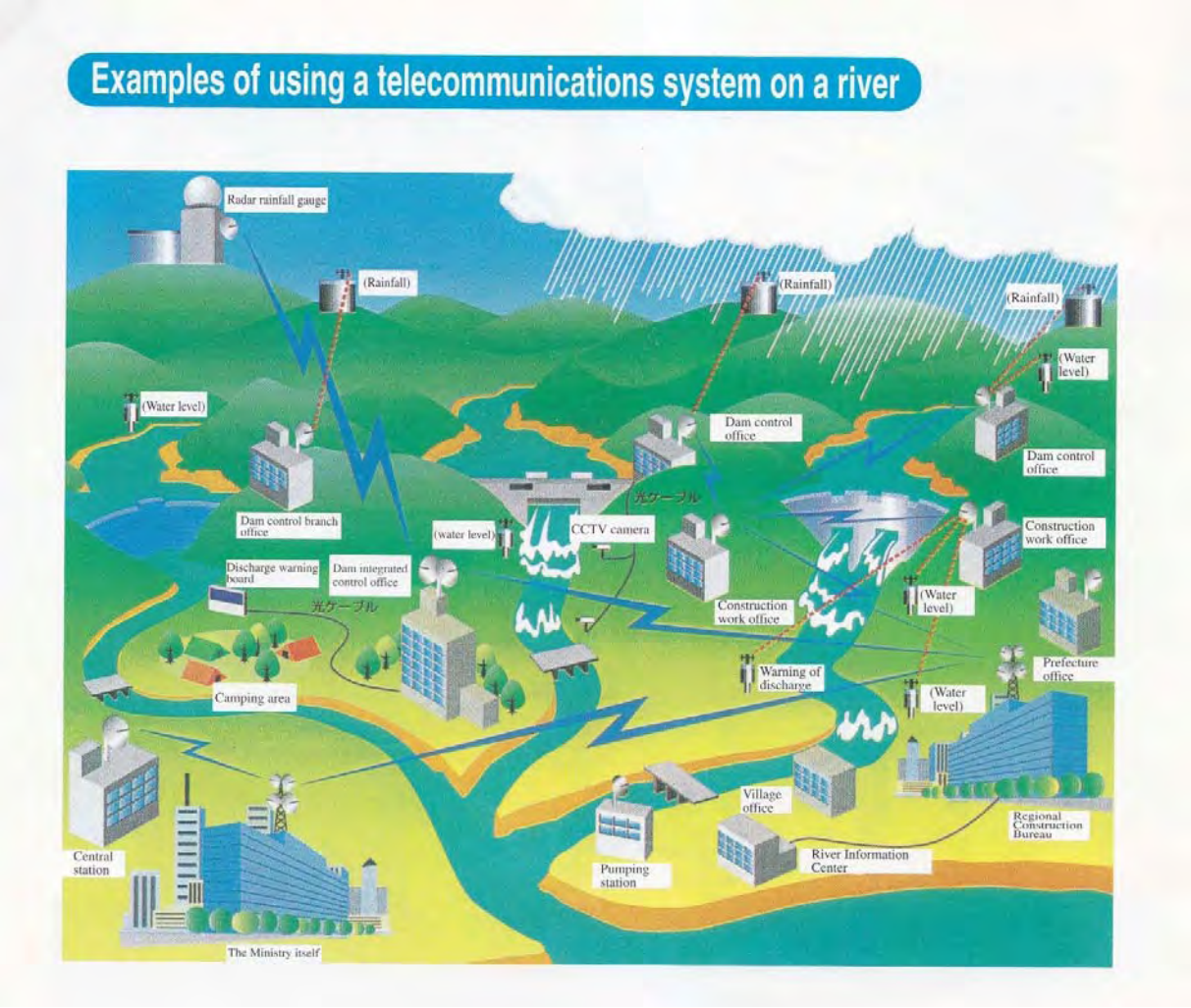


Figure 7.2: Diagram showing monitoring of rain, flood and issuing early warning

Following are some examples for comprehensive flood control in Japan

(1) Countermeasures on watershed

Kirigaike regulating reservoir, Kanagawa Prefecture- This is normally used as a tennis court. But, in June 1985, this reservoir filled with water. (Figure 7.3)

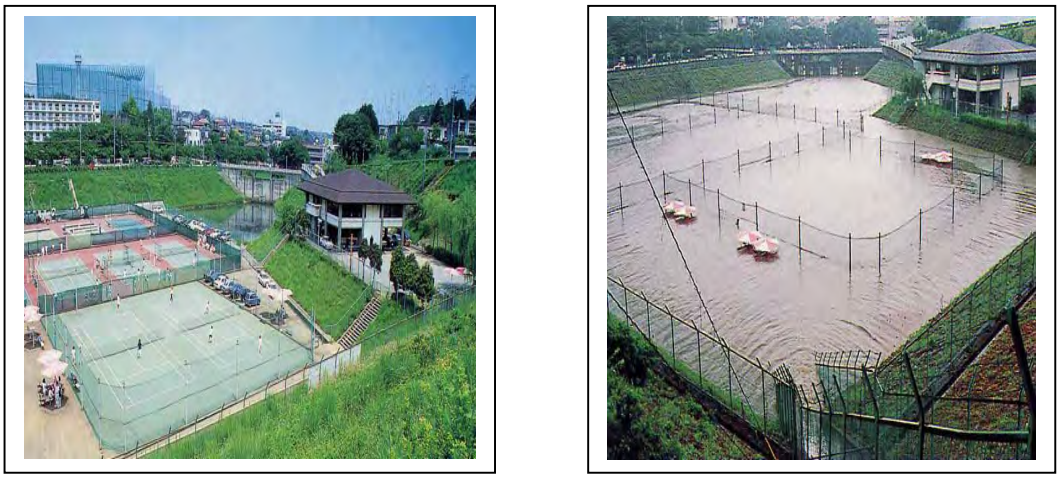


Figure 7.3

(2) Multipurpose retarding basin of Tsurumi River, Yokohama City, Kanagawa Prefecture

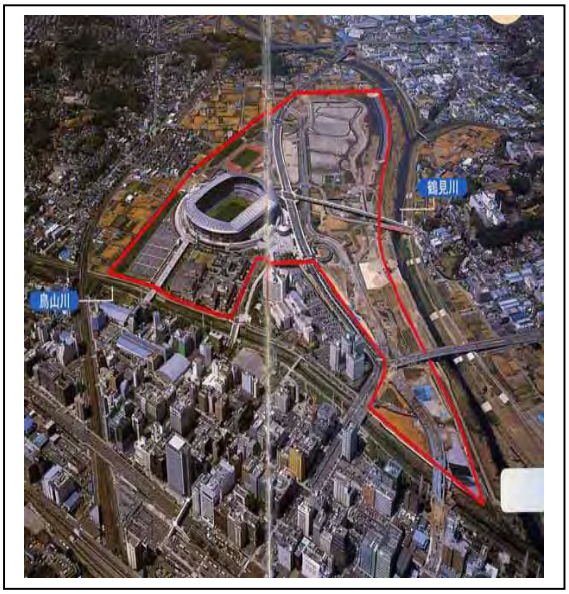


Figure 7.4

(3) Development of underground floodways and underground regulating reservoirs

- The outer flood way of the metropolitan area is the 6.3 km underground river (Kasukabe City to Showamachi ,Saitama Prefecture) running through a tunnel 10 meters in diameter under Route 16,which rains the water of Naka River from its midstream section to Edo River. This is intended to alleviate flood damage sustainability.

- Underground drainage channel in the upper part of the Shoge river

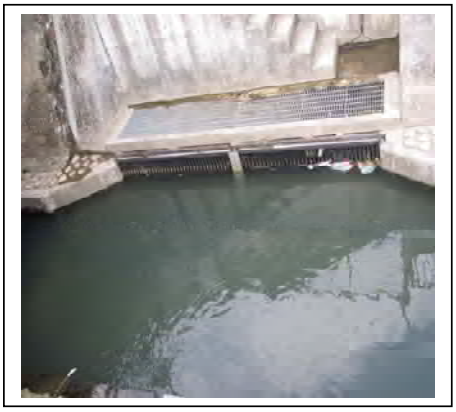


Figure 7.5

(4) Measures to prevent flood disasters in specific urban rivers by constructing divergent channels

Figure 7.6: Koyogawa Divergent Chanel and Pumping Station

Four pumps are used to pump water to Inagawa river. Pumping capacity is 25 m3/s.

(5) Measures to prevent sea water intrusion into low land area in Amagasaki in Hyogo prefecture.

- Constructing a wall along the sea-beach. Two sea-gates are established to avoid sea water to flow inland at Kyusamondo river.
- Elevation of the ground surface is lower than the Mean Sea Level in this area. Tohin drainage pumping station is constructed to pump river water to the sea. There are ten pumps in this pumping station to pump river water to the sea. Water pumping capacity is 72 m3 /s. (Figure 7.7)
- Sea water levels in 1934 and 1950 are marked the gauge located in that area.

Lock 2

Wall along the sea- beach in Amagasaki Area

Lock 1

Tohin Drainage Pumping Station

Figure 7.7

- Mitsushima Pumping station in Samondogawa river was constructed for the same purpose, which pump river water to the sea. Water pumping capacity is 91 m3 /s.

  There is a gate across the river for avoiding garbage flow down to the sea.

Figure 7.8

(6) Heightening and Widening of River Banks

Figure 7.9: Construction of Inagawa River (left) and Construction of Shoge River (right)

7.5. River Information in Japan

Real time information on rivers could be easily obtained through Internet. Internet Portal in Hyogo-weather warning s/advisories are readily available. Through this, river Information (Rainfall, water level), road Information (rainfall, snow), Sea Information (elevation of tide) can be obtained. As shown figure 7.12, real time river Information on rainfall and water level are collected using advanced instrumentation. Here in regard, radar rainfall gauges (Figure 7.10) and digital water level devices (Figure 7.11) are used.

Figure 7.10: Radar rainfall gauge used to get real time rainfall

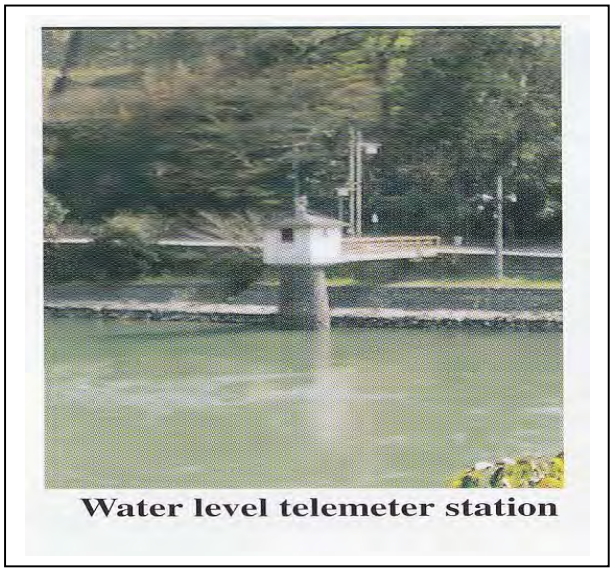


Figure 7.11: Water level telemeter station

(1) In order to disseminate the instant, where water level reaches its critical level, automatic flash lights are on (Figure 7.16). In order to disseminate early warning to the vulnerable community, Alarm system (flashing lights) and electronic media are used to enable for vulnerable people to evacuate quickly (Figure 7.12).

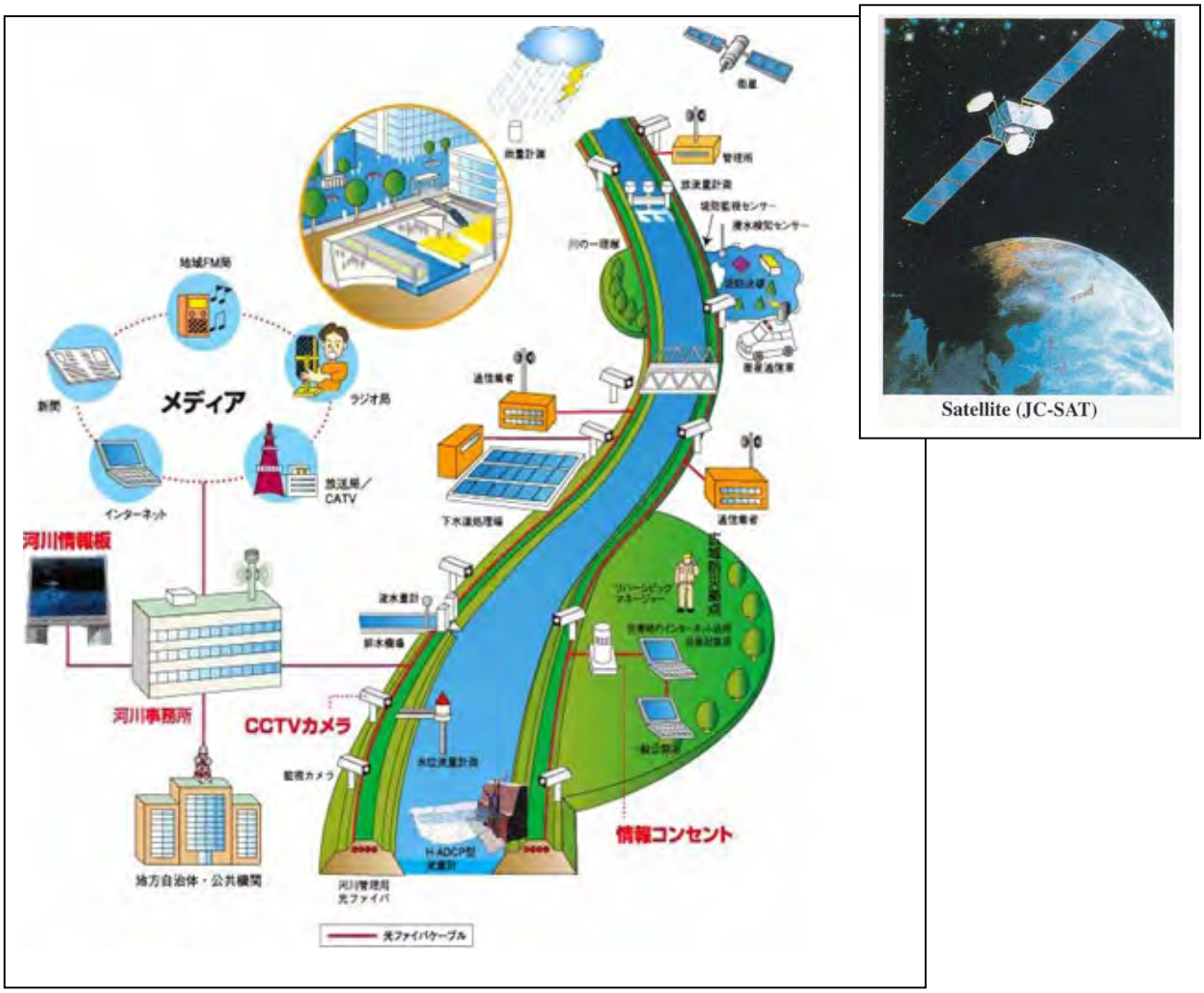


Figure 7.12: Flood early warning system in Japan

Following figures shows some of real time information acquiring methods in Japan.

Figure 7.13: CC Cameras (Closed–circuit television) fixed to the river banks to monitor the river water

Figure 7.14: Water level measuring gauges and senses fixed to the river banks

Figure 7.15: Speakers installed along the river to give announcement

Figure 7.16: Flash lights installed along the river to warn community

Figure 7.17: Sign Boards fixed to the river banks

(2) For early response, evacuation and land use planning processes following maps are readily available for long term use.

(a) Flood hazard map

(b) Expected Inundation Area map

(c) Past flooding area map

(d) Key area and river facility map for Flood Control

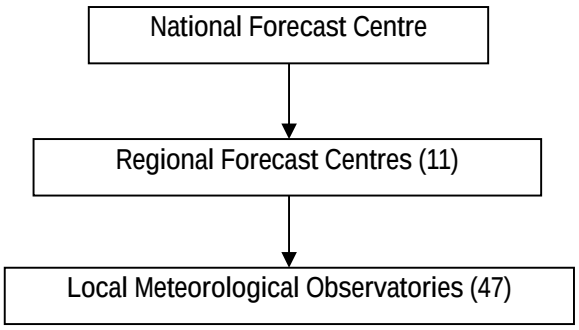
7.6. Flood forecasting system

Japanese Meteorological Agency is playing the major role in forecasting natural disasters through its advanced monitoring network including satellites. The whole role of activities implements with the following goals in compliance with the Act of Ministry and meteorological services act,

- Prevention and mitigation of natural disasters.
- Safety of transport.
- Development and prosperity of industry.
- Improvement of public welfare.

Figure 7.18: Satellite communication facilities

7.6.1. Framework of Forecast Operation (JMA)



7.6.2. JMA's Meteorological Services

(i) Space-based Observation

(ii) Upper-air Observation

(iii) Radar Observation

(iv) Surface Observation

(v) Ocean Observation

(vi) International Data Exchange

LMO is responsible for issuance of information on weather disaster prevention such as warnings/advisories for each prefecture.

7.6.3. Main Objective of Local Meteorological Observatories

Disaster Forecasting to save lives

- Collecting weather and EQ data
- Analysis and Prediction of Weather
- Issuing Warnings and Meteorological Information

7.6.4. Methods used to acquire real time weather data by Kobe Local Meteorological Observatory Office

(1) AMEDA Systems (Automated Meteorological Data Acquisition System)

Measurements of Wind, Temperature, Rainfall and Sunshine can be measured using these equipments. There are 26 AMEDA Systems installed in Hyogo Prefecture and 1,300 AMEDA Systems in Japan. All the systems are computerized and data can be monitored through the screen. (Figure 7.19)

Figure 7.19

(2) Normal Rain Gauges

There are 258 Rain-gauges are installed by Local Government with cooperation with National Government in Hyogo prefecture. All the systems are computerized and data can be monitored through the screen.

Rain Gauges

Method for Observe Weather Condition (Small rain drops, snow…) – Can not measure the amount

Method used to observe snowfall

Plants to observe variations due to seasonal difference

Figure 7.20

(3) Using Radar Systems

There are 20 radar systems in Japan. One is in Osaka Prefecture.

Approximate Rainfall and Cloud information can be observed from Radar.

8. OVERVIEW OF FLOOD DISASTER IN SRI LANKA

8.1. Introduction of Flood Disaster

Wet zone of the country, where a large number of major rivers are flowing through, is prone to severe flooding frequently. Mostly human settlements located on the riverbanks and low-lying areas are mainly subjected to flooding. Sometimes, settlements below the man made irrigation tanks are subjected to flooding mostly when tank bunts fail. During the heavy rainy session in 2011, most of earth bunts of ancient irrigation tanks (lakes) were broken causing damages to agricultural lands, properties and even to human lives.

A flood is an unusual temporary excess amount of water on the land. Depending on the magnitude, a flood can be just a nuisance to the public or can damage services and properties and even cause loss of human lives. Considering the type of floods, many categories could be seen such as river floods, flash floods, dam failure due to catastrophic flooding, failure of dams or other man-made hydraulic structures and urban floods.

8.2. Overview of Flood Disaster in Sri Lanka

Sri Lanka has a dense network of rivers originating from the central hills and reaching the sea from all sides of the island (Figure 8.1). Central hilly region is surrounded by low flat plains and extending to the sea. There are three major penne-plains in terms of elevation in Sri Lanka. The area between each adjacent penne-plain usually consists of steep slopes, steep and narrow valleys, spurs (Figure 8.2). All major rivers start from the central hills and hence their respective catchments are situated on this central mountainous region. With the mountain region receiving the most rainfall for the country, especially the western slopes, flooding has been common in the western lowlands within a short period of time because of rapid water flow down steep valleys to increase the water level suddenly in highly populated downstream planer areas (Figure 8.3, 8.4, 8.8)

Figure 8.1: Rivers in Sri Lanka

In addition, some flat areas, which are situated in the mountains also, get flooded. As a result, every year, during rainy seasons people who are living in the downstream areas are severely affected by flood. The main contributions to flood hazard are excessive rainfall and bursts of intense rain in short periods. This type of rainfall can also be attributed to cyclones and atmospheric depressions.

Out of the 103 river basins, Kelani, Kalu, Gin, Nilwala and Mahaweli experience floods every year. In addition to increase rainfall, blockages of drains in urban areas (especially the city of Colombo) and land use patterns have increased its flood hazard risk. Seasonality is also observed in the flood risk. Flood occurrences in the eastern slopes and plains coincide with the North-East rainfall season, September to January. In western slopes floods occurs during North-East rainfall season, but more common in South-West season from May to August. In between these two rainy sessions there are another two rainy seasons called inter-monsoonal seasons called first and second inter-monsoons, which exist respectively March to April and October to November (Figure 8.11, 8.12, 8.13, 8.14).

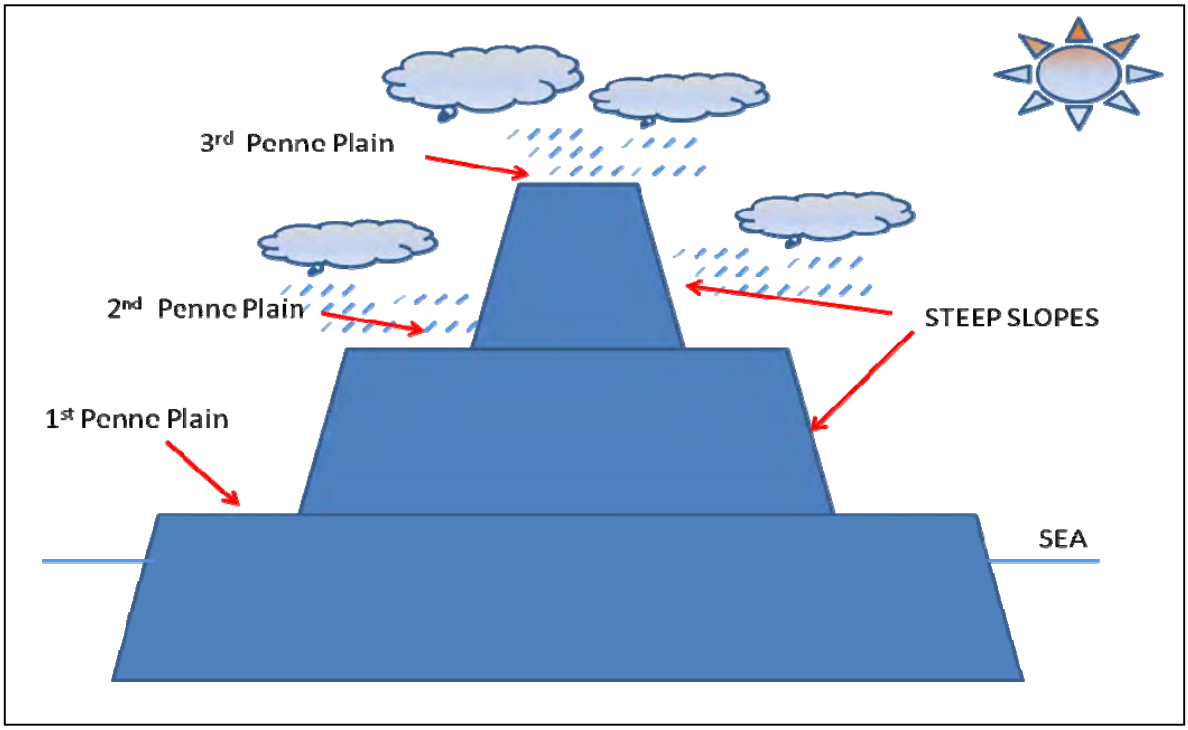


Figure 8.2: Cross Section showing the general morphological setting of Sri Lanka

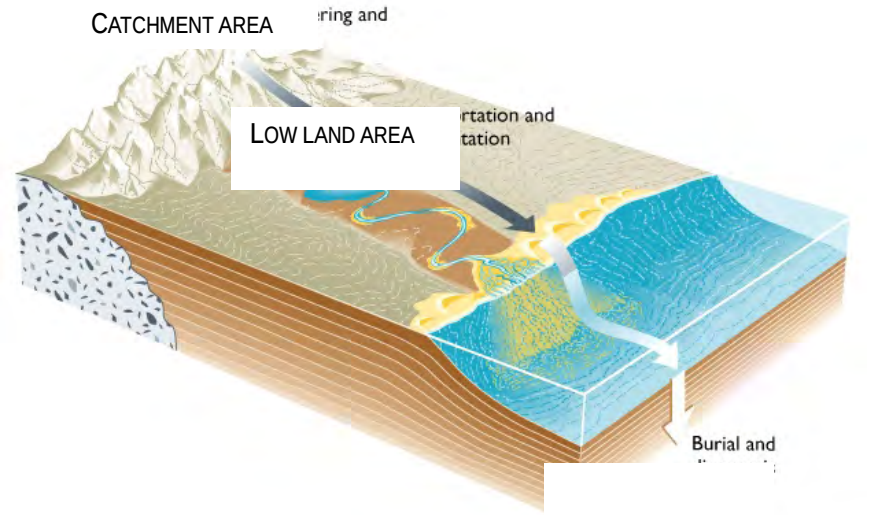


Figure 8.3: General Geo-morphological setting leading for severe flooding in low land area

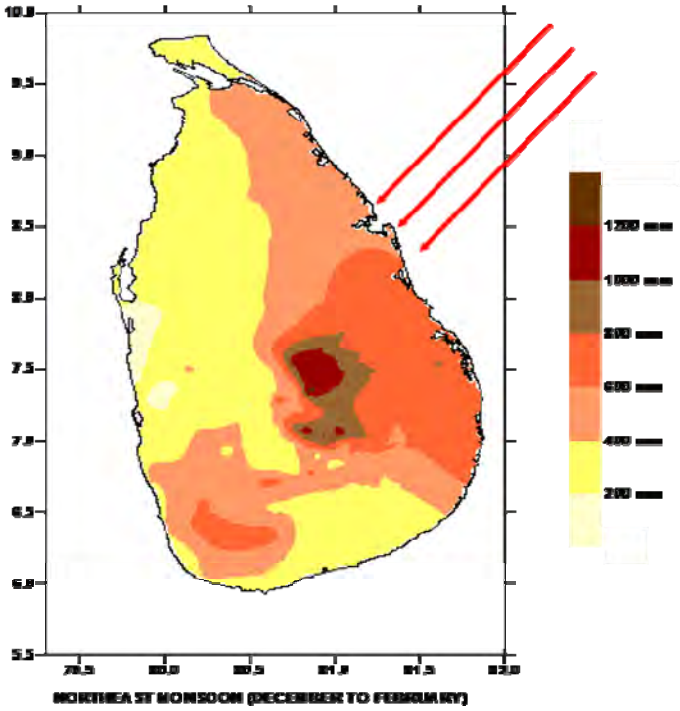


Figure 8.4: North-East monsoon from December to February

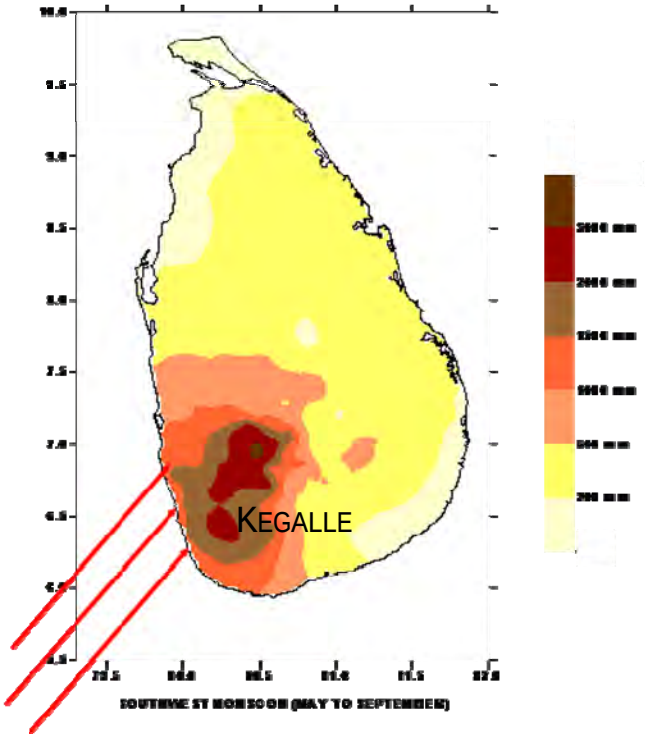


Figure 8.5: Rainfall Pattern During SW Monsoon from May to September

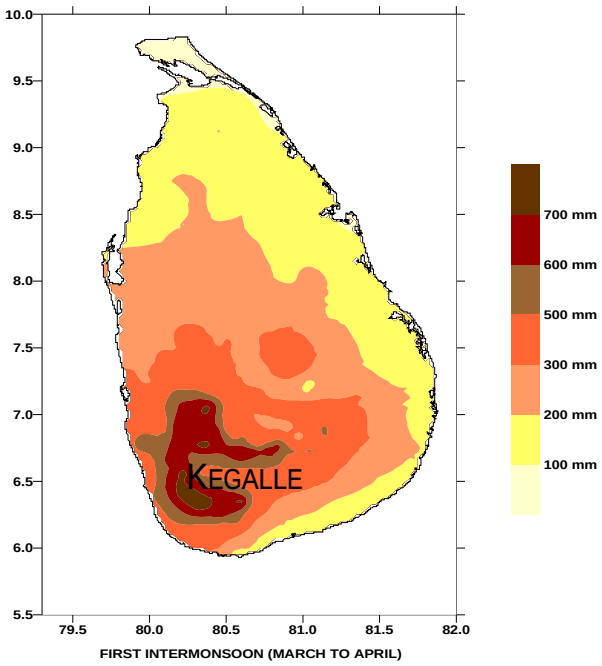


Figure 8.6: Rainfall Pattern during First Inter-monsoon Period from March to April

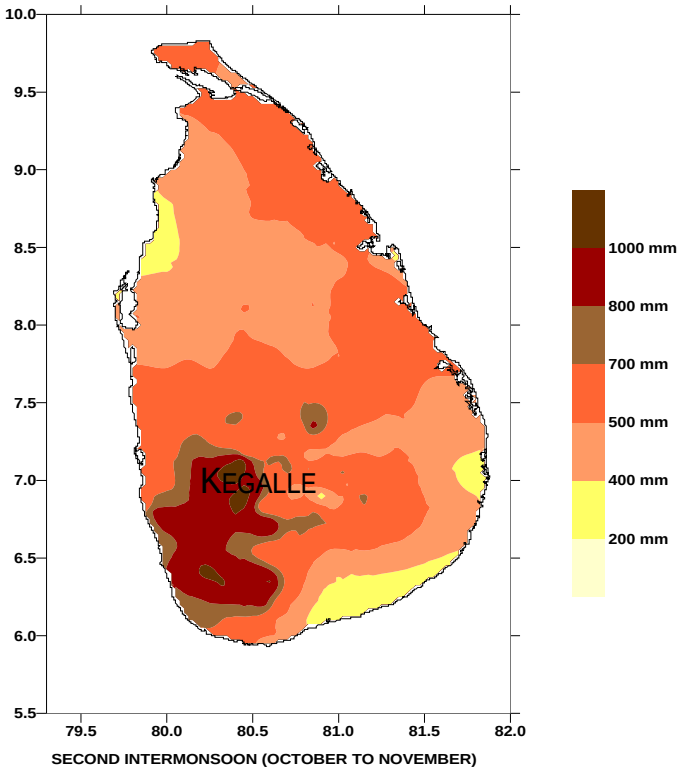


Figure 8.7: Rainfall Pattern during Second Inter-monsoon from October to November

Figure 8.8: Rapid flow in catchment area and sudden flood water spreading in low land areas

Due to prevailing inadequate early warning systems or absence of them in all flood prone areas, many human deaths are reported each year even though adequate information on rainfall and flood level data are collected regularly.

Tea and rubber estates situated within the catchment area collect daily weather information for their plantation management processes (Figure 8.9). Disaster Management Centre distributed several normal rain-gauges among vulnerable community (Figure 8.10). Meteorological Dept. installed several automatic and normal rain gauges for use their weather forecasts.

Figure 8.9: Rain Gauge operated by rubber Plantation (one at Parambe estate, Kegalle District)

Figure 8.10: Normal Rain-gauges distributed by Disaster Management Centre
(one at Bulathkohupitiya Divisional Secretariat,Kegalle District)

RAIN GAUGES INSTALLED BY METEOROLOGICAL DEPT. IN KEGALLE DISTRICT

	STN-ID	STN-NAME	DISTRICT		LAT	LON	ELEVATION
12. KEGALLE							
1	01KE0002	ALAGALLA	KEGALLE		7.28 N	80.48 E	323.2
2	01KE003A	ALGAMA ESTATE	KEGALLE		7.18 N	80.18 E	16
3	01KE0009	AMBANPITIYA	KEGALLE		7.23 N	80.32 E	201.2
4	01KE009B	AMBANPITIYA ESTATE	KEGALLE		7.23 N	80.32 E	201.2
5	01KE016A	ANHETIGAMA ESTATE	KEGALLE		6.93 N	80.27 E	300
6	01KE0021	ARANAYAKE GOVT. HOSPITAL	KEGALLE		7.18 N	80.47 E	16
7	01KE021B	ARANAYAKE MINI HYDRO PRO	KEGALLE		7.13 N	80.47 E	0
8	01KE0028	BADAGAMUWA	KEGALLE		7.50 N	80.40 E	16
9	01KE0043	BERNA ESTATE	KEGALLE		7.47 N	80.17 E	16
10	01KE048A	BODIMULLA GROUP	KEGALLE		7.52 N	80.10 E	16
11	01KE0064	CHESTERFORD	KEGALLE		7.07 N	80.18 E	198.2
12	01KE0073	DABAR ESTATE	KEGALLE		6.90 N	80.38 E	228.7
13	01KE079B	DEDIGAMA	KEGALLE		7.22 N	80.25 E	100
14	01KE0089	DIGALLA ESTATE	KEGALLE		6.95 N	80.30 E	122
15	01KE0091	DIWELA ESTATE	KEGALLE		7.22 N	80.38 E	16
16	01KE0100	DUNEDIN ESTATE	KEGALLE		7.03 N	80.28 E	122
17	01KE104C	EILA ESTATE	KEGALLE		6.98 N	80.33 E	220
18	01KE0113	ERAMINIGOLLA	KEGALLE		7.30 N	80.38 E	16
19	01KE113B	ERAMINIGOLLA (COCONUT)	KEGALLE		7.30 N	80.37 E	16
20	01KE0115	ETNAWALA	KEGALLE		7.20 N	80.20 E	16
21	01KE152C	HAIMATTA	KEGALLE		7.07 N	80.25 E	50
22	01KE141D	HAKBELLAWAKA	KEGALLE		6.98 N	80.35 E	200
23	01KE0155	HAVILAND ESTATE	KEGALLE		7.10 N	80.42 E	16
24	01KE0181	INGOYA ESTATE	KEGALLE		7.02 N	80.43 E	304.9
25	01KE0205	KANANGAMA ESTATE	KEGALLE		7.00 N	80.28 E	16
26	01KE0230	KEGALLE	KEGALLE		7.25 N	80.35 E	16
27	01KY0234	KELLIE ESTATE	KEGALLE		7.12 N	80.43 E	16
28	01KE0235	KEMPITIKANDA (WOODLANDS)	KEGALLE		7.30 N	80.43 E	16
29	01KE0275	LINIYAGALA GROUP	KEGALLE		6.93 N	80.37 E	16
30	01KE300B	MAKANDURA	KEGALLE		7.32 N	79.98 E	26
31	01KG300B	MAKANDURA	KEGALLE		7.32 N	79.98 E	26
33	01KE0301	MALIBODA	KEGALLE		6.88 N	80.43 E	274.4
34	01KE0321	MAWANELLA HOSPITAL	KEGALLE		7.25 N	80.45 E	16
35	01KE345B	MORALIOYA	KEGALLE		7.02 N	80.22 E	90
36	01KE0365	MOUNT CARMEL	KEGALLE		7.52 N	80.15 E	16
37	01KY356A	MURUTALAWA,SURIYAGODA	KEGALLE		7.32 N	80.40 E	16
38	01XX356B	MUWAPITIYA	KEGALLE		7.32 N	80.40 E	16
39	01KE0365	NARANGALLA,MOUNT CARMEL	KEGALLE		7.13 N	80.43 E	16
40	01KE0423	PINDENIYA	KEGALLE		7.17 N	80.30 E	16
41	01RT428A	POOLE ESTATE	KEGALLE		6.87 N	80.35 E	11
42	01KE0445	RAMBUKKANA	KEGALLE		7.32 N	80.40 E	16
43	01KE247A	RAMBUKKANA,KIRIWALLAPITY	KEGALLE		7.33 N	80.37 E	0
44	01KE0458	RUWANWELLA REST HOUSE	KEGALLE		7.05 N	80.25 E	16
45	01KE478D	STINSFORD	KEGALLE		7.05 N	80.18 E	190
46	01KE485E	THELIGAMA	KEGALLE		7.00 N	80.38 E	0
47	01KE104D	UDABAGE	KEGALLE		6.97 N	80.35 E	440
48	01KE504A	UDAHENKANDE DIVISION	KEGALLE		6.93 N	80.33 E	16
49	01KE505B	UDAPOLLA ESTATE	KEGALLE		6.88 N	80.33 E	240
50	01KE0503	UNDUGODA	KEGALLE		7.13 N	80.37 E	16
51	01KE0523	VINCIT ESTATE	KEGALLE		7.08 N	80.22 E	16
52	01KE0526	WAGOLLA	KEGALLE		7.30 N	80.38 E	16
53	01KE530A	WARAKAPOLA(NIYADURUPOLA)	KEGALLE		7.15 N	80.22 E	280
54	01KE537B	WEDDAWALA, WAHARAKA	KEGALLE		7.07 N	80.20 E	0
55	01KE0544	WEWELTALAWA ESTATE	KEGALLE		7.05 N	80.38 E	16
56	01KE0553	YATADERIYA ESTATE	KEGALLE		7.13 N	80.37 E	16
57	01KE0555	YOGAMA ESTATE	KEGALLE		6.92 N	80.27 E	16
58	01KE319A	MATHEMAGODA (COCONUT)	KEGALLE	1	**	**	16

STATIONS IN BLACK COLOR - FUNCTIONING **25**

STATIONS IN RED COLOR- NOT FUNCTIONING **32**

Rain fall data are directly measured by the meteorological department of Sri Lanka

Figure 8.11: Water Level gauge at Thunthota, Kegalle District maintained by Irrigation Dept.

There are several water level gauges maintained by our Irrigation Dept. (Figure 8.11) These measurements are taken manually and transferred to the Dept. regularly.

Due to lack of coordination, poor communication and information system among data collectors, government, vulnerable communities and people living in catchment areas, flood early warning dissemination are still not in progress in Sri Lanka. An effective early warning system could be easily established but unavailability of modern technological supports or inputs, it is still to be underway.

Lack of public awareness, perception of the people regarding the disaster and unplanned settlement in vulnerable areas are also the other major issues to overcome with immediate effect.

8.3. National Organizations for Disaster Risk Reduction

There are several technically sound government organizations, which can predict, forecast and issue early warning to the general public. Organizations such as Department of meteorology, Geological Survey and Mines Bureau, National Building Research Organization, Coastal Conservation Department, NARA, Urban Development Authority, Fire Brigade, Military and Police, Department of Irrigation, Atomic Energy Authority, Central Environmental Authority, Medical Research Institute, Department of Agriculture, Health Department etc. They are capable of handling activities related to different disasters. As shown in Figure 8.12, Disaster Management Centre disseminates the Early Warning to all stake holders. Here in this regard, early warnings are issued up to Divisional and Village level DM committee. Presidential secretariat, three forces and POLICE, all electronic and paper media are also aware soon after issuance of any type of early warning. This is practiced in Sri Lanka up to a satisfactory level.

It has been identified that local authorities, Non-governmental organizations, village committees, youth committees are the Local Organizations for Disaster Risk Reduction.

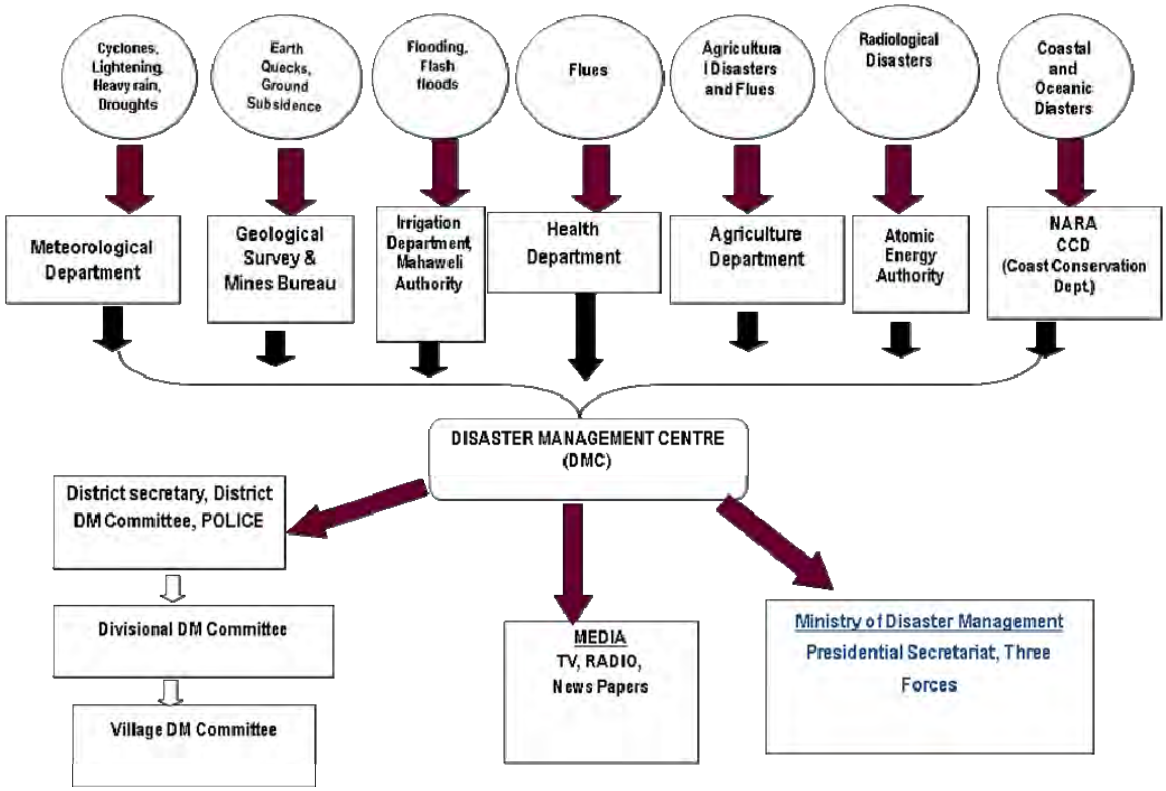


Figure 8.12: Flow Chart Showing Early Warning Dissemination in Sri Lanka

The above flow chart clearly shows that there is a well organized structure to forecast, predict and monitor hydrological disasters.

(1) Metrological Department of Sri Lanka forecasts weather change with the help of satellite imageries. However, due to unavailability of a Radar system to make real time prediction, all weather forecasting is done only in provincial level. Therefore, the weather forecast is not up to smaller scaled predictions and therefore perhaps the forecast may not be correct with what is actually happening. Rain gauges have been positioned in different areas and daily rain fall is monitored.

(2) Irrigation Department of Sri Lanka is monitoring river water level but they do not issue early warning to vulnerable communities.

8.4. Issues caused due to absence of Sustainable Flood Early Warning System in Sri Lanka

Lack of real time flood early warning system put the vulnerable people in a great trouble since the time for quick evacuation is not sufficient and hence, damages caused to their properties and threats to their lives are significant.

But, an appropriate early warning system will be of immense help of minimizing the damages caused. Severe flooding also causes several other impacts in the area such as,

(a) Disturbances to the transportation due to flooded roads
(b) Interruption to electricity, communication
(c) Disturbances to supply of medicine and foods
(d) Spreading of water borne diseases
(e) Damages to cultivated lands including paddy fields.

In the recent event of Flooding in Sri Lanka in year 2011 (Figure 8.13), highly populated area got severely affected by flash floods, which were totally caused by

- Unplanned human activities such as illegal and inappropriate construction, blocking of water ways through unplanned construction, poor waste dumping procedures,
- Unplanned land use practices,
- Low land reclamation
- River sand mining
- Cultivation on hill slopes without applying soil erosion prevention procedure

During recent disaster, which was caused by heavy rainfall due to sudden change of climatic condition, such improper land use practices worsened the situation.

Figure 8.13: Inundated area due to recent flooding in Sri Lanka

8.5. Problems Encountered in Mitigation of Floods

Mitigation of flood hazard is also a difficult task to achieve in Sri Lanka. Even now, there is no any specific institution in the country to control floods. In some of the major rivers, dams have been constructed to generate hydropower. They are now playing a major role in controlling the flood. Within the MAHAWELI River, the longest river in Sri Lanka, five hydro power generating dams have been constructed and as a result, whole MAHAWELI flood plain, which is highly populated, is not affected by severe flood. However, in the rest of rivers and stream network, dams or flood control structures have not been constructed and as a result, every year, severe flooding affects the whole areas situated near by those rivers. Following problems still exist against avoidance and mitigation of flood disasters.

(i) All the river banks are highly populated due to the lack of land availability in Sri Lanka. Most of the community there are self-employed by fishing, sand mining etc. Providing alternative jobs are still difficult for the government. Therefore, implementation of resettlement procedures is also impossible. Construction of flood retention levees is also a difficult task due to the high population density and lack of annual budgetary allocation by the government.

(ii) II. Negligence of the people is also a very big problem to be overcome natural hazards with an immediate effect. Although, the institutions, involved in the disaster mitigation activities, are already carrying out public awareness programs, public participation is still unsatisfactory. In addition, government has introduced several favorable construction methodologies and guidelines for disaster prone areas, people never follow such construction methodologies. It is true that, most of the people living in disaster prone areas are not having the required financial strength (Figure 8.14).

Figure 8.14: Settlement in Flood Prone area- Santee house

(iii) No early warning system has been established at any of the river due to the lack of financial allocation. River-water level gauging stations are operated in most of the rivers by Irrigation Department currently, but use of them is still limited.

(iv) Even though the Rainfall data are collected by the Meteorological Department, the flood early warnings are not issued respectively.

9. RECOMMENDATIONS

With the experiences and knowledge gained from the Visiting Researcher program conducted by the ADRC, the following recommendations can be made.

(1) Installation of rain gauges over the catchment areas. Maintenance and operation activities should be entrusted to groups or individuals who are interested to be volunteers in flood management activities. The interested parties can be selected through public awareness programs. Existing locations where rain gauges are fixed and monitored should be upgraded.

(2) If possible, automatic rain gauges have to be installed with a link to the district disaster management coordinating unit, Kegalle, which enable for real time monitoring of rain fall.

(3) Flood gauges and sensors should be installed along the flood prone streams. In this aspect, both flood prone area and catchment area have to be considered for site selection.

(4) Remote cameras (CCTV), which are capable of monitoring rainfall and rise of water level, should be installed. Such cameras have to be linked to a monitoring station such as District Emergency Operation centre attached to the District Disaster Management Coordinating Office.

(5) Flash lights and loud speakers should be installed in flood risk locations to give early warnings.

(6) A strong coordination link among data collectors, disaster management bodies and vulnerable people should be established through continuous public awareness programs & training programs, mock drills and continuous monitoring and steering committee meetings.

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