RESEARCH REPORT

VISITING RESEARCHER PROGRAMME, FY-2018

TITLE OF RESEARCH

Community Based Disaster Risk Reduction Practices for Flood Risk Management with special focus on Early Warning, Infrastructure resilience and Livelihood improvement along with other scalable DRR interventions for Flood plains- Case Study of Japan.

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ACKNOWLEDGEMENT

Disaster Risk management is not a stand-alone process, rather it's a collaborative effort. Disaster Risk Reduction is the most challenging task in the disaster management process. Prevention and Preparedness has to be imbibed as a culture in the society, if disaster risk management has to be successful. However, in most cases it's an uphill task for disaster managers who try to build a culture of safety in the society despite adversity and challenges. The task is more tedious when the target group is large. Japan is known for its disaster management practices and most of the global DRR frameworks have been adopted in this country. Therefore, it is quite exciting for me to be a part of the Visiting Researcher Programme of ADRC, Japan for the FY-2018. I sincerely thank the Ministry of Home Affairs, Govt. of India, Govt. of Japan, Govt. of Assam and the Asian Disaster Reduction Centre, Japan for accepting my research topic and giving me the opportunity for doing the research.

I would like to convey my deep sense of gratitude towards the Cabinet Office, Japan, Hyogo Prefecture Government office, Hyogo Police, IRP, Educational institutions (Kobe University, KUIS), the private entities and the other DRR organizations of Japan that helped me in fruitful conduct of my research. During my stay in Japan, I had an opportunity to experience disaster in real time in Japan like the TYPHOON JEBI (Typhoon21), Hokkaido earthquake and TYPHOON TRAMI (Typhoon 24). It provided a learning experience for me as I was a part of the community of Nada ward and could discern how warnings are disseminated in real time, how disaster is managed and the way people cope with the disaster as well as resilience of infrastructures (communication, electricity etc.) are striking examples for me.

Last but not the least, I am grateful to the ADRC staff who arranged a number of site visits and facilitated my learning. Special thanks to Mr. Masanori Hamada, Director, ADRC, Mr. Koji Suzuki, Executive Director, ADRC, Nakamura San and Arakida San, Senior Researcher and Mentors, Shiomi San, Researcher and In-charge, VR Program and Mr. Kawahara. Without their efforts it won't have been possible for me to complete the program and compile this report. I am also thankful to my VR colleagues Ms. Mazni Binti Azis, Malaysia and Ms. Shaufa Aminath, Maldives, Ph.D Scholar Anastasia Kvasha (Russia), Intern Amelie Hoffarth (Germany) and Ms. Ree & Mr. Okazaki of DK House, Kobe for their cooperation during the stay.

I hope this research work will be useful for me in my career as disaster manager and also to the Government of Assam, Government of India and Government of Japan.

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CHAPTER-1
INTRODUCTION

1.1 Background of the Research

Every year India is affected by a significant number of disasters. Due to its topographic diversity, different parts of India experience different kind of disasters. However, vulnerability to flood is unique to certain regions of India, depending on the monsoon patterns, topography as well as to some extent the un-sustainable development pattern.

This research is proposed to be applied in a geologically significant part of India i.e. North-Eastern India. North East India is severely prone to flood, erosion, earthquake, landslide and thunderstorms. However, Assam- one of the states of NE India is located in the continental shelf region and is perennially affected by riverine flooding. Risk of earthquake & landslide induced flooding is also quite high in this region. Most of its neighbor states or border countries have hills which contribute to huge amount of rainfall run-off to the shelf area of Assam. Large volume of silt laden water from the mountains enter into the shelf every year during monsoon, leaving thick silt deposits in the upstream and devastating the entire plain areas with flooding. People lose their livelihood due to varied factors that arise as a consequence of flood disaster. The main rivers that cause flood havoc in Assam are Brahmaputra and the Barak in addition to a large network of interconnected tributaries.

According to the satellite data mapped between 1998 to 2007 (Flood Hazard Atlas for Assam State, July, 2011 by NRSC) 6% area of the State falls in very high flood hazard zone, 10% in high flood hazard, 16% in moderate flood hazard, 22% in low flood hazard and 46% in very low flood hazard zone. However, the frequency & intensity as well as geographical coverage of floods in the State has shown increasing trend over the period of time and so is the extent of damage. As per Cumulative Flood Report of 2017, no. of deaths due to flood increased to 160, which is quite high compared to previous years. With the changing climatic conditions, the death toll has significantly increased thus lessening the coping ability of the local communities.

Taking into account, flood experience of the past, Assam State Disaster Management Authority (ASDMA) took up a pilot project for building up flood resilience in the lowest administrative units (villages). The

project villages were prioritized based on already available scientific reports and studies of ASDMA. The project was formulated initially for a time period of 3 years. ASDMA succeeded to carry out only few non-structural interventions in the project villages in the first phase of the project during the 1st & 2nd Year of the proposed timeline. Few of the interventions were Village mapping exercises, preparation of flood evacuation kits, training of Task forces and Pre Monsoon camps for scheme awareness, IEC circulation etc. However, ASDMA plans to have a second phase of the project which will mostly focus on improving the existing Early warning system, create alternative Livelihood opportunities and building resilient infrastructures including introduction of some climate resilient agricultural practices in the proposed areas.

1.2 Objective of the Research

The objective of the research is to make a detailed study of the following systems that exist in Japan and transfer the knowledge into the project areas:

1. Understanding the Disaster Risk Reduction Legislations and mode of governance in the lowest administrative units of Japan
2. Mode of Planning with focus on method of preparation of Hazard /vulnerability map by local government in Japan and preparation of localized Disaster Management plans (development of contingency plans, community action plan for DRR, local development plan etc.)
3. Institutional Mechanism at village level / forums for convergence among sectors and stakeholders. (Business Continuity Planning etc.)
4. Early Warning Systems to improve dissemination of communication to the last mile in probable flood condition.
5. Resilient Infrastructure patterns for all hazard sustainability with special reference to flood hazard.
6. Livelihood opportunities for communities in pre-during and post flood condition.

1.3 Significance of the Research

The proposed research is expected to address the areas for DRR intervention in the project areas of Assam and explore possible collaborations with external agencies on the project. The research will provide a knowledge base to address the following issues-

1. Understanding local governance systems along with mode of DRR integration into development plans.
2. Improvement of the existing Community Early Warning Systems to improve dissemination of hazard information to the last mile.
3. Livelihood improvement of the communities for pre-during and post flood condition.
4. Identify resilient infrastructure patterns for hazard sustainability.

1.4 Reason for opting Japan as the research area

1. Disasters occur frequently in Japan due to its geographical location. Japan is situated in the "Pacific Ring of Fire" which is geologically very active and significant. This area is prone to multiple hazards like frequent volcanic eruptions and seismic activities. Japan is also vulnerable to several meteorological hazards like typhoons, storm surge etc. The frequency of natural disasters that occur in Japan due to its geographical position and geological history is one of the reason
2. The disaster management system in Japan was adopted long time back compared to Indian Disaster Management system and was adopted as a need to counteract disaster vulnerabilities.

   The fact that- "need for a disaster management system in Japan was felt after the severity of damages caused by Ise-wan Typhoon of 1959. The Disaster Countermeasure Basic Act was enacted in 1961, which formulates a strategic disaster management system. The laws have been revised and strengthened after the lessons learnt from the Great Hanshin Awaji Earthquake of 1995. The Disaster Management System of Japan addresses all the phases of the Disaster management cycle prevention, mitigation and preparedness and emergency response as well as recovery and response." Is another reason for considering Japan for case study.

3. Japan is known for its disaster counter measures all over the world.
4. Infrastructures in Japan are built back as per resilience standards.
5. Due to similarity in the kinds of natural disasters faced by both India and Japan, learning from Japan experience would widen the scope of understanding of DRR and also help in better planning of future initiatives.

CHAPTER-2
METHODOLOGY

2.1 Data Collection

Data Collection process involves both primary and secondary data collection process. However secondary data has been collected from books, reports, brochures, online portals etc. Whereas, primary data collection is more qualitative than quantitative. Qualitative data collection methods include discussions, interviews, open-ended questions, observation, case studies etc. The data for the research is collected from research reports mentioned under the references. Few data and reports were collected from books and journals available at ADRC, Japan during the program and few others have been collected from the internet. And mostly primary data is collected from site visits to relevant areas of study and also from attending lectures of different experts in the relevant field, interaction with experts etc.

2.2 Data Analysis

Data analysis is mostly based on literature survey, summary of lectures from the experts, field visits, interaction with experts etc. Data has been analyzed qualitatively and mostly is opinion based. No quantitative method of analysis is applied during the research since the time was limited.

2.3 Study Area

Study areas in Japan, relevant to the research topic were selected by ADRC. Special visits to those areas were conducted.

2.4 Limitation of the Study

Each of the sites in the study area had so much of DRR information, but to collect all the information in this limited period of 3 months is not possible. Therefore, the research can be considered as a preliminary report of a reconnaissance survey of the study area.

CHAPTER-3
COMMUNITY BASED DRR IN JAPAN

3.1 Community Types:

Community is a social institution, that is, a stable structure and agreed set of procedures and conventions that provides social order and meaning. Communities can be established depending on varied factors like by geography or choice; they may be based on activities or beliefs etc. A community is believed to foster a sense of belonging, connection, communication and interaction. Virtual communities also exist where people share common interests but do not meet or interact frequently. Kegley (1997) writes about engaging with 'genuine community' as a means of improving individual well-being by strengthening knowledge, intentionality and enlightenment.

If we consider from the perspective of Disaster management, there are basically two broad categories of communities that play an important role in DRR and disaster response are Rural and Urban communities. Apart from these two broad categories there may be other groups or communities that play specialized roles in disaster reduction, education or response. But any member/individual of such specialized group is also a member of either of the two broad categories. An individual can be member of multiple communities depending on his interests, engagement or social activity.

An "Urban Community" is mostly referred to as a "society" whereas the Rural conglomeration is a "community". However, the social cohesiveness is more in rural than urban communities. Members of rural communities are childlike, close and have frequent interactions. Residents are familiar with each other and have common way of life or beliefs. In contrast, Urban communities have socially mature relations, interactions are more distant and not very frequent. They comprise mostly of citizens who are relatively unknown to each other and whose lifestyle and beliefs are different and change constantly.

In Japan, there are both "rural" and "urban" types of communities. However smaller groups or communities under these two broader groups exist which contribute and work for DRR. These communities are known as "Disaster safe Welfare Community groups" which work for DRR and manage disasters in their own localities. However, there are no significant age criteria to be a member of this community. Any person can be a member depending on his social activeness and interest in DRR. Children are junior task force volunteers in these community groups and extend support during disasters.

However, one of the important component of DRR education in schools of Japan is that, the students are taught to greet each other, to know each other and to help one another. One fundamental principle proposed in Japanese DRR is to promote “Self Help” and “Mutual Help” This lesson has emerged as an experience of the Great Hanshin Awaji earthquake (GHAE). After the GHAE occurred there were instances where neighbors did not know each other which is a common scenario in Urban societies. So if a family in the neighborhood were trapped, or dead, nobody knew exactly how many people under the debris. Nobody helped each other. Therefore, we can say that disaster management is a culture, to be adopted through daily life practices. If DRR has to be a fruitful initiative, the concept of “Self Help” and “Mutual Help” should be practiced by communities (or societies) in daily life. This can be fostered only through regular meetings or gatherings, discussions or by being a member of the community groups.

3.2 Vulnerability of communities to disasters

Communities are vulnerable to disasters due to lack of knowledge and most importantly due to lack of understanding of the risk areas in which they live. Both Rural as well as urban communities are vulnerable to different risk patterns. Rural communities are more ignorant of risks compared to urban communities. The government in this regard has a major role to play by making the communities aware of the risk prone areas and providing them with sufficient information on the measures to be taken for residing in risk prone areas. Vulnerability of the community to hazards may be due to various factors- Lack of understanding of risk, poverty, lack of accessibility to resilient infrastructures, lack of faith in government policies and inability of the government to sensitize the community on disaster risk.

However, if we take the case of Japan, the local government (For Example: Hyogo Prefecture) has already mapped the risk prone areas and created hazard maps which are widely circulated to the people residing in municipalities in the form of hazard bulletins. Therefore, sufficient efforts have been made on the part of the government to sensitize urban communities about the vulnerable areas. Moreover, the Fire bureau of the city government has museums to educate the community on risk and measures to be taken for disasters like preparation of emergency kits, do’s and don’ts for different hazards, disaster education for children through organizing disaster awareness camps etc. Besides these the city government also has a website in which all disaster management information including hazards maps, vulnerable areas marked in different colors in accordance with risk category as well as disaster booklets on preparedness measures are available in local language (Japanese). In Japan, rural communities are more vulnerable to typhoon risk as compared to the urban population due to lack of resilient housing.

Traditional style Japanese houses in rural areas suffer damages due to Typhoons as well as earthquakes. Flood hazard in urban areas are mostly managed by the municipality and city government. People are mostly vulnerable to flooding as well as sediment disasters (Landslides) caused by typhoons and tsunamis and in few cases due to overtopping of the riverbanks.

3.3 DRR Legislations

DRR laws were established in Japan during Early Meiji period i.e. 1871 onwards and subsequently after lessons learnt from 1923 Kanto earthquake. In 1923 the Special law on Urban Planning was developed after the Kanto Earthquake. 1947 Disaster Relief law was established after 1946 Nankai earthquake in which 1330 people lost their lives. 1961 Basic law on Disaster Countermeasures was adopted after the 1959 Ise-wan Typhoon (5098 lives lost), 1998 Law on Support for Life reconstruction was framed after 1995 Hanshin Awaji Earthquake (6434 lives lost) and 2013 law on Recovery from Mega Disasters was adopted after the 2011 East Japan Earthquake (15894 lives lost). Each law has been adopted as a lesson learnt from certain major disaster and subsequently amended with time and newer lessons learnt.

There are separate laws for each phase of Disaster management like- Disaster Prevention, Emergency response, disaster Relief and Rehabilitation. Some significant laws on Disaster prevention are-1896/1964 law on Rivers, 1897 Law on Forestry, 1950 Law on Building standards etc. Emergency Response laws like 1948 Fire Fighting law, 1949 Flood Prevention law, 1954 Police law etc. Disaster Relief Laws like 1949 Law on disaster Relief, 1972 Law on Condolences, 1998 Law on Reconstruction of Living of Disaster victims etc. Rehabilitation laws like 1951 Law on National defrayment for Rehabilitation of Disaster stricken Public facilities, 1962 Law on Special Financial Aid for Heavy Disasters etc.

Under several acts like Sediment Disaster Countermeasures Act, the Flood Control act etc., the Ministry of Land Infrastructure Transport and Tourism is the nodal agency to define Land Use regulations in the country. The ministry prepares hazard maps and provides disaster management information. Hazard maps are distributed to the communities in printed form. As of March 2014, cabinet office report, 1272 municipalities have published flood hazard maps. 95% municipalities have prepared and 5% yet to prepare. The Ministry designates Yellow, Red and Orange zones in the maps. People residing in yellow zones are encouraged to prepare for flooding & sediment hazards. However Red zones are banned areas and people are not permitted to live in those zones. Article 29 of the constitution protects “Freedom of Ownership” and so government cannot take strict actions or force but only can provide subsidies. If residents dwell in such areas despite restrictions, no compensation is paid to the dwellers in the event of disaster loses. And the Ministry encourages early evacuation of such areas. The Ministry acquires

/purchases land from residents living in red zones and buys a subsidized land elsewhere in yellow zone for the resident using the money received from the resident. However orange zones are designated for land development by government for making it suitable for living through land re-adjustment, widening roads, raise heights etc. People affected by disasters are generally rehabilitated into such areas after land development. But there are long waiting periods for citizens and till completion they have to reside in temporary shelters.

The local (municipal) government is responsible for translating disaster laws into certain easy to comprehend forms of communications that can be easily understood by communities. Awareness materials are printed and distributed in the form of advisories/ booklets for understanding of communities with pictorial descriptions.

Article 5 of the Basic Disaster Countermeasure act, envisages municipal governments to protect lives, limbs and properties of the residents, making disaster preparedness plans for the residents and its implementation according to the laws, promotion of Shobo-Dan, Suibo-Dan and other autonomous Disaster Preparedness institutions (Jisyu-bosai-soshiki), Establish mutual assistance between municipalities and co-operation with volunteers by national & local governments.

3.4 Local Governance systems for DRR

The Governance system of Japan follows a bottom up approach and the system has vertical divisions as well as strong local and municipal government connections. The Government system in Japan has three vertical layers and a 4th layer was added to the structure after the 1995 Great Hanshin Awaji earthquake as shown below-

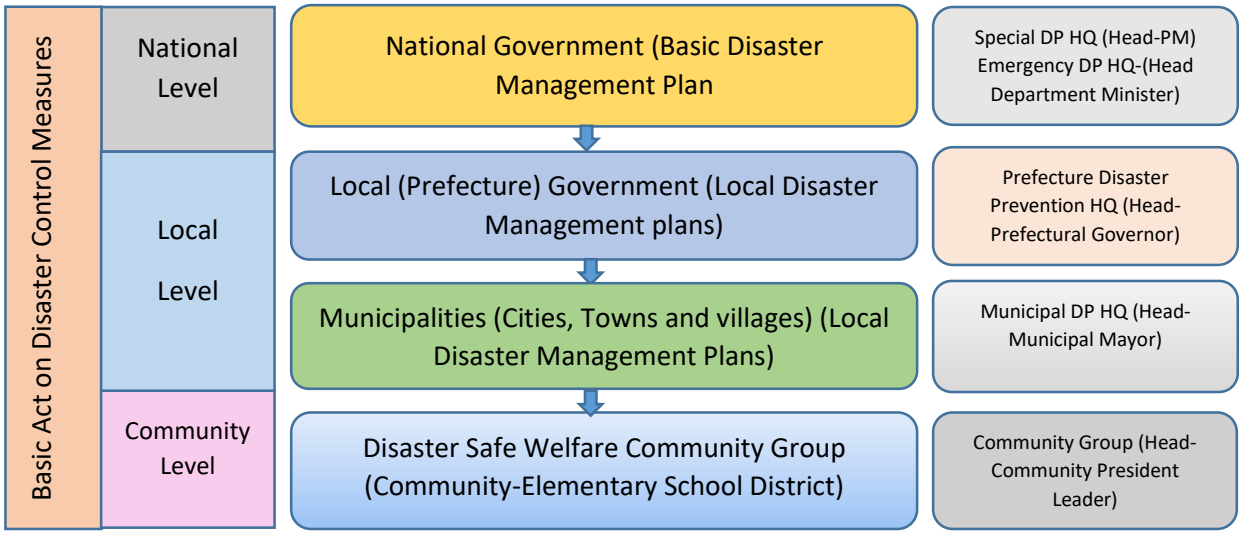


Figure 1: Flowchart showing Disaster Management structure in Japan

Source: Pg. 52, Point No. 14

The entire system operates in a bottom up manner. Whenever an inquiry is sent by National Government regarding any matter, local government takes one week to send the matter to municipalities. The municipalities take one week for investigation, aggregation of data and sending to prefectural government. The Prefectural government aggregates data from municipalities and replies to the National government.

However, the Mayor of city as well as village, have equal powers like Prefecture Governor for making disaster management decisions at the local level. The Mayor has a major role in emergency response. The Mayor under his discretion can establish Municipal Disaster Prevention Center, take preventive measures, issue evacuation order, designate risk areas, utilize human resources and private properties for public use and request for self-defense force. The Mayor has the following responsibilities like Collection and dissemination of information, report of damages, warning citizens to prepare for evacuation, command on dispatch, Order for vertical evacuation, emergency response including provision for disaster relief, issuance of certification of disaster victims (Risai certificate), utilization of GIS and information sharing.

Article 5 of the Basic Disaster Countermeasure act, envisages municipal governments to protect lives, limbs and properties of the residents, making disaster preparedness plans for the residents and its implementation according to the laws, promotion of Shobo-dan, Suibo-dan and other autonomous Disaster Preparedness institutions (Jisyu-bosai-soshiki), Establish mutual assistance between municipalities and co-operation with volunteers by national & local governments.

The 4th layer of Governance is quite significant for Community based Disaster Risk Management (CBDRM) as it plays a vital role in encouraging citizen representation in governance. Disaster Management can be successful only if the citizens equally participate in the process. And Disaster Welfare Community Group constitution is an example of citizen centric governance. The Disaster Safe Welfare Community Group (Jisyu-bosai-soshiki) is supported by two more technical voluntary units namely Shobo-dan and Suibo-dan. The Structure is as shown below-

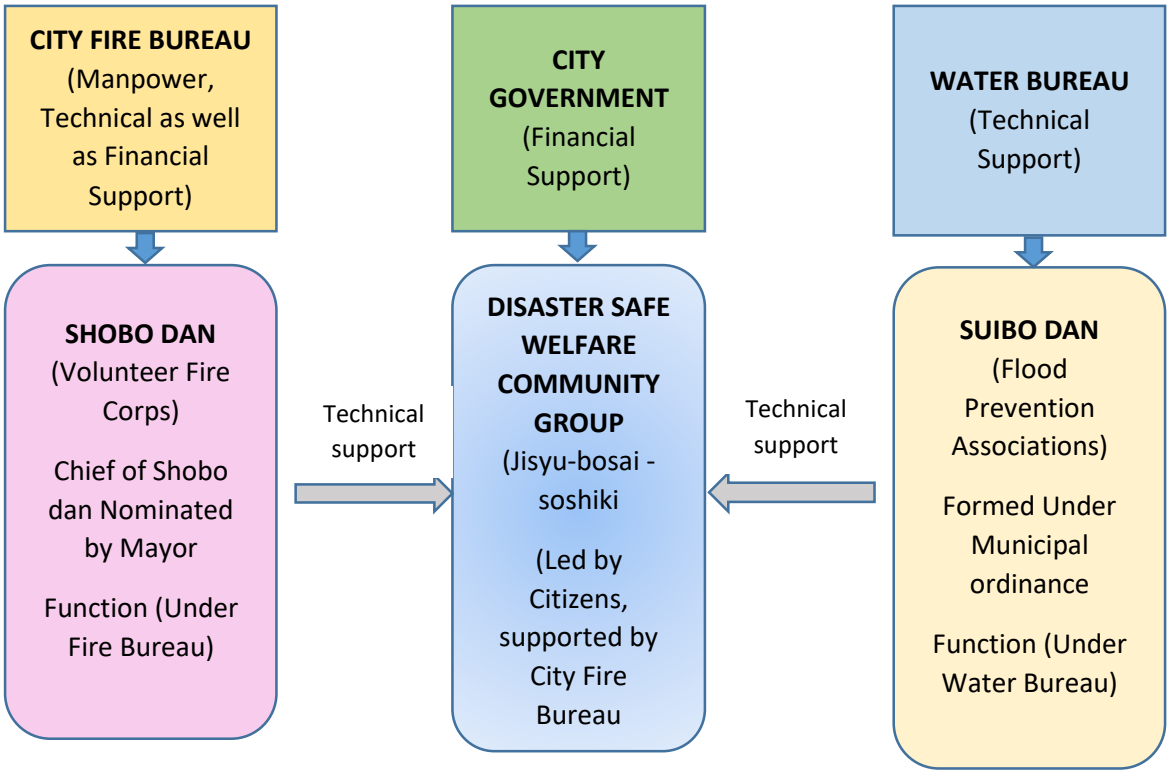


Figure 2: Flowchart showing Community Based Disaster Management structure in Japan

Source: Pg. 52, Point No. 12

In Kobe City, 1400 personnel (Full Time) from Kobe City Fire Bureau and 4000 Volunteer Fire Corps (part-time) support 191 Disaster Safe Welfare Community Group. 13000 Citizen leaders have attended ToT and 800 Drills are conducted per year. (source: Lecture notes on "Issues of disaster risk reduction" by Prof. Yuka Kaneko, Kobe University)

The **Shobo Dan** functions under the Law on Fire-fighting. The Shobo-Dan (Local Fire Brigade) are engaged either on full time/part time basis and perform under Shobo dan chief. The Mayor nominates the Shobo Dan Chief and Shobo Dan Chief selects the other members with approval of Mayor. The Shobo Dan members has responsibility of local fire fighting, conduct rescue operation and also help in flood prevention/protection activities along with Suibo Dan. In other times Shobo Dan also conducts preparedness/ awareness activities like Education for families, Elderly people, Training of First Aid, Increase awareness of local residents. The Shobo-Dan have remuneration as well compensation for the activities they perform.

The **Suibo Dan** are formed under the 1949 Law on Flood Prevention and 1908 law on Flood Prevention Associations. The Suibo Dan are local Community Flood Prevention Associations formed under the

Municipal ordinance. These are autonomous bodies that conduct Flood protection works as well as prevention works. These associations function under the Water bureau.

Figure 3: Models showing activities on Flood Protection/ Prevention by Suibo-Dan (Flood Fighters) using sand bags, bamboo and local materials ***(photo source: Tsunami & Storm Surge Disaster Prevention center, Osaka)***

The **Disaster Safe Welfare Community Group** is a voluntary disaster prevention organization that carries out disaster prevention training etc. The functional area of each Disaster Welfare Community Group is around an Elementary school. The Disaster Welfare Community Group conducts its meetings in the elementary school. The structure and functions of Disaster Welfare Community Group is as shown below-

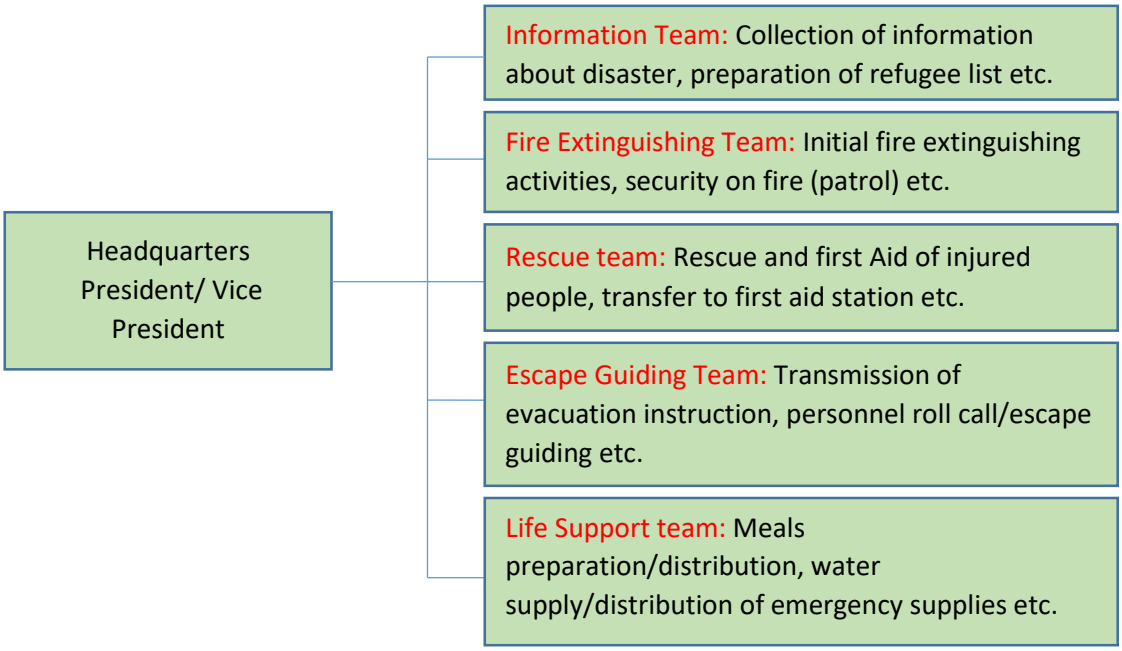


Figure 4: Diagram showing structure of "Disaster Safe Welfare Community Group" in Japan

Source: Pg. 52, Point No. 12

The Disaster Safe Welfare Community Group is supported by the City government for implementing its activities. The following are the support measures are provided by City Government to Disaster Safe Welfare Community Group -

a) Provision of disaster prevention materials and equipment at the time of formation
b) Subsidizing of activity expenses
c) Support of development of citizen's disaster prevention leader.
d) Support by fire-fighting officer service system by district
e) Support by volunteer fire corps
f) Other support measures like training fire-men, fire fighting vehicles and subsidy etc.

The Disaster Safe Welfare Community Group has following functions for DRR: Taking up activities for welfare of community with financial support from City Government, conduct trainings, meetings, prepare hazard maps, develop Community Disaster management plan, conduct drills with the help of Fire Service personnel in-charge etc. 2-3 Fire Service personnel are in-charge of each Disaster Safe Welfare Community Group.

3.5 Preparation of Hazard Maps:

The hazard map is prepared by local residents (community) under the guidance of municipalities to chalk out the expected damage areas by foreseeing the damage to be caused by flood, sediment or other natural disasters. The map shows information such as areas at risk of damage from disaster, the extent of damage and evacuation routes/sites. Sometimes even if places are not designated as risk area on the hazard map, they may suffer damage due to disaster or in some cases may suffer damage at a larger scale than the area designated in hazard map. The hazard map is prepared in three steps. Firstly, they divide into block-wise groups, prepare a draft map in the map building workshop, mark the houses, evacuation routes, sites etc. make a presentation by community blocks. Secondly, they conduct a "town watching" on the subsequent day with the draft map for identifying the hazards/risks and correcting and collecting more data on the 1st draft map. Brainstorming sessions are conducted for revision of first draft on the basis of information obtained from "Town watching". The details are presented in the second workshop. And Thirdly, the city officials print the 2nd draft and conduct a third workshop. The community attends the third workshop for any final correction in the printed map. The contents of the final map are presented by city official with a request to use the hazard map in the community drill.

3.6 Community Disaster Prevention Planning:

There are different layers of planning in Japan Disaster Management System. The following types of plans are prepared by respective agencies as mentioned in the table and reviewed as per following timeline as indicated below-

Types of plans	Planning Body	Timeline for review
Basic Plan of Disaster Prevention	Central Disaster Prevention Body	Yearly review
Disaster Preventive Operation plan	Designated Administrative Org. Designated Public org.	Yearly review
Prefectural Disaster Prevention Plan	Prefecture Disaster Prevention Body	Yearly review
Municipal Disaster Prevention plan	Municipal disaster Prevention Body	Yearly review
Community Disaster Prevention plan	**Proposal by Local Residents (**Disaster Welfare Community Group)	
Intra Prefecture Disaster Prevention Plan	Co-ordination Committee of Prefecture Disaster Prevention Bodies	Yearly review

Inter Prefecture Disaster Prevention Plan	Co-ordination Committee of Municipal Disaster Prevention Bodies	Yearly review

Table 1: Disaster Management Planning System in Japan
(*Source: Pg. 52, Point No. 12)*

Community Disaster Prevention plan is the smallest unit of planning and several community disaster prevention plans are integrated to make the Municipal Disaster Prevention Plan/ Local Disaster Prevention plan. The Disaster Safe Welfare Community Group of a locality is responsible for making the Community Disaster Prevention plan. The Disaster Safe Welfare Community Group was established after the Great Hanshin Awaji Earthquake (GHAE) of 1995. Disaster Welfare Community Group are established based on municipal elementary school districts by the residents. Disaster Safe Welfare Community Group are based on elementary school districts because there is an "welfare community" organization established for welfare purposes in each elementary school district and a disaster risk reduction organization was integrated into the existing organization. Also elementary schools operate as "evacuation site" during emergencies for the communities. Disaster Safe Welfare Community Group is established in Elementary schools so that they can easily operate their evacuation site in the case of emergency. One Elementary school is established against a population of 10,000 people. There are also voluntary community groups in areas which do not have an elementary school.

The Disaster Safe Welfare Community Group also works during peacetimes on several areas like fire-fighting, rescue & aid etc. formed within the organization. Once a disaster occurs, Disaster Welfare Community Group Headquarters will be set up by the specialized teams to direct each of the district blocks.

The Disaster Safe Welfare Community Group is a section smaller than the Municipality and hence the smallest administrative section. So each small administrative section is expected to prepare the "Community Disaster Management plan" The Community Disaster Management plan specifies action to be taken at the site, or at the community level, during a disaster. Hazard Map is one of the component of the "Community Disaster Management plan" used for planning disaster prevention. "Local disaster management plans are characterized by their style of specifying actions and plans to be taken in a disaster in the form of checklists. A checklist in the community Disaster Management plan is described as "a chapter clearly specifying the locations within the block in which the local Disaster Welfare Community Group members as well as other community members should gather" and a chapter listing out "items essential in disaster response in a checklist". This style enables every Disaster Welfare

Community Group to immediately participate in organizational management with this list in his/her hand when a disaster strikes. Prior instructions for action are developed as per the community disaster management plan so that Disaster Safe Welfare Community Group members (disaster response teams) in each Block know what to do at the disaster site including "information collection and communication" and confirmation of safety of residents. In case of large scale disaster, the groups reach out to the neighbor blocks for mutual help in response. The following points are taken into consideration while preparing the Community Disaster Prevention plans-

a) Location of Disaster Welfare Community Group Headquarters where the members will gather during a disaster
b) Location of different places/locations where local residents will gather for each block to perform individual responses to disasters (Example: places where machinery, materials, water tanks or other resources are available)
c) Check for disaster risks and hazard locations in the community through walking around the areas
d) Examine the checklists for response items necessary for community

The Community Disaster Management Plan prepared by community is in loose leaf of papers in a file folder so that the specific parts of the plan can be detached for reading during emergencies or easily updated after disasters by replacing the old sheets for new ones. The Disaster Welfare Community Group prepares the plan in a very simple way so that every person can easily understand the plan. They prepare the plan in Flow charts and diagrams as well as bullet points. The Disaster Welfare Community Group policy focuses on "Self Help" and "Mutual Help" by residents.

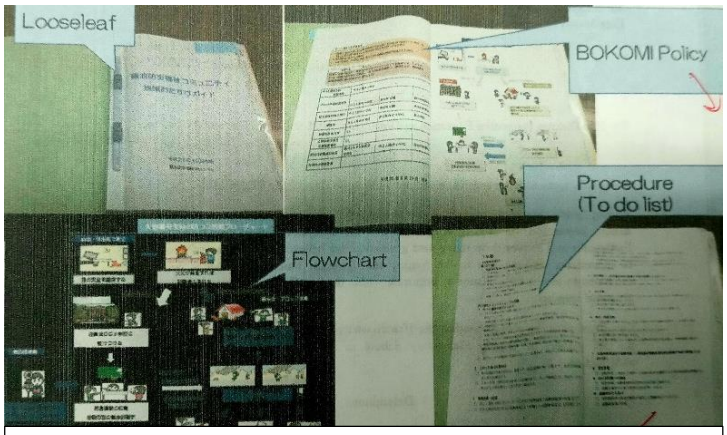


Figure 5: Community Disaster Management Plan of Kobe City

3.7 Execution & testing of plans through Drills:

The Disaster Welfare Community Group conducts regular mock-drills to test the preparedness of its residents. The Disaster Welfare Community Group organizes the drills with the help of Fire services and local government support. The city government provides the funding to conduct drills based on “Activity Plans” submitted by each Disaster Welfare Community Group. The Business communities, Youth associations, Volunteer Fire corps, Resident’s association, Elderly association, Women’s association, Parent-Teachers association, child committee members and other groups support the drills as well as welfare activities in addition to support received from Fire Service personnel. The emergency preparedness drills conducted by the Disaster Welfare Community Group has the following significance- 1. It helps to enable safe evacuation of local residents during emergencies 2. It helps to smoothly operate evacuation sites during emergency situations 3. It brings cohesiveness amongst the local residents. Evacuation drills also help to identify suitable transportation routes for different kinds of vehicles, the distance as well as the time required and number of helpers required can be easily gauged.

The Disaster Welfare Community Group conducts drills as per the “Drill plan”. They involve the government officials and conduct the drills. They conduct different kinds of drills depending on the scenario like “Drill for information gathering and information transmission”, “Fire Drill”, “Evacuation drill”, “Rescue Drill”, “Drills for provision of meal and water”, “disaster imagination games”, “First Aid training” etc. They decide the scenario of drill, decide date & venue, participants, alternative plan, co-ordination with Govt. etc. The Disaster Welfare Community Group receives equipment support from the city government. The City Government provide the Disaster Welfare Community Group with list of equipment and they choose the equipment which they require. The equipment and materials are stored in storehouses, local parks etc. Drills help in evaluation of preparedness level of the communities and provide a scope for further improvement of conditions to handle a disaster efficiently.

(A)

(B)

(C)

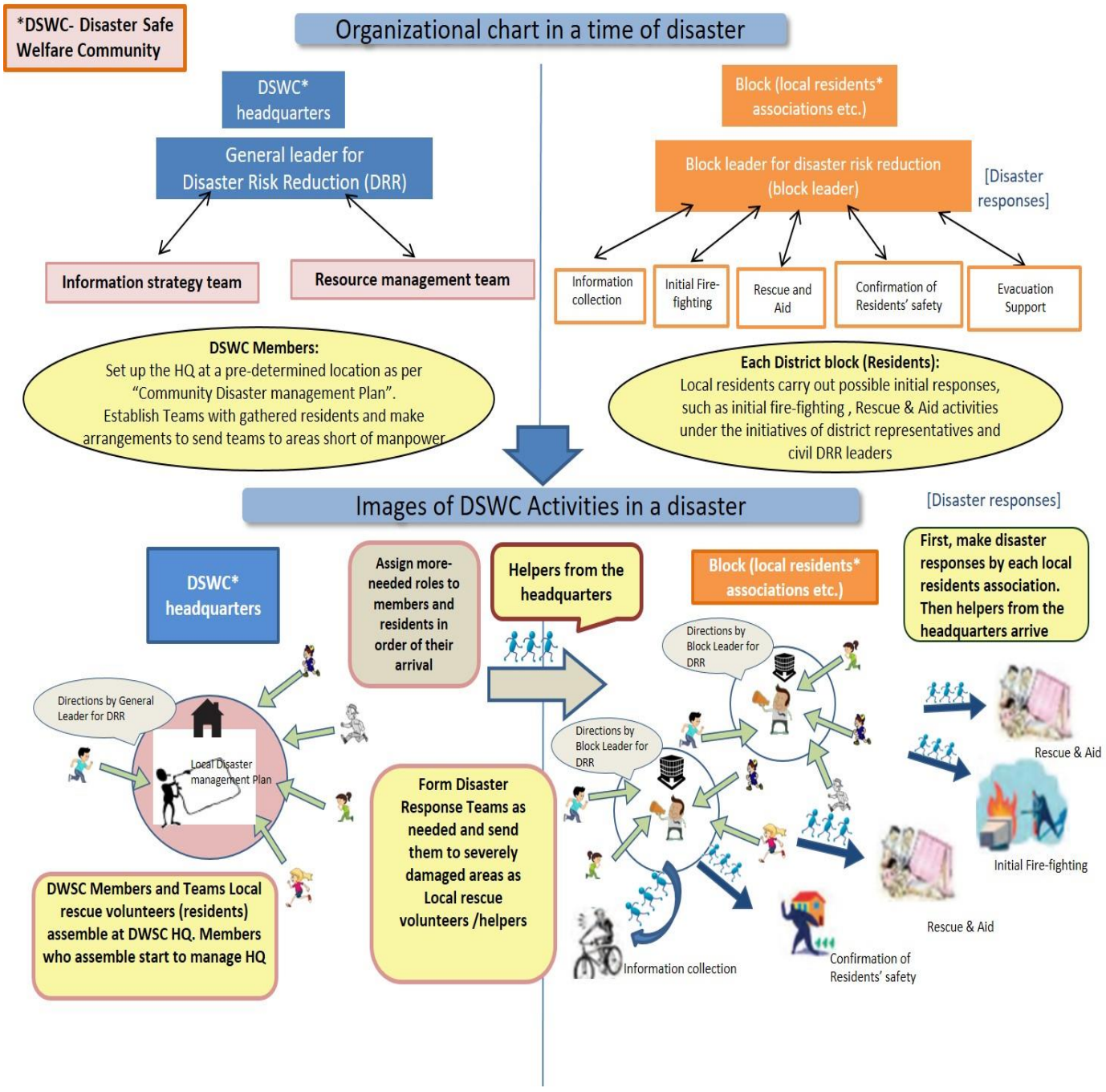
(D)

Figure 6 : (A)Bokomi Members engaged in setting up Community Kitchen (B) Community Emergency Drinking water facility (C) Display of Emergency Food Packets during Drills (D) Fire Fighting Drills by Shobo Dan and Fire Bureau officials (Photo source: HAT Kobe Drill, October,2018)

3.8 Community's response to Disaster:

In a real scenario of disaster, the Disaster Welfare Community Group actually follows the CBDP plan and act as per the details practiced during mock drills. In case of Flood, the Suibo Dan act as a primary body for flood mitigation activities. The Suibo-Dan are mainly responsible for reinforcing river banks and assisting peoples' evacuation during floods. The Suibo-Dan are also responsible for patrolling river banks at normal and disaster times, piling of stock of materials, issuing early warning by using temple bells or conch shell horns, and mobilizing volunteers for reinforcing banks during floods. The Suibo-Dan as per

law are also responsible for installation of river level gauges for monitoring floods. However, in recent times due to Flood proof constructions and structures, the activity of Suibo Dan has decreased but the other group Slobodan is quite active. But in few parts of Japan like Osaka, the Suibo-Dan are still responsible for closing of flood gates during heavy rainfall/tsunami warnings. The response activities carried out by the Disaster Welfare Community Group during disaster is explained in the diagram below:



(Disclaimer: this image is partially modified version of the image available in the "Bokomi Guidebook" of Kobe city for easy understanding of role of DSWC in DRR)

Figure 7: Flowchart showing Disaster Response by "Disaster Safe Welfare Community Group" in Japan

CHAPTER-4

COMMUNITYS' ACCESS TO EARLY WARNING INFORMATION IN JAPAN

4.1 Early Warning Organizations:

Japan Metrological Agency (JMA) is the nodal agency for providing early warning information to the citizens. The Japan Metrological Agency observes metrological phenomena that cause storm and flood disasters using the Automated Meteorological Data Acquisition System (AMeDAS), which automatically measures rainfall, air temperature and wind direction/ speed, weather radar, and geostationary meteorological satellites. These are used to announce forecasts and warnings to prepare against disasters (weather warnings and advisories for individual municipalities began in May, 2010).

Figure 8: Automated Meteorological Data Acquisition System (AMeDAS) (photo source: JMA,Kobe)

The rainfall and water levels in rivers are observed by the Ministry of Land, Infrastructure, Transport and Tourism (MLITT) and Prefectural Governments utilizing visual observation methods, mechanical observation equipment, and a wireless telemeter system that transmits automatically observed data from remote locations.

Sometimes due to heavy rainfall triggered by Tsunamis or Earthquakes, sediments give away, blocking river channels causing artificial lakes in upstream or causing disruption of road communication and sometimes loss of human lives. Warnings regarding sediment disasters are also issued by the JMA through various alert systems.

The Municipalities in the Prefectures also prepare and disseminate hazard maps for general information of the public on type of hazards.

4.2 Early warning Systems:

The Japan Meteorological Agency (JMA) announces the information for severe weather preparedness such as weather warnings / advisories and bulletins to prevent or mitigate disasters caused by heavy rains and storms. To support the activities of disaster management related organizations and judgement of residents for ensuring their safety, JMA announces the "bulletins" a few days before such severe phenomena triggering disasters are expected to happen, then announces advisories, warnings and emergency warnings in each stage of the danger intensification.

Type	Category	Warning Class
Emergency Warning	Heavy rain (sediment disasters, inundation), windstorms, snowstorms, heavy snow, high wave, storm surges	Issued if there is significant likelihood that a serious disaster will occur
Warning	Heavy rain (landslide, inundation), flood, windstorm, snowstorm, heavy snow, high wave, storm surge	Issued if there is chance of a serious disaster
Advisory	Heavy rain, flood, gale and snow, heavy snow, high wave, storm surge, thunderstorm, snow melting, dense fog, dry air, avalanches, low temperature, frost, ice accretion, snow accretion	Issued if there is potential for the development of serious adverse conditions
Weather Bulletin	• Real time risk map • Weather bulletins on Heavy rains • Typhoon Information • Hazardous wind watch • Bulletins on exceptionally heavy downpours • Probability of warnings • Warning bulletin on long term high temperature	• Announced every 10 mins to show where the risk of disasters is rising to supplement warnings • Announced as required several days before a warning to attract attention and amid ongoing warnings as necessary to explain the progress and prediction of the phenomena and the points to be considered for disaster management • Announced as required to show weather conditions not subject to warnings but likely to have significant impacts on society

Table 2: Category of Information for severe weather preparedness

Source: Cabinet Office, Govt. of Japan brochure on "Flood and Sediment Disasters"

Both real time risk maps and heavy rain warnings are issued collectively for information. When a heavy rain warning or sediment disaster alert information are announced, it is important for the residents to ensure their safety by checking when and where the risk is expected to increase by the real time risk map and being fully aware of the danger approaching the community.

Once a warning level phenomenon occurs, there is danger to loss of lives. A warning is generally announced 3-6 hours ahead of the probable time of occurrence of the serious disaster. Before 6 hours of expected occurrence an advisory is issued before announcement of warning. For instance, if a severe disaster is expected to occur on the dawn of the following day, an advisory is issued with an indication of "High possibility of becoming a warning by dawn". Bulletins on exceptionally heavy rains is announced only after a heavy rain warning is issued, in order to inform that the rainfall is at levels rarely observed and may cause sediment disasters, inundation and flood in small and medium rivers. The observation points and municipalities where heavy rain was observed are specified clearly in this announcement. It is possible to check where the disaster risk is actually rising by referring to "the real time risk map (sediment disaster, inundation or flood)."

Figure 9: MLIT River Monitoring System using Water Gauge
((source:http://whrmkamoto.com/assets/files/Early%20Warning%20System%202013%20(PPT).pdf)

4.3 Early warning dissemination mechanism:

JMA issues "Warnings" and "Advisories" to municipalities when meteorological phenomenon (Surface water index, Soil water index, wind velocity, wave height, tide height) is expected to reach criteria in the municipalities. The criteria are set in co-ordination with DM organizations of prefectures in light of relation between disaster occurrence and meteorological elements.

The criteria vary among municipalities and are reviewed accordingly in consideration of changes in disaster occurrences and DM progress.

A flood forecast is jointly announced by the MLIT (or Prefecture) and Japan Meteorological Agency when there is a risk of river flooding due to heavy rain. The forecast contains critical information needed for appropriate flood fighting activities to protect areas from damages caused by flooding and for self-protection measures conducted by local residents. Among the large rivers designated by MLIT (or Prefecture) and JMA for flood forecasting, the designated rivers, a forecast is announced for one(s) that has a risk of severe damage caused by flooding. The JMA s local office sends forecast to specific areas. The announcement is specifically targeting small/medium River that is not included in the designated rivers for flood forecasting.

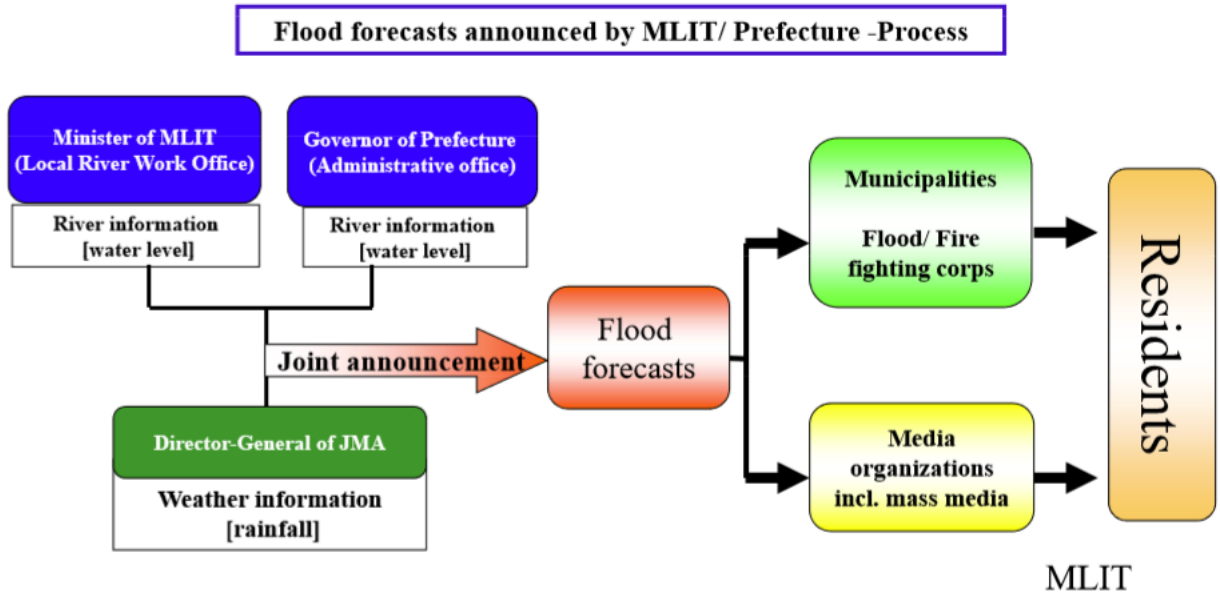


Figure 10: Flowchart depicting Flood forecast dissemination from government to residents
(source:http://whrmkamoto.com/assets/files/Early%20Warning%20System%202013%20(PPT).pdf)

A flood fighting alarm is issued by MLIT or Prefectures is sent to related organizations in order to provide flood fighting corps with instructions such as stand-by, preparation and operation.

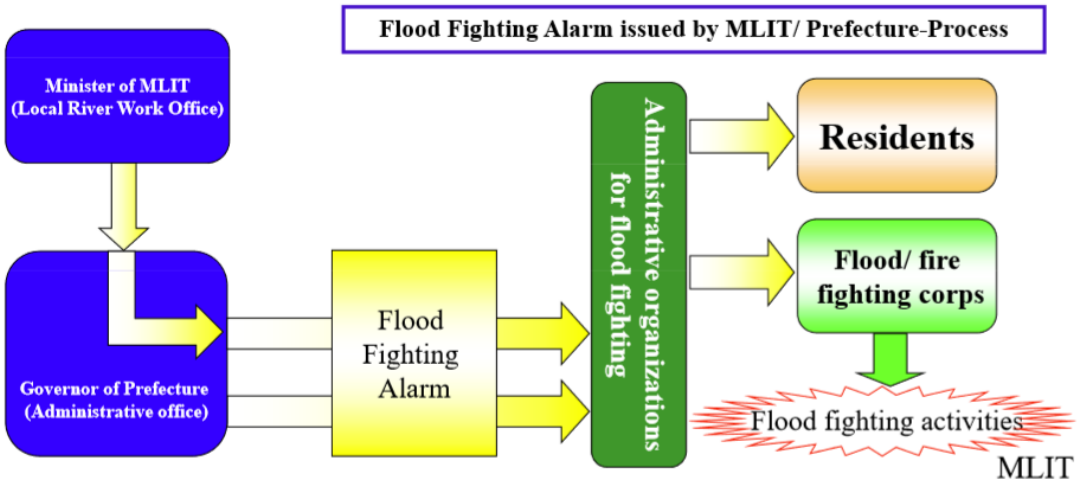


Figure 11: Flowchart for showing activities after issue of "Flood Fighting Alarm" *(source:http://whrmkamoto.com/assets/files/Early%20Warning%20System%202013%20(PPT).pdf)*

Administrative organizations for Flood Fighting are the Municipalities, Fire Department, DM organizations etc. JMA Warning, Advisory, Meteorological info are provided via Prefecture and NTT and available via J-ALERT and media (TV, Radio etc.) as well. DM Info Provision System and JMA website provide necessary information.

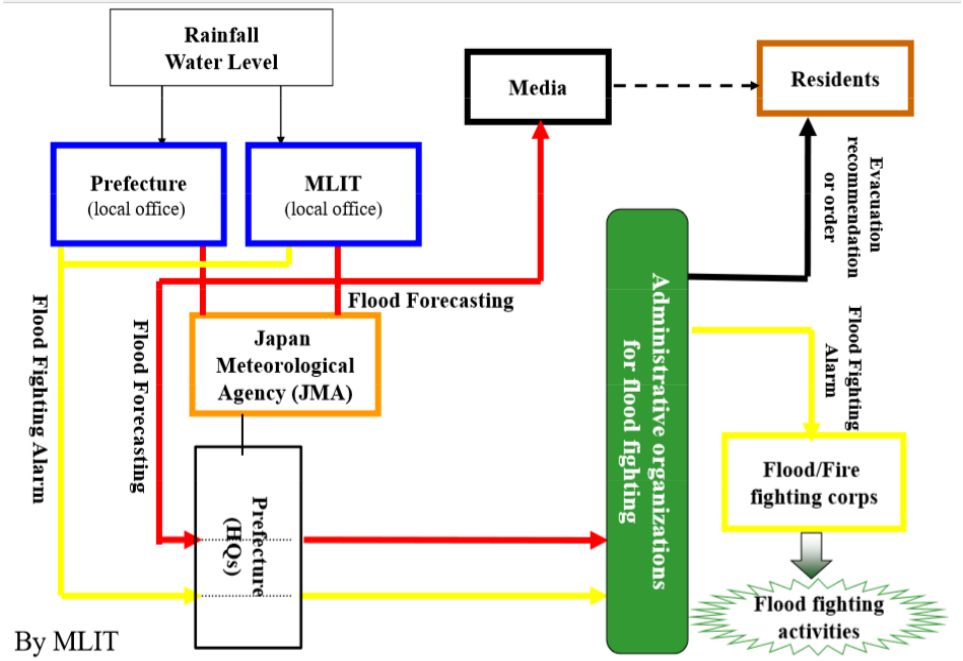


Figure 12: Flowchart showing activities from "Flood Forecast" to "Flood Fighting" *(Photo source: (source:http://whrmkamoto.com/assets/files/Early%20Warning%20System%202013%20(PPT).pdf)*

As per Article 16, Clause 1 of Flood Fighting Act, Minister of the Ministry of Land, Infrastructure and Transport issues a flood fighting alarm for rivers, lakes or coasts that were specified and recognized as risks which may cause serious damage to the national economy due to a flood or high tides, and Prefectural Governor issues a flood fighting alarm for rivers, lakes or coasts that are not included in the above rivers, lakes or coasts but were specified and recognized as risks, which may cause significant damage due to a flood or high tides. In Clause 2, While issuing a flood fighting alarm in accordance with the previous clause 1, Minister of Land, Infrastructure and Transport immediately informs related Prefectural Governor(s) of the contents of the alarm. As per Clause 3, while issuing a flood fighting alarm in accordance with Clause 1 or receiving an alarm in accordance with the previous clause, Prefectural Governor immediately informs related administrative organizations for flood fighting or other flood related organizations of Flood the alarm received/issued in accordance with the prefecture's flood fighting plan.

Since FY 2017, another feature of "Real-Time Flood Risk Map" was added to the Early warning dissemination system. The Real time flood Risk Map includes information on the small and medium rivers that are not target of Flood Forecast (Rivers for which water level information is announced and others), that indicates the flood risk level of approximately 1km section each of the river by five levels in different colors on the map. As forecasts up to 3 hours ahead are updated every 10 minutes, it is possible to check which river is exposed to increased flood risk at a glance when a flood warning/ advisory is announced.

When the highest risk level "extremely dangerous" (dark purple) is indicated out of the 5 risk levels, it may become difficult to evacuate because the roads may already be covered in flood water. Also, given the exceptionally rapid rise in the water level of small and medium rivers, it is important to check the latest situations of the river with a water gauge and surveillance camera and promptly decide to commence evacuation when the "very dangerous" level (light purple) implying a further rise of water level appears.

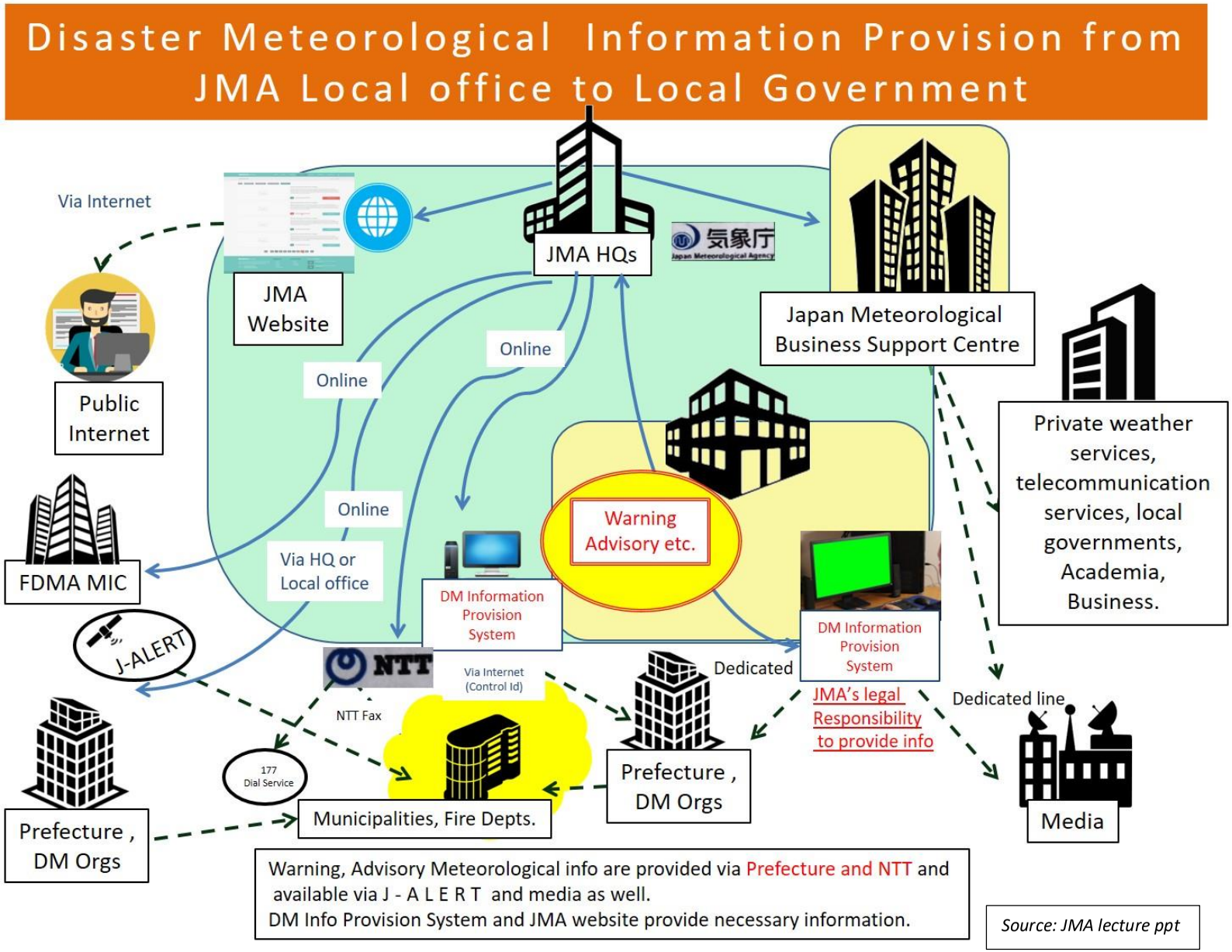


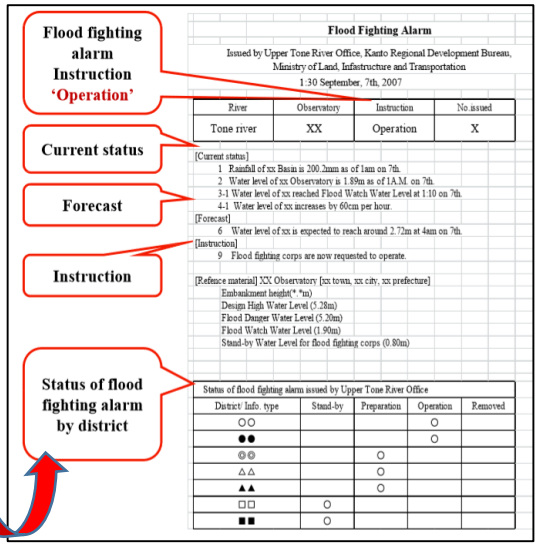
Figure 13: Japan Meteorological Agency (JMA) early warning dissemination mechanism

4.4 Response to Early warning information:

When there is a flood watch water level, Flood advisory is issued. Once the flood fighting alarm is declared, flood fighting corps (Suibo-Dan) are mobilized. Local residents are advised to pay

Announcement of flood forecasts/ warnings		Types of Flood Forecasts/ Warnings
(1) Flood Forecasts		Joint announcement by MLIT and JMA
XX River Flood Forecast	<1> Flood caution/advisory	Issued for urging caution when the water reaches Flood Watch Water Level and is expected to increase above the level.
	<2> Flood warning	Issued for urging more vigilance when the water reaches Evacuation Alert Water Level and is expected to reach Flood Danger Water level.
	<3> Flood danger information	Issued when the water reaches Flood Danger Water Level.
	<4> Flood notification	Issued when a flood occurs.
(2) Flood Fighting Alarm		Announcement by MLIT/ Prefecture
	1 "Stand-by"	When a flood or increase of the water level is expected, a warning is issued to request flood fighting corps to be on stand-by for action.
	2 "Preparation"	Sharing of flood fighting-related information, gathering flood defense equipment and securing transmission/ transportation as well as issuing a warning that requests flood fighting corps to prepare for operation.
	3 "Operation"	When the water level is expected to increase beyond Flood Watch Water Level, a warning is issued to request flood fighting corps to act.

(A)



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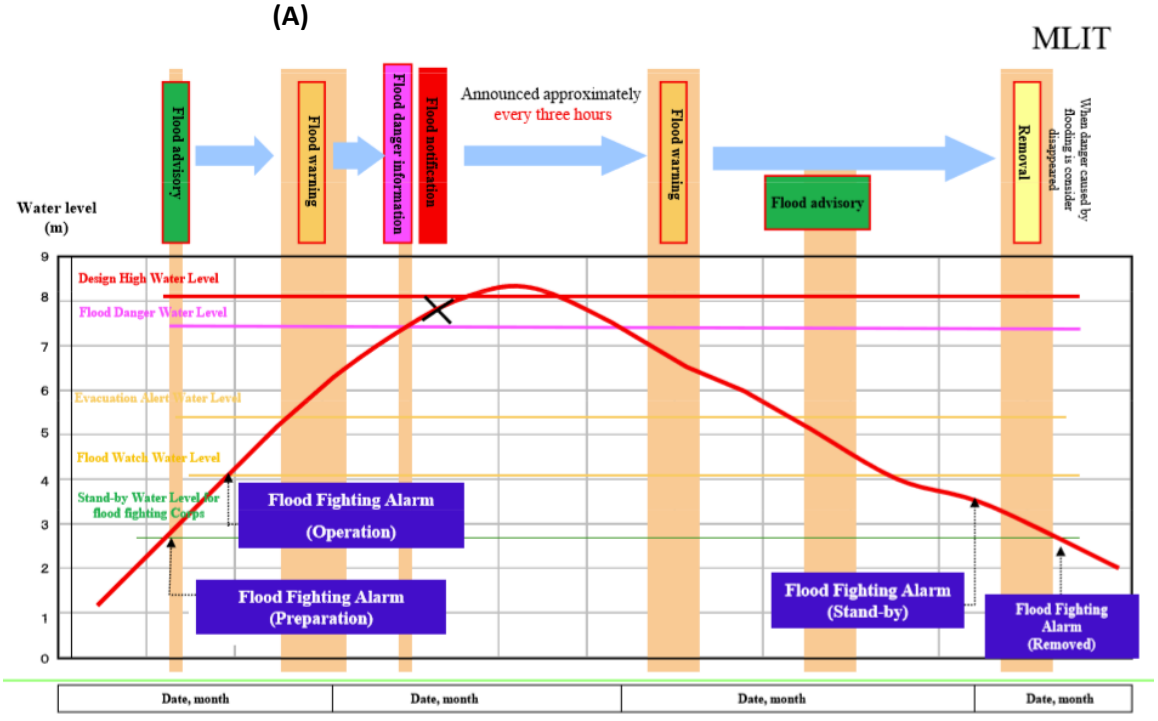


(C)

Source A, B. C: River information system, Flood Forecasting and Early Warning, Images are from: Kanto Regional Development Bureau, Ministry of Land , Infrastructure, Transport and Tourism (MLIT) And Foundation of River and Basin Integrated Communication(FRICS)

Figure 14: "Flood Fighting Alarm" announcement by MLIT/Prefecture

attention to river information provided by TV, radio and MLIT's "River Disaster Prevention Information" available in the website and mobile site. Once information on Flood warning is issued, flood fighting corps conduct preventative activities in accordance with disaster situation. Local residents are advised to pay attention to the river information and evacuation order issued by respective top local officers. The Disaster Welfare Community Group Leader helps in Evacuation of residents once the alarm is issued.

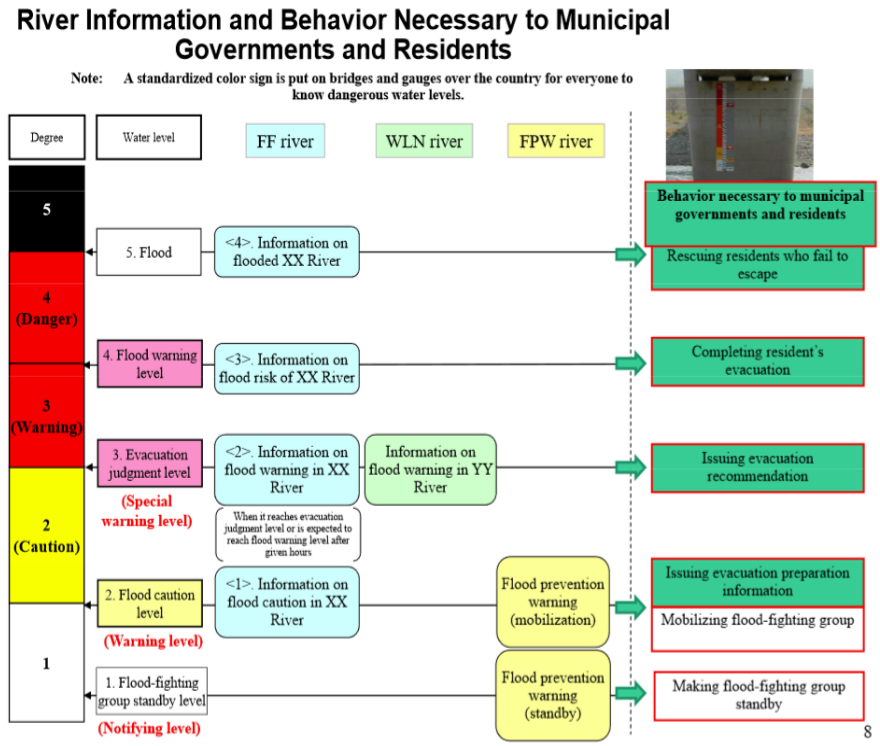


Figure 15: Warnings and corresponding action of municipality residents
*(source:http://whrmkamoto.com/assets/files/Early%20Warning%20System%202013%20(PPT).pdf)***es/**

Flood fighting activities are conducted in-order to protect human lives and assets and to

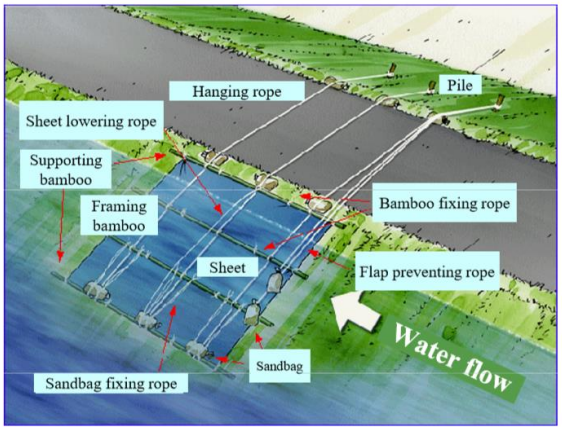


Figure 16: Sheet Covering Method

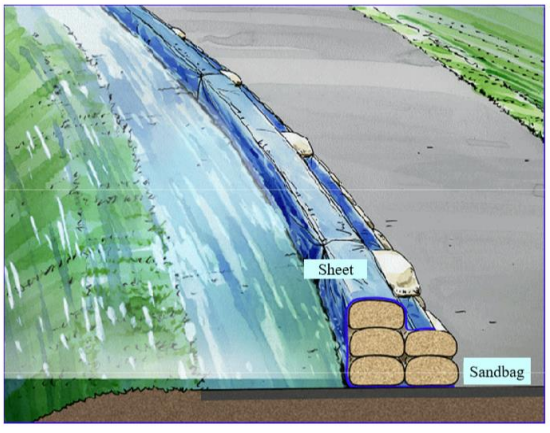


Figure 17: Improved Sand Bag Piling Method

*(source:http://whrmkamoto.com/assets/files/Early%20Warning%20System%202013%20(PPT).pdf)***es/**

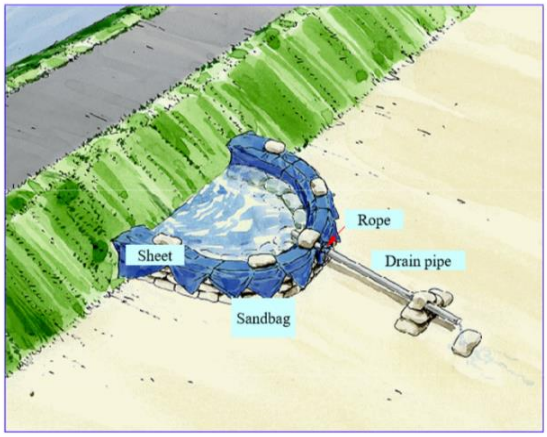


Figure 18 : Hooping Method

minimize damages when a flood occurs, flood fighting groups and fire-fighters use a variety of technologies and conduct flood-fighting activities mainly near to the river for which flood warning has been issued. Once the flood alarm is raised, flood fighters are in stand-by mode. However, on issue of "Flood Caution Level" the flood fighters prepare equipment and materials required for operation. The following activities as shown in diagrams below are carried out by flood fighters during flood emergency declaration:

Evacuation order/ Evacuation recommendation is issued to the residents when there is a danger to life of residents or inundation is expected. This evacuation activity goes on parallel with the Flood Fighting activities. The Elderly and People with Special Ability are recommended to evacuate first to the nearby "Evacuation Centre" in the locality followed by residents of other age groups. Usually the school Gymnasium, Community halls etc. are designated evacuation sites and there are sign boards outside each center for easy identification of safe shelters. However, the residents have the liberty to decide evacuation on their own will.

Figure 19: Evacuation Area for residents

CHAPTER-5

INFRASTRUCTURES IN JAPAN-RESILIENT TO HYDRO-MET HAZARDS

5.1 Hydro-Met Hazards and related phenomena:

Hydro-met hazards may result into disasters that may lead to huge amount of economic losses. In recent times, Flooding is one of the most severe hazards that causes huge amount of economic losses as well as life loss in different parts of the world. However, the nature of occurrence of flooding is different in different parts. Flooding may occur due to heavy rainfall due to onset of monsoon or may be Tsunami induced. Heavy rainfall may also lead to sediment disasters in different parts depending on intensity of rainfall. Sometimes large intensity earthquakes may also result into flooding. Sediment Disasters induced by earthquake may block river channels and cause formation of artificial lakes in the upstream. And if the artificial lake bursts, it may result into flooding in downstream.

Risks of flooding may vary under different circumstances. Therefore, it is essential to keep in consideration the various risks while planning infrastructure.

5.2 Infrastructure planning for sustainable recovery from disasters:

In Japan, there are stand by agreements between public sector and relevant private sector organizations for mapping and need analysis as well as post disaster damage assessments. Need Analysis is carried out by the Government through comprehensive survey and assessments. Therefore, planning of infrastructures are carried out in a detailed way by carrying out questionnaire surveys, conducting workshops and also aerial mapping and ground survey of the areas in which newer infrastructures are being planned. After the Great Hanshin Awaji Earthquake of 1995, when infrastructures and amenities were severely damaged, it took a 10-year span for complete recovery of the infrastructure, livelihood as well as life of citizens. After the Great Hanshin Awaji Earthquake, the entire PDCA (Plan/Do/Check/Act) process for

reconstruction took a period of 10 years with two consecutive periods of comprehensive assessment in the 5th & 10th year. Suggestions and opinions for recovery of critical infrastructures were initially collected from citizens. 1600 citizens helped the government to identify critical areas for reconstruction. Housing reconstruction was identified by citizens as the most critical element required to support recovery followed by Social ties, Community re-building, physical and mental health, preparedness, economic and financial situation, relation to government. University students helped the government in conducting detailed survey and analysis. The results of the social analysis were later used by the Government during infrastructure planning in collaboration with private sector entities.

5.3 Convergence forums of private & public entities:

In DRR systems of Japan, there are convergence platforms of public and private entities which provide support for disaster resilient constructions across Japan depending on their area of operation. These private entities have successfully carried out resilient constructions in various parts of Japan through application of appropriate technologies and is now trying to extend support using the same technologies in other countries across the World for disaster mitigation through the consortium called "***Japan Bosai Platform***". Japan Bosai Platform is an association of Japanese private companies with leading disaster mitigation solutions. The JBP has over 100 member companies and organizations enlisted as members. The JBP is founded with strong support and collaboration with Japanese Government, academia and the private sector. The public sector organizations are "Supporting members" of the JBP.

One of the instances of pre-emergency agreements with private companies is the detailed Mapping of areas using Technology and surveys carried out by the Geospatial Information Authority (GSI) under standby agreement with Association of Precise Survey and Applied Technology (APA). 94 Member companies under the association carried out independent surveys for rapid damage assessment of affected areas using remote sensing technology. Such pre-agreements and involvement of private sector helps the government to take faster decisions in case of emergencies and also to prepare well for emergency situations in advance.

5.4 Infrastructures for resilience to Hydro-met hazards:

Japan has many infrastructures which can be called as resilient infrastructures but if we discuss about flood preventive measures, few of them are quite noteworthy. Hydro-met disasters can be flood, sediment disasters, erosion, dam bursts due to excessive rainfall etc. So few solutions observed in Japan, to such hazards are as detailed below. There may be more infrastructures but the ones detailed below were observed and found to be significant during the study tour.

1. Flood gates: Flood gate models were observed during the visit to Tsunami & storm surge disaster prevention station in Osaka. The Flood Gates are strong iron gates operated by the Suibo-Dan on issue of flood/Tsunami warnings. The gates are closed using a lever and these gates prevent the water from entering into the city. These gates are installed at the areas the rivers meet the sea or at the edge of the city. The flood gates also prevent back flow of water from Sea into the rivers. The actual flood gates were observed during the visit to Higashi-nada ward, Sewerage treatment plant.

Figure 20: Flood gate models at Tsunami Storm Surge Station in Osaka

Figure 21: Flood gate at Higashi-nada ward in Kobe

2. Sediment Disaster countermeasures:

Several techniques have been applied to different parts of Japan for sediment disaster prevention and slope protection. A few techniques help in prevention of slope failure and few others help in early detection or warning for possible slope failures. Many mountains in Japan are prone to risk of landslides due to the fragile lithology as well as frequency of natural hazards. In few areas slope protection measures have been applied post failure of slopes, triggered by earthquake or heavy rains. Sediment disaster countermeasures in Japan include Landslide prevention works (Drainage works, prevention works etc.), Steep slope collapse prevention works (retaining wall construction, grating crib works etc.), Soil Erosion Control Project (Sabo dams, Stream protection works etc.). Based on the designation of a sediment disaster prone area- preparing a sediment disaster hazard map, preparing and transmitting the sediment disaster warning information, preparing information systems etc. are mandatory by law. Controlling land-use and land development in sediment disaster designated areas is done by Ministry of land Infrastructure Transport & Tourism department.

Figure 22 : (A) Model showing Sediment Disaster Prevention using Anchor work in Nigawa Landslide Museum (B) Sediment disaster countermeasures in Tamba city

Figure 23: Model showing (A) Sediment Disaster Early warning system using "Inclinometer" in Nigawa Landslide Museum (B) Sediment disaster prevention using "Drainage works"

3. Sabo dams:

Sabo dams built in the upstream areas of mountain streams accumulate sediment and suppress production and flow of sediment. During our field visit to Tamba city, observed the Sabo works in the mountains. Those built at the exits of valleys work as a direct barrier to debris flow which has occurred. A Sabo dam with slits is particularly effective in capturing debris flow because it has a larger capacity of sand pool under normal conditions. In case that there is a fear of flow-down of driftwood, a slit Sabo dam is built as a preventive measure (fig B).

(A)

(B)

Figure 24: (A) Sabo works for sediment erosion control in Tamba city (B) Slit Sabo Dam for capturing Drift wood

Dams are constructed in the rivers to control the amount of water flow from the mountains. Dams are structures that can help in flood mitigation if operated in a sustainable way. The Kanayama Dam in Hokkaido is one of the examples of successful flood mitigation and a multi-purpose dam. The dam facility is used to generate power in downstream, supply water to neighboring cities in downstream and also for the purpose of irrigation. The dam authorities received award for flood management in the downstream in the year 2016. The mode of operation of the dam facility varies with the amount of water flow in dam. During heavy rainfall, when the water rises in the dam, the dam authorities inform the private water supply companies in the downstream that water will be released and they should supply the water to neighboring cities. The excess water is also used for irrigation purposes.

(A) **(B)**

Figure 25: (A) Kanayama Dam in Minamifurano city, Hokkaido (B) Dam Power Generation station

5. River Intake facilities (Underground River Water Regulating Reservoir):

Kanda River Underground Regulating Reservoir is a facility for flood mitigation. The River intake facility uses the drop shaft method of dropping excess flood water into the underground tunnel measuring 4.5 Km in length and having an inner cross sectional diameter of 12.5 m. The flood water is stored in the tunnel during flooding period and released back into the river when the flood recedes. The underground Tunnel had reached its maximum storage capacity during one of the flooding seasons and therefore the government plans to extend the length of the tunnel.

There are models of the water intake facility in the control station. The tunnel is located at 43m below the ground. This facility is a good example of urban flood water management.

Figure 26: Model showing Kanda River Underground Regulating Reservoir Tunnel

6. Flood Proof Embankments:

Construction of scientifically designed flood proof embankments can be a sustainable way to mitigate flood. Such scientific embankments were observed in Hokkaido. The Hokkaido Development Bureau under the Ministry of land, Infrastructure, tourism and Transport is responsible for constructing such embankments. Sorachi river restoration work in Minamifurano, Hokkaido is a good example of construction of scientifically designed river embankments for flood mitigation.

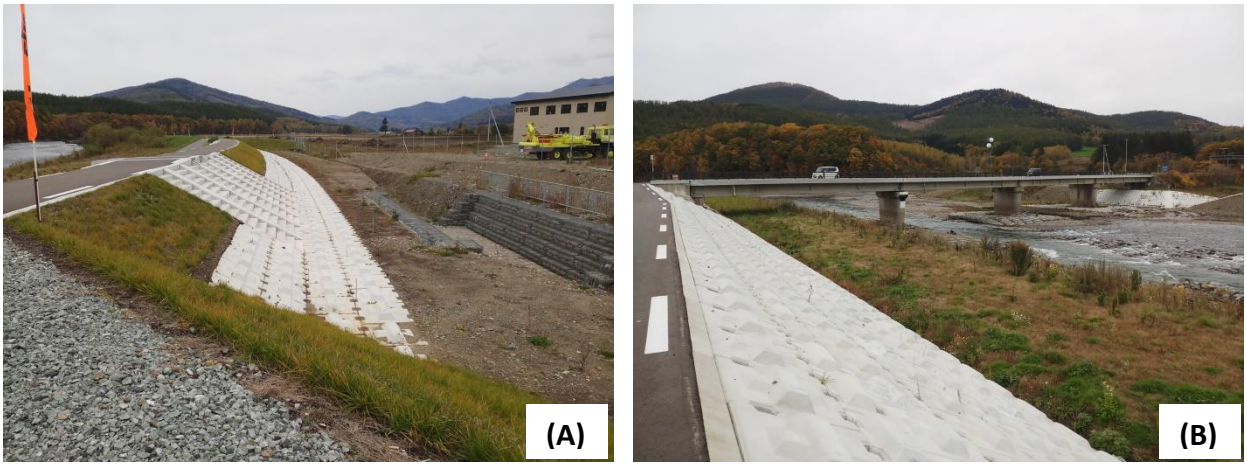
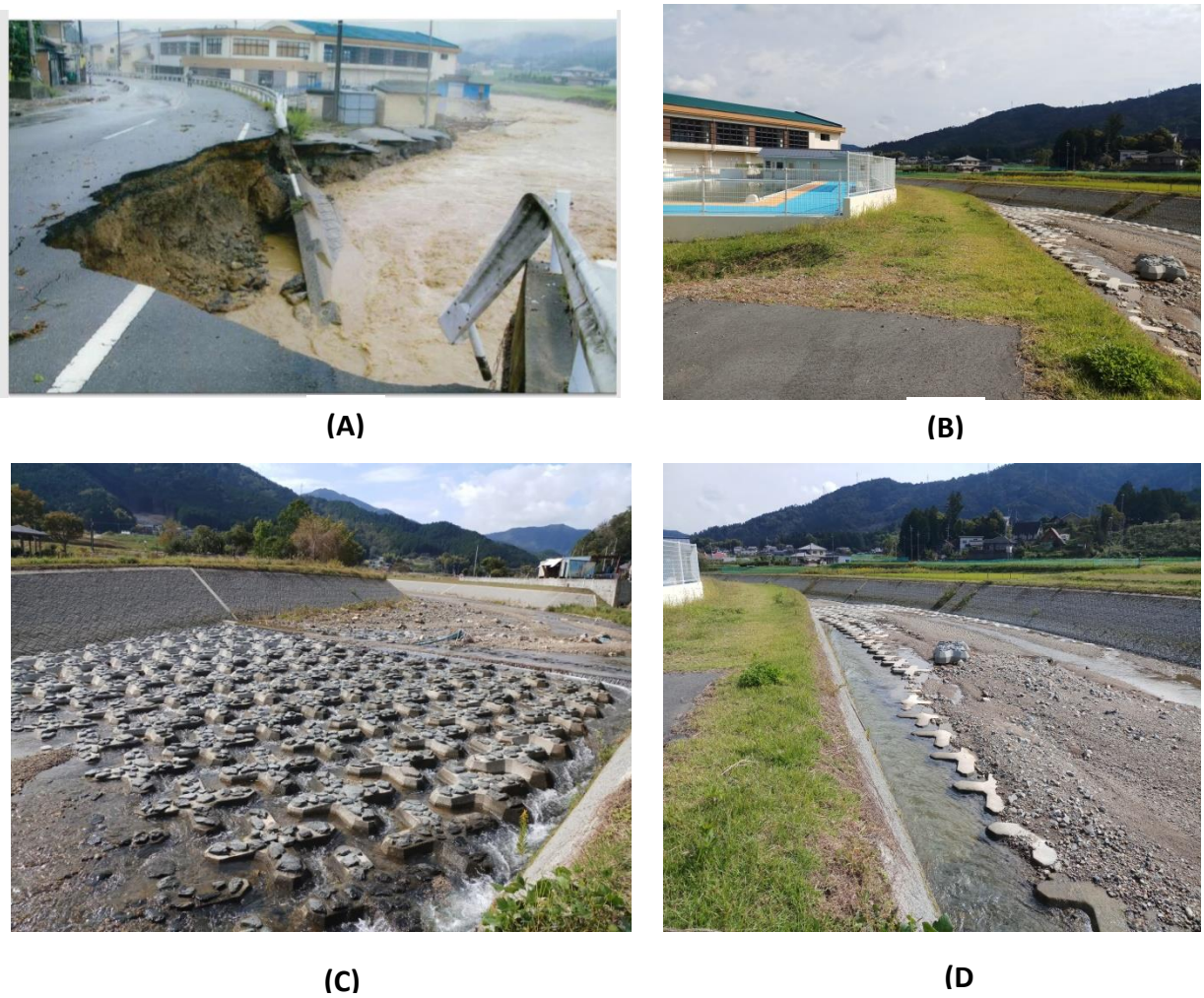


Figure 27: (A) Road cum Embankment in Sorachi river, Hokkaido (B) Embankment on Left bank of River with river channel improvement measures in river bed, Minamifurano, Hokkaido

7. Channel improvement & River Restoration works:

Channel improvement works carried out in Tamba city after heavy rains led to flash flooding in the river causing massive damage to the road near the Sakiyama Elementary School. Huge amount of sediments from the mountains flowed into the river, widening the river channel and devastating the entire area.



(A) **(B)**

(C) **(D**

Figure 28: Channel Improvement measures in river of Tamba City (A) During Aug,2014 disaster the River damages caused by flood *(photo source: SEEDS, ASIA)* (B) Same site of River after restoration (pic-2018) (C) Restoration work (Example of Build Back Better initiative) through channel improvement, levee reconstruction etc.

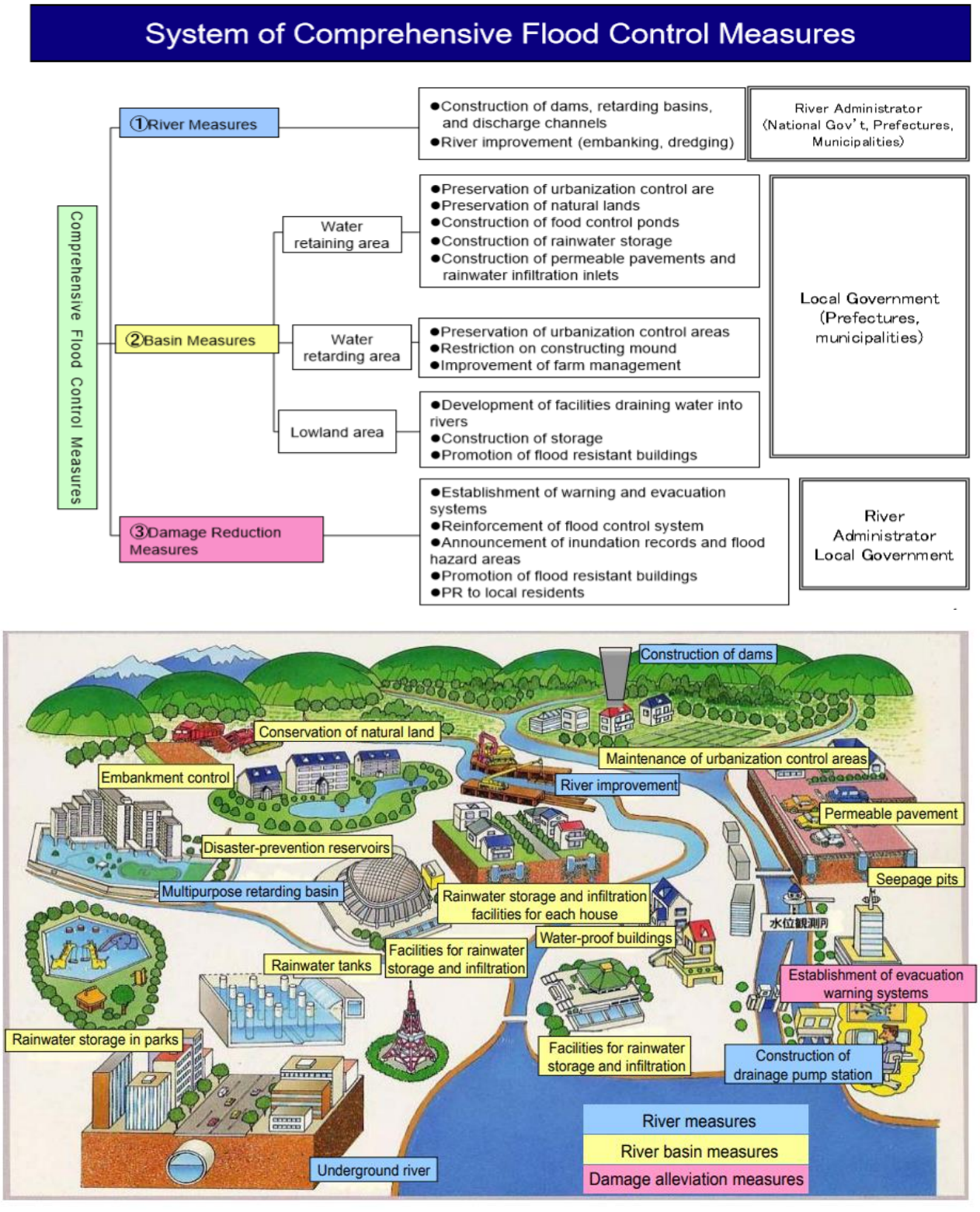


Figure 29: Diagram showing (A) System of "Comprehensive Flood Control Measures" and (B) Pictorial representation of Flood Control Measures

(source: MLIT website http://www.mlit.go.jp)

5.5 Approach of communities towards resilient infrastructures:

The local residents in the community play a very important role in supporting the government in maintenance of such infrastructures. Because any public infrastructure created by the government cannot sustain if it is not accepted or maintained by citizens. The citizens involve in city planning of the infrastructures during disaster recovery and therefore take ownership of such assets. The residents also understand the need for such sustainable public infrastructures, since they face the wrath of severe disasters very frequently. Although the local residents don't engage financially in maintenance but they monitor such assets with the help of the municipality and city government. The Municipality, the city government or the National government has a role in financial maintenance of such public assets. In Japan," the government also has a robust monitoring system with over 4000-5000 monitoring cameras installed at public places" *(source: Hokkaido development Bureau)*. These closed circuit cameras not only help in regular monitoring activities but also aid in disaster monitoring. Even man-made disasters like road accidents are monitored through closed circuit cameras.

The resilient infrastructures cannot sustain unless maintained jointly by citizens and government. Assets will be subject to wear and tear, but having a robust back-up plan for maintenance and a strong support system for sustenance and a preparedness plan for unforeseen circumstances that may arise due to failures are indeed the strength of infrastructures created by Japanese government. However, the system for generation of economy for maintenance of such infrastructures was not very clearly understood during the study.

CHAPTER-6
LIVELIHOOD SUPPORT FOR COMMUNITY

6.1 Livelihood opportunities in peacetime:

The water resources in Japan have been utilized as an opportunity by promoting tourism/recreational facilities around the resources and sustainable use of available water sources. The resilient infrastructures in Japan provide sustainable livelihood opportunities for the community. For instance, the Rain water storage parks, multi-purpose retarding basins, usage of sewerage treated water for artificial water falls/fountains/toilets; River improvement and beautification, creation of museums by preservation of disaster occurrence sites are opportunities for local residents amidst climatic/geographic adversities posed by natural disasters. These infrastructures provide opportunities for people to earn from recreation sites, tourism and small local businesses. Since in urban areas /municipalities people are mainly dependent on salary/local businesses therefore such infrastructures provide ample opportunities for a better and sustainable livelihood. The sewerage treatment plant in Japan, generates “phosphorous” from sewer sludge treatment which is a very useful fertilizer for agricultural produce. The “Phosphorous” bags are sold in the local markets to enhance agriculture production. Raw materials like “Ash” generated from drying sludge in the treatment process are also used for making “pavement blocks”. Thus sustainable use of each and every raw material generated out of waste treatment, can be termed as an opportunity for livelihood

Figure: 30 “Phosphorous bags” sold in local markets generated by Higashinada Sewerage Treatment plant as a byproduct of treatment process

improvement. It also provides opportunities to the local industries to be self-sustainable as raw materials are easily available in the local market.

6.2 Pre-disaster Livelihood:

People of Japan residing in remote cities/ villages depend mostly on agricultural produce and abundantly produce local beans, rice, coffee, tea, vegetables and fruits. They set up small shops or cafes that serve local food to residents as well as visitors. They mostly have fewer infrastructures nearby and have to move to nearby bigger cities or towns for selling their local produce or other livelihood opportunities. Most people from the villages specially the younger generations work in nearby big cities and earn their livelihood. However, the retired/ elderly people prefer to work in the local agriculture farms, small co-operative shops or community institutions as a service towards the society.

Figure 31: Nigawa landslide Museum park is a recreation site for public during flowering season. People plant flowers in memory of their dear ones who lost their lives in massive landslide during GHAE of 1995.

However, in bigger cities of Japan, the societies are much urbanized and have lesser opportunities for agriculture and farming due to space constraints and mostly depend on jobs or local businesses for livelihood. These people are also equally vulnerable to disaster risks because of lesser social ties and lack of mutual support.

6.3 Business Continuity Planning at Community level

Local Businesses in Japan usually have general equipment for disaster support and few business establishment conduct or participate in regular community drills. Evacuation routes are marked in most of the business places. But business continuity in terms of financial planning/ disaster

insurance is perhaps still evolving. However, BCP for the critical infrastructures is essential and as per the Cabinet Office “White paper-2016”, as lessons learnt from the Kanto-Tohoku Torrential rains of September 2015, the Government of Japan plans to promote the “formulation of evacuation implementation plans and BCPs by hospitals etc.”

6.4 Post-disaster Livelihood support

In rural areas of Japan, during disasters, if there is a disruption in road communication, and people are not able to fetch food from shops /market places of nearby cities, these small communities rely on the local produce and promote self-help and mutual-help to recover from the shock of disasters. The people support each other in case of livelihood disruption and help each other to recover.

However, in urban areas the businesses /work-places are expected to have their “Business continuity plans” for smooth running of businesses post disasters. In case of major disasters, the government extends all support till few days of return of normal situation.

CHAPTER-7
CBDRR IN ASSAM, NE INDIA

Flood is the most frequent disaster that happens in Assam, almost perennially and people have started living with flood as a part of life. Community Based Disaster Risk Reduction (CBDRR) is still an evolving concept in Assam. Many efforts have been made towards sustainable community development involving DRR. However due to lack of robust infrastructures, proper strategies and lack of planning, efforts fail to build resilience. In Assam, the disaster management system involves the following administrative layers- State, District, Revenue Circle, Villages. Village is the smallest unit of the DM institutional structure. Creation of a Disaster Management institutional structure up to the District level is mandatory as per DM Act (2005). However, there is no strict law about creation of Village DM institutions/structures. The Act mentions about creation of "Local Authority" in general. In Assam, Circle Disaster Management Committees (CDMC) were created in 2016 along with Village Land Management and Conservation Committees (VLMCC)s. There are 154(approx.) CDMC and 16000 (approx.) VLMCC in Assam. VLMCC are responsible for CBDRM. These committees help CDMC in disaster response. However, the government is yet to fix responsibilities of these committees in pre/post disaster time. These VLMCC committees assist the CDMC in village level disaster

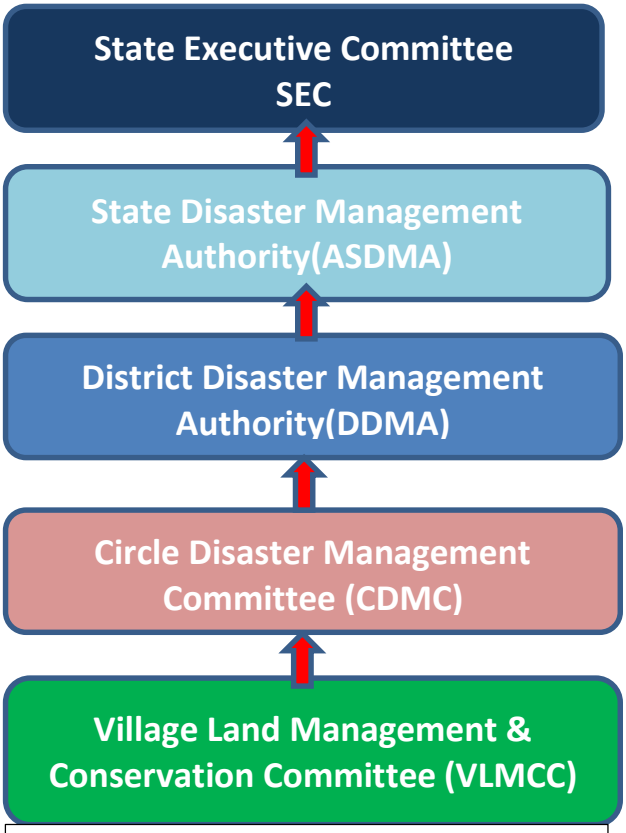


Figure 32: DM Institutional structure in Assam

management. With the increasing population, management of disasters has become a tedious task. And therefore more decentralized institutional mechanisms need to be created to support disaster mitigation. It has become important to fix responsibilities and assign roles at the lowest administrative divisions to act during disasters. In Assam, the responsibility of public infrastructure creation lies with the various departments like, Water Resources, Public Works Departments (Roads), Public Works Departments (Building & NH) etc. Therefore, the concept of resilient infrastructure has to be adopted by the departments if DRR has to be integrated into city planning. The enactment of stringent laws on adopting DRR measures for infrastructure construction is need of the hour. Build Back Better initiatives should be conceptualized and accordingly infrastructures have to be planned. Moreover, institutional strengthening of community based DRR organizations in Assam is essential for better planning and citizen awareness.

CHAPTER-8
CONCLUSION & SUGGESTIONS

5.1 Conclusion:

A. Community Based Disaster Risk Management is still an evolving concept and needs to be strengthened and institutionalized into a system. The Community groups exist but there is still lack of clarity regarding total strength of members, mode of constitution etc.
B. More focus should be laid on preparation of Community Disaster Prevention plans
C. The Community Groups mostly include Elderly citizens and sometimes High school students as volunteers. Middle Age group of citizens should be encouraged to join community groups and participate in Drills
D. The Technical support groups for Flood Fighting like Suibo-Dan should be encouraged and more members should be volunteering in such flood fighting activities. It can be regarded as a “Good practice” for community based flood mitigation
E. Disaster adversities can be turned into opportunities for livelihood generation through scientific infrastructure creation
F. Water resources can be used sustainably for cities and towns through proper planning of infrastructures thereby reducing the probability of flood occurrence

5.2 Suggestions:

A. Infrastructures like “Sabo dam” are good examples for sediment erosion control and perhaps can be replicated in North East India with a proper scientific feasibility study of the region. These kind of infrastructures perhaps has the potential to solve the problem

of excessive siltation in northern Assam districts like Dhemaji, Lakhimpur etc. and also prevent river widening due to excessive siltation

B. Early warning dissemination mechanisms need to be more strengthened in Assam with integration of alarm systems, water level gauges at different locations, Installation of Public Announcement systems (like mics etc.), closed circuit camera installation to monitor upper reaches of river etc.

C. The Dam monitoring and operation mechanism in Assam/North-East India perhaps can be strengthened with proper estimation of water levels and release of excess water into down streams. Establishing water supply companies or other related companies to distribute excess water to the neighborhood cities or towns for drinking or irrigation purpose perhaps can be a solution for flood mitigation

D. Strengthening the community groups with equipment support, training through frequent drills as well as fixing responsibilities can help in institutionalizing CBDRM at community level

E. Livelihood opportunities can be created for the communities through sustainable use of water resources. Tourism or Urban Development (City Beautification) can be a sectors for livelihood generation

LIST OF FIGURES & TABLES

FIGURES

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PHOTOGRAPHS

(Few photographs captured during the research in Japan)

A.


B.


C.


D.


E.


F.

Figure 33: (A.) Automated External Defibrillator (AED) installed at public places and offices (B.) River Alarm systems for early warning (light & siren) (C.) Designer Manhole covers of Sewerage Bureau, Kobe (D.) Evacuation height information displayed in a signboard near the river bank in Chitose river, (Hokkaido) (E.) Life Buoy installed near the river for Fishermen at Chitose river(Hokkaido)(F.) Local agricultural produce red beans of Hokkaido local market (G.)Drift wood barriers afloat in dam site (H.) Sediment control measures in Tamba city