Government of Saint Lucia

USAID/OFDA Project

Damage Assessment and Needs Analysis [DANA] Plan

Document of the Saint Lucia National Emergency Management Plan
Dated: July 12, 2004
Rev. April 16, 2005, April 17, 2007

Based on
Damage Assessment Plan of Jamaica – Date Unknown

Approved by Cabinet Conclusion 1151/2009


Cap Pt.
Pigeon I.
Rodney Bay
Gros Islet
CASTRIES
Grande Cul de Sac Bay
Babonneau
Anse la Raye
Roseau
La Caye
Canaries
Dennery
Mt. Gimie
Praslin
Soufrière
Micoud
Canelles
Desruisseaux
St. Lucia I.
Choiseul
Laborie
Hewanorra Int'l. Airport
Vieux Fort
Maria Is.

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SECTION 1 – OVERVIEW

1. INTRODUCTION

Damage assessment can be described as an inspection/investigation into the damage of either a specific facility and/or a particular area, to aid disaster managers in deciding on the type and amount of assistance required to restore a sense of normality to the affected area. The result of this inspection is to be recorded and assessed at the National and/or District levels by the appropriate agencies

2. ASSUMPTIONS

- That Damage Assessment and Needs Analysis [DANA] Committee is the lead responder to situations requiring DANA.

- A large scale emergency will result in increased demands on DANA Committee Members.

- That the Government of Saint Lucia shall respond to a National Disaster.

- That Emergencies in Saint Lucia may be categorised in two ways:

  - Those that are preceded by a build-up [slow onset] period, which can provide the DANA Committee and NEMO with advance warnings, which is used to facilitate timely and effective activation of national arrangements

  - Other emergencies occur with little or no advance warning thus requiring mobilization and almost instant commitment of resources, with prompt support from the Government of Saint Lucia just prior to or after the onset of such emergencies

3. STATUTORY AUTHORITY

Disaster Preparedness and Response Act No 13 of 2000

> *Section 8(2) -- The National Disaster Response Plan shall include – (a) procedures related to disaster preparedness and response of public officers, Ministries and Departments of Government, statutory bodies, local government units… for, response to and recovery from emergencies and disaster in Saint Lucia.*

4. THE PLAN

This Emergency Response Plan is a guide for the DANA Committee into the way the Committee will handle a disaster.

Every Committee Member is to be aware of the existence of this plan and is to be fully knowledgeable of their roles and responsibilities in any disaster as set out in the Standing Operating Procedures [SOP].

This plan shall be available to every Committee Member. Should a disaster occur during the absence of the Chair, Committee Members should have easy recourse to the plan.

The plan is to be renewed annually with a revised copy being submitted to the Director NEMO.

5. RELATED DOCUMENTS

This plan is a "stand alone" document that may be activated to support hazard management plans. Other documents related to this plan are:

1. ALL Ministry Continuity of Operations Plans [None are complete… yet]
2. DANA Guidelines
3. Standing Operating Procedures - Volume #1: General
4. Organisation of Eastern Caribbean States/ Technical Manual For Post-Disaster Rapid Environmental Assessment - Volume 1: Manual
5. Organisation of Eastern Caribbean States/ Technical Manual For Post-Disaster Rapid Environmental Assessment - Volume 2: Forms, Guidelines & Reference Notes
6. DANA Field Guide
7. IDA Field Guide
8. Emergency Action Plan for Agricultural Pests and Diseases

6. LIMITATIONS

This plan is limited to the coordination of the DANA Committee responses to actual or potential major events, and is not activated to be the only responder.

The National Emergency Management Organisation [NEMO] must be notified of all MAJOR activations. This is necessary to allow for the rapid coordination of resources should the incident escalate to a level requiring National mobilisation.

7. TRAINING

It is recognized that to achieve the capacity and competency that will allow staff to function smoothly during a response, training must be an ongoing component of professional development. The flowing subjects shall be presented, but by no means is limited to:

1. Introduction to Disaster Management [IDM]
2. Emergency Operations Centre Management
3. Incident Command System [ICS]
4. Telecommunications
5. Initial Damage Assessment [IDA]
6. Damage Assessment and Needs Analysis [DANA]
7. First Aid

Where appropriate it shall be the responsibility of Member Agencies to ensure that said training is incorporated into its annual training program.

8. MEMBERSHIP

Membership of the DANA Committee comprises of but is not limited to:

1. CHAIR
2. Engineers, Valuators, QS, Architects
3. WINCROP
4. Banana Companies/WIBDECO
5. Culture: FRC, A&H, SLNT, SLNA
6. Saint Lucia Red Cross
7. Meteorological Services
8. Utility Companies
9. Ministry of Works
10. Ministry of Tourism
11. Ministry of Physical Development
12. Ministry of Housing
13. Ministry of Health
14. Ministry of Agriculture
15. Ministry of Education
16. Department of Statistics
17. Department of Forestry
18. Department of Fisheries
19. Department of Sports
20. Agricultural Services
21. Chamber of Commerce
22. Saint Lucia Cadet Corps
23. Saint Lucia Air and Seaports Authority
24. Saint Lucia Hotel and Tourism Association
25. Eighteen IDA Team Leaders of District Disaster Committees
26. Fifteen Liaison Officers from Government Ministries

Members Pending

27. Churches
28. Digicel
29. Cable and Wireless
30. Department of Environmental Health
31. OECS/ESDU
32. Environmental Sectors *[SUCH AS???]*

See Appendix 6 for Committee Organisational Structure

9. DISASTER CYCLE

The Disaster Cycle comprises of the following elements:

<u>BEFORE</u>

- Prevention
- Mitigation
- Preparedness

<u>DURING</u>

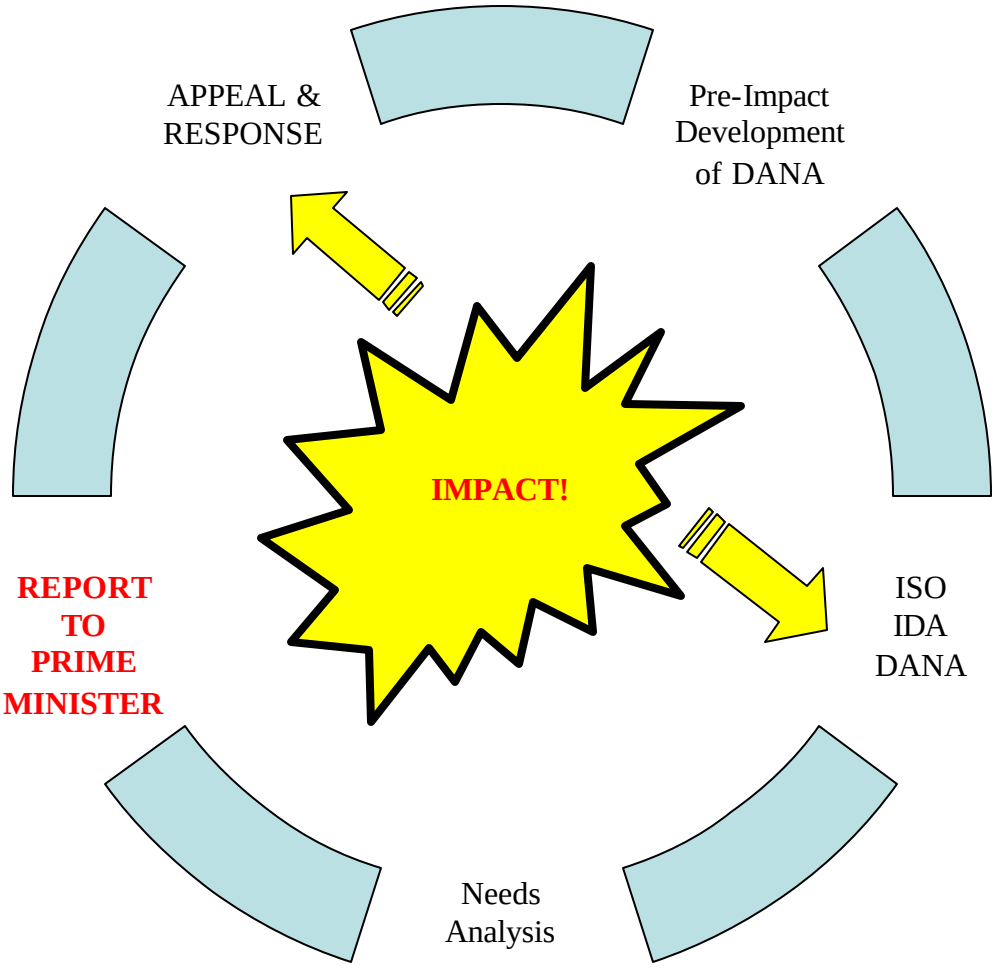
- DISASTER OCCURS

<u>AFTER</u>

- Response
- Reconstruction / Recovery
- Rehabilitation / Rebuilding

DANA DISASTER CYCLE [Source: OFDA]

The Damage Assessment Disaster Cycle comprises of the following elements:

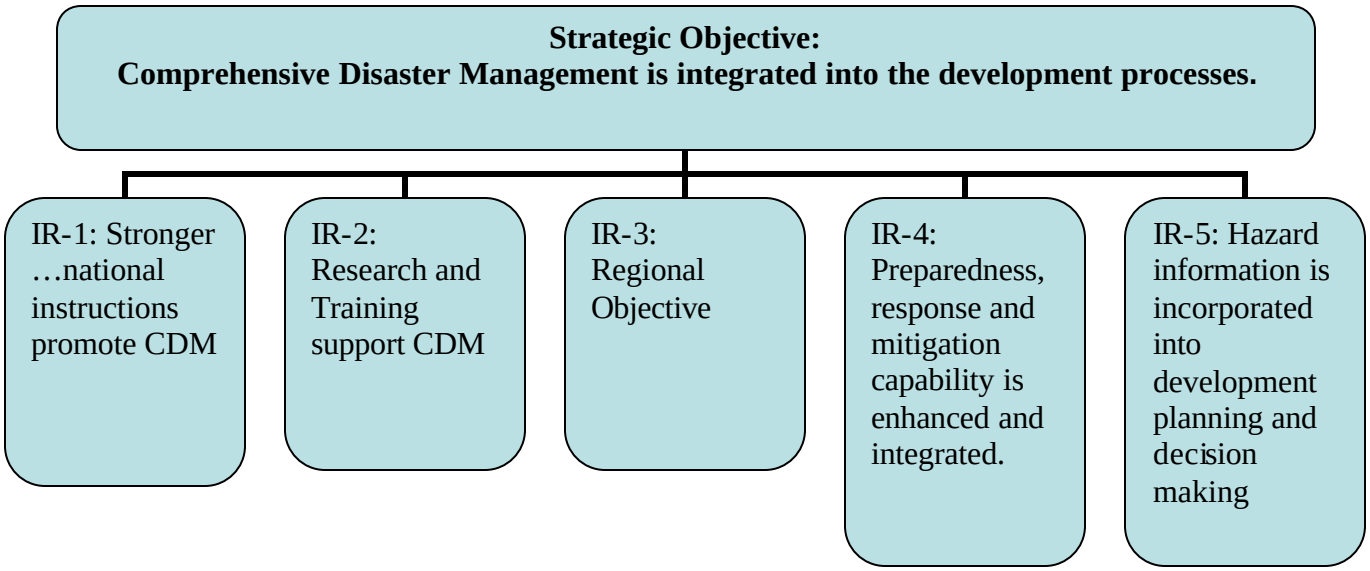


10. COMPREHENSIVE DISASTER MANAGEMENT

It is understood by the Government of Saint Lucia [GOSL[_that the disaster cycle lends itself to a comprehensive approach to disaster management, whether within this organisation or at a National Level.

Comprehensive Disaster Management [CDM] was conceptualised by the Caribbean Disaster Emergency Response Agency [CDERA] as a new direction for disaster management for the 21st century. It moves away from the relief and response mode to a comprehensive approach which takes disaster and mitigation considerations into account during the planning and development stages. It also expands the partners to include economic, social, and environmental planners, architects, engineers, and health professionals among others. *[CDERA Press Release of Feb 27, 2004]*

With the main objective being to integrate Comprehensive Disaster Management into the development planning process it is GOSL's intension to weave Comprehensive Disaster Management into the Corporate Life through the recommended Intermediate Results [IR]



11. ST. GEORGES DECLARATION OF PRINCIPLES

It is understood that as a tool to achievement of the CDM Strategy it is this Agency's undertaking to support Principle Nine of the St. Georges Declaration of Principles for Environmental Sustainability in the Organization of Eastern Caribbean States [OECS].

Where each member state agrees to:

a. Establish at the community, national and regional levels appropriate and relevant integrated frameworks to prevent, prepare for, respond to, recover from and mitigate the causes and impacts of natural phenomena on the environment and to prevent man made disasters;

b. Exchange information with each other, relating to the experiences and lessons to be learnt from the causes and impacts of natural and man made hazards and phenomena on its environment.

12. SITUATION

Disasters actually result from three (3) types -- or combinations -- of incidents, caused by:

1. Natural or cataclysmic events (*e.g., earthquakes, fires, floods and storms*);
2. Human behavior *(e.g., robberies, bomb threats, acts of arson, hostage events or transportation strikes*); and
3. Technological breakdowns (*e.g., power outages, computer crashes and virus attacks*).

Hazard analysis and experience have confirmed that Saint Lucia is at risk from numerous hazards, both natural and technological:

- Meteorological Hazard: Hurricanes, Tropical Wave, Tropical Storm, Storm Surge, Flooding, Land Slides, Drought
- Seismic/Volcanic Hazard: Volcanic Eruption, Earthquake, Tsunami [Marine and land based]
- Technological: Fire, Explosion, Hazardous Material Spill, Mass Poisoning, Pollution, Civil Unrest
- Other: Plague, Mass Causality, Epidemic Outbreak, Dam Failure, Office Violence, Terrorism, Bomb Threat/Explosion, Utility Failure

SECTION 2: THE NATIONAL DAMAGE ASSESSMENT PLAN

1.0 Introduction

The damage assessment exercise is critical to the country's ability to restore all sectors to normality in the shortest possible time after a disaster, hence the need for the development and implementation of this plan.

Relationship to National Disaster Plan – the Damage Assessment Plan is a sub-plan of the National Disaster Plan. The authority, roles and standard procedures remain the same as outlined in the National Disaster Plan.

The plan will be reviewed and revised annually.

2.0 Authority

NEMO will be responsible for all preparedness, response and relief activities for the island as mandated under the Disaster Preparedness and Response Act No. 13 of 2000. NEMO will therefore facilitate the design and review of this plan.

3.0 Objectives of the National Damage Assessment Plan

The objectives of the Plan are to:

(i) Enable the rapid collection of information pertaining to the damage incurred after any disaster event.
(ii) Standardise the instruments and methods used to measure, record and report damage sustained after an event.
(iii) Guide the process of assessing, estimating and reporting the damage.
(iv) Define the time required to prepare detailed and accurate reports.
(v) Facilitate the quick recovery of lifeline[1] facilities in a timely and orderly manner by assessing the magnitude of the damage incurred and identifying priorities and resources required for the resumption of normal operations.

4.0 Types of Damage Assessment Teams and Composition

4.1 Types of teams

A damage assessment team is a group of technical and professional persons who have been trained in the field of data collection as it relates to the varying needs of affected communities.

[1] Lifeline facilities include health facilities, bridges, roads, utilities, police stations and shelters.

The team should consist of persons who are able to recognise the varying types of damage. Special teams will be named as Damage Assessment Teams at National and District levels. After the disasters, either the National Emergency Operation Centre (NEOC) or the Secretariat of the National Emergency Management Organisation (NEMO-Sec) will dispatch them to the disaster site where the information will be collected. The teams will be responsible for data collection, evaluation and reporting.

There are a number of Damage Assessment Teams; the type and magnitude of the event will determine the team deployed. The teams are:

a) Reconnaissance Team [Recon Team]
b) National Damage & Needs Analysis [DANA] Team
c) District Damage Assessment Team [DDAT]
d) Sector Assessment Team [SAT]

4.2 Reconnaissance Team [Recon Team]

This team which operates only at the national level will conduct an initial overview, after all large-scale disaster events. This overview may require aerial reconnaissance of the affected sites and is to provide an assessment of the damage within the first 4-6 hours.

Roles and Responsibilities

a) Confirm the reported emergency and estimate the overall extent of damage.
b) Identify, characterise and quantify populations at risk in the disaster.
c) Identify access routes and the levels of entry into the affected areas
d) Identify damage to critical buildings, infrastructure/facilities.
e) Identify existing and potential threats.
f) Make recommendations to mitigate or lessen the discomfort or risk of the victims.

Composition of the team

There shall be one (1) Team. Based on the type of event the team shall be taken from the following pool:

(a) The Prime Minister,
(b) Deputy Director of NEMO,
(c) The Chair of National Damage Assessment and Needs Analysis (DANA) Committee
(d) The National Immediate Works Committee Chairperson,
(e) Saint Lucia Government Information Service (GIS) camera-operator.
(f) Commissioner of Police
(g) Chief Fire Officer
(h) Chief Medical Officer
(i) National Shelter Management Committee Chairperson
(j) Ministry of Agriculture representative

The members of the team are expected to be available at all times. In an emergency, the members of the team are to contact NEMO, if they are not contacted within four hours after the event has occurred.

4.3 National Damage Assessment and Needs Analysis Team (DANA)

This team is responsible for conducting the Initial Damage Assessment (IDA) for all major disasters within the island. The members of the National Damage Assessment Team (NDAT) are drawn from the National Damage Assessment and Needs Analysis (DANA) Committee. It will operate in close collaboration with the National Emergency Operation Centre. The Chairperson of the National Damage Assessment and Needs Analysis Committee (DANA) will provide information to the Director of the National Emergency Operations Centre (NEOC) or the Director of NEMO. The members of the team will carryout assessments independently or jointly, but each agency will report damage to the Chairperson of the DANA at least once every 24 hours initially and then as required.

Roles and Responsibilities

The role of the national damage assessment team is to:

a) Continue detailed identification and quantification of populations at risk.
b) Help define and prioritise the actions and resources required to reduce immediate risks.
c) Identify the priorities of the affected people
d) Estimate the additional support required from local, national and international sources for relief and recovery.
e) Identification and documentation of existing resources.
f) Identify areas that may be unfit for homeowner habitation where evacuation is necessary.
g) Identify, characterise and quantify populations at risk in the disaster.
h) Identify and classify type of damage.
i) Identify access routes and the levels of entry into the affected areas
j) Identify damage to critical buildings, infrastructure/facilities.
k) Identify existing and potential threats.
l) Make recommendations to mitigate or lessen the discomfort or risk of the victims.

Composition of the Team

The team is responsible for all events affecting either the entire island or one (1) or more Districts. The DANA Team will operate in close collaboration with the NEOC. Each member of the team is expected to provide reports on the damage incurred to its (facilities island-wide) island facilities as well as the damage observed.

Engineers, Evaluators, Quantity Surveyors, Architects
Ministry of Liaison Officers
Ministry of Health
Ministry of Works
Ministry of Tourism
Ministry of Physical Development
Ministry of Housing
Ministry of Agriculture
Ministry of Education
Department of Statistics
Chamber of Commerce
WINCROP
Banana Companies/WIBDECO

Folk Research Centre
Saint Lucia National Trust
Saint Lucia Archives Authority
Archaeological and Historical Society
Saint Lucia Red Cross Society
Met Services
WASCO
LUCELEC
Cable and Wireless

Members Pending

- Department of Forestry
- Department of Fisheries
- SLASPA
- Churches
- AT&T
- Digicel
- Department of Environmental Health

4.4 District Damage Assessment [DDAT] Team

The DDAT is responsible for the Initial Situation Overviews (ISO) and the Initial Damage Assessments (IDA) pertaining to disaster events within the District. The members of this team will also assist the Rapid Damage Assessment and National Damage Assessment Teams whenever the need arises.

The DDAT will be a sub-committee of the District Disaster Management Committee. The DDAT will operate in close collaboration with the District Disaster Management Committee Chairperson, the National Damage & Needs Assessment Committee Chairperson and the Director of NEMO.

The DDAT shall not be expected to place a financial cost to the damages reported.

The role of the DDAT is to:

a) Confirm the reported emergency and estimate the overall magnitude of the damage.
b) Identify, characterise and quantify populations at risk in the disaster.
c) Help define and prioritise the actions and resources to reduce immediate risks.
d) Identify the priorities of the affected people
e) Estimate the additional support required from local and national sources for relief and recovery.
f) Identification and documentation of existing available resources.

4.5 Sector Assessment Team [SAT]

(1) Insurance
(2) Agricultural
(3) Cultural
(4) Religious
(5) Tourism
(6) Manufacturing

(7) Housing
(8) Environmental
(9) Communications

All sectors are members of the DANA and submit the sectoral report to the Chair of DANA or the Director – NEMO.

4.6 Internationals

a. Caribbean Development Bank

In the transition between the initial response and rehabilitation phases, CDB staff will participate in a detailed assessment of the social and economic impact and sectoral damage caused by the disaster. An effective recovery strategy and a programme of rehabilitation works will also be developed. Factors which would be considered in the formulation of the recovery strategy include:

- the quickest possible alleviation of human suffering;
- the severity of the impact of the disaster on the economic performance of the country, which may require the Government to modify its priorities and investment programmes, and the need for early re-establishment of economic activity;
- the achievement of the best match between resources required for rehabilitation and available resources, in particular, financial and manpower resources;
- the mitigation or removal of post-disaster threats to the affected population and early restoration of economic activity; and
- the commitment on the part of Government to restore normalcy to administrative, regulatory and cost recovery mechanisms at an early date.

b. Organisation of Eastern Caribbean States [OECS]

On request the OECS Secretariat can field a multidisciplinary team to assist the Governments undertake a macro-socioeconomic assessment of the damage caused by a disaster. The OECS Team works with local counterparts to complement the compilation of damage and needs assessments prepared by numerous other agencies.

c. Rapid Needs Assessment Team [RNAT]

The RNAT comprises of multi-discipline specialist from a variety of sectors and are deployed under the mandate of the Eastern Caribbean Donors Group.

5.0 TRAINING

Damage assessment training is the responsibility of the individual organizations and/or agencies. However, NEMO-Sec will be responsible for providing training for the DANA Teams. These training exercises will be conducted annually and will seek to empower the participants in quantifying, classifying and evaluating damage.

6.0 THE INITIAL ASSESSMENT PROCESS

This is designed to assist the National Emergency Operations Centre and/or the District Emergency Operations Centre in its decision-making process. The assessment process is important because it helps to:

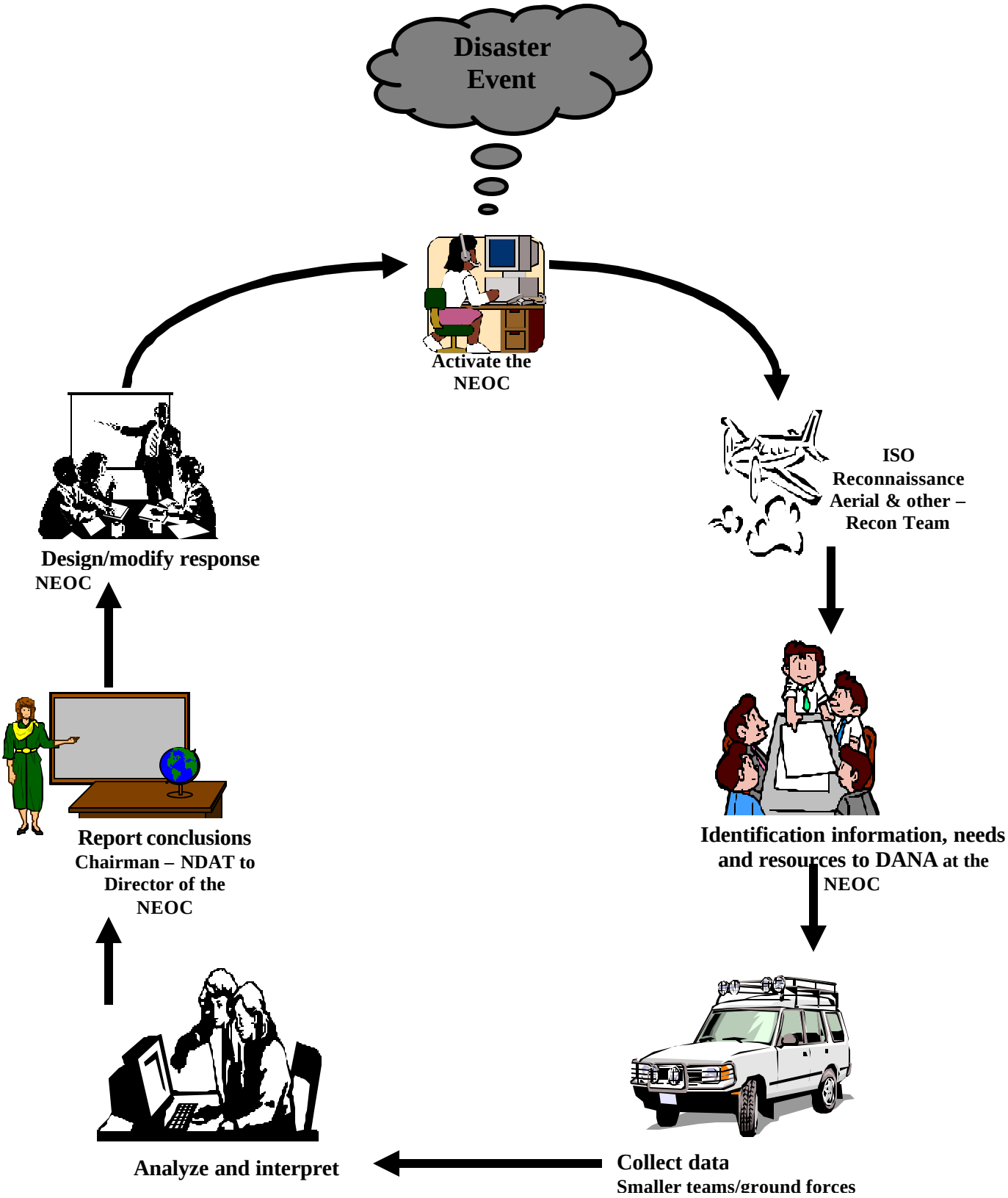
- Determine the impact of the event on the island and its people;
- Determine the needs and priority areas for assistance;
- Identify the resources available and what can be accessed for recovery as shown in Figure 1.

The five components of the process are:

a) Information, needs and resources identification
b) Data gathering
c) Data analysis
d) Reporting

"An interesting point is that this scale is quadratic, so that a category 2 hurricane does not cause twice as much damage as a category 1, but four times as much. A category 3 hurricane does not cause three times as much damage as a category 1, but nine times as much, and so on,"
José Rubiera, the head of the national forecast centre of Cuba's Institute of Meteorology, in an article published in Enfoques magazine, produced by the IPS bureau in Cuba. [2008]

Figure 1. THE ASSESSMENT PROCESS



Source: UNDP Damage Assessment Process

6.1 Information, Needs and Resources Identification

This is the first stage in the assessment process. It involves the recording of the emergency event, identification of the resources, which will be required based on the reports, anticipating the needs of the person in the affected areas and estimating the magnitude of the event.

6.2 Data Gathering

This stage is concerned with the confirmation of the reported event, identifying, characterizing and quantifying the populations at risk as a result of the disaster.

6.3 Data Analysis and Interpretation

The analysis of the data collected to:

a) Define and prioritize the actions and resources needed to reduce suffering and deaths;
b) Identify the existing local and functional response capacity;
c) Anticipate future immediate problems.

This involves the use of the GIS systems and/or any other such analytical programmes.

6.4 Reporting

The process relates to the information analyzed in stage 3. The results of the analysis will be sent to the relevant response agencies for their immediate attention.

6.5 Response

This is the final stage of the assessment process and it entails the enforcement of the pre-designed disaster response plans. This stage is also concerned with the re-designing or modification of existing plans as the situation deteriorates or improves.

6.6 Deactivation

On deactivation of the NEOC the DANA Team follow the SOPs as stated in the National Hurricane Plan

- Emergency Procedures HP-600 DANA.
- Emergency Procedures HP 800 Protection & Rehabilitation of Infrastructure
- Emergency Procedures HP 900 Reconstruction

7.0 Reporting Procedures

7.1 Damage Assessment Reports

For each type of assessment there are different types of reports, which are listed in the table 7.1 below. Each assessment report requires its own individual form.

These instruments are designed to assess:

i. Life threatening situations by the provision of search and rescue;
ii. The need for emergency food, water, shelter, medicine and medical assistance;
iii. The need for restoration of critical facilities and services, and
iv. The need for removal/clean up of debris and
v. The restoration of basic utilities.

Table 7.1
Types of Assessment Reports for Emergency Relief and Short-term Restoration

Type of assessment	Time Period	Purpose	Responsibility
Initial Situation Overview [ISO]	4 – 8 hours after the disaster has occurred and/or the *All Clear* given	To provide a "snap shot" of the situation.	District Committee
Initial Damage Assessment [IDA]	12 - 24 hours after the disaster has occurred	To provide information on overall damages and causalities and needs to permit allocation of critical supplies in the first 24 hours after a disaster.	District Committee
Detailed Sector Report [DSR]	24 - 36 hours after disaster occurs	To summarize data on overall damages and causalities by Sector.	Sector Agencies
National Damage Assessment Report #1	48 hours after disaster	Summary of Information provided over time in the ISO, IDA and the DSR. It also provides more details on damages in order to continue the allocation of emergency resources.	DANA Committee
National Damage Assessment Report #2	7 days after disaster	Revision and update on the First DANA Report	DANA Committee
National Damage Assessment Report #3	14 days after disaster	Revision and update on the Second DANA Report. This process can be repeated as needed.	DANA Committee
Macro Socio Economic Report	From 21 days after the disaster has occurred.	Starting with the DANA Reports a sector-by-sector analysis of the impact of the event is produced. Sectors are grouped into four categories: • Social • Productive • Infrastructural and • Environment.	OECS Secretariat with DANA Committee

These reports shall be prepared and forwarded simultaneously to the Cabinet of Ministers and the relevant Donors within the time lines as set out above.

8.0 Notification

NEMO will notify the National DANA Committee and the District Disaster Management Chairpersons as follows:

a) In the event of a hurricane 24-48 hours before expected impact.
b) In cases of flooding, immediately.
c) In cases of reported landslides, immediately.
d) After a major fire, immediately.
e) After a major earthquake as soon as possible (time frame should not exceed a 4 hour limit).

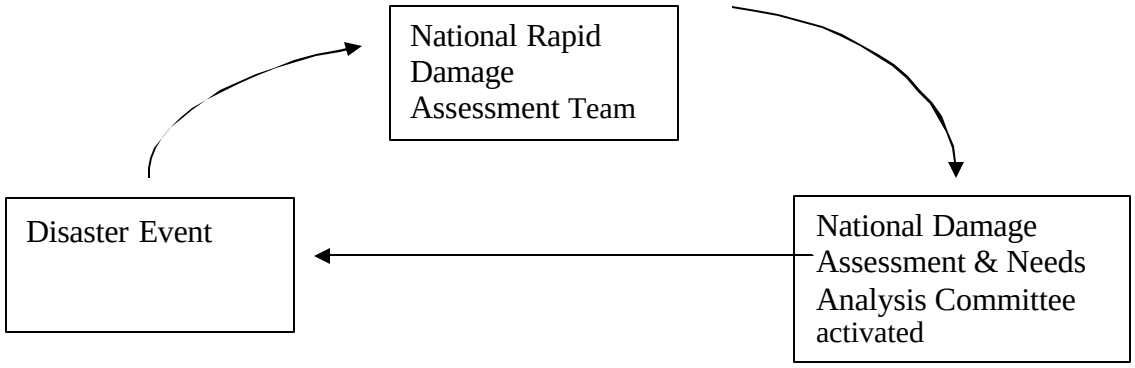
Fig 2 on page 11 shows the structure and relationship of the NEMO, DANA and the National Emergency Operations Center (NEOC).

9.0 Activation

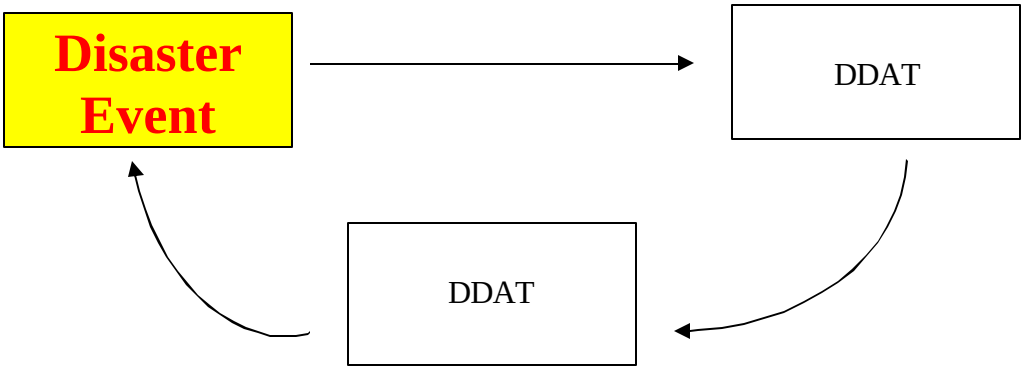
The Director of NEMO in conjunction with the Chairman and/or the Vice-Chairman of the DANA will activate the plan, either partially or fully based on the following:

i) Once either one or more District Disaster Response Mechanisms have been overwhelmed.
ii) Once there is the receipt of any Situation Reports indicating that a major incident has occurred.
iii) The number of calls received from affected residents will also help to decide if the plan is to be activated.

Sequence of Events leading to Activation of the National Damage Assessment Teams



Sequence of Events leading to Activation of the District Damage Assessment Teams [DDAT]



9.1 Call out Procedure

A. Disasters with a long warning period [e.g. hurricanes, drought and epidemics.]

The Director of the NEOC will notify the Chairman of the National Damage Assessment & Needs Analysis Committee. The Chairman will then call out the DANA Team, who will report to the NEOC.

B. Disasters with little or no warning period [e.g. earthquakes, flash flooding and landslides.]

The Director NEMO will notify the Chairman of the National Damage Assessment & Needs Analysis Committee. The Chairman will then call out the levels of DANA Team as needed, who will report to the NEOC.

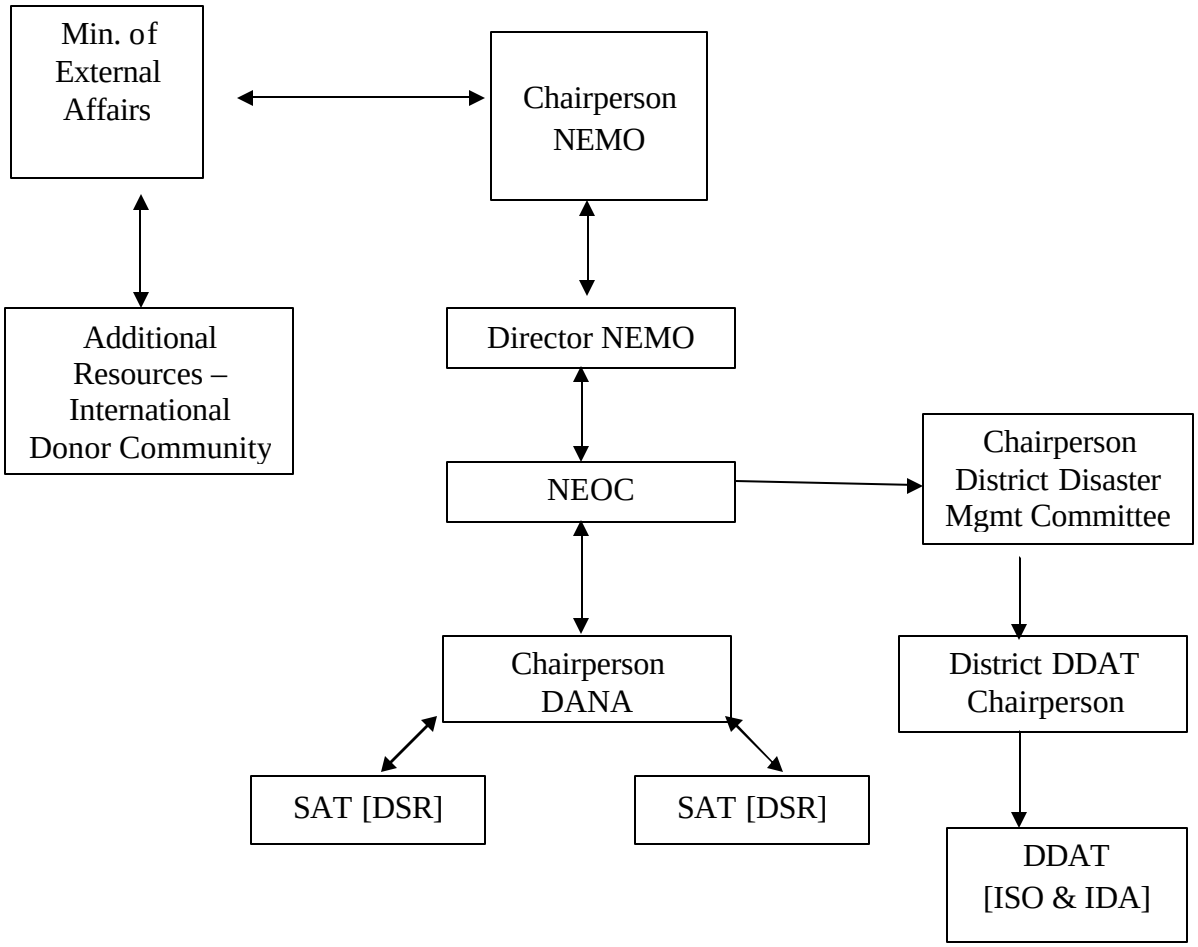
9.2 Dispatch of Team

Teams will be dispatched at the discretion of the Chairman – DANA or the Director - NEMO, in consultation with team members, and may be dispatched either individually or jointly. Each team will be required to provide the Director of the NEMO with a copy of an itinerary (field assessment schedule) for the assessment in order to allow for the optimum use of the resources available.

10.0 Reporting

Damage Assessment Teams would proceed to damage sites with the necessary communication equipment. The team will use the communication facilities existing within the group/centre.

Figure 2. Communication Flow chart
Large Scale Disasters (Islandwide)



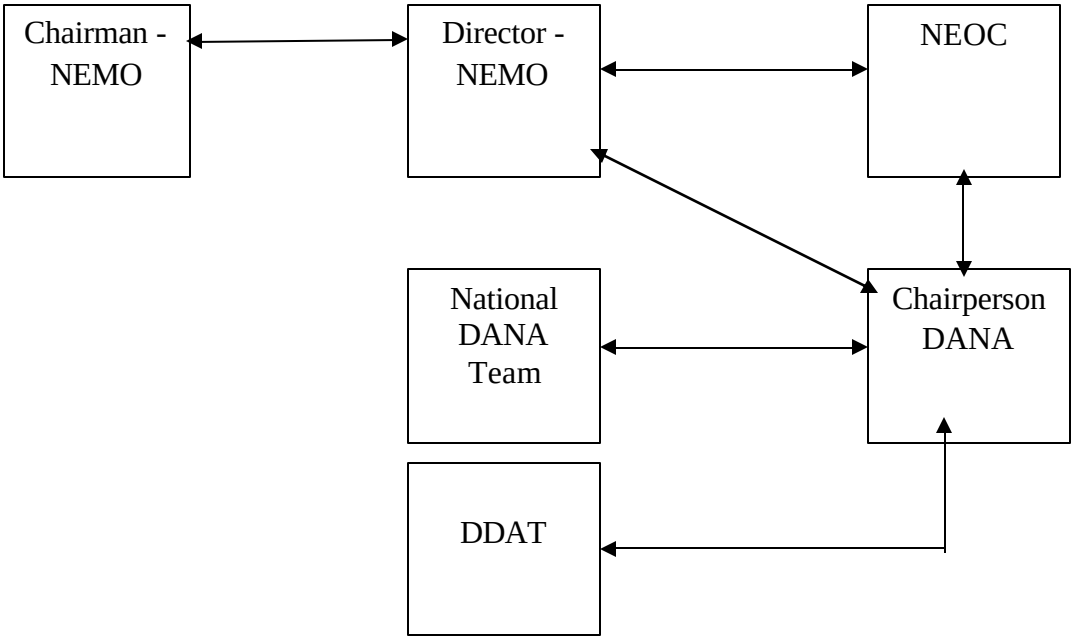
Small Scale Disasters (District Level)

11.0 Reporting Relationships

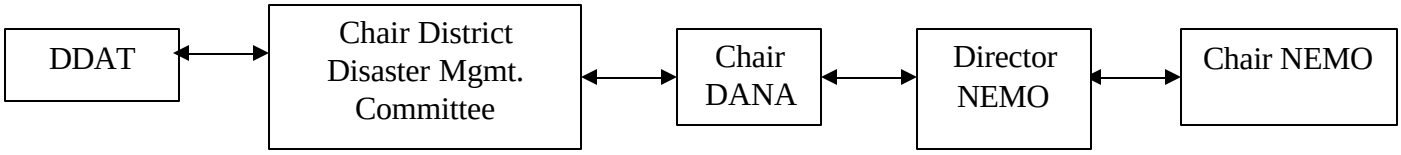
The diagram below is a graphic representation of the teams responsible for collecting and preparing damage assessment reports.

Reporting Relationships for Large scale Events

Island-wide – 18 Districts

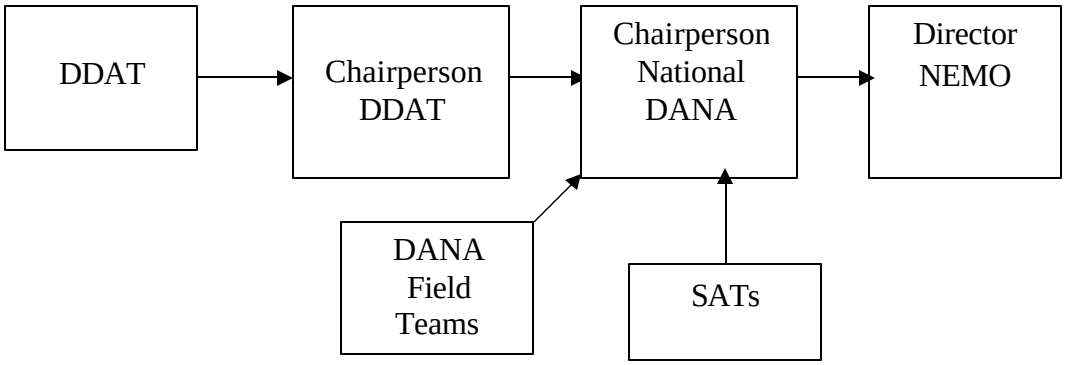


Reporting Procedure for Small Scale Events



12.0 Deactivation

The Chairperson of the DANA, will in conjunction with the Director of the NEOC (or the Director – NEMO) decide when to deactivate the teams. If the NEOC is deactivated before the damage assessment process is completed then the field teams will report to their respective Chairpersons. These reports will then be sent to the Chairperson of the National Damage Assessment & Needs Analysis Committee. The diagram below shows the expected communication flow.



13.0 Agencies and their Responsibilities

Table 13.1 below lists the members of the National DANA Team and the role and responsibilities of these agencies.

Table 13.1 National Damage Assessment and Needs Analysis [DANA] Team members and their responsibilities

Agency	Roles and Responsibilities
Saint Lucia Institute of Engineers	To provide a pool of resources from which the NEOC can draw upon to assist in the damage assessment process.
Utility Companies	To provide report on the extent of damage incurred to the utilities sector and estimated time for repair of damage facilities.
Royal Saint Lucia Police Force	To maintain law and order; to provide security for Damage Assessment Team to provide reports of alternative routes where possible; to provide initial reports of damage as well as general situation reports and information on the damage sustained to all RSLPF facilities.
Ministry of Agriculture	To identify and record the extent of damage to agricultural crops,

	holdings and industries
NEMO & Ministry of Social Transformation, Local Government and Culture	To ensure the activation of DEOC's and coordination of all activities at District Level.
Saint Lucia Fire & Ambulance Service	To provide qualitative and quantitative analysis of the situation, to provide hazardous material incidents and search and rescue reports.
Ministry of Health	To identify pending medical outbreaks/potential medical emergencies and on the damage sustained to all health facilities. This should include all medical storage facilities.
Ministry of Health & Human Services and Ministry of Social Transformation	To assess and quantity the welfare needs of the affected families and recommend assistance.
Ministry of Communications, Works, Transport & Public Utilities	To identify the most affected areas, prioritize areas for the deployment of relief and welfare workers and to identify sites for the establishment of welfare registration centres. To provide report on infrastructural damage and to government facilities.
Ministry of Education	To do damage assessment on educational facilities and advise on ability to be used as shelter and when can be re-opened.
Department of Statistics	To provide field personnel to assist in data collection and to provide reports.
Planning Institute of Saint Lucia	To assess the national economic impact of the disaster on the country, in collaboration with sector ministries development of sectoral recovery and rehabilitation plans.
Water & Sewage Company	To provide information on state of underground water facilities
Meteorological Service	To collect data on rainfall amount and intensity, to monitor and provide information on weather conditions.
Saint Lucia Air & Sea Ports Authority	To assess the condition/damage done to port facilities and indicate availability for use.
Ministry of Physical Development, Environment and Housing	To monitor and provide information on housing stock across the island.
Building Societies Association of Saint Lucia	To provide information on status of Housing Stock

Source: NEMO Secretariat

14.0 Activities according to Phases of Disaster Management

Activities for the Damage Assessment Team were divided into two sets according to the phases of the disaster management system. The two phases that are applicable to the damage assessment are Preparedness and Response. The table below highlights the activity associated with the phase and the agencies responsible for performing these activities. The agencies are listed in order of priority, that is those with the primary responsibilities are listed first (**1**), secondary agencies are next (**2**) and support agencies are last (**3**).

Table 14.1
Preparedness activities associated with the Damage Assessment Process

ACTIVITY	AGENCIES RESPONSIBLE
a) Recording the emergency event Acquire the equipment required to record the data. Install and/or upgrade equipment	(1) Met. Service / WASCO (2) NEMO (1) DANA (2) NEMO
b) Identification of resources for conducting damage assessments in the field	(1) MOH / MOST / STATS. (2) MOA. (3) NEMO / WASCO
c) Anticipating the needs of the population most vulnerable	(1) DANA (2) NEMO / Met. Service / MOH
d) Estimating the magnitude of the event i.) Training ii) Conduction of simulation exercise	 (1) DANA / NEMO
Data Gathering	(1) DANA / NEMO
a) Characterizing vulnerable population	(1) MOH / MOA (2) STATS / DDPC (3) NEMO
b) Quantifying vulnerable population	(1) STATS. (2) MOH / MOA / DDPC. (3) NEMO
Define and prioritize (actions) resources	(1) DANA. (2) NEMO
a) Identify the location of existing functional resources locally	(1) DANA / NEMO
b) Identify potential problem areas	(1) DANA / NEMO. (2) MOH / MOA
Reporting	
a) Review damage assessment forms	a) 1. DANA / NEMO
b) Conduct training sessions in their usage	b) 1. DANA / NEMO
Response	
a) Test time required by the teams to get activated and operating in the field	(1) DANA / NEMO
b) Test time required to file a properly completed damage assessment form	(1) DANA / NEMO

Source: NEMO Secretariat

Table 14.2
Response activities associated with the Damage Assessment Process

ACTIVITY	AGENCIES RESPONSIBLE
a) Record event	(1) Met. Service / (2) NEMO
b) Identify (collect) resources	(1) DANA / DDAT (2) NEMO / DDPC
a) Anticipate needs of affected areas	(1) MOH / MOA / MOST. (2) NEMO / DDPC
b) Estimate magnitude of event	(1) Met. Service (2) DDPC
a) Confirm the event	(1) Met Service / DDAT
b) Identify, characterize affected population	(1) RDAT / MOH / MOA / DDPC. (2)MOST
c) Quantify affected population	(1) MOST / DDPC / STATS
a) Define and prioritise resources	(1) DANA / NEMO
b) Identify existing local resources	(1) DANA / NEMO / DDPC (2) MCWTPU
c) Identify problem areas	(1) RSLPF / MCWTPU (2) MOA / MOH. (3) NEMO / DDPC / DANA
Reporting	
a) Report for the Director NEMO	(1) Director – NEMO. (2) Chairperson – DANA
b) Report for NEMO	(1) Chairperson – DANA (2) Individual agencies headquarters
c) Report for the DDC	(1) DANA

Source: NEMO Secretariat

Key

(1) Agencies with primary responsibility
(2) Agencies with secondary responsibility
(3) Agencies with support role.

Characteristics of Events that Generate Adverse Effects
[SOURCE: OFDA/DANA Field Guide]

The origin of disasters has been broadly discussed in academic circles, concluding that they can be classified that they can be classified simply within two broad categories:

- Those resulting from the occurrence of natural events such as earthquakes, volcanic eruptions, tropical storms, hurricanes, etc.
- And those that are derived from threats created by human activities, be technological activities [failures in safety systems, accidents, spills, explosions, fires], or social, such as armed conflicts, terrorism, as well as related consequences [displaced people and refugees]

There are difficulties involving these groupings because in many situations we find an interaction between natural events and human actions; such as in the case of

- Landslides (erosion, defects in water mains, settlements in unstable areas),
- Floods (deforestation along river banks, dumping of sediments and other materials into Hydrographic basins, and even in the construction itself of dikes),
- Water-borne epidemics (due to deficient sanitary conditions),
- Other infectious contagious diseases (from person to person, such as eruptive diseases)
- Vector transmitted diseases, complications or additional infections in traumas and wounds.

Other people prefer to group disasters based on how they originate:

- Sudden onset – earthquakes, tsunamis, steep gradient floods, tropical storms, volcanic eruptions, some types of landslides, explosions, fires.
- Slow onset – drought, famine, environmental degradation, desertification, deforestation, flat land flooding, some types of landslides.

Although they have many elements in common, there are some particularities of each threat that characterise each event and which should be known.

In order to describe them the methodology introduced in the Guide entitled “An overview of disaster management” (Disaster Management Training Programme of the United Nations Development Programme – UNDP), shall be used.

For each event we will determine:

- causes
- origin of the event
- characteristics
- elements of the event
- adverse effects
- results of the impact of the event in terms of physical damage, with emphasis on housing and public buildings
- health
- life lines and productive infrastructure

- possibilities for prediction - instrumentation and lead time measures
- possible measures to mitigate the risk
- medium- and long-term actions
- preparedness measures
- readiness and preparedness actions
- frequent post-disaster needs

The probability of more than one event occurring simultaneously should be taken into account, such as in the case of an earthquake in a zone where there is armed conflict, or floods accompanied by landslides.

Hurricanes

Causes

Changes in atmospheric pressure and winds that reach up to 63 kph form a tropical depression. When the winds reach speeds of 64 kph to 119 kph, and and a rotary circulation of winds becomes distinct, they are designated "tropical storms". These are accompanied by heavy rains formed over open seas, storm surge with large coastal waves, sea and river overflowing, lightning and thunder. A tropical storm is upgraded to hurricane when the winds exceed constant speeds of 120 kph and circulate around a calm centre, the distinct "eye" of the storm, accompanied by strong rains and major variations in atmospheric pressure.

A hurricane is caused by hot humid air coming from the ocean and interacting with cold air; these currents rotate and move at 10 to 50 kph, with an area of influence of about 100 kilometres in diameter; its path is erratic and unpredictable.

In the northern hemisphere, winds revolve counter clockwise in a generally northwest direction, while in the southern hemisphere they revolve clockwise and in a generally southwest direction.

Characteristics

Winds and strong rains are caused by important differences in atmospheric pressure. There is often a rise in sea level (storm surge) with the formation of enormous waves, particularly in those zones where atmospheric pressure has dropped. When hurricanes touch land, especially along continental coasts, they decrease speed, generating intense and sudden precipitation.

The Saffir-Simpson Hurricane Damage-Potential Scale

The Saffir-Simpson Hurricane Damage-Potential Scale is a hurricane force scale using the numbers 1-5 to rate a hurricane’s intensity. The scale was developed by engineer Herbert Saffir and pioneer hurricane expert Dr Robert Simpson in 1971. The scale is assigned to a hurricane based on its peak wind speed. The scale is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall.

Wind speed is the determining factor in the scale as storm surge values are highly dependent on the slope of the continental shelf in the landfall region. Pressure values are closely associated with peak winds but may vary in certain situations. Note that all wind speeds are determined using the US 1-minute average of wind speed.

Saffir-Simpson Hurricane Scale

Category	Sustained Wind Speeds (miles)	Damage Potential
1	74-95	Minimal
2	96-110	Moderate
3	111-130	Extensive
4	131-155	Extreme
5	>155	Catastrophic

According to the US National Hurricane Center, the following damage can be expected from hurricanes in the various Safir-Simpson categories:

- Category 1 Minimal: Damage primarily to shrubbery, trees, foliage and unanchored mobile homes. No real damage to other structures. Some damage to poorly constructed signs. Low-lying coastal roads inundated, minor pier damage, some small craft torn from moorings in exposed anchorage.
- Category 2 Moderate: Considerable damage to shrubbery and tree foliage; some trees blown down. Major damage to exposed mobile homes. Extensive damage to poorly constructed signs. Some damage to roofing materials on buildings; some window and door damage. No major damage to buildings. Coastal roads and low-lying escape routes are inland cut off by rising water two to four hours before arrival of storm. Considerable damage to piers. Small craft torn from moorings.
- Category 3 Extensive: Some structural damage to small residences and utility buildings with a minor amount of curtain wall failures. Damage to shrubbery and trees with foliage blown off trees and large trees blown down. Mobile homes and poorly constructed signs are destroyed. Low-lying escape routes are cut by rising water 3-5 hours before arrival of the hurricane center. Flooding near the coast destroys smaller structures with larger structures damaged by battering of floating debris. Terrain continuously lower than 5 ft (1.7m) above mean sea level may be flooded inland 8 miles (13 km) or more. Evacuation of low-lying residences with several blocks of the shoreline may be required.
- Category 4 Extreme: More extensive curtain wall failures with some complete roof structure failures on small residences. Shrubs, trees, and all signs are blown down. Complete destruction of mobile homes. Extensive damage to doors and windows. Low-lying escape routes may be cut by rising water 3-5 hours before arrival of the hurricane center. Major damage to lower floors of structures near the shore. Terrain lower than 10 ft (3.3 m) above sea level may be flooded requiring massive evacuation of residential areas as far inland as 6 miles (10 km).
- Category 5 Catastrophic: Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. All shrubs, trees and signs blown down. Complete destruction of mobile homes. Severe and extensive window and door damage. Low-lying escape routes are cut by rising water 3-5 hours before arrival of the hurricane center. Major damage to lower floors of all structures located less than 15 ft (5.1 m) above sea level and within 500 yards (455 m) of the shoreline. Massive evacuation of residential areas on low ground within 5-10 miles (8-16 km) of the shoreline may be required.

- Adverse Effects -

Physical Damage
Structures are damaged and even destroyed by the force of the wind, floods, waves and landslides. There is frequent interruption of telecommunications (fallen antennas, telephone and power lines), blocked roads, and damaged wharves that limit air and maritime traffic. These facts make it difficult to furnish timely information and hinder response operations in general. There is damage and destruction to crops, caused by high wind, big waves and increase in salinity concentration resulting from seawater in the crops, and even an increase in salinity concentration of underground water used for consumption.

Health
Since it is possible to signal a state of alert for a hurricane, there is usually an apparent discrepancy between the great physical destruction and the low morbi-mortality.

Mortality
There may be some deaths due to the huge waves and high winds.

Morbidity
Minor lesions, wounds and contusions caused by flying objects. In response to the event, local health resources mostly concentrate their efforts on emergency activities, often neglecting routine programmes, such as fumigation. In areas with endemic pathologies, this can give rise to an increase in malaria cases and other vector transmitted diseases.

- Life Lines -

Drinking water and sewers
Contamination of wells and water deposits from flood waters and large waves is possible. In some cases this contamination can be caused by the proliferation of pathogenic micro-organisms in decomposing animal carcasses in water supplies or sources; or due to backwash, obstruction or damage to drainage systems. Where drinking water and sewers are concerned, alternative water sources must be provided for some days or weeks.

Energy, telecommunications and transportation
Destructive effects on power networks are common, resulting in short circuits. On occasions, service suspension is due to safety reasons, while checks are being made on networks to prevent failures and short circuits, or the effects of other accompanying events such as flooding that could constitute a potential risk.

The collapse of telecommunications is common for two reasons: first because networks and installations are affected, causing interruptions of service at the time it is most needed; the second is the aforementioned “telephone collapse”; in some cases both situations can occur simultaneously.

It should be noted that the new wireless telecommunications systems are less vulnerable and allow for rapid repair and return to service.

Transportation is affected by various factors, such as:

- collapse of traffic movement, caused by curious onlookers, disorderly evacuations, lack of coordination by transit authorities, deficiency or failure of the traffic light system;
- obstruction from rubble, trees, fallen posts across roadways;
- temporary closure of roadways due to nearby work;
- indiscriminate and unnecessary use of vehicles.

- Productive Infrastructure -

Agricultural and Livestock Sector (Primary Sector)

The combination of strong winds and intense rains, with or without flooding can ruin crops and plantations. Some stored food products may have been damaged either from contamination or from being stored in destroyed installations. In some cases food availability may increase for a short period due to the need to quickly gather crop products to avoid later damage from salinity or other factors.

Industrial and Manufacturing Sector (Secondary Sector)

This sector is not commonly affected; some difficulties can occur as a result of damage to the structure of facilities or paralysis of the production process due to failures or interruption in public utilities. In some cases marketing difficulties and the population's reduction in purchasing power can create losses.

Banking, Tourist and Trade Sector (Tertiary Sector)

From the pre-disaster stage when an alert is declared until the post disaster period, some cases of paralysis in the daily activity of exposed communities can be observed. This absence of activity leads to a decrease in purchasing power. Areas exposed to hurricanes generally coincide with tourist and business zones, explaining the many cases of significant and prolonged damage to affected industries.

Frequent post-disaster needs

- Search and rescue, especially in urban areas; teams should be able to respond immediately and during the first 48-72 hours;
- Medical and surgical assistance during the first 72 hours;
- Heavy machinery and removal equipment;
- Epidemiological supervision;
- Restoration of telecommunications;
- Provision of potable water supply and water purification systems;
- Control in handling of food supplies;
- Materials for emergency shelters (rolls of plastic);
- Provisional energy generation;
- In crop zones, maintenance and storage of seeds that can be planted immediately.

Floods

Causes
There are different types of floods:

- floods caused by rivers overflowing their banks (flatland currents);
- flash floods (steep gradient currents);
- floods caused by torrential rains and lack of absorption and drainage;
- coastal flooding.

Overflowing rivers are caused mainly by intense rains or thawing at the sources of hydrographic basins.

Flash floods result from localised torrential rains, with or without landslides, where the soil is rapidly saturated and all the precipitation converges in the river bed.

Coastal floods are caused by the incursion of seawater along exposed coasts.

It is increasingly common to find floods caused by human intervention, as in the case of the rupture of dykes. After a dyke is constructed, it is common for the solutes from the river to form sediments which raise the level of the river bed which, in turn, requires raising the height of the dyke.

Thus, a never-ending cycle starts, which leads in many cases to rivers being at a level higher than the surrounding land, becoming a serious threat to inhabitants and crops. For this reason, a dyke requires permanent maintenance, dredging of its channel and the preservation of the basin upriver.

Undoubtedly, degradation of the environment, deforestation, certain land use techniques and, in general, alterations to the ecosystem of hydrographic basins, tend to encourage flooding.

However, it is important to clarify that in many cases floods are not really unlucky or random events, or caused by human intervention or abnormal natural phenomena. Sometimes they follow defined patterns through which basins regulate the increase of rains over extensive zones by flooding (cushioning effect); also contributing to the irrigation and fertilization of lands temporarily covered by water.

Many of the lands described are used for urbanization or agricultural development, and thus become exposed to “floods” during the historically established flooding seasons.

Lastly, floods generated along coasts, especially by secondary waves from storms and hurricanes, originate from a decrease in atmospheric pressure that raises the level of the water and creates intense winds. Similar situations are found in the so-called “Niño Phenomenon” along the Pacific coasts of South America and in tsunamis.

Characteristics
Overflowing is generally seasonal; we can see how river levels slowly rise, reaching the overflow level. Flash floods are characterised by their rapid onset and development, quickly showing their demolishing power. When waves generated from storms and other meteorological phenomena hit the shore, the flooding of extensive coastal areas is commonly observed.

- Adverse Effects -

Physical Damage
Overflows have low destructive potential, except in zones with cultivated plains where land could remain under water for many weeks or even months, depending on the slope, drainage and absorption of the terrain.

Serious damage is common in steep gradient zones, and depends on the incline and morphology of the basin, the occurrence of concomitant landslides and small blockages, intensity of rains, and finally on the degree to which infrastructure and human settlements are exposed to the phenomenon.

Coastal floods have great destructive power. On hitting the coastline, they impact with great force and then withdraw suctioning, dragging and eroding, causing far greater damage than on their arrival. The effects of this were already described in the section on hurricanes.

Health
Health implications can be of varying degrees. In overflows there is environmental damage, but no direct aggression against individuals; flash floods, on the other hand, can cause a great number of victims. The case of hurricane waves has already been described.

Mortality
The death toll can be high during flash floods, and often when large waves are formed.

Morbidity
There are few minor lesions, wounds and contusions caused during floods. An increase in snake bites has been reported, caused by both animals and humans tending to gather in the same non-flooded areas. Similarly, there is evidence of an increase in the vector population following floods. As is the case for all disasters, it is common for local health resources to focus their activities on emergency response, thus neglecting routine programmes, such as fumigation. This neglect, combined with the presence of stagnant water pools, encourages the proliferation of malaria and dengue vectors.

- Life Lines -

Drinking water and sewers
Wells contaminated by water deposits left flood water is common, originating sometimes from overflowing latrines, dry wells and even sewers.

Water supply is frequently interrupted when aqueduct intakes are obstructed with material dragged by the overflowing river basin. There may also be severe damage to facilities, intakes or distribution pipes. Consequently, alternative water sources are required for some days or weeks.

Energy, telecommunications and transportation
Damage to power supply systems is not common during slow or flatland floods; in some cases networks can be affected or there can be a risk of short circuits, requiring a preventative shut down of the power supply. In steep gradient floods, power service infrastructure may be affected due to their vulnerability.

As in the case of electrical power, the collapse of telecommunications during flatland floods is rare; however, flash flood damage may be severe.

Transportation is affected by various factors, such as:

- collapse of traffic movement, caused by curious onlookers, disorderly evacuations, lack of coordination by transit authorities, damaged or complete failure of the traffic light system;
- damage to roadways from flooding; destruction or damage to bridges and their access routes;
- obstruction by rubble, trees, fallen posts across roads;
- temporary closure of roads due to nearby work;
- unnecessary use of vehicles outside of the public transport system.

- Productive Infrastructure -

Agriculture and Livestock Sector (Primary Sector)

Depending on the time they occur, floods can ruin crops and plantation fields. Collection and storage centres can usually be preserved, but a long-term shortage could result from crop destruction as, once the reserves are exhausted, there is no way to replace stock. This happens frequently in indigenous or relatively isolated rural communities.

As with hurricanes, food availability could increase briefly due to the need to quickly gather and stock the products in order to avoid subsequent damage from flooding. In the case of sea water flooding, the increased salinity could make the soils sterile for a long period of time, in contrast to what happens with overflows where sediments swept down by river channels constitute an excellent fertilizer for future crops.

On the other hand, grazing animals frequently face difficulties in these circumstances, resulting in shortages of meat, milk and dairy by-products.

Industrial and Manufacturing Sector (Secondary Sector)

It is not common for this sector to be affected, except where physical damage to structures of facilities cause adverse conditions (flash floods), or when production is paralyzed by temporary flooding or interruption of public utilities services. Losses from poor marketing conditions and diminished purchasing power are possible.

Banking, Tourist and Trade Sector (Tertiary Sector)

Except in cases of intense physical destruction, the temporary economic recession in these sectors is over when flooding recedes; however, in some cases it could last for years.

Frequent post-disaster needs

- Search and rescue, especially in urban areas; teams should be able to respond immediately and during the first 48-72 hours;
- Medical and surgical assistance during the first 72 hours;
- Heavy machinery and removal equipment;
- Epidemiological supervision;
- Restoration of telecommunications;
- Water purification systems;
- Control in handling food supplies;
- Materials for emergency shelters (rolls of plastic);
- Provisional energy generation;
- In crop zones, maintain and store seeds that can be planted immediately.

Earthquakes

Causes

Movements of the earth's crust generate intense deformations in the earth's interior, accumulating energy which is suddenly released in the form of waves that move the land surface, resulting in earthquakes, tremors or seismic movements.

They occur more frequently in the so-called Pacific belt and in the Mediterranean-Himalayan belt, although they can occur in any other zone.

Primary effects of a quake:

- destruction from vibration
- liquefaction occurs in sandy soils, saturated with water, usually located near rivers or seas, or in places where lakes or lagoons lay in the past. These soils lose consistency when earthquakes occur, and during the earthquake's vibration lose their bearing capacity, that is, their ability to hold up the structures built there.

Secondary effects of a quake:

- landslides
- fires
- floods, caused by rupture of pipes, rupture of water dams, or by landslides and damming of river beds with subsequent avalanches
- spills of chemical products

Characteristics

Earthquakes appear suddenly, frequently followed by tremors that can last from hours to days, depending on the depth at which the movement is generated. Damage is produced by vibration, faults and cracks in the earth's surface, rising and falling of the terrain, liquefaction and landslides.

To compare one earthquake to another, two types of measurement are used: *magnitude and intensity*.

Magnitude is the measurement of energy released at the focal point or hypocentre (point of origin within the earth where the movement comes from and which is itself the cause of the quake). It is calculated by tracing the effect of seismic waves on a device known as a seismograph, situated at a particular distance from the epicenter (the point on the surface of the earth situated above the focal point).

The best-known scale for measuring magnitude is the Richter scale, where the magnitude of the smallest quake is close to zero and where the magnitude of the strongest quake recorded is 9.0 [December 26, 2004 – Indian Ocean: Tsunami]

On this scale, a one degree shift represents a change of released energy equal to approximately 32 times.

Intensity expresses the destructive effects at the site where is measured. The best known scale is the 12 level Modified Mercalli Scale. This scale registers lesser to greater intensity according to the degree of destruction, and varies from 1 (when only detected by very sensitive measuring instruments) up to 12, when it is classified as almost total destruction.

Table 1 MODIFIED MERCALLI SCALE
[Source: CDERA]
See Appendix 5 - Comparing the Richter and Modified Mercalli scales

I.	**Instrumental.** Not felt except by a very few under especially favourable conditions detected mostly by Seismography.
II.	**Feeble.** Felt only by a few persons at rest, especially on upper floors of buildings.
III.	**Slight.** Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration similar to the passing of a truck.
IV.	**Moderate.** Felt indoors by many, outdoors by few during the day. At night, some awakening. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like a heavy truck striking building. Standing motor cars rock noticeably.
V.	**Rather Strong.** Felt by nearly everyone; many awakened. Some dishes, windows broken. Un-stable objects overturned. Pendulum clocks may stop.
VI.	**Strong.** Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII.	**Very Strong.** Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in ordinary structures; considerable damage in poorly built or badly designed structures.
VIII.	**Destructive.** Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX.	**Ruinous.** Damage considerable in specially designed structures; well designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X.	**Disastrous.** Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bend greatly.
XI.	**Very Disastrous.** Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bend greatly.
XII.	**Catastrophic**. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

- Adverse Effects -

Physical Damage
Damage and destruction of human settlements, buildings, structures, bridges, bypasses, railway lines, water storage towers, water treatment facilities, sewers, pipes, electrical lines, transformer stations. Reverberations (tremors) can cause great damage to infrastructure that has already suffered as a result of the main earthquake. Secondary effects such as fires, cracks and leaks in dams, landslides, rupture of pipes causing subsequent flooding, damage to facilities where

hazardous chemicals are produced or stored, and failure of telecommunications systems, can be serious.

Health

Mortality
The number of deaths is often high, especially when earthquakes occur in densely populated areas, large grouping of housing units, places where there is a failure to observe seismo-resistant building specifications, unstable soils, non-reinforced multi-story housing, and houses with heavy roofs. The hour of the event also has an effect on the number of victims, being higher when it occurs at night. Under similar conditions, the morbi-mortality rate usually decreases as the distance from the epicenter increases.

Morbidity
Health centres will receive patients with trauma-type wounds. Other types of disease or sickness can be present as secondary effects, such as in the case of floods caused by earthquakes, poor disposal of solid waste (garbage) and liquid waste (sewage water), contamination of water sources with resulting water-borne pathologies (severe diarrhea, cholera, dysentery, etc.). Inadequate food handling, and large gatherings of people following the event, can give rise to overcrowding and deterioration of environmental conditions.

Frequently, many health problems arise not from the direct or indirect effects of the disaster, but rather because the area's health personnel tend to concentrate their efforts on the emergency, thus neglecting daily programmes such as the fumigation of endemic malaria or dengue fever zones, or vaccination programmes (normal immunization programmes). Interruption of these activities can cause an increase in vector populations (mosquitoes transporting infectious agents) causing an increase in malaria or dengue cases, or can cause epidemics of immuno-preventable diseases, such as measles.

- Life Lines -

Drinking water and sewers
Among the many factors that can cause problems are:

- rupture of water and sewerage pipes with resulting water contamination;
- damage to water dams, inability to use them, and water supply deficits;
- interruption in water treatment facility services, inability to use them and therefore a reduction in the quality and quantity of supply. This interruption could be caused by landslides, from obstruction without physical damage to the plant, or from cracking, collapse or physical damage to the structure of the treatment plant;
- damage to well walls and pipes;
- changes in the geological structure of springs and natural wells with variation in their levels, and even the drying up of some of them.

Energy, telecommunications and transportation
Direct effects of the earthquake on power transformer stations and even more so on power lines and networks are common; short circuits occur frequently, an important factor giving rise to fires.

The final result is the direct interruption of the power supply caused by the quake, or suspension of service for safety reasons, while checks on networks and connections are made to prevent failures, short circuits, or the effects of other related events such as gas leaks and floods that could increase the potential risk.

The collapse of telecommunications is usually due to two factors;

1. damage in networks and facilities, resulting in an interruption of service at the time it is most needed;
2. post-disaster demand exceeds the capacity of the equipment causing the so-called "telephone collapse".

Both situations can occur simultaneously, with the loss of some of the communication networks and the collapse of others. It is worth noting that the newer wireless telecommunications systems are less vulnerable and allow for more rapid repair and restoration of their operation, at substantially lower costs than with conventional systems.

Transportation is affected by various factors, such as:

- collapse of traffic movement, caused by curious onlookers, disorderly evacuations, lack of coordination by transit authorities, deficiency or failure of the traffic light system;
- damage to roadways, cracks, collapse of bridges;
- obstruction from rubble, trees, fallen posts across roadways;
- temporary closure of roadways due to nearby work;
- indiscriminate and unnecessary use of vehicles.

- Productive Infrastructure -

Agriculture and Livestock Sector (Primary Sector)

Generally, earthquakes do not cause problems with food production. Secondary floods caused by rupture of dams or by overflowing rivers, creeks, or canals blocked by rubble or landslides, may affect crops. What usually happens is an adverse alteration in transportation and marketing; more important is the decrease in the affected population's purchasing power. This means that even when food is available, people lack the means to buy it.

Industrial and Manufacturing Sector (Secondary Sector)

It is common for this sector to be affected, especially by physical damage to structures, which causes disruption to processing, production and storage.

Banking, Tourist and Trade Sector (Tertiary Sector)

Because of damage to physical infrastructure and life lines, there is frequently an interruption in customer services during the post-disaster phase which causes disruption

to the general population. Tourist and trade sectors can be seriously affected for prolonged periods, generating substantial economic losses that also have repercussions on the informal economy in tourist zones.

Frequent post-disaster needs

- Search and rescue, especially in urban areas; teams should be able to respond immediately and during the first 48-72 hours;
- Fire control;
- Traffic and crowd control;
- Medical and surgical assistance during the first 72 hours;
- Restoration of telecommunications;
- Provision of potable water supply;
- Control in handling of food supplies;
- Materials for emergency shelters (rolls of plastic);
- Transportation for personnel in charge of relief, damage assessment and life line rehabilitation.

Tsunamis

Causes
If movement in the earth's crust such as that described for earthquakes occurs in the ocean floor, it could form and propagate extremely high waves; this phenomenon is called a tidal wave or tsunami, a Japanese word now used internationally that literally means "large waves in ports".

Characteristics
If the tsunami originated nearby, it will cause the same damage described for an earthquake, in addition to destruction caused by the crashing of the wave and its undertow, contamination and flooding with brackish water. If the tsunami originated some distance away, it can move a great volume of water, creating a wave that can travel at 800 km/hr at deep sea. In shallower waters the speed decreases, with smaller waves following at intervals of 20-30 minutes. For this reason the impact of a single tsunami will vary noticeably from one place to another depending on the topography of each site.

- Adverse Effects -

Physical Damage
The tsunami generates simultaneous situations such as the dragging effect of the wave as it returns to sea, causing erosion of foundations, shifting of structures, collapse of bridges and contention walls. The impact of the wave frequently damages port facilities as well as vessels. In some cases, it can result in great loss of human life in exposed coastal towns. Heavy objects dragged around (vehicles and boats) can cause further damage.

Health

Mortality
The death toll will greatly depend on the possibility of signaling an early alert, as well as on the topographic characteristics of the coast and the presence of communities in the areas exposed to the event. The time of the event is also an important factor; the number of victims will be higher if the event takes place at night.

Morbidity
As in the cases of earthquakes, health centres will receive patients with trauma type wounds. Secondary effects can also occur, such as those mentioned for earthquakes.

- Life Lines -

Drinking Water and Sewer
Energy, telecommunications and transportation.
For tsunamis originating nearby, the effects will be the same as those described for earthquakes.

Productive Infrastructure

Agricultural and Livestock Sector (Primary Sector).

Usually tsunamis do not generate important losses, except in cases where sea water flooding causes loss of crops and delay in land recovery for agricultural and livestock use. However, the fishing industry can experience significant losses due to damage to vessels and harbours, as well as due to time lost responding to the emergency, which uses up important resources that otherwise would have been used for fishing activities.

Industrial and Manufacturing Sector (Secondary Sector)

This sector is more commonly affected by tsunamis originating nearby, or in situations where sources of raw materials are affected, as in the case of fish and seafood processing industries.

Banking, Tourist and Trade Sector (Tertiary Sector)

Tourist and trade sectors can be seriously affected for prolonged periods of time, generating substantial economic losses that also have repercussions on the informal economy in tourist zones.

Frequent post-disaster needs

- Search and rescue, especially in urban areas; teams should be able to respond immediately and during the first 48-72 hours;
- Fire control;
- Traffic and crowd control;
- Medical and surgical assistance during the first 72 hours;
- Restoration of telecommunications;
- Provision of potable water supply;
- Control in handling of food supplies;
- Materials for emergency shelters (rolls of plastic);
- Transportation for personnel in charge of relief, damage assessment and life lines rehabilitation.

Volcanic Eruptions

Causes
An eruption is the transfer of matter (magma), ash and gases from the earth's interior to its surface. The volume and magnitude of an eruption will vary according to the amount of gas, viscosity of the magma and permeability of ducts or chimneys. Magnitude and duration will vary not only from one volcano to another, but also within the same volcano. The frequency of eruptions is quite variable; some have continuous eruptions, while in others, intervals of hundreds or thousands of years take place between one eruption and the next.

Characteristics
Volcanic eruptions contain various elements. One or several may occur simultaneously. Among these we find ash emissions, pyroclastic rocks and bombs, pyroclastic and mud flows and even tsunamis, when these volcanoes are located near the coast. Even though volcanic activity is accompanied by seismic movements, these never reach sufficient magnitude or intensity to cause severe damage.

Ash emissions can be of differing intensity and cover extensive areas, depending on the wind speed and direction. Ash precipitates to form layers the thickness of which can vary from a few centimetres to almost 1 or 2 metres. The roofs of houses without sufficient slope can collapse from the weight of ash, especially if it rains at the same time. Acidity to crops caused by the ash can be neutralized by both irrigation and the application of special chemicals.

Ash is composed of small particles which are easily transported by the wind. Other much larger materials which, when expelled do not travel far, are the pyroclastic rocks that vary from a few centimetres to a few metres in diameter. The larger they are, the shorter the distance they travel from the crater.

Pyroclastic flows are considered to be the most dangerous elements arising from volcanic eruption. They appear when the column of gases and material expelled by the volcano is so heavy that it suddenly breaks apart, ceases its upward movement, and slides downward along the sides of the volcano. Their composition, volume, duration and speed will vary depending on the type of volcano. Flows have been described advancing at speeds of 100 km. per hour at temperatures above 1000 degrees centigrade. They can last up to 10 minutes, occurring sporadically or intermittently during volcanic eruptions.

Second in destructiveness to pyroclastic flows are mud flows. These can be caused either by volcanic activity, which causes a ice or snow to break off and thaw at the cone of those volcanoes situated at high altitudes, or by intense rainfall, or water spillage within the crater.

This phenomenon is characterized by a mixture of torrents of water with ash and volcanic products, as well as vegetation and minerals present on the surface of the cone; this forms a dense mixture similar to wet concrete, moving at speeds of up to 100 kph along the sides of the volcano. A mud flow can reach a temperature of more than 100oC or it can even be cold. It causes severe destruction along its path and deposits substantial amounts of material that can

reach several metres in height. The total destruction of towns is possible, as well as changes to the course of rivers and creeks.

Lava flows and gases emanating from volcanoes are less dangerous. Lava is melted rock, a material that can be dense and move down mountainsides at speeds of a few kilometres per hour, or be more fluid and descend at tens of kilometres per hour, destroying everything in its path. However, because of its relatively slow speeds, a lava flow usually allows people and animals enough time to reach safety.

Gases are expelled in all volcanic eruptions. There have been cases in which toxic gases have caused deaths in small towns located very near the volcanoes.

- Adverse Effects -

Physical Damage
In the case of pyroclastic, mud and lava flows, the destruction of vegetation, crops, human settlements, roads, bridges, oleducts, aqueducts, power and telephone lines, located in their path, is expected. Some structures may collapse due to ash deposits; rains can help form a mass with a weight greater than one ton per cubic metre.

Floods are frequently caused by the effect of great quantities of volcanic material being dragged into rivers and ravines; this accumulation raises the water levels, modifying its course in many cases. Likewise, irrigation systems are affected, resulting in damage to the agricultural and livestock sector.

Health
Health effects will vary from one volcano to another and between eruptions of the same volcano. They will depend on the degree of exposure of persons and animals to different elements of the volcano, and the degree to which systems or life lines are affected, especially contamination of water sources, supplies and potable water treatment plants.

Mortality
Most deaths are caused by pyroclastic rocks, pyroclastic and mud flows and, to a lesser degree, by lava flows and toxic gases.

Morbidity
Severe injuries and burns are caused by rock fragments, pieces of lava, vapours and burning ash. Burns and injuries to lungs and the respiratory system are caused by breathing in vapour, dust clouds and hot gases. These types of gases are heavier than air; carbon dioxide can be very dangerous when it settles into dips in the terrain.

Health problems from water contaminated with chemical compounds, especially fluor, are possible.

- Life Lines -

Drinking water and sewers
Springs and brooks developing along the sides of volcanoes is common; these become part of the water sources that provide drinking water to the communities located near a volcano. Water supplies and treatment plants need to be protected by covering tanks and open ducts, adding substances that help coagulate and precipitate particles in suspension, and controlling chemical contamination.

In some instances, more extreme measures are required such as the suspension of service or the temporary dumping of large volumes of water (for days or even weeks), until the physical-chemical qualities that guarantee safe drinking water to users are re-established. This calls for the temporary supply of water in bags, bladders, bottles, cans, drums or cistern-cars until the regular drinking water supply is restored. Energy, telecommunications and transportation Occasionally, volcanic eruptions are accompanied by electrical discharges that can harm power transforming stations; however, except in cases of thawing, pyroclastic, mud or lava flows, electric networks and power lines are not usually affected.

During ash and gas emissions there might be interference with radio communications, especially in portable communications systems. This can affect evacuation, relief, rescue efforts, and air-to-land communications, disrupting air navigation. Communications by cable (traditional telephone) are usually left intact, although there is often a "telephone collapse" due to the sudden surge inpost-disaster demand. In some cases volcanoes are selected as sites for the location of repeater stations due to their height, thus increasing the vulnerability of systems.

Transportation is affected by various factors, such as:

- collapse of traffic movement, caused by curious onlookers, disorderly evacuations, lack of coordination by transit authorities, deficiency or failure of the traffic light system;
- damage to roadways, cracks, collapse of bridges;
- obstruction from rubble, trees, fallen posts across roadways;
- temporary closure of roadways due to nearby work;
- indiscriminate and unnecessary use of vehicles.

Productive Infrastructure

Agricultural and Livestock Sector (Primary Sector)

Following a volcanic eruption there are three situations that can have an effect on food supplies:

- Pyroclastic, mud or lava flows affect vegetation, destroying agricultural areas, human settlements, roads and bridges with resulting impact on production, transportation, storage and marketing of agricultural products.
- Economic impact on the zone, resulting in a lack or decrease of purchasing power among the inhabitants of the area.
- Contamination of extensive zones by ash and chemicals coming from the volcano that make lands unusable and require prolonged and costly irrigation, chemical treatment and ploughing to recover the farming capacity of the terrain.

These situations may occur simultaneously, requiring immediate action for food supply and, in many cases, medium- and long-term recovery actions.

Industrial and Manufacturing Sector (Secondary Sector)

It is not common for this sector to be affected, except in cases where proximity to the volcano threatens its physical facilities; in some cases losses have been reported due to disruption to marketing, as well as from decreases in purchasing power of the population.

Banking, Tourist and Trade Sector (Tertiary Sector)

During the stage prior to the disaster and into the post-disaster period, an economic recession can result, caused by the doubt or certainty that damage will occur, and also by a certain apprehension regarding the ability to pay bank loans and deliver merchandise under deferred payment. Purchasing power is diminished. Contrary to other situations, if there is no damage to hotel infrastructure, an increase in demand is commonly observed.

Frequent post-disaster needs

Needs should be met immediately from local sources for:

- Evacuation support;
- Search and rescue, especially in urban areas; teams should be able to respond immediately and during the first 48-72 hours;
- Fire control;
- Traffic and crowd control;
- Medical and surgical assistance during the first 72 hours;
- Restoration of telecommunications;
- Provision of potable water supply;
- Control in handling of food supplies;
- Materials for emergency shelters (rolls of plastic);
- Transportation for personnel in charge of relief, damage assessment and rehabilitation of life lines.
- Medium- and long-term credit and technical assistance for relocation and development of productive activities.

Landslides

Causes
Landslides occur as a result of sudden or gradual changes in the composition, structure, hydrology or vegetation of a descending or sloping terrain. These changes can be unleashed by:

- vibrations such as those caused by earthquakes, explosions, machinery, traffic;
- removal of the lateral support by erosion, geological faults existing in the slope, excavations, constructions, deforestation and loss of vegetation;
- overloading of the terrain caused by the weight of water, ice, snow or hail, accumulation of rocks or volcanic material, garbage and waste, buildings and structures loads, and even vegetation.
- strong rainfall, increased phreatic levels or water saturation.

In urban areas, where human actions induce the phenomenon, very specific factors exist, such as:

- interruption in water ways (for rain or drainage, sewers, drinking water);
- construction landfills that affect the stability of slopes;
- the weight of structures.

Characteristics
In most cases, landslides occur as secondary effects caused by other events such as strong storms, earthquakes and even volcanic eruptions. They are characterised by detachment and slippage of rocks or other materials on steep slopes or escarpments, like rapidly moving mud flows that can cover great distances.

- Adverse effects -

In general the adverse effects are similar to those described for seismic events; however, their impact is limited to a contained or specific area.

Physical damage
There is destruction of infrastructure and settlements located along the path of the landslide. It is common for roadways and rivers to be blocked, with the resulting risk of damming and flooding.

Health
Because these are confined events, morbi-mortality is directly proportional to population density and the mass of matter displaced.

Mortality
Mortality is high when slides occur in densely populated areas; deaths can be caused by the direct effect of land movements or by destruction of housing or structures, collapsing or caving in on people and property. As with quakes, the hour of the occurrence is another determining factor. The number of victims is greater when it occurs at night, but contrary to earthquakes, the affected area is limited and therefore the effects are more confined.

Morbidity
Characteristically, health centres will receive patients with trauma-type injuries.

- Life Lines -

Drinking water and sewers
Situations similar to those described for earthquakes may occur, but confined to a limited area:

- rupture of water and sewerage pipes with resulting water contamination;
- interruption in water treatment facility services, inability to use them, and therefore a reduction in the quality and quantity of supply. This interruption could be caused by landslides, from obstruction without physical damage to the plant, or from cracking, collapse or physical damage to the structure of the treatment plant. The population may also be transferred to some other community, overloading the demand on public utilities and significantly altering the quality and quantity of supplies.

Energy, telecommunications and transportation
Landslides have limited effects; therefore, electrical systems and networks are rarely affected, except in particular or exceptional circumstances (the presence of a high tension tower in the landslide zone).

Rarely is there interruption in communications service, except for the so called "telephone collapse" or when lines are located in the zone of the event.

Transportation is affected by various factors, such as:

- collapse of traffic movement, caused by curious onlookers, disorderly evacuations, lack of coordination by transit authorities;
- obstruction from rubble, trees, fallen posts across roadways;
- temporary closure of roadways due to nearby work;
- indiscriminate and unnecessary use of vehicles.

- Productive Infrastructure -

Agricultural and Livestock Sector (Primary Sector)

There are no food production problems in the case of landslides. In some cases, earth movements can generate secondary floods when rivers, ravines or channels are blocked by rubble or slides; although this could affect crops, this type of situation does not usually occur.

Industrial and Manufacturing Sector (Secondary Sector)

This sector is not affected, except when the proximity of the landslide causes damage to the structure of its facilities.

Banking, Tourist and Trade Sector (Tertiary Sector)

Because of its confined characteristics, it is not common for this sector to suffer, except from direct damage to facilities.

Frequent post-disaster needs

- Search and rescue, especially in urban areas; teams should be able to respond immediately and during the first 48-72 hours;
- Heavy machinery and removal equipment;
- Medical and surgical assistance during the first 72 hours;
- Control in handling food supplies;
- Materials for emergency shelters (rolls of plastic).

Droughts

Causes
Irregular or insufficient rains, inadequate use of underground water, water deposits or irrigation systems.

Characteristics
Droughts are slowly evolving events that last for months, years, decades or even centuries, and whose consequences are observed gradually: decrease in sources of drinking water, diminishing crop water, death of animals, etc.

- Adverse Effects -

Physical Damage
Effects will vary significantly depending on intensity, duration of the drought, extent and obviously, pre-existing conditions. A short drought could affect crops with immediate consequences of a drop in food supplies, until the next harvest comes. If the drought persists it could affect several harvests and eventually reach the point of famine.

Health
Mortality
It is the result of extreme morbidity conditions described below: dehydration, malnutrition and viral diseases, especially measles.

Morbidity
Dehydration can occur from diminished water consumption; morbidity also includes diseases derived from poor use of limited water resources, such as diarrhea and malnutrition; infant viral diseases, especially measles; and other diseases resulting from deficiencies and infections caused by the population's general condition of weakness. Droughts can generate migrations of communities which disrupt family ties and have a severe impact on the infant population.

- Life Lines -

Drinking water and sewers
Characteristically and by definition these services are insufficient. One of the first options in searching for water is drilling wells, an activity that could soon after alter the moisture level in the land itself, thereby aggravating the process. Rational distribution and use of available water resources and long-term work in land use and recovery is recommended.

Energy, telecommunications and transportation
Areas exposed to drought and socio-economically depressed zones coincide in their overall deficiency or absence of infrastructure. For this reason, we will not describe here the impact of droughts on a system that is practically nonexistent. Therefore, any work performed in these regions will require mobile power generating systems, portable (wireless) telecommunications

systems and transportation that has been organized for self-sufficiency (all-terrain vehicles, cistern cars, mobile repair shops, etc.).

- Productive Infrastructure -

Agriculture and Livestock Sector (Primary Sector)

> During droughts, serious shortages in food supplies are evident since even seeds are used as food, which interrupts the cycle of agricultural production. Research and consultation in search of drought-resistant crop varieties as well as instructions on their planting and harvesting, constitute the key for a long-term solution. In the livestock sector, impact is created by water and feed shortages. During prolonged droughts, cattle ownership becomes a status symbol and cattle is used as currency or as a trade element. Changes caused in the ecology of the affected region can become practically irreversible.

Industrial and Manufacturing Sector (Secondary Sector) and Banking,
AND
Tourist and Trade Sector (Tertiary Sector)

> Given the characteristics of the territories affected by droughts, development of productive infrastructure other than the shrunken agricultural and livestock sector is usually minimal or non-existent. Limitations in access to public utilities, the absence of purchasing power and serious limitations on labour impede development.

Frequent Post-Disaster Needs
Because this is a prolonged process that develops slowly, post-disaster measures tend to be tied to those developed in the mitigation stage.

Appendices

Appendix 1	Quick Check-List for Frequent Post Disaster Needs List
Appendix 2	Form 1: Local Situation Report Form Form 2: Damage Assessment Report Form Form 3: National Damage Assessment Report Form
Appendix 3	DANA Field Guides
Appendix 4	Comparing the Richter and Modified Mercalli scales
Appendix 5	Committee Structure

APPENDIX 1 - Quick Check-List for Frequent Post Disaster Needs List

[SOURCE: OFDA/DANA Field Guide]

Tropical Storm / Hurricanes

- Search and Rescue, particularly in urban areas, teams should be able to operate immediately and during the first 48 – 72 hours.
- Medical / Surgical assistance during the first 72 hours
- Heavy Machinery and Removal Equipment
- Emergency Shelter Materials [rolls of plastic]
- Food Supply control and handling
- Water purification systems
- Epidemiological supervision
- Re-establish communications
- Provisional power generation

Floods

- Search and Rescue, particularly in urban areas, teams should be able to operate immediately and during the first 48 – 72 hours.
- Medical / Surgical assistance during the first 72 hours
- Heavy Machinery and Removal Equipment
- Emergency Shelter Materials [rolls of plastic]
- Food Supply control and handling
- Water purification systems
- Epidemiological supervision
- Re-establish communications
- Provisional power generation
- In planning zones, preserve seeds that can be planted immediately

Landslide

- Search and Rescue, particularly in urban areas, teams should be able to operate immediately and during the first 48 – 72 hours.
- Medical / Surgical assistance during the first 72 hours
- Heavy Machinery and Removal Equipment
- Emergency Shelter Materials [rolls of plastic]
- Food Supply control and handling

Earthquake and Tsunamis

- Search and Rescue, particularly in urban areas, teams should be able to operate immediately and during the first 48 – 72 hours.
- Fire Control
- Traffic and Public Control

- Medical / Surgical assistance during the first 72 hours
- Re-establish communications
- Drinking Water Supply
- Food Supply control and handling
- Emergency Shelter Materials [rolls of plastic]
- Transportation for personnel in charge of relief, DANA and lifeline rehabilitation

Volcanic Eruptions

- Evacuation Support
- Search and Rescue, particularly in urban areas, teams should be able to operate immediately and during the first 48 – 72 hours.
- Re-establish communications
- Drinking Water Supply
- Food Supply control and handling
- Emergency Shelter Materials [rolls of plastic]
- Transportation for personnel in charge of relief, DANA and lifeline rehabilitation
- Credit and Technical assistance for development of productive activities in medium and long term

Drought

- Efficient handling of water, by means of adequate storage, channels, irrigation systems etc.
- Crop diversification in search of species of low water consumption
- Search for and use of deep water, without exceeding allowed limits
- Supply of appropriate seeds
- Supply of inputs and technology to guarantee survival of cattle
- Early installation of nutritional monitoring system
- Installation of an information system on
    - climatic conditions,
    - probable plagues,
    - food production estimates,
    - drinking supply,
    - population shifts,
    - health and environmental sanitation problems.
- Development of a monitoring system on climatic conditions that will provide some predications on medium and long term trends, in order to allow the use of agreed measurers when signals or indicators show a deterioration in the conditions being monitored.

APPENDIX 2 - FORMS
Form 1

SITUATION REPORT

EMERGENCY OPERATIONS CENTRE

EVENT:	
DATE OF EVENT:	
SITUATION REPORT NO.:	
DATE: ***TIME:***	

NATURE OF EVENT:

AREAS AFFECTED:

CASUALTIES:

ACTIONS TAKEN:

NEEDS ASSESSMENT:

WELFARE/RELIEF:

DAMAGE:

1. CRITICAL FACILITIES

a) Hospitals/Health Centres:

b) Police Stations:

c) Fire Stations

d) Electricity:

e) Emergency Shelters

f) Water:

2. **INFRASTRUCTURE**

a) Roads

b) Bridges

c) Retaining Walls/River Training Works.

3. BUILDINGS

a) Public Buildings

b) Ports/Airports

c) Private/Commercial

d) Houses

4. AGRICULTURE

a) Crops/Livestock/Fisheries

5. TOURISM/COMMERCE/INDUSTRY

6. OTHERS

RESOURCES NEEDED:

ACTION TO BE TAKEN:

Contact:
E-Mail:
FAX#:

Form 2: Initial Damage Assessment Report [IDA]

This report is to be completed within 12 - 24 hours after the disaster has struck. This will be a detailed report containing information on damages to houses, roads, bridges, public utilities and private enterprises. The information gathered will be complied in order:

a) To assist NEMO and the Government of Saint Lucia in determining the magnitude of damage and estimating resources needed to recover from the disaster.
b) To assist NEMO and the Government of Saint Lucia in coordinating the allocation of additional resources to respond to the disaster or emergency and to begin short-term restoration of damaged facilities and disrupted services.

It will also be used to assist in the coordination and allocation of the available resources for the resumption and short-term repair to damaged facilities.

A detailed assessment of damages incurred requires sector specific knowledge and the knowledge of pre-disaster conditions. Damage assessment teams should have representatives from the affected areas, as well as representatives from the respective sectors.

For large-scale disasters the National DANA Team will be activated and this group will have the responsibility of collecting damage assessment information.

In assessing disaster events of a smaller magnitude, that is, within a District, the Chairperson of the District Damage Assessment Team [DDAT] will have the primary responsibility for preparing the Damage Assessment report. The data collection, for this report will be the responsibility of the DDAT. In cases where the event affects more than one District, the Chairperson for the National DANA is expected to submit the final damage assessment report. The respective Chairpersons of the DDAT will assist with supply of information for this report.

This form is to be complete as soon as possible using, the most accurate estimate available at the time of completion. It is to be used to report data for communities and or districts. In the event of large disasters information collected for each community/district is to be summarised and a total submitted for each District. When the form is being used to submit a summary for a District, a listing of all the towns involved is to be attached to the back of the form.

HOW DO WE ADDRESS THE PROTOCOL OF THE LINK BETWEEN THE DDAT, THE NATIONAL DANA CHAIR AND THE DIST DISASTER COM CHAIR?

Form 2

DAMAGE ASSESSMENT OF CRITICAL BUILDINGS

Date _____ Time _____ Inspector _____

A. BUILDING LOCATION

1. Address _____
2. District/Community _____
3. Owner _____ Tel. No. _____
4. Occupancy/Use

a. Public Buildings

☐ Cinema ☐ Community Centre ☐ City/town Hall ☐ Church
☐ Court house ☐ School
☐ Lecture Hall ☐ Theatre
☐ Other (please state) _____

b. Institutional Buildings

☐ Hospital ☐ Prison ☐ Orphanage
☐ Infirmary ☐ Other (state) _____

c. Commercial and Industrial Buildings

☐ Power Station ☐ Warehouse ☐ Commercial Laboratory
☐ Factory ☐ Aeroplane hangar
☐ Other (state) _____

d. Office, Administrative and Retail Service Buildings

☐ Banks ☐ Office ☐ Market/Shop/Store
☐ Civil Administration ☐ Radio/TV station
☐ Other (state) _____

e. Residential Buildings

☐ Apartment ☐ Guest house ☐ Halls of Residence
☐ Dormitory ☐ Private residence ☐ Tenement
☐ Hotel/Motel ☐ Other (state) _____

f. Buildings used for storing and/or processing hazardous materials

Hazardous material(s) stored _____

Hazardous material(s) process _____

B. DESCRIPTION OF BUILDINGS

Type of Construction

☐ Steel frame ☐ Bearing wall ☐ Reinforced concrete
☐ Wood frame ☐ Pre-cast concrete ☐ Block & steel masonry
☐ Brick masonry ☐ Wattle & daub ☐ Timber stud & hor. boarding
☐ Other (state) _____

Number of Stories _____

Typical Floor Area _____

Total Building Area _____

Type of foundation used

☐ Striped ☐ Assumed ☐ Confirmed
☐ Pile ☐ Assumed ☐ Confirmed
☐ Pad ☐ Assumed ☐ Confirmed
☐ Raft ☐ Assumed ☐ Confirmed
☐ Other (state) _____

C. CONSTRUCTION

1. Exterior Walls

☐ Wooden ☐ Nog ☐ Block & steel masonry
☐ Reinforced concrete ☐ Pre-cast concrete
☐ Other (state) _____

2. Roof

☐ Reinforced concrete slab ☐ Pre-cast concrete
☐ Steel Framing and sheeting ☐ Timber framing & sheeting
☐ Other (state) _____

3. Floors

☐ Pre-cast concrete ☐ Wooden ☐ Steel Deck

☐ Reinforced concrete slab ☐ Other (state) _____

4. Interior Walls

☐ Block & steel masonry ☐ Brick masonry ☐ Wooden
☐ Reinforced concrete ☐ Pre-cast concrete
☐ Other (state) _____

5. Partions

☐ Glass ☐ Bagasse ☐ Wooden

☐ Gypsum Panel ☐ Other (state) _____

6. Stairs

☐ Steel ☐ Wooden ☐ Reinforced concrete

☐ Other (state) _____

D. DAMAGE NOTED

ELEMENT	NONE	SLIGHT	MODERATE	SEVERE	TOTALLY DAMAGED
Exterior walls					
Frame general					
Frame members					
Frame connections					
Roof					
Floors					
Interior walls					
Partitions					
Stairs					
Foundations					
Falling Hazards					
Mechanical Equipment					
Elevators					
Glass					
Plumbing					
Electrical					

E. DEGREE OF DAMAGE TO BUILDING

	Yes	No
Minor – No Hazard	☐	☐
Damaged	☐	☐
Major Hazard	☐	☐
Severe Hazard	☐	☐
Safety jeopardised by unsafe adjacent building	☐	☐
Building damaged by fire	☐	☐
Falling Hazards:		
Boiler Ducts/Pipes	☐	☐
Fascade	☐	☐
Verandahs	☐	☐
Antennae	☐	☐
Elevated Water Tanks	☐	☐
Ornamentation	☐	☐
Light Fixtures	☐	☐
Ceilings	☐	☐
Air conditioning ducts & condensers	☐	☐
Cabinets	☐	☐
Transformers	☐	☐

F. SUMMARY OF STRUCTURAL DAMAGE

	Yes	No
Minor	☐	☐
Slight	☐	☐
Moderate	☐	☐
Severe	☐	☐

G. SUMMARY OF NON-STRUCTURAL DAMAGE

	Yes	No
Minor	☐	☐
Slight	☐	☐
Moderate	☐	☐
Severe	☐	☐

H. SOIL AND GEOLOGIC PROBLEMS

	Yes	No
Settlement	☐	☐
Liquefaction	☐	☐
Landslide	☐	☐
Faults	☐	☐

Others (state) _____

I. PHOTOGRAPHS

	Yes	No
Photographs taken	☐	☐
No. of rolls/frames taken	_____	

J. RECOMMENDATIONS

Total Demolition of building ☐ Yes ☐ No

Shoring and Bracing

- ☐ Not needed
- ☐ Needed to protect building
- ☐ Needed to protect adjacent building
- ☐ Needed to protect public safety

Re-inspection required ☐ Yes ☐ No

Inspector's signature: _____

Prepared by _____

Source: Ralph Field

DEFINITIONS

(Level 0) NO DAMAGE - No Damage

(Level 1) MINOR DAMAGE - means the item is damaged but may either be used for the intended purpose, or may be restored to service with minimal repairs.

(Level 2) MODERATE DAMAGE – means item can be safely occupied, used under limited conditions or reduced levels of service and may be returned to service with extensive repairs.

(Level 3) MAJOR DAMAGE - means the item is damaged to the extent that it is no longer usable but can be returned to service with extensive repairs.

(Level 4) DESTROYED - means the item is a total loss or damage is to the extent that it is no longer usable and that, repairs are not technically or economically feasible.

National Damage Assessment Report

This report is to be completed within 44 hours following the disaster and is to be used only for critical facilities after the initial situation report has been submitted. It is to be completed by the respective sectors and/or essential services and sent to the NEOC/NEMO.

The objective of this report is to

- Provide the Prime Minister within 48 hours of an event with a report on the situation.
- Help the NEOC/NEMO in determining the basis for the allocation of the available manpower and equipment. It also serves as a guide to both NEMO and the NDE to the critical facility (facilities) requiring the most immediate assistance.

The completion of this report form requires technical expertise and henceforth it is to be completed by experts within the respective sectors. If the National DANA Team is activated, it will have the responsibility for collecting data on the repair needs of the critical facilities within the area(s) assigned. The nature and scale of the event would determine the composition of the team. If a DDAT is activated its primary purpose will be to collect data on the critical facilities within the affected areas. Like the Recon Team, the composition will vary depending on the size and the nature of the event.

A separate form is to be completed for each critical facility/system. However, the following is to be specified as appropriate:

a) Water Supply System – storage area, distribution lines and/or source.
b) Electricity producing plants – type of power generating facility and size of transmission lines.
c) Telecoms
d) Road Net-work
e) Major Infrastructure
f) Ports

FORM 3: CRITICAL FACILITIES/SYSTEMS REPORT

Name of Facility:_____

Location of Facility:_____

Type of Facility:_____

District &/or Region: _____

Date:_____ Time:_____ Inspector:_____

Location of Problem/ Damage	Description of Damage	Type &/or Extent of Damage	Equipment	Personnel	Supplies	Repair Urgency

Prepared by_____

Source: Ralph Field

Appendix 3 DANA Field Guides

The Damage Assessment and Needs Analysis Field Guide [DANA/FG] is a field tool produced by the USAID/OFDA, that all members of the Damage Assessment and Needs Team should posses. It is a stand alone document and provided by the NEMO Secretariat.

The Initial Damage Assessment Field Guide [IDA/FG] is a field tool produced by the USAID/OFDA, that all members of the District Damage Assessment Team should posses. It is a stand alone document and provided by the NEMO Secretariat.

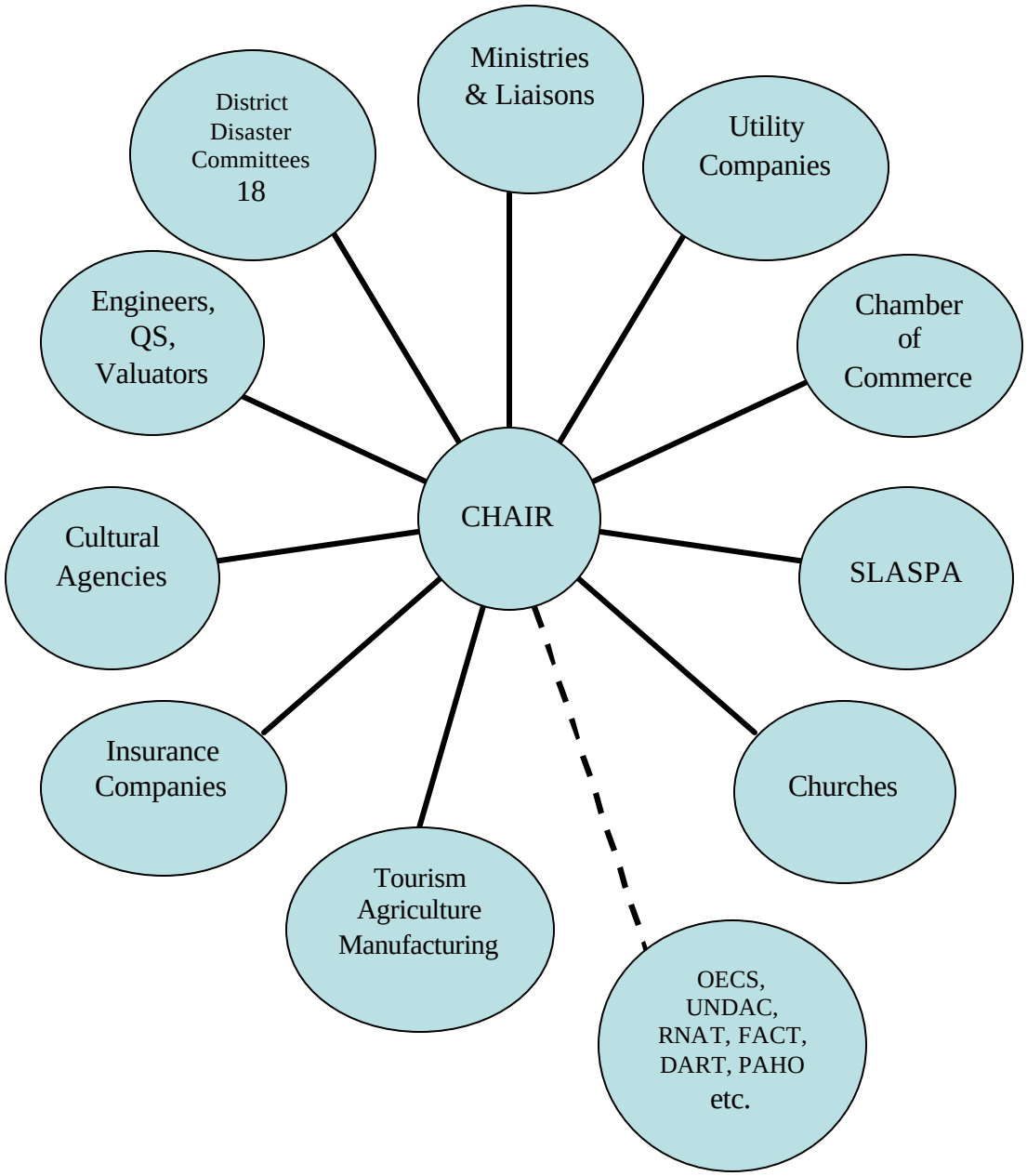
The Rapid Environmental Damage Assessment Manual [REA] is a field tool produced by the OECS Secretariat, that all Environmental Agencies/Members of the Damage Assessment and Needs Team should posses. It is a stand alone document, an electronic copy shall be provided to the Agencies by the NEMO Secretariat.

Appendix 4 - Comparing the Richter and Modified Mercalli scales
Remember - Richter measures energy of the seismic wave or shock while Mercalli measures the intensity or effect on the surface of the earth.

Richter	Modified Mercalli	Effect
2	I	**Instrumental.** Not felt except by a very few under especially favourable conditions detected mostly by Seismography.
	II	**Feeble.** Felt only by a few persons at rest, especially on upper floors of buildings.
3	III	**Slight.** Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration similar to the passing of a truck.
	IV	**Moderate.** Felt indoors by many, outdoors by few during the day. At night, some awakening. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like a heavy truck striking building. Standing motor cars rock noticeably.
4	V	**Rather Strong.** Felt by nearly everyone; many awakened. Some dishes, windows broken. Un-stable objects overturned. Pendulum clocks may stop.
5	VI	**Strong.** Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
	VII	**Very Strong.** Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in ordinary structures; considerable damage in poorly built or badly designed structures.
6	VIII	**Destructive.** Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of factory stacks, columns, monuments, walls. Heavy furniture overturned.
7	IX	**Ruinous.** Damage considerable in specially designed structures; well designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
	X	**Disastrous.** Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bend greatly.
8	XI	**Very Disastrous.** Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bend greatly.
	XII	**Catastrophic**. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Source: CDERA

Appendix 5 – DANA Committee Structure



FACT – Field Assessment and Coordination Team [Red Cross]
UNDAC – United Nations Disaster and Coordination Team
DART – Disaster Assessment and Response Team [United States/OFDA]
RNAT – Rapid Needs Assessment Team [CDERA]