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Introduction

Hurricane Mitch posed a major threat to the country of Belize during the last week of October 1998. The hurricane did not strike the country Yet, it precipitated tremendous response from the government, support agencies and the people of Belize It generated the greatest evacuation exercise the country has ever implemented This report will examine Belize's Hurricane Preparedness Plan and its implementation, the threat posed by Mitch, the effectiveness of the response, the government's assessment of its response, lessons to be learned and recommendations for improvements to Belize's hurricane preparedness plan and preparedness for emergencies and disasters in general

The report is based on the *Belize Disaster Management Plan/Hurricane Preparedness Vol. I Revised July 1997*, the reports of several of the Operational Committees and agencies which responded to the threat, recommendations to the Senior Minister, inter-ministerial correspondence concerning the response and recovery efforts, and personal correspondence with officials in the public and private sectors.

It is intended to serve as a record of the actions taken in response to the threat of Mitch. Disaster response agencies may wish to use it in refining their disaster preparedness plans. The National Emergency Management Orgarization may wish to consider the report including its recommendations when it revises the National Emergency Plan

The Office of the Prime Minister and Senior Minister, the Ministry of Foreign Affairs, the Ministry of Economic Development, the Ministry of Health, and the Belize Defense Force provided tremendous assistance. Charts were provided by the Land Information Center and the National Meteorological Service.

Belize's Disaster Preparedness Plan

Belize has had a Hurricane Preparedness Plan since the 1960's. This was prepared in response to disasters caused by hurricanes in Belize on several occasions. Memorable hurricanes to have affected Belize include the 1931 hurricane, Janet (1955) and Hattie (1961).

The plan was updated on several occasions. However, in 1997 a major revision of the plan was completed.

A National Emergency Management Organization (NEMO) is responsible for the implementation of the Belize Emergency Plan. NEMO is comprised of the members of Cabinet with the Prime Minister as its Chairperson. The Cabinet Secretary is the Secretary of NEMO. He is responsible for advising the Prime Minister of any potential emergency threats and recommending the activation of NEMO. He is also responsible for ensuring that the country is prepared to respond to the threat of all disasters.

The plan also calls for the establishment of a National Office of Emergency Management comprising of a National Disaster Coordinator, operational staff and the Chairpersons of the ten Operational Committees To date the National Disaster Coordinator has not been appointed; there is no dedicated staff or office. The Cabinet Secretary is the National Disaster Coordinator. He delegates the routine daily functions of disaster management to personnel from other ministries and departments.

NEMO has ten Operational Committees that are activated at different stages of an emergency. These are:

- The Education, Communication and Warning Committee,
- The Medical and Relief Measures Committee,
- The Housing and Shelter Committee,
- The Search, Rescue and Initial Clearance Committee,
- The Utilities Committee,
- The Collection, Control and Distribution of Food and Materials Committee,
- The Assessment and Evaluation of Damage Committee,
- The Foreign Assistance Committee,
- The Transport Committee, and
- The Environment Committee.

A Permanent Secretary is the Chairperson of each of the Operational Committees.

Every district, every town and Belize City is required to have its own Operational Emergency Committee The Mayor of each municipality is the Chairperson of his/her Emergency Committee. The Prime Minister appoints the Chairpersons of the District Committees Each Emergency Committee should liase with the NEMO (See Figure 1)

Each Committee is responsible for writing its emergency response plan. The Public Service Regulations stipulates that each Ministry and Department is required to prepare emergency plans to deal with all emergencies. (Paragraphs 194 and 195 of Public Service Regulation, 1996 No.153 of 1996)

The Belize Hurricane Preparedness Plan has clear written guidelines for the activation of the Emergency Plan and NEMO. The plan has four phases.

Phase I is declared if :

(i) a tropical depression is south of 21 degree north latitude and west of 80 degrees west longitude, or

(ii) a tropical storm or hurricane is south of 21 degrees north latitude and between 80 and 83 degrees west longitude, or

(iii) a tropical storm or hurricane will strike the coast within 36 hours.

Phase II is declared if.

(i) a tropical storm or hurricane is south of 20 degrees north latitude and between 83 and 85 degrees west longitude, or

(ii) a tropical storm or hurricane will strike the coast within 24 hours.

Phase III is declared if the tropical storm or hurricane is south of 20 degrees north and west of 85 degrees west. The system is expected to strike the country within a matter of hours.

The latitudes and longitudes mentioned act only as guidelines in the decision making process of declaring the phases of the emergency plan. The time required to implement actions to prepare for the onset of hurricane conditions is the critical element. This plays a much more important role in the advice given by the Chief Meteorologist to the NEMO.

Phase IV is declared whenever the system no longer poses a threat to the country.

The plan requires the Chief Meteorologist to appraise the Prime Minister about all storms approaching the country whenever they are south of 21 degrees north and 75 degrees west. This information is also passed to certain agencies such as the utility companies and the Belize Defense Force (BDF) since they require more time to position their resources to respond to emergencies. (See Figure 2)

The plan has a system of warning flags, which are used to denote each phase. The flags are flown from "Signal Centers" designated in the plan

The government publishes a hurricane pamphlet each year prior to the start of the hurricane season. It contains a list of the hurricane names to be used, the hurricane shelters, a hurricane tracking chart, and useful information for responding to the threat of hurricanes.

Each Operational Committee and the Belmopan and District Emergency Organizations are expected to prepare their emergency plans prior to the start of the hurricane season and submit it to the Disaster Coordinator.

The plan lists the responsibilities of the relevant committees during each stage of the emergency. However, it does not list the actions required to fulfill those responsibilities. That is delegated to the Chairpersons of the Operational Committees who are expected to write their Committees' emergency plans.

The headquarters of NEMO is located in the Office of the Prime Minister. In the event of a national emergency, a National Emergency Logistics Centre is established and located in the New Administration Building in Belmopan. The plan lists the agencies and personnel required to staff the Centre along with their duties.

Although Belize has a Disaster Management Plan, it has no full-time staff dedicated to emergency management nor does it have a dedicated Emergency Control Center.

The Threat of Hurricane Mitch

The generic name for tropical depressions, tropical storms and hurricanes is tropical cyclone. Tropical cyclones are steered by currents in the atmosphere similar to river currents. During the summer, these currents usually push tropical cyclones on a west to northwest path, gradually turning them to the north and eventually to the northeast where they dissipate over the cool Atlantic waters. However, in October and November the trajectories become more erratic as the atmosphere is in a transition stage. It is changing from its summer pattern to a northern winter pattern.

The tropical depression that would later strengthen to hurricane Mitch developed on Wednesday evening, October 21, 1998 in the southwestern Caribbean Sea west of Colombia. From its inception, the atmospheric currents, which would steer Mitch, were very weak. At first it made a loop in a counterclockwise direction and then started moving toward the north. At one stage it even moved east of due north. However, it was evident that Mitch would eventually begin moving northwestward towards the Yucatan Peninsula.

Waters in the western Caribbean Sea were unusually warm. Combined with favorable atmospheric conditions, it was likely that Mitch would become a major hurricane, of Category 3 or higher.

Both predictions were fulfilled. Moving north toward Jamaica, Mitch intensified rapidly achieving hurricane status late Friday. **On Saturday, it started turning towards the northwest all the while getting stronger. Moving on a more westerly track on Sunday, Mitch soon became a major hurricane.** Intensification continued, and Mitch eventually achieved Category 5 status, the strongest category possible. But it would not stop there. **On Monday, Mitch attained winds of 180 miles per hour (mph) making it the fourth strongest hurricane ever recorded in the Atlantic Basin and the strongest October hurricane on record.** (Figure 3)

At this stage Mitch was heading slowly towards Belize and all indications were that it would make landfall somewhere on the Yucatan Peninsula later that week. Steering currents remained extremely weak. Although the guidance available offered different future paths, they all suggested that Mitch would remain somewhere in the northwest Caribbean until the weekend.

Belize was thus under a very grave threat. Wind and storm surge hazard charts indicated that the entire country was in extreme danger. If a minimal Category 5 hurricane were to cross the coastline near Belize City, the storm surge would be approximately 20 feet. Surges in excess of 25 feet would occur north and south of the city and in the Chetumal Bay. Attempts to run the model for hurricane Mitch failed as the storm surge values exceeded the scale. Conservatively, Mitch could have produced a storm surge of 25 feet in Belize City.

In comparison, hurricane Hattie was a category 5 hurricane as it approached Belize. However, it weakened as it got closer to the country. At landfall, it had maximum sustained winds of 135 mph. It crossed the coastline between Belize City and Dangriga moving in a southwesterly direction. It generated a storm surge in Belize City of 10 to 15 feet.

Figure 4 is a storm surge hazard for Belize for Category 5 hurricanes.

Wind damage would have been extreme. Virtually all structures and vegetation within 50 miles of the center would have been destroyed. There would have been extensive roof failure on structures within 100 miles of the center. Flying debris would have compounded the damage. Structures not damaged by the wind would have been battered and undermined by the huge storm surge and waves. Naturally, there would have been great loss of life in these areas among those who had not evacuated. Had Mitch crossed east to west across central Belize, the impact to the country would have been catastrophic. Figure 5 is a wind hazard map for Belize for Category 5 hurricanes.

Fortunately, Mitch never crossed the coastline. The center got within 180 miles of the coast and then moved slowly southward on Tuesday. Mitch stopped some thirty miles north of the Honduras coastline and remained there for approximately 36 hours battering the Bay Islands and coastline with hurricane force winds. Rain bands feeding in towards the center produced extensive rainfall over Honduras, Nicaragua, El Salvador and Guatemala. Some meteorological stations in Honduras reported values of 40 inches in 5 days. It is almost certain that other locations in both Honduras and Nicaragua received more rainfall. However, some 200 stations in both countries were washed away by floods and mudslides.

The feeder bands did not stay over Belize very long. Because Belize is not as mountainous as these countries, we were spared the extreme rain events. Nevertheless, portions of central Belize still received about 15 inches of rainfall during that week which produced flooding. Central Belize was most affected. (See Figure 6)

Mitch eventually made landfall on Thursday as a tropical storm along the north coast of Honduras. It moved south and then curved to the west crossing into southern Guatemala where it was downgraded to a tropical depression. It crossed Guatemala and entered southern Mexico where it dissipated on Sunday 1st November. However, its remnants moved north, and it re-emerged into the Gulf of Mexico. There it was reclassified as a tropical storm. It made landfall on the western Yucatan Peninsula and then re-entered the Gulf of Mexico as it moved northeastward. It crossed southern Florida and then entered the Atlantic Ocean where it was soon transformed into a non-tropical system by the cool Atlantic waters.

Mitch's strength and slow movement toward Belize generated tremendous swells, which traveled all the way to the Louisiana coastline in the United States of America. It generated waves forty feet high in the open Caribbean. These waves arrived in Belize on

Monday and would batter the coastline through Friday. They destroyed virtually every pier on the offshore islands, produced great erosion on exposed coasts and accretion in other places. Some islands were cut in two. Others were flooded Structures were undermined, relocated or buried

Heavy rainfall also resulted in flooding of inland areas Some residents were trapped in shelters when the access roads became inundated These were located in different areas of the country such as Monkey River and Gracy Rock. These shelters experienced food shortages while waiting out the hurricane and emergency supplies had to be taken in by the military on several occasions.

Residents in low lying areas and in some flood plains had to be evacuated because of flooding This occurred in San Ignacio and Lousiana

An unusual phenomenon occurred during the days after the emergency was over and as Mitch, now a tropical depression was crossing Central America and traversing the Gulf of Mexico. Unusually high tides occurred twice per day inundating Belize City and other low-lying areas. This may have been caused by several factors.

- A neap tide was occurring that week (an annual high tide produced by sun and the moon re-enforcing each others gravitational pull on the earth),
- Low-lying areas were already flooded by heavy rainfall;
- Storm waters were rushing down-river from upstream;
- A strong easterly wind was driving the sea westward toward the mainland,
- The sea remained elevated because of low atmospheric pressure and the tremendous inflow of fresh water from Honduras;
- Mitch may have induced a seiching (water sloshing back and forth) effect.

Saltwater intrusion and waste contaminated some sources of freshwater. Flooding also posed some health risks. There were five reports of cholera in Belmopan and government initiated a program to head off an epidemic outbreak. PAHO provided assistance in assessing the situation. A Committee was established to monitor the water supply and institute a super chlorination program. This was especially important since the tourist season would soon commence.

The Response

The Chief Meteorologist informed the Cabinet Secretary Wednesday night as soon as the tropical depression formed because of its proximity to the country. The Cabinet Secretary, the Prime Minister and then NEMO would be kept appraised of Mitch thereafter. **The briefings on Friday were especially important since agencies were forewarned that there was the potential for an emergency that weekend and key personnel should make themselves available if needed.**

At 3:00am on Sunday, the Chief Meteorologist advised the Cabinet Secretary that Mitch could threaten Belize within 36 hours. The first meeting of NEMO was scheduled for 5:00pm. **At 1:45pm the government declared the Preliminary or First Phase of the Hurricane Warning Plan.** The order to fly one red flag on public buildings was given. NEMO met at 5:00pm, assessed the state of readiness of the Operational Committees and agreed to set up its headquarters in the Cabinet Room in Belmopan. NEMO would meet formally on Monday.

The warning system was severely compromised Sunday night when lightening struck somewhere in the vicinity of the Philip Goldson International Airport where the office of the National Meteorological Service is located. Virtually all the Met. Services' tracking equipment was damaged by the electrical discharge. Communication was also disrupted and full telephone services were not activated until Tuesday. Fortunately the Met. Service had spare equipment and through the Internet was able to access meteorological data from other sources.

Communication was affected throughout Ladyville impacting even the Headquarters of the Belize Defense Force. Other areas of the country were also affected. The telecommunication carrier claimed that they had been in the process of changing software in their switching system. Combined with the extraordinary load on the system placed by the emergency, the telephone system was rendered almost non-functional on occasions on Monday. Fortunately, the faults were repaired by Tuesday.

Other communication problems surfaced because personnel with radios were not deployed to shelters. District Operational Committees also did not have sufficient access to independent communication equipment. As a result, the telephone system was greatly stressed.

Broadcast television stations went off the air on Monday when they began dismantling their equipment for storage in safe grounds. Cable operators did maintain transmission providing a continuous feed from the Weather Channel and CNN. This proved to be a great source of information to the population. Radio stations remained on air throughout the exercise, providing great coverage and disseminating information on a regular basis. Love FM set up its transmission site within the headquarters of NEMO. The radio stations provided updates as soon as they became available. Personnel from NEMO and the National Meteorological Service provided frequent on-air interviews, interpreting

the bulletins and providing advice. Almost everyone in Belize had access to a continuous feed of weather bulletins and warning messages throughout the exercise.

On Monday morning, NEMO and it Operational Committees were activated. It was decided to implement voluntary evacuation of the cayes and low lying coastal areas. However, local communities, alarmed by the strength of Mitch and its trajectory, preempted NEMO's decision and had already commenced evacuation. The evacuation of San Pedro and Caye Caulker was especially efficient. A total of 7000 persons were evacuated from San Pedro, 2000 persons by air and 5000 by boat. Approximately 462 persons were housed in shelters there, while in Caye Caulker, 123 sought refuge in shelters. It is estimated that some 2000 persons were evacuated from Caye Caulker primarily by boat. The evacuation ended on Tuesday when the sea became too rough and the wind became too gusty for both aircraft and boats. Therefore, many persons who remained on the islands did not do so by choice, but had to stay because time had run out. Unfortunately many family units were divided by the exercise.

Heeding the warnings, most residents along the coast and in the cayes evacuated their homes. Most went to Orange Walk Town, Belmopan, San Ignacio/Santa Elena and Benque Viejo. It is estimated that between 60,000 to 75,000 persons were evacuated. Most did so in private vehicles. The government provided free transportation through the BDF and by chartered buses.

Most tourists were also evacuated out of the country, primarily to the United States. About 100 tourists remained in the country. It is estimated that 3000 persons left the country by air on fifteen regularly scheduled flights and 4 chartered flights from Sunday through Tuesday when the international airport was closed. Incoming flights during the period were limited to passengers returning home or who had a safe refuge.

The Belize Airport Authority (BAA) began their emergency operations on Sunday by installing their hurricane shutters, procuring emergency supplies and deploying equipment and staff. They also accommodated the requests of other agencies to safeguard their equipment. The BAA reopened the airport on Thursday.

Many residents and businesses began hurricane preparations on Monday and had completed the exercise by Tuesday. This included the installation of hurricane shutters, purchasing emergency supplies, securing important items, and evacuation where necessary.

At 2:00pm on Monday, NEMO declared Phase II or Red I of the hurricane plan, a hurricane warning. This was done to provide the population with more daylight time to take preparatory action and to signal the seriousness of the threat. **On Tuesday Phase III or Red II was declared.** The appropriate flags were raised on both occasions. The hurricane shelters were then opened in all areas. The Acting Prime Minister ordered the evacuation of residents from all coastal areas at 9:00 o'clock Tuesday night.

Most shelters were not prepared to receive people. In many instances people arrived before the shelters were declared open to the public. In Belize City and Belmopan, there were reports of people breaking into shelters or occupying areas that had not been made available to them.

The shelters were not physically adequate. Some buildings were structurally inferior. They had zinc roofs and siding; others had no windows. Several buildings had brick outer walls with ventilation holes. Many shelters did not have hurricane shutters and occupants improvised barricades utilizing valuable furniture and teaching aids such as blackboards. Sanitary facilities were inadequate in most instances, as were areas for the preparation of meals.

There was also a shortage of shelters. Most were overcrowded. Private residences were also filled to capacity. Some evacuees simply drove inland and stayed in their vehicles, parking on the street or in vacant lots.

Many communities were overcrowded and the infrastructure could not support the numbers. Belmopan's water and sewage facilities were especially stressed and did experience some disruption.

The following table is from the US Office of Disaster Assistance (OFDA) with corrections and supplementary data from the Ministry of Economic Development and the San Pedro Emergency Committee.

Location	Shelters	People	Food	Water	Sanitation	Hygiene	Wind Damage	Flooding
Corozal Dist.	24	3320	Adequate	Adequate	Poor	Poor	None	Minimal
OrangeWalk Dist	28	3264	Adequate	Adequate	Poor	Poor	None	Minimal
Caye Caulker	6	123	?	?	?	?	Moderate	Extensive
San Pedro	22	462	Adequate	Adequate	Adequate	Adequate	Moderate	Extensive
Belize City	16	4033	Needed	Needed	Poor	Poor	None	Extensive
Belize Rural	7	1165	?	?	?	?	?	?
Belmopan	20	5477	Adequate	Adequate	Poor	Poor	None	None
Cayo District	46	5218	Adequate	Adequate	Poor	Poor	None	Minimal
Stann Creek	9	1965	Adequate	Adequate	Poor	Poor	None	Minimal
Toledo	15	1605	Adequate	Adequate	Poor	Poor	None	None

The Ministry of Economic Development estimates that 28,049 persons were housed in 166 shelters throughout the country.

People arriving at the shelters were not adequately prepared. Some brought large, bulky, personal possessions including household appliances and pets. Others did not bring an adequate supply of food, water or bedding.

On Wednesday 28th, NEMO instructed the Food Committee to provide one meal per person for those in shelters. The committee had not included this in its plan. Normally this committee activates its food program after the passage of the storm. However, in this instance since people came inadequately prepared and would be in the shelter for a long time, a food program became essential.

The Belize Marketing Board, which is the key executing agency in the Food Committee, met on Friday the 23rd to review its role in the emergency plan. It arranged for the collection, transportation and storage of food supplies and other essential items. However, on Monday when the Chairperson of the Committee ordered the execution of the plan, several key players were unable to fulfill their obligations.

The Port Authority's heavy equipment for loading containers was occupied on other tasks. In addition, the storage sites were unable to receive the goods on Monday as their personnel had been given the time off to secure their families and personal effects.

The exercise of gathering and transporting the supplies was thus put off to Tuesday. The private trucking companies failed to provide trucks and drivers to assist in the effort. The heavy equipment to offload the containers was not positioned in the designated locations. Some suppliers closed their warehouses that morning and thus the Committee did not have access to those supplies. Supplies did not all go to the designated storage depots but were diverted to other sites. This would prove to be a serious obstacle in the food preparation program. At the end of the day, supplies were below the stock required and were improperly deployed.

On Wednesday the BDF was requested to implement the food preparation program This task had not been assigned to them in the Emergency Plan. Cooking equipment had to be secured. Containers, which had been diverted to other locales, had to be located and transported to the food preparation sites. Some of the trucks experienced difficulties which slowed down the operation. Upon opening the containers, it was discovered that some contained totally inappropriate supplies including pig tail, lard, salad dressing and dog food. The Committee resorted to scrounging up supplies from the few retailers who were still open. After the initial difficulty of setting up a food preparation program, the BDF then executed it admirably for the following two days The food program ended on Friday. One meal per day was provided for three days. The cost was estimated at BZ$375,000

Health officials had concluded prior to the start of the hurricane season that the health facilities in Belize City, Corozal Town and Dangriga could not withstand hurricane force winds The Orange Walk Hospital had just undergone refurbishment. The health plan called for discharging patients to the care of their relatives and the evacuation of critical cases to the Belmopan, Orange Walk and San Ignacio hospitals. However, the plan never envisioned the total evacuation of Belize City. There was a delay in the implementation of the plan as senior staff were in Chetumal on Monday attending a meeting with their Mexican counterparts The plan was eventually implemented and staff deployed to various health centers. However, many shelters did not have nurses for the first 12 hours and there was a serious shortage of medical supplies in those shelters. The Belmopan Hospital was also not physically able to deal with the added responsibility Fortunately, there were no serious medical emergencies. There was one birth in a shelter Three other pregnant ladies were transported to proper medical facilities for delivery There were no casualties during

the exercise One elderly infirm person died in Belize City as she was carried from her home to a car for evacuation to Belmopan.

NEMO experienced problems with transportation Vehicles to assist in evacuation and transportation were in short supply Apparently, there was no list of available government vehicles, or the officers responsible did not make them available for use by the Committees

The Foreign Assistance Committee kept its Embassies updated on conditions in Belize. It coordinated the response of foreign governments' representatives and international agencies present in the country and provided them with regular briefings from NEMO It was able to direct requests for assistance to these representatives and to the embassies. Regrettably, these requests did not arrive in the Ministry of Foreign Affairs in suitable formats utilizing the SUMA procedures and software. They had to be reformulated with the assistance of the Red Cross. This added to their tasks and slowed the process.

The United Nations agencies coordinated their efforts in providing assistance to the Foreign Assistance Committee utilizing their Inter Agency Disaster Response Plan. This required its chairperson, the UNDP Program Officer to be the focal point through whom information and requests were channeled.

The evacuation from Belize City left it vulnerable to the criminal element. On Wednesday, NEMO ordered the Police and BDF to implement a saturation patrol operation. Looting was quickly halted and a number of arrests made.

Besides being a crucial element of NEMO's Operation Centre, implementing the food program. and patrolling with the Police, the BDF also assisted in the evacuation exercise by land, sea and air. The Maritime Wing also performed search and rescue operations by sea

There was very little loss of shipping. Most boats were prepared and acted quickly. They were moved to safe anchorage in Belize and Guatemala.

At 9:00pm on Friday NEMO downgraded its warning to the Preliminary Phase or Phase I. On Saturday the All Clear was declared and the emergency ended.

The Medical and Relief Measures Committee then began an assessment of environmental conditions to prevent an outbreak of epidemics. It requested support from PAHO/WHO The agency responded by providing a team of experts to conduct a rapid assessment of the post hurricane situation, identify potential risks for disease transmission, develop an action plan to assist with surveillance and the prevention and control of food, water and vector-borne diseases, and to develop a proposal for the control of Chagas Disease

The Environment Committee and the Evaluation of Damages Committee became active after the threat had subsided. It is estimated that Mitch cost the country approximately BZ$20 million in response and damage The following table is from figures provided by the Ministry of Economic Development

Municipal Streets and Drains	$2,591,041.39
Highways and Access Roads	$1,940,623.50
Beach and Coastal Erosion	$3,450,000.00
Damage to Reef	$5,000,000.00
Rehabilitation of Piers	$2,987,500.00
Repairs to Hurricane Shelters	$ 550,000.00
Damage to Meteorological Equipment	$ 193,800.00
Reimbursement for Food and Shelter	$ 100,804.81
Agricultural Losses	$2,052,712.00
Credit Facility for:	
Repairs to Tourist Facilities	$ 811,900.00
Repairs to Fishing Equipment	$1,078,312.00
Repairs to Piers	$ 162,500.00
TOTAL	$19,593,024.70