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**BELIZE: ASSESSMENT OF THE DAMAGE CAUSED  
BY HURRICANE KEITH, 2000**

*Implications for Economic, Social and  
Environmental Development*

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This document has not undergone formal editing.





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## EXECUTIVE SUMMARY

Following the significant physical damage and economic losses that this country sustained as a result of Hurricane Keith, a request for this social, environmental and economic impact assessment was submitted to the Economic Commission for Latin America and the Caribbean (ECLAC) by the Prime Minister of Belize, Hon. Said Musa, on 12 October 2000. This appraisal considers the consequences of the Hurricane's passing over the northern half of this country and the outlying keys ("cayes") from 30 September to 1 October 2000.

The study undertakes a sector by sector analysis leading to an overall assessment of the damage; it appraises the macroeconomic and environmental effects and proposes some guidelines for rehabilitation and reconstruction programmes. To carry out this task full co-operation was received from national authorities, the Inter American Development Bank (IDB), the Inter American Institute for Cooperation on Agriculture (IICA), the United Nations Development Programme (UNDP) and other United Nations agencies. Officials and consultants of the Pan American Health Organization (PAHO/WHO) and of the United Nations Children's Fund (UNICEF) joined the mission. This assessment complements the Compilation of Damage and Needs Assessments, Response and Rehabilitation Plans in connection with Hurricane Keith prepared for the United Nations Disaster Assistance Coordinator (UNDAC) by UNDP, UNICEF and PAHO. The direct and indirect damage has been assessed in accordance with the methodology developed by ECLAC. The results are based on the mission's estimates; the study incorporates the information available and evidence collected in interviews and visits to affected locations.

It is ECLAC's and the Government of Belize intention to emphasise the need for a reconstruction process that reduces the country's vulnerability, is compatible with its development strategy and can be implemented within the government's and the private sector's absorption capacity. It is estimated that the magnitude of the losses exceeds the country's capacity to address reconstruction needs on its own, particularly if the aim is also to reduce the impact of similar events in the future, and therefore international cooperation is considered essential.

The Belize society and government face the opportunity of undertaking the reconstruction with renewed values and criteria, embarking on institutional, legal and structural reforms to reduce economic, social and environmental vulnerability. Just as Hurricane Hattie over forty years ago transformed Belizeans attitude toward hurricane threats and led to important relocation of public and administrative functions, Keith – following closely the footsteps of Mitch – could become an important instrument for a changed attitude to environmental and risk management. An important aspect of such reforms will be to strengthen the country's savings, investment and management capacity as part of the reconstruction.

Total damage is estimated at BZ\$560.1 million (US\$280 million), of which direct damage, estimated at BZ\$423.3 million (US\$211.6 million) constitutes about 75 per cent. Direct damages were valued at present value or replacement cost at current prices – whichever seemed

more appropriate for the specific sector. Indirect damages of BZ\$136.8 million (US\$68.4 million) were yielded on the basis of flows affected as the direct consequence of the disaster. Since some assumptions were necessary for these costs, the computed figure in some cases may underestimate the medium or long term impact in the Belizean economy. A summary table of the damages is as follows:

	Thousand of US dollars		
	Direct damage	Indirect damage	Total damage
Total	211,640.7	68,406.2	280,046.9
Social sector	36,653.9	1,119.7	37,773.6
Infrastructure	26,520.9	17,918.7	44,439.6
Economic sectors	116,111.2	49,179.0	165,290.2
Environment	24,525.5	0.0	24,525.5
Miscellaneous	5,241.5	188.8	5,430.2
Emergency expenditures	-	188.8	188.8
Foreign Assistance	2,587.9	0.0	2,587.9

Source: ECLAC

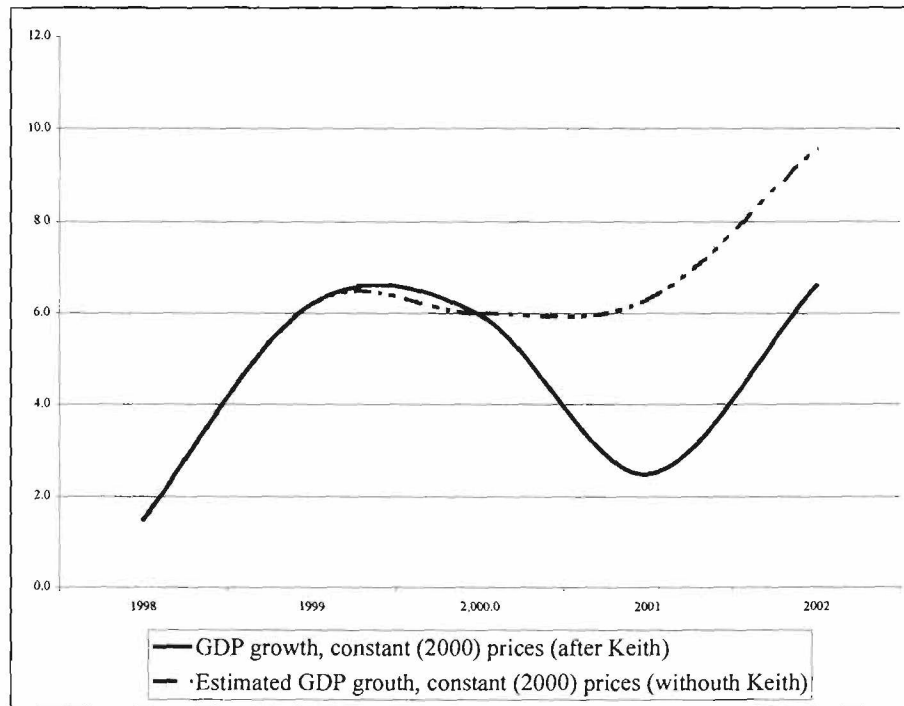
The summary data on direct and indirect damage indicates that the most affected sectors are the productive ones: tourism and agriculture represent over 47 per cent of the direct damage measured. Total damage to the economic sectors is estimated to be BZ\$330.6 million, some 59 per cent of total damage estimated. Losses of infrastructure account for about 16 per cent of total damage. Their repair or replacement must be a priority as they perform a generator function to economic and social activity nation-wide.

Damage to the social sectors is almost as large as the damage to infrastructure and, considering that there tends to be some underestimate of the social effects, Keith had stronger negative consequences on societal variables than on physical ones. The most important social damage occurred in housing (over 12 per cent of total direct and indirect damages). Thus the urgency to face the challenge not only of replacing lost housing and other social infrastructure but to do so with new, more resilient criteria and giving full attention to risk reduction since – as Keith made apparent – Belizean society has a high level of exposed vulnerability.

The measure of Keith's effect in Belize may be very well be highlighted by pointing that direct damages (losses or damage to infrastructure) are equivalent to almost 93 per cent of the country's gross capital formation in 1999. Seen from another angle, Keith's indirect damage (negative impact on economic flows) is anticipated to be almost 46 per cent of the 1999 savings of Belizeans. Additionally, these reduced flows are equivalent to more than twelve percent of 1999's domestic consumption)

The extent in which the Belizean economy will suffer as a consequence of the passage of Keith is shown by the fact that its dynamism will be reduced more severely in 2001 than in the remainder of 2000 and it is expected that by 2002 it could regain its pre-disaster fast pace of

growth. Its impact in 2000 will reduce the estimated rate of growth by one percentage point (from a forecasted 6.9 to only 5.9). This will open a gap between the expected evolution of the economy as was being forecasted before Keith and the actual development patch that will ensue – having consequences at least till 2000, as is shown by the following graph:



The hurricane has no doubt set back the government's poverty alleviation strategy that had set a target on containment of the Central Government deficit to no more than 2 per cent of GDP. With the new estimate indicating a fiscal deficit of 3 per cent of GDP, the target of poverty alleviation may have moved somewhat, delaying its achievement. Any alternative strategy that keeps the attainment of the poverty alleviation date fixed at the previously targeted date will place the foreign exchange parity at risk.

Hurricane Keith has impacted macroeconomic performance in a number of ways. There has been a fall-off in economic activity as attested to by the loss of property, hours of work, the loss of business and the loss of crops. These have impacted negatively on livelihoods, although the impact has not had an even incidence over the population. As an example, the subsistence farmers in the Orange Walk district and the lobster fishermen operating on Ambergris Caye who, because of the loss of their crops and fishing gear, respectively, are unable to feed their families, merit some consideration for relief. Export earnings from fishing are expected to decline in 2001.

Exports and export earnings are estimated to have fallen as much damage was sustained in the tourism areas and in areas that cultivate export crops. Whereas there are no firm figures to quantify the extent of the phenomenon, indications are that the poorer households have been more adversely affected in terms of damage and displacement than other income groups in the population. The damage caused by the hurricane will also have implications on the import bill.

To the extent that direct damage will have to be repaired by reconstruction of houses and physical plant for which there is a high import content of materials, possibly of the order of 70 to 85 per cent of total cost of materials. On the other hand, to the extent that the damaged properties were insured, the settlement of insurance claims will result in capital inflows – a positive aspect of the country's balance of payments. Further, the reconstruction effort will result in increased activity in construction, which, in turn will create conditions for increased demand. The upsurge in construction activity may, however, require the importation of labour from adjacent countries.

The loss of tourist visitors, when combined with the estimates of direct and indirect damages to the sector will impact the balance of payments in the final three months of 2000 and into 2001. An estimated impact on international trade puts the import figure at BZ\$115.3 million to be spread over the rest of 2000 and 2001.

With well-organized support from friendly donor countries pledging investments in strategic areas and with proper project sequencing, the balance of payments may be able to avoid the pressure that would otherwise be brought to bear on the exchange rate parity of the country.

As an addendum to the document the mission has prepared a list of project profiles, currently being developed and some already with some degree of advance or development. The purpose of these profiles is to provide basic information on their aims, scope, expected results, activities and tasks to be carried out, investment to be made, expected financing, and the special characteristics of each project.

The sectoral composition of the projects identified – in the amount of BZ\$211.6 million (or US\$105.8) is the following (in percentages):

Projects in social sectors	48.0
Health and sanitation	2.5
Education	1.4
Housing	44.1
Energy, water supply, sanitation and telecommunications	6.1
Transport subsector	15.8
Productive sectors	24.8
Agriculture	24.3
Tourism	0.5
Environmental management	5.3
Prevention and mitigation	0.0

On occasion an event like Keith – fortunately enough without major losses of lives as has recently occurred in other countries – opens the opportunity for a change of policy and a soul-searching effort to avoid preserving or aggravating presently negative trends. Certainly Keith represents an economic setback in some aspects but it may be just the kind of reminder needed to give a hard look to ongoing processes that may be rectified.

It will be important – on the basis of this occurrence – to set priorities and consider the time frame and the necessary changes to design, construction and land use regulations in keeping with the situation in each country. In any event, reconstruction should be carried out on the basis of a significant qualitative improvement over the previous circumstances.





## PREFACE

This study was prepared for the Government of Belize, following the significant physical damage and economic losses that this country sustained as a result of Hurricane Keith, which struck part of the Central American region, Belize and Mexico. A request for this social, environmental and economic impact assessment was submitted to the Economic Commission for Latin America and the Caribbean (ECLAC) by the Prime Minister of Belize, Hon. Said Musa, on 12 October, 2000. This appraisal considers the consequences of the Hurricane's passing over the northern half of this country and the outlying keys ("cayes") from 30 September to 1 October 2000.

The study undertakes a sector by sector analysis leading to an overall assessment of the damage; it appraises the macroeconomic and environmental effects and proposes some guidelines for rehabilitation and reconstruction programmes. It complements other sector or partial assessments conducted by national and international institutions and financial and bilateral cooperation agencies. It is ECLAC's and the Government of Belize intention to emphasise the need for a reconstruction process that reduces the country's vulnerability, that is compatible with its development strategy and can be implemented within the government's and the private sector's absorption capacity.

National authorities, the Inter-American Development Bank (IDB), the Inter-American Institute for Cooperation on Agriculture (IICA), the United Nations Development Programme (UNDP) and other United Nations agencies, collaborated in the preparation of the study. Officials and consultants of the Pan American Health Organization (PAHO/WHO) and of the United Nations Children's Fund (UNICEF) joined the mission. This assessment complements the Compilation of Damage and Needs Assessments, Response and Rehabilitation Plans in connection with Hurricane Keith prepared for the United Nations Disaster Assistance Coordinator (UNDAC) by the United Nations Development Programme (UNDP), UNICEF and PAHO.

The direct and indirect damage has been assessed in accordance with the methodology developed by ECLAC.<sup>1</sup> The results are based on the mission's estimates; the study incorporates the information available and evidence collected in interviews and visits to affected locations. It is estimated that the magnitude of the losses exceeds the country's capacity to address reconstruction needs on its own, particularly if the aim is also to reduce the impact of similar events in the future, and therefore international cooperation is considered essential.

This appraisal is designed to provide the government and the international community with guidelines for setting national and regional priorities in rehabilitation and reconstruction programmes. An economic approach would be limited, and such programmes should therefore include actions of a more integral nature. Designed not only to face the economic, fiscal and external sector implications of the event but to alleviate the suffering of those segments of the

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<sup>1</sup> ECLAC/IDNDR (1999), *Manual for Estimating the Socio-Economic Effects of Natural Disasters*, May.

population affected as well as the environmental and vulnerability implications of the event. Questions of improved physical planning, watershed and coastal management, early warning, emergency response and structural preparedness for evacuation and sheltering potentially affected population are seen as important considerations for the reconstruction process. Special attention and priority should be placed on including sustainability and increased-governance criteria in making social and productive investments, and on allocating resources to the reinforcement and retrofitting of vulnerable infrastructure, basic lifelines and services as part of the reconstruction strategy.

The Belize society and government face the opportunity of undertaking the reconstruction with renewed values and criteria, embarking on institutional, legal and structural reforms to reduce economic, social and environmental vulnerability. Just as Hurricane Hattie over forty years ago transformed Belizeans attitude toward hurricane threats and led to important relocation of public and administrative functions, Keith – following closely the footsteps of Mitch – could become an important instrument for a changed attitude to environmental and risk management. An important aspect of such reforms will be to strengthen the country's savings, investment and management capacity as part of the reconstruction.

## I. BACKGROUND

Hurricane Keith evolved very rapidly from an area of disturbed weather that had persisted in the western Caribbean during the last week of September. Late in the hurricane season – as happened in recent years with Georges and Mitch in 1998 and Lenny in 1999 – on the morning of 29 September, the fifteenth tropical depression of the Atlantic Basin formed from a weak surface low just off the north-eastern coast of Honduras. In a period of barely 24 hours the depression had strengthened into a tropical storm and was named Keith, and by noon of 30 September was poised to strike the coast of the Yucatan Peninsula in Mexico, and or Northern Belize. Following an apparently erratic pattern, the by now hurricane-level Keith pursued a westward drift and stubbornly battered the outlying keys (“cayes”) and drenched the low-lying plains of Belize. This caused severe wind damage to the coastal tourist resorts and drenched a vast area of northern Belize with severe flooding that has persisted for over six weeks.

Natural disasters, whether climatic, seismic or volcanic, are frequent in the region. The scale of human and economic damages caused by natural disasters in Latin America and the Caribbean is staggering by any set of measurements. Some estimates put the affected (directly and indirectly) population at 150 million over the last 30 years. Between 1972 and 1999 alone the number of dead reached 108,000 and the total of those directly affected exceeded 12 million.<sup>2</sup>

The total damages covered by the assessments made by ECLAC between 1972 and 1999 amounts to more than 50 billion dollars. The true figure for human and material damages is much greater because ECLAC has only assessed damages when governments have asked it to, and because such assessments only cover a fraction of the disasters faced by the region.

The Caribbean is subject to meteorological (hurricanes, floods and droughts) and geophysical (earthquakes, landslides, volcanoes) hazards. Depending on the degree of vulnerability of given States/territories, exposure to hazards may result in natural disasters that, in small islands and countries such as these, can have devastating economic, social and environmental effects.<sup>3</sup>

Tropical hurricanes are the most frequent of the natural hazards that affect the region. The decade of the nineties was one of contrasts. Landsea<sup>4</sup> reported that the first half of the 1990s decade saw the least active four-year period in at least fifty years. However, in the second half of the decade, the region experienced an upsurge in the incidence of hurricanes. Indeed, Guy

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<sup>2</sup> See ECLAC/IDB, *A Matter Of Development: How To Reduce Vulnerability In The Face Of Natural Disasters*, (LC/MEX/L.428), 7 March 2000.

<sup>3</sup> The regional information and analysis was prepared by Erik Blommestein, ECLAC Subregional Headquarters for the Caribbean, October 2000.

<sup>4</sup> Landsea, C. W., N. Nicholls, W.M. Gray, L.A. Avila, 1996. Downward trends in the frequency of intense Atlantic hurricanes during the past five decades. *Geophysical Research Letters* 23:1697-1700; Landsea, Christopher, Roger A. Pielke, Alberto M. Mestas-Núñez and John A. Knaff. 1999. Atlantic basin hurricanes: Indices of climatic change. *Climate Change*, 42: 89-129.

Carpenter reported that 1999 saw the highest number of category 4 hurricanes since records began in 1886. In 1999, Hurricane Irene crossed western Cuba; hurricanes Dennis and Floyd and tropical storm Harvey made landfall in the Bahamas and in the Turks and Caicos Islands; and the northern Leeward Islands were exposed to hurricanes Jose and Lenny. Because of its unusual East to West track hurricane Lenny also caused damages in the Windward Islands.

The increased incidence may indicate that the region is undergoing a new cycle of heightened hurricane activity. This would follow the period of the 1970s to the middle of the 1990s, which was relatively quiet and from the 1920s to the 1960s, which was relatively active. This long-term cycle would be more important in its effects than any expected impacts of climate change, because its effects could affect development patterns faster and its outcomes would spread over at least the next decade. Furthermore, current research seems to indicate that neither the frequency nor the intensity of hurricanes will be very much influenced by climate change.

Hurricanes remain the major cause of loss of life due to natural disasters, with a death toll of 1,745 persons during the decade. In the insular Caribbean, the largest loss of life occurred in Haiti, caused by Hurricane Gordon in 1994 and in the Dominican Republic by Hurricane Georges in 1998. See Table 1.

Table 1

LOSS OF LIFE CAUSED BY NATURAL DISASTERS IN THE INSULAR CARIBBEAN  
AND BELIZE a/

Period	Loss of life			
	Total	Floods	Windstorms	Other
1990-1998	1 966	155	1 745	66
1980-1989	1 640	925	584	131
1970-1979	1 829	265	1 561	3
1964-1969	953	0	953	0
Total	6 388	1 345	4 843	200

Source: EM-DAT: The OFDA/CRED International Database, <sup>5</sup> Université Catholique de Louvain, Brussels, Belgium.

a/ For the Guyanas, there are no recorded deaths in the EM-DAT database.

Haiti with 2,598 deaths and the Dominican Republic with 1,862 fatalities over the period 1964 to 1998 account for almost 70 per cent of the death toll in the region. This is a reflection of social vulnerability caused by poverty, environmental degradation and in some instances insufficient or inadequate mitigation and risk reduction policies. This high degree of vulnerability was highlighted in 1994, when rainfall, associated with, then, tropical storm Gordon, caused floods and mudslides which resulted in 1,122 fatalities, even though the centre of Gordon did not

<sup>5</sup> To be included in the database, at least one the following criteria has to be satisfied: 10 or more people killed; 100 people reported affected; a call for international assistance or the declaration of a state of emergency.

pass over Haiti. The Dominican Republic and Haiti are not alone in this vulnerability, as many of the characteristics are shared with other low-income countries or with the poor in higher income countries.

Increasingly fatalities caused during the passage of tropical cyclones are not wind related but stem from secondary disasters like flood or landslides and mudslides. This highlights the role of environmental degradation and policy failures as major factors that account for the loss of life.

If population growth is taken into account, the data show that there has been only a slight reduction in the annual disaster death rate over the last 35 years.

Clearly, even a small disaster, in terms of monetary damages can have major economic implications in a small country, even when larger countries may be susceptible to a larger number of disasters. However, during the second half of the decade, the small islands of the Northeastern Caribbean seemed to be particularly vulnerable.

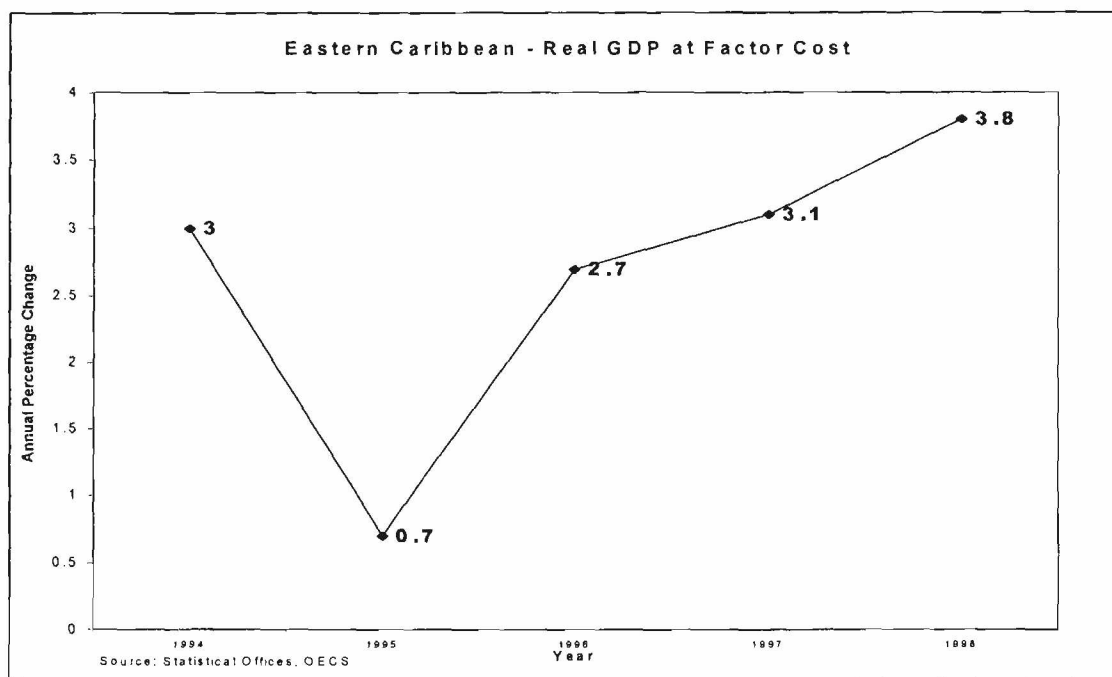
Graph 1 illustrates the impact of the 1995 hurricane season on the economic performance of the Eastern Caribbean area. During 1995 hurricanes Marilyn and Luis and tropical storm Iris hit the Eastern Caribbean. The 1995 storm season caused a drop from 3.0 to 0.7 in the annual rate of growth of real gross domestic product (GDP) in the countries member of the Organization of Eastern Caribbean States (OECS), according to figures from the Eastern Caribbean Central Bank (ECCB). The impact on the individual countries was even more severe with Antigua and Barbuda and Anguilla experiencing a decline in the growth rate to -5.0 and -4.1 respectively. Tourism, agriculture and real estate and housing were the sectors most affected. In Anguilla tourist arrivals did not recover until 1997, while by 1999 Sint Maarten had still not recovered.

In a large continental or archipelagic country, the economic impacts on given sectors/areas can either be diluted or offset by robust growth in other areas. For example, Hurricane Floyd was classified as a category 4 hurricane when it struck the Family Islands in the Bahamas. Here, the impacts of the extensive damages on Eleuthera and Abaco were counteracted by a strong improvement in tourism in the other islands, notably in Nassau and Paradise Island. Coupled with reinsurance inflows and reconstruction activities, the result was a real economic growth of about 5.5 per cent. On the other hand, the IMF noted that the long-term economic impact of hurricanes Luis and Marilyn in Sint Maarten contributed to the continued economic malaise, which is facing the Netherlands Antilles.

In the Dominican Republic, hurricane Georges caused an estimated US\$ 2.2 billion in economic damages in 1998. The sectors most affected were housing, with over 49,000, mostly low-income houses destroyed, tourism and agriculture. Nevertheless, the high buoyancy which characterized the economy in the second half of the decade, was maintained albeit, at an estimated loss of 1 percentage point of real GDP growth.



Graph 1



The volcanic eruptions in Montserrat have had catastrophic and cumulative consequences on the islands' economy, social fabric and its natural environment. Real GDP declined from EC\$ 132.1 million in 1994 to EC\$ 68.3 million in 1998. The GDP increase in 1990 was fuelled by a 60 per cent increase in construction, as compared with 1989. This increase more than compensated for the decrease in tourism, manufacturing and banking and insurance. The year thereafter and in 1992, most sectors returned to pre hurricane levels and the temporary boost of reconstruction activities was no longer felt in the economy. Crowards (1999) concluded that, although broad patterns could be observed in selected macro-economic variables, the considerable variation in individual events and country results made meaningful inter-country comparisons impossible. Table 2 sets out the broad patterns on selected economic variables in Caribbean countries.

The economic vulnerability of the region to natural hazards has been increased as a result of population growth, economic development, a focus on coastal tourism together with policy failures and environmental degradation. While economic development tends to reduce social vulnerability through improved housing, increased insurance and improved social welfare systems, it obviously increases the economic vulnerability because of the accumulation of wealth.

Caribbean environments have evolved in the presence of disasters. Arguably then, the region's natural systems depend on such disasters for ecosystem resilience and diversity. However, many of the region's ecosystems are significantly degraded, a process which continues. In such cases, additional stress caused by a disaster can result in damage that is irreparable. Ecosystem restoration may no longer be feasible and vulnerability may be reduced only by recourse to man-made investments etc. Marine and coastal degradation tend to aggravate

economic vulnerability through the increased exposure of coastal infrastructure to high energy wave action and storm surge because natural barriers such as mangroves, sand dunes or coral reefs have lost much of their protective functions.

Table 2

## ECONOMIC IMPACTS FOLLOWING A NATURAL DISASTER

Variable	Year of event	Year after	Subsequent years
GDP	Immediate drop in GDP growth	Rise in GDP growth from reconstruction	Slow down in 2nd and 3rd year as boost subsides
Exports of goods	Reduction in rate of growth	Return to previous levels a/	Spillover to next year
Imports of goods	Considerable increase in rate of growth	Return to pre-disaster level	Further drop, possibly caused by reduced incomes
Tourist arrivals	Considerable drop	Some recovery	Recovery continued
Cruise ship arrivals	Considerable drop		
External debt	Increase in rate of growth	Drop of the rate of increase to below pre-disaster levels	

Source: Crowards, 1999.

a/ Depending on crop season, the reduction for agricultural exports, etc. may occur in the year following the disaster.

The cumulative impacts of environmental degradation increase social as well as economic vulnerability. The effect of terrestrial degradation, combined with policy failures, may very well be the increased loss of life as was experienced in Hispaniola following Gordon and Georges, or in Puerto Rico, following the floods and landslides in 1985.

Because of the concentration of economic activities in the coastal zone (e.g. tourism) the increased exposure of coastal infrastructure results in increased economic vulnerability. For example, the earlier quoted drop in real GDP growth rates in the Eastern Caribbean following the 1995 hurricane season was mostly caused by an 11.3 per cent contraction in the value added for hotels and restaurants. Likewise over 80 per cent of the economic damages in Anguilla following Hurricane Lenny are tourism related and a consequence of cumulative environmental degradation.

Responsibility for change pertains to both the public and private sector and largely stems from a corresponding failure to incorporate disaster prevention and mitigation measures. Policy failures can include the absence of a system whereby pre disaster information can be made available to the public. This was identified as a contributory factor for the high death toll in the Dominican Republic following Georges in 1998 and in Puerto Rico following the floods in 1985.

Policy failures might also relate to poor or corrupt building and construction practices resulting from the non-existence or non-compliance with building standards, or from the lack of incorporating risk into insurance rates. In view of the existence of high levels of environmental degradation and a correspondingly high level of economic vulnerability, the continuing policy of granting permission for the construction of hotels and residences in obviously high-risk environment is to be construed as an important policy failure.

The extent of the damage caused by Keith to the small economy of Belize – affecting its main foreign currency earning activities of tourism and agriculture – and the efforts required for the recovery point up the need for the country to receive cooperation from the international community. Its effects will be felt over the 2000 and 2001 period, affecting the economic outcome of both years, at least. Some of the reconstruction process will certainly extend beyond that, as projects will develop over the years and their completion and maturing process may take some time. This recuperation process involves the creation of a less vulnerable physical development strategy and a better preparation in the face of climatic phenomena that cyclically affect the country, that seem to have increasing force and less reliable patterns and cause increasing economic and developmental losses. International funds will be needed to complement national efforts – both public and private – to carry out the reconstruction programme. The attached project profiles show the magnitude of the efforts involved and indicate the degree of urgency and the priorities to be set, with the participation of the international community

## **1. The mission**

The Government of Belize, at the recommendation of the IDB and the World Bank, requested ECLAC's technical assistance to undertake a comprehensive damage assessment report in the aftermath of Hurricane Keith. After a preparatory mission ECLAC prepared the terms of reference for the study to be undertaken and convened a team of experts to carry out the evaluation mission. Funded by the Government through the emergency resources received from IDB, ECLAC completed the rapid evaluation included in this document.

The mission had the full support of the UNDP Resident Coordinator for Belize and received the full cooperation of the United Nations agencies and other international and regional organisations with offices in Belize. The work was carried out with the full cooperation of the national authorities and benefited from the preliminary assessments of damages prepared by the National Emergency Management Organization (NEMO) and the administrative and substantive support of the ministries of Economic Development and of Finance. The IDB and PAHO Representations in Belize provided office space for the mission and the local representatives of IICA and UNICEF also assisted the mission.

The mission visited Belize from 12 to 22 November 2000. The team included the following ECLAC officials, external consultants and officials of other international organisations who joined the team:



- Ishmael, Len, Director of ECLAC Subregional Headquarters for the Caribbean (Urban planning and overall development implications)
- Zapata-Marti, Ricardo, Mission co-ordinator
- Andersson, Bernt (PAHO)
- Budhram, Dowlat (IICA)
- Buescher, Gabriella (UNICEF)
- Busby, Lancelot (Macroeconomist)
- Ghisolfo, Francisco (Transport, communications and telecommunications and project formulation)
- Gómez, José Javier (Tourism and overall environmental aspects)
- Kambon, Asha (Social affairs, including housing)
- Mojica, Francisco (Basic Infrastructure and Services)
- Osorio, Claudio (PAHO)
- Pérez, Jose Miguel (IICA)
- Rojas, Ricardo (PAHO)
- Smith, David (Beach and coastal environmental assessment)
- Tapia, Antonio (Agriculture)

This document contains an independent assessment of the disaster, which sets forth the overall magnitude of direct and indirect damages and their effects on the behaviour of the economy as a whole. It is intended to assist in drawing up proposals for reconstruction priorities and needs, one of which should be the explicit incorporation of measures to reduce the country's high vulnerability to such disasters and increase Belize's sustainability for development.

## **2. Description of the phenomenon and its effects**

The hurricane season in the northern hemisphere and the Atlantic Ocean (July to November) has been unusually long for the last three years – since 1998 – and caused enormous and cumulative devastation, loss of life, and economic, social and environmental damage in the Central American and the Caribbean. Data for the nineties appears in Table 3.

### **a) Storm description**

Tropical Storm Keith began to intensify on 29 September 2000. Between Saturday 29 and Sunday 1, this system intensified from a tropical storm status to a category 4 hurricane. (Table 4 describes the Saffir-Simpson scale used to categorize hurricane's strength in terms of windforce and energy.) Over this period, central pressures dropped from 1 004 milibars (mb) to 942 mb, with a corresponding increase in sustained wind speed from 25 kilometres (km) to 115 km. During that period also, the hurricane remained almost stationary over the northern part of Belize, with the eye approximately over Ambergris Caye. A key feature of this hurricane was its rapid progression from a tropical depression to a category 1 hurricane in less than 24 hours and further rapid development to a category 4 hurricane in less than an additional 24 hours (see Graph 2).

Table 3

## MAJOR TROPICAL STORM AND HURRICANES IN THE CARIBBEAN, 1990-1999

Year	Classification	Name	Area	Dates
1990	Tropical Storm	Arthur	Tobago/St. Vincent and the Grenadines	22-27 July
	Hurricane	Diana	Yucatan	3-7 August
	Tropical Storm	Fran	Trinidad	11-14 August
	Hurricane	Klaus	Virgin Islands	2-9 October
1991	Tropical Storm	Fabian	Cuba	14-15 October
	Hurricane	Caesar	Trinidad and Tobago/Netherlands Antilles	24-29 July
1992	Hurricane	Andrew	Bahamas	16-27 August
1993	Tropical Storm	Bret	Trinidad/ Belize	4-11 August
	Tropical Storm	Cindy	Martinique	14-17 August
1994	Tropical Storm	Debby	St. Lucia	9-11 September
	Tropical Storm	Gordon a/	Jamaica/Cuba/Bahamas	8-21 November
1995	Hurricane	Erin	Bahamas	31 July
	Hurricane	Iris	Leeward Islands	6 August
	Hurricane	Marilyn	Virgin Islands b/ Netherlands Antilles/Leeward Islands/Dominica/Puerto Rico	22 August
	Hurricane	Luis	Leeward Islands c/ Netherlands Antilles	4 September
1996	Hurricane	Lili	Cuba/ Bahamas	12-22 September
1997		None		27 August
1998	Hurricane	Georges	Leeward Islands/Netherlands Antilles/Puerto Rico/Dominican Republic/Haiti/Cuba	11 September
1999	Hurricane	Floyd	Bahamas	14-27 October
1999	Hurricane	Jose	Anguilla/Netherlands Antilles/Leeward Islands/British Virgin Islands	15 September
	Hurricane	Lenny	Netherlands Antilles/ Virgin Islands	1 October
	Hurricane	Irene	Cuba	7-17 September
	Hurricane	Dennis	Bahamas	17-25 October
				13-27 November
				13-19 October
				24 August
				7 September

Source: United States National Hurricane Centre.

a/ Haiti severely affected. Rain/Floods.

b/ US and British Virgin Islands.

c/ Antigua and Barbuda, St. Barts, St. Maarten, Anguilla.

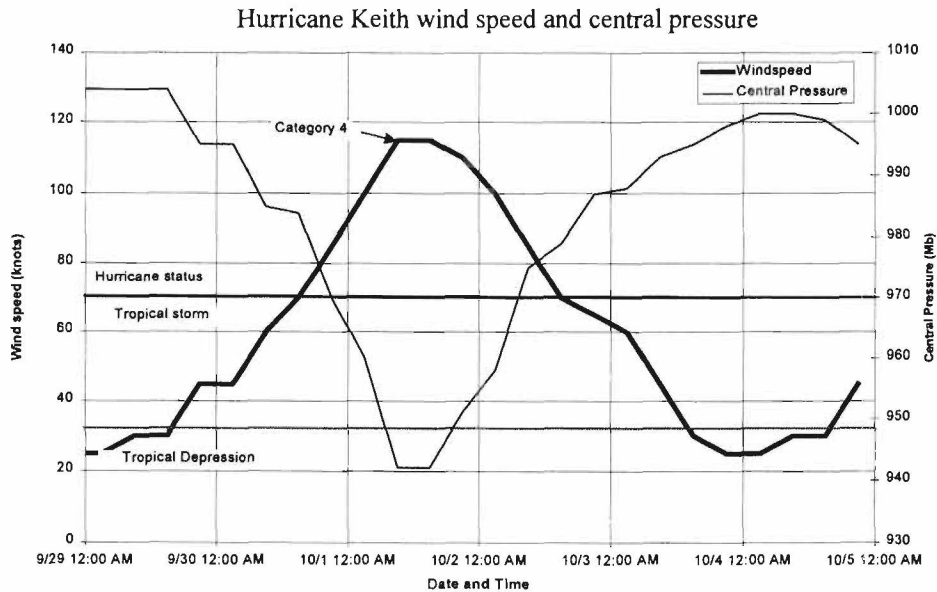
Table 4

## SAFFIR-SIMPSON HURRICANE SCALE VALUES

S-S Category	Maximum sustained wind speed (km/h)	Minimum surface pressure (mb)	Storm surge (m)	Relative damage value
Tropical storm				
1	119-153	>980	1.0 to 1.7	1
2	154-177	979 to 965	1.8 to 2.6	10
3	178-209	964 to 945	2.7 to 3.8	50
4	210-249	944 to 920	3.9 to 5.6	250
5	> 249	< 920	> 5.6	500

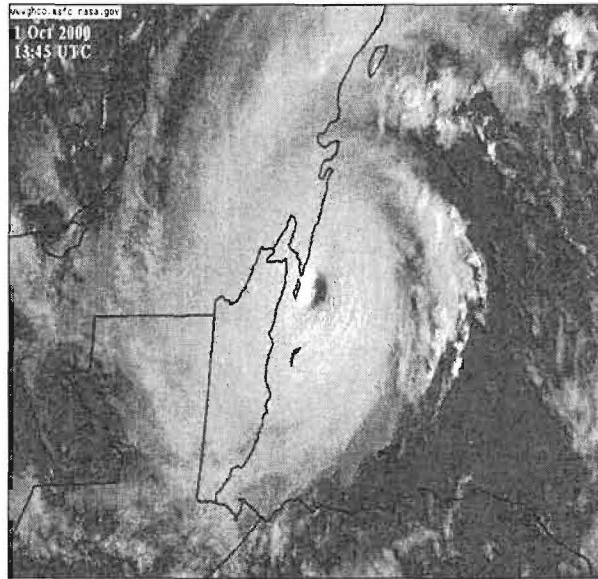
Because it was nearly stationary, this hurricane resulted in a record amount of rainfall on Belize. It is estimated that approximately 815 mm of rainfall fell in a 72-hour period between Saturday, 29 September and Monday, 1 October (see Graphs 2 and 3). This was one of the most extreme rainfall events that have been experienced in Belize in recent memory. Graph 3 shows the stationary position of the hurricane on 1 October., 2000.

Graph 2



Graph 3

THE WESTERN EYEWALL OF HURRICANE KEITH OVER  
AMBERGRIS CAYE, BELIZE



**b) Impacts on cayes and mainland**

The impacts of this hurricane varied considerably, depending on the location considered. At the keys (particularly Ambergris Caye and Caye Caulker or Cayo Hicaco), there was extensive damage from high winds, rainfall and storm surge on the leeward side of these islands. As a result of this, roofs were removed and extensive damage to property occurred. Because of the rapid intensification of this system from a tropical storm to a hurricane, there was limited time to carry out an effective evacuation from Ambergris Caye to the mainland. Graphs 2 through 5 indicates the general areas most severely affected by wind, rain and flooding, in the Belize, Cayo and Orange Walk districts.

On the mainland, the majority of the damage was confined to areas north of Dangriga. Extensive flooding was experienced, with roads being cut off and rivers subsequently flooding their banks. Belize City, for example, was cut off from access to or egress from it, as both main roads leading away from this city were under water. Further north, the road to Orange Walk Town was accessible only to trucks, busses and SUVs, as floodwaters cut off the main roadway. North of this town, there was extensive flooding of areas adjacent to the Rio Hondo, which resulted in loss of sugar cane crops and some livestock. In general, the damage on the mainland was restricted to some wind damage and extensive flood damage and hindrance in low-lying areas.

Table 5

BELIZE: RAINFALL DISTRIBUTION ASSOCIATED WITH HURRICANE KEITH<sup>6</sup>

(Millimetres)

Station	Friday Sep. 29	Saturday Sep. 30	Sunday Oct. 1	Monday Oct. 2	Tuesday Oct. 3	Total mm	Total ins
PSWGIA	22.4	136.6	472.5	178.4		809.90	32.67
LA Milpa				Flooded			
Libertad	54.1	101.1	34.4	0.0		189.6	7.46
Towerhill	40.2	63.3	54.0	46.0		203.5	8.01
Central Farm	68.2	16.3	44.2	135.6	0.3	264.6	10.41
Belmopan	33.6	20.5	88.4	186.2		328.7	12.94
Barton Creek	33.3	0.0	11.0	30.0	0.0	74.3	2.92
Chaa Creek		27.5	38.6	100.4	0.0	166.5	6.56
Baldy Beacon	25.9						
La Democracia				Flooded			
Belize Zoo	1.8	34.5	233.5	197.2	1.2	468.2	18.43
Hcl3							
Melinda	17.0	103.6	47.9	3.2	0.0	171.7	6.56
Middlesex	24.5	15.3	124.8	89.4	0.0	254.0	10.00
Pomona			114.3	50.0	0.0	164.3	6.47
Mayan King	11.0	10.0	47.1	23.0		91.1	3.59
Flores Farm							
Savannah	3.6	11.2	33.2	10.2	3.3	61.5	2.42
Bigfalls	3.7	2.3	120.1	13.9	2.0	142.0	5.59
Pgagstat	0.2	0.2	17.7	25.8	3.4	47.3	1.87
Blue Creek							
Spanish Lookout	72.2	14.8	37.0	120.1	6.2	250.3	9.85
Las Cuevas							
Rum Point							
Consejo							
St Johns College	57.7	33.5		535.9	0	627.1	24.69
Gallon Jug1						205.7	8.1
Gallon Jug2						208.3	8.2
Gallon Jug3						208.3	8.2
Gallon Jug4						243.8	9.6

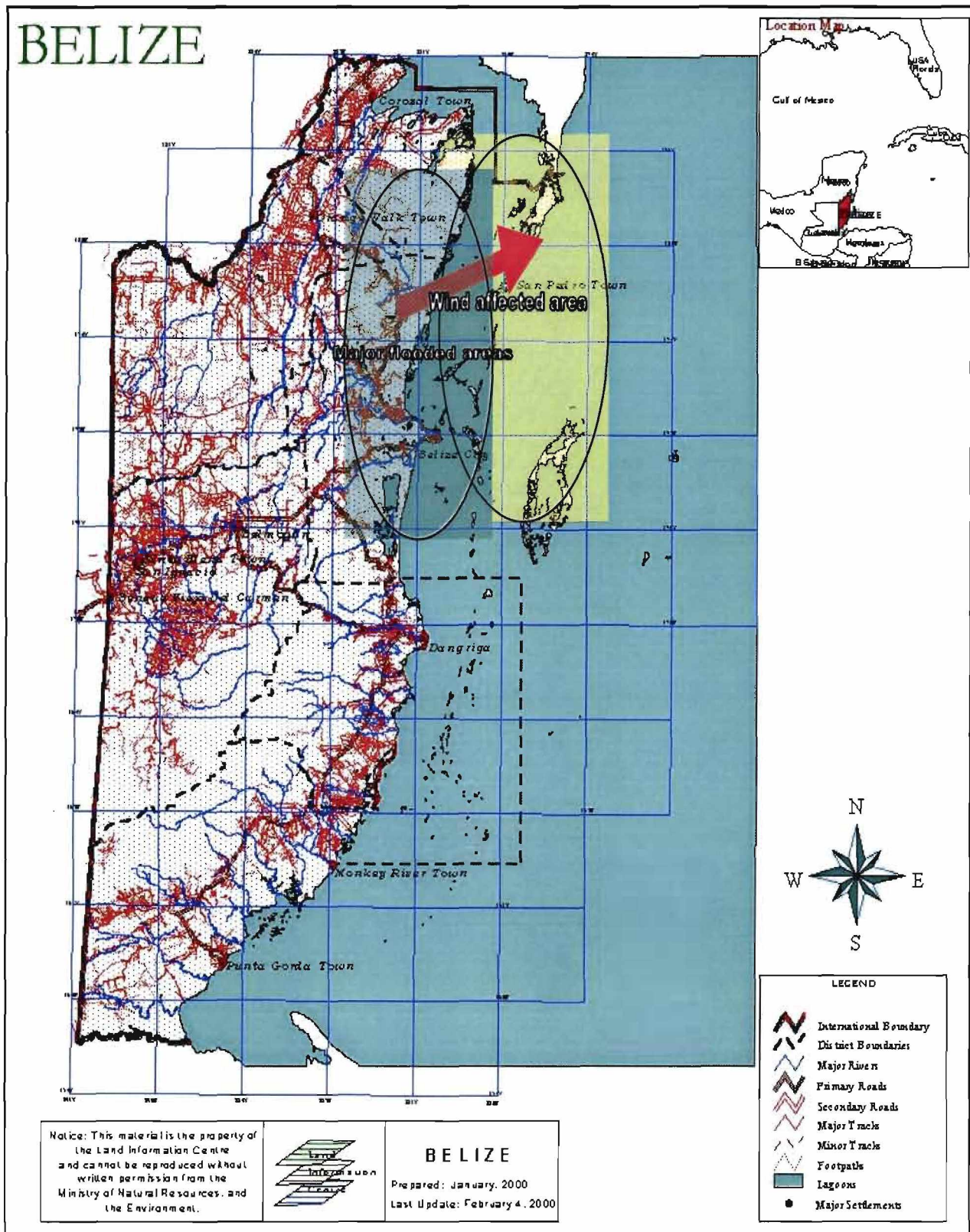
Source: ECLAC, on the basis of official data.

This hurricane clearly highlighted the areas of the country that are presently very vulnerable to extreme flooding. The lessons learnt from this experience must therefore be incorporated into the planning and decision making process.

<sup>6</sup> Period: 9:00 am – 9:00 am, 29/9/2000 – 3/10/2000.

Graph 4

## LOCATIONS OF MAJOR IMPACT OF HURRICANE KEITH IN BELIZE





### 3. Population affected

Of the four districts that were affected by Hurricane Keith, (Orange Walk, Cayo, Belize District, and Corozal) with a total population of over 125,000, more than 57,400 were affected. This represents 46 per cent of the inhabitants of these districts and 23 per cent of the national population. (See Table 6.)<sup>7</sup> Worst hit were the people who lived on the Cayes, namely Ambergris and Caye Caulker, as all their inhabitants were affected.

Table 6

BELIZE: ESTIMATED AFFECTED POPULATION DUE TO HURRICANE KEITH a/

As of 11 October 2000

Location	Total population as per census 2000	Total population as per PHI or key informant	Affected population
Total of affected districts	125,535	...	57,403
Belize District	62,729	...	27,308
Caye Caulker	742	1,300	279
San Pedro	4,499	10,000	3,000
Belize City	49,059	N/A	14,717
Rest of Belize District	8,429	9,415	9,303
Orange Walk District	26,244	17,988	14,126
Orange Walk Town	13,483	10,410	2,435
Rest of District	12,761	7,578	11,691
Corozal District	26,748	23,788	11,356
Cayo District	9,814	3,107	4,613

Source: ECLAC on the basis of official data.

a/ Utilizing Census 2000 information, except for the islands (Caye Caulker and Ambergris Caye) and villages not listed in the census report.

b/ Estimate, 20 per cent of persons living in flooded areas.

More than 5,000 persons were evacuated and 3,279 made homeless. Thirteen thousand persons were isolated due to the flooding and more than 57 thousand were affected due to the heavy rains and flooding. Ten lost their lives. PAHO/WHO reported that some 72,000 persons were at high risk of health impairment. (See Table 7.) This will aggravate a pre-existing deficit in sanitary conditions. Approximately 40 per cent of the urban and 80 per cent of the rural population did not have access to the public sanitation system before the hurricane.

<sup>7</sup> According to the 2000 Census, Belize has a population of 240,204 and has a 2.7 per cent growth rate. Belize is said to have the highest growth rate in the Caribbean. Fifty two per cent of the population lives in rural areas of the country and approximately 65 per cent of the population is under 25 years of age and 40 per cent of the population is under 14 years of age.

Table 7

## BELIZE: LIVING CONDITIONS OF AFFECTED POPULATION

Location	Living in flooded areas	Living in flooded houses a/	Living in shelters	Homeless	Displaced	Isolated	At high risk of health impairment
Total of affected districts	62,651	9,370	65	3,279	5,335	13,460	72,092
Belize District	24,029	4,863		3,279	3,279	4,555	35,314
Caye Caulker				279	279		1,300
San Pedro				3,000	3,000		10,000
Belize City	14,717	2,943					14,711
Rest of Belize District	9,303	1,920	0	0	0	4,555	9,303
Orange Walk District	13,673	2,732	65		2,056	7,509	15,536
Orange Walk Town	2435	487			420		2,855
Rest of District	11,393	2,245	65	0	1,636	7,509	12,681
Corozal District	19,126	610				1396	15,419
Cayo District	5,823	1,165					5,823

Source: ECLAC on the basis of official data.

a/ Estimates based on number of houses flooded. Assuming an average of 5 inhabitants/household based on census data.

Presumably this will have an undermining effect on the welfare of the most vulnerable households since in the four districts which were affected by the Hurricane, as many as 20 to 30 per cent of the households have been defined as poor. 26 to 40 per cent of the population have been defined as living below the poverty line by the 1996 poverty assessment survey. At the national level, 25 per cent of households and 33 per cent of individuals were found to be poor and 9.6 per cent of households and 13.4 per cent of individuals were considered to be extremely poor or indigent. It was noted that their level of expenditure was not enough to enable them to satisfy their basic food requirements.

Female heads of households comprise anywhere from a low of 25 per cent in Cayo, of the poor households, to a high of 38.5 per cent in Orange Walk. This percentage is higher than the national average. Women head Twenty-two percent of households. Cayo was one of the districts in the country, which had been defined as comprising the second highest indigent population in the country. Although there is no disaggregated data on the effect of the disaster on the female population, prevalent social conditions lead to believe that their vulnerability has increased. The UNDP Human Development Report for 2000, for Belize (soon to be published) notes that the female unemployment rate is approximately 20 per cent, which is almost twice the national rate, which stood at 12.8 per cent. The gender unemployment gap widened from 7.5 per cent in 1996 to 11.2 per cent in 1999. More than one quarter of the labour force work in the informal sector. Additionally, almost 30 per cent of everborns are to mothers under twenty. A study undertaken



on childbearing patterns among the young in Belize notes that 17 per cent of 21-24 year old had “not one or two but three or more children”.

It was reported to the mission that in the case of San Pedro the teenage pregnancy rate is above the national average. It was also pointed out that the migration factor has been so prevalent over the recent years that nowadays only one out of four of the inhabitants in the island are native “sanpedranos”.

Migration plays an important factor in the demographics of the country. While large numbers of young educated Belizeans emigrate to the United States and elsewhere, incoming migrants from neighbouring Central America have been making Belize their home. The United Nations High Commissioner for Refugees (UNHCR) estimates that during the past decade some 29,000 refugees have migrated to Belize, comprising 14 per cent of the population. At the aftermath of Hurricane Mitch that struck Central America severely in 1998, migration out of the most severely affected areas increased substantially and it is apparent some of that flow reached Belize. After Keith there seems to be no major migratory effect out of the country. To the contrary, inasmuch as the reconstruction process might increase the demand for labour force, there could be an attraction effect from neighbouring countries to provide workers to fill this need. This will only continue an ongoing process that has defined Belize’s demographic profile over the years.

In Corozal and Orange Walk there is a large dependence on agriculture and fishing. In the Belize District workers are distributed in construction, wholesale/retail and manufacturing and miscellaneous activities. Tourism is the lifeblood of the Cayes. In the country 52 per cent of the population live in rural areas and approximately 65 per cent of the population is under 25 years of age and 40 per cent is under 14 years of age.

As mentioned above, low-income groups are among the most affected. Some factors will increase their risks after Keith. First, the economic activities will experience a temporary setback, particularly in respect of some artisan activities like fishing, lobster capture. Agricultural subsistence farmers will require resources to recuperate and employment in the larger farms will be affected while the flooding persists. This problem will continue for several weeks still since natural drainage in the low-lying areas of the flood planes will be very slow given the small incline to the sea. This also entails that some health risks associated with stagnant waters will persist for a while. In the cayes the dynamics of the recuperation of the tourism sector has generated a temporary demand for labour force while the momentarily reduced flow of tourists has been compensated – in employment terms – by the self-help and community reconstruction undertaken in the small island communities.

Secondly, due to the characteristics of the cayes and the limited sanitary infrastructure’s coverage of rural areas and the islands, the health risks will persist unless specific actions are taken. Morbidity (and eventually mortality) levels resulting from this situation could be affected in the short term. Additionally in the affected areas there is a limited coverage of the water distribution network. The floods and silt deposited could affect provision of drinking (or at least safe) water supplies from local wells. Given the amount of debris as a result of the hurricane, particularly in the areas affected by wind, a proper waste disposal and garbage handling seem to be in order. The existing systems are not capable of processing the amount that has resulted since

most are open dumps or flow into the neighbouring lagoons with the inevitable consequence of decomposition and pollution. The hurricane highlighted the fragility of infrastructure to remedy these deficiencies, which was built in the same high-risk areas. Floods and the rain affected many latrines and water mains.

Finally, lack information may increase the risks faced by the affected population. Some communities have traditional ways of dealing with disasters, based on previous experiences. Since Belize had not suffered a similar event in some years, some local communities were inadequately prepared to face a situation such as that caused by Keith.<sup>8</sup>

#### **a) Vulnerability of women and children**

Poverty and environmental deterioration increase the risks stemming from natural disasters, and women and children are usually the most affected. The destruction of their homes, worse health conditions and loss of jobs and crops has a direct effect on their living conditions. Children are exposed to higher health risks, which can even lead to death; greater economic risks, as their education might be short by their need to enter the labour market at an early age, and greater psychosocial risks, since they are highly sensitive to changes in their surroundings. Women face greater challenges in the day-to-day running of their homes, as the task of organizing family resources becomes all the more difficult. Pregnant and nursing mothers suffer the effects of their deteriorated environment (particularly affecting their nutrition), which places them at great risk of contracting lethal diseases.

According to available data – which does not give gender disaggregated information – almost 5,000 houses were affected, directly causing harming almost 11,300 children through the loss of their houses, being displaced, having their family dislocated, living temporarily in shelters and interrupting their normal school and play routines. (See Table 8.)

#### **b) Psycho-social trauma rehabilitation**

Disasters affect people in different ways, however, the psycho-social impact of a hurricane on the family and especially children often remains invisible in disaster assessment studies. Yet, disaster situations may mean loss of loved ones including relatives, friends and neighbours; it may also mean loss of property, furnishings and cherished belongings. Sometimes it means starting over with a new home or business.

Although only ten people died, the emotional effects of material loss and social and family disruption may show up immediately or may surface many months later. It is important to remember that a disaster of any size will cause unusual and unwanted stress in those attempting to reconstruct their lives. In the aftermath of Hurricane Keith, trauma rehabilitation was only

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<sup>8</sup> At the national level, though, it must be noted the country had recently adopted a new disaster management plan (revised after the scare caused by Hurricane Mitch). This revised plan came into force in April 1999 and strengthens the National Emergency Management Organization (NEMO).

conducted on an ad-hoc basis by regular health staff who was mainly focusing on the physical effects of the emergency. It was, however, the first time in Belize that trauma was addressed.

Table 8  
BELIZE: FAMILIES AND CHILDREN AFFECTED BY HURRICANE KEITH  
(Number)

Area	Families affected	Household members	Adults	Children
Total	4,872	22,863	11,566	11,297
Belize Old Northern	326	1,321	594	727
Belize River Valley	155	712	320	392
Belize Central	132	598	270	328
Belize City	1,168	4,762	1,843	2,919
San Pedro	1,145	5,622	3,155	2,467
Caye Caulker	45	231	138	93
Orange Walk	1,085	5,051	2,273	2,778
Corozal	816	4,566	2,973	1,593

Source: ECLAC on the basis of official data.

Dealing with the consequences of the hurricane does not merely involve rebuilding destroyed social infrastructure, but also stepping up social and productive investment to address the vulnerability of low-income groups, so as not to leave them as exposed as they were prior to the hurricane.

#### 4. Emergency actions

##### a) Government actions

The Government of Belize declared the Preliminary Phase during the early hours of 30 September, and by 9:00 am that day had declared Phase III or Red II, in compliance with the Disaster Management Plan developed in 1999 after Hurricane Keith hit the Central American region. A Hurricane Warning was declared for northern Belize, meanwhile the government of Mexico had posted hurricane warning for the coast of Yucatan from Cabo Catoche to the Border with Belize. This became necessary as Keith intensified and kept drifting on a westerly track towards Belize's northern coastal waters. By 6:00 pm minimal tropical storm force winds were already spreading over northern coastal areas of Belize.



Given the rapid development of Hurricane Keith from a tropical depression to a category 4 hurricane evacuation orders were not issued to the residents of Belize City nor the two Cayes that were severely affected. However, on Sunday, 1 October 2000, transportation was made available free of cost to those persons in Belize City who felt insecure in their homes and wished to seek shelter inland, namely in Belmopan and San Ignacio. Residents of some settlements along the coastline of the Corozal District were advised to seek higher ground.

Throughout the approach and passing of the hurricane the NEMO issued reports of the storm's progress and advisories to the citizens of Belize. Special concern was expressed regarding the boarding up of their homes, provided information on transportation and shelters, and generally keeping the population abreast of what was happening throughout the country. The Food and Material Committee estimated initially that it would cost US\$820,000 to feed those in need (19,151 individuals on a declining basis) for the four-month period during which they will not be able to sustain themselves. Current figures are somewhat larger. Even before the hurricane emergency advisory was lifted (the "all clear" announcement by the Government) BZ\$49,091 had been spent in food supplies. Government has budgeted food provisions for a period extending from 4 to 16 weeks in some areas, which will imply an expenditure of over 1.8 million Belize dollars (see Table 9).

Table 9

## BELIZE: COST OF FOOD EMERGENCY

District	Total cost (Thousands of BZ\$)	Population to be fed (number)
Total	1,844.6	11,202
Orange Walk (between 4 and 6 weeks, according to local conditions)	856.5	5,472
Corozal (3 weeks in average: from 2 to 7 depending on community needs)	103.5	2,673
Belize (16 weeks in average)	831.9	2,420
Cayo (1-2 weeks in most cases, except for one community that will receive 8 weeks supplies)	45.5	637
Stann Creek	7.4	...

Source: ECLAC, on the basis of official data.

a/ At a cost of BZ\$ 2.00 per person per day for a period that varies in each district and community according to needs. Rate of exchange is BZ\$ 2 per US dollar.

The Ministry of Health (MOH) in collaboration with PAHO/WHO conducted a Rapid Health Assessment in a timely and systematic manner. The information collected was used to guide the decision making process of the MOH in relation to the relief and mitigation phase, and to guide the request for external assistance.

Given the evidence on the importance of psycho-social counselling during and after an emergency situation, this is the first time that a proposal was put forth to have a psycho-social component as part of emergency and rehabilitation efforts in Belize. Table 10 shows no breakdown between the number of people who visited health services and the number of people seen informally by health personnel. Trauma management was also only conducted in Belize district. The type of problems addressed is exemplified in Table 11.

On the other hand, in order to handle the emergency a number of regularly provided counselling services were interrupted by the hurricane (including family violence casework, child protective services and community counselling centre). Thus, to the emergency costs indicated in Table 12 should be added the loss of services not provided, which are estimated to total BZ\$57,643.33.

Table 10

BELIZE: PSYCHO-SOCIAL/TRAUMA REHABILITATION IN THE AFTERMATH  
OF HURRICANE KEITH

	Sex	Age	District	Total
Number of persons who visited health services	36 women 25 men	16-65 years	Belize District (Caye Caulker* & San Pedro)	61 adults a/
Number of persons seen due to trauma	No disaggregated data	No disaggregated data		
Number of days worked on trauma management	3 females 1 male	-	Belize District (Caye Caulker & San Pedro)	5 days x 5 staff = 25 man days

Source: ECLAC on the basis of official data.

a/ Caye Caulker also reported 18 new patients and two new ones seeking psycho-social services, in addition to the ones reported in the table above.

Human relief services provided to affected population by government staff and volunteers during the emergency in terms of social attention, counselling and others and the contribution of the Defence Forces were instrumental in alleviating some of the more traumatic effects and tending to the basic need during the emergency. Table 12 details some of the expenses incurred.

Table 11

## BELIZE: TYPES OF TRAUMA MANAGEMENT PROGRAMMES CONDUCTED

Group Trauma management counselling (with persons over age 30 in one shelter with a population of 130)
Conflict resolution counselling meetings
Support group meetings for psychiatric, medical and social worker staff
Public service announcements for stress and crisis management
Individual and family counselling; stress management.

Source: ECLAC.

Table 12

BELIZE: EMERGENCY COSTS AFTER  
HURRICANE KEITH

Services	Cost (Thousands of BZ\$)
Human and Development Staff	84.3
Social Workers	113.6
Counselling in institutions	33.6
<u>Sub Total Cost</u>	<u>231.5</u>
Belize Defence Force	146.0
<u>Total</u>	<u>377.5</u>

Source: ECLAC, on the basis of official data.

**b) International cooperation**

The United Nations Disaster Response Team (Belize), chaired by the PAHO/WHO responded to the emergency in an organised manner according to their disaster plan. The plan was activated by the Chairperson, who is the Country Representative of PAHO/WHO, on Friday, 29 September 2000 at 4:00 p.m. during a joint meeting of the three agencies. The UN Emergency Operation Centre (UNEOC) was established according to the plan at the UN House in Belmopan on Sunday morning. Throughout the passing of the hurricane, the chair of the UN Disaster Response Committee was in direct contact with NEMO and its committees to get information on

national needs. NEMO was informed at an early stage on what type of assistance the UN Agencies could offer and the UN Committee made all initial contacts in preparation to respond quickly at the behest of the Government of Belize. Regular contact was maintained with the UN Agencies' Headquarters and Regional Offices.

The official request for assistance came from the Government of Belize on Tuesday, 3 October 2000. At that time the first meeting of the Foreign Affairs Committee took place and was attended by representatives of the three UN Agencies in Belize. No assessment of damages and needs had been conducted at that point. The UNEOC was officially closed on Thursday morning, 2 November 2000.

The UN System has coordinated the donation of hundreds of thousands of dollars in emergency supplies to NEMO and non-governmental organizations (NGOs) in Belize. Over 11 Situation Reports have been issued by the UN Office for the Coordination of Humanitarian Affairs and by 2 November UNDP, UNICEF and PAHO/WHO had completed a "Compilation of Damage and Needs Assessments, Response and Rehabilitation Plans in connection with Hurricane Keith".

Total foreign assistance received – as reported by PAHO's SUMA and the Government of Belize – amounts to a total of BZ\$5,175,734.

The international financial institutions activated their emergency response mechanisms in case of disasters. A World Bank Mission was in the country to assess the road and infrastructure situation in order to reorient its available resources for Belize and study the possibility of providing additional funds. The IDB approved an emergency loan for US\$20 million to assist following Hurricane Keith. This was done through the Emergency Reconstruction Facility the Bank operates for such purposes.

## II. ASSESSMENT OF THE DAMAGE

This chapter contains an assessment of the damage caused by Hurricane Keith to the social (housing, education, health), infrastructure (energy, transport and communications, water and sewerage) and production sectors (agriculture, fisheries, tourism, industry and services), and to the environment. The assessment was carried out on the basis of information available during the mission and incorporates aspects that became known soon afterwards.

Direct damages or effects were assessed, i.e., to physical infrastructure and the country's capital reserves, and indirect damages or effects, such as lower production of goods and services and emergency outlays. Direct damages have been assessed on the basis of capital assets prior to the disaster; i.e., taking into account depreciation and normal use of capital goods.

In keeping with ECLAC methodology, the loss of crops, either about to be harvested or stored for distribution, is calculated as direct damage, and damages to inventories and production under way in the industrial sector are classified as direct costs.

The cost of rebuilding damaged assets has also been calculated where relevant. If the aim were to return to the situation prior to the hurricane, the value would be the same as the direct cost according to this methodology. However, for the purpose of a reconstruction programme, the assessment should also take into account the value of improved replacement, including disaster prevention and mitigation criteria, such as better technology and quality and more resistant structures. The country now has an opportunity to rebuild on sounder economic, social and environmental bases while simultaneously reducing its vulnerability to natural disasters.

The ECLAC mission interviewed representatives of the government, the private sector, international organizations, UNDP and other United Nations agencies, who frequently provided information and valuable suggestions for the preparation of this document.

The figures used in this chapter were calculated in local currency and in US dollars, based on the exchange rate of BZ\$2.00 per US dollar.

### 1. Social sectors

#### a) Housing

Some 3,000 houses have been so badly damaged by Hurricane Keith that they require complete replacement for families to be able to occupy them once again. This represents a little less than 10 per cent of the affected area's housing stock which was estimated in 1994 at 35,355 units. Of these the destroyed ones are almost two thousands. The most affected districts were Belize (namely in San Pedro and Caye Caulker) and Orange Walk. Table 13 indicates the breakdown by district.



Table 13

BELIZE: LOCATION AND NUMBER OF HOUSES AFFECTED BY  
HURRICANE KEITH

District	Number	Damaged houses (Cost of damages)	Lost houses (Reconstruction costs)
		Thousands of Belize dollars	
Total	1,988	21,725.3	46,735.3
San Pedro	406	10,280.0	12,670.0
Caye Caulker	275	6,625.0	9,625.0
Belize District (other than cayes)	65	2,761.0	3,490.0
Orange Walk	1,212	1,889.3	11,034.3
Cayo District	30	90.0	90.0
Corozal District	0	80.0	80.0
Other a/	...	...	9,746.0

Source: ECLAC, on the basis of official data.

a/ Damaged houses in the villages of More Tomorrow, Roaring Creek and Black man Eddy were not yet counted and, thus, not included here.

Many dwellings were either totally destroyed or suffered complete or partial roof damage, particularly in the coastal areas hit by hurricane-force winds. Others suffered damage as a result of flooding. In all cases there was severe losses in spite of the materials used.

Damages to house in Caye Caulker are expected to have some negative effect on the tourism sector as many of those home offered a tourist service of bed and breakfast. It was estimated that approximately 238 homes on the Cayes were completely destroyed while 558 needed roofs and other repairs.

The repairs and replacement to similar conditions (which appear in Table 14) have a value of BZ\$36 million. To this cost must be added the indirect costs of lost or increased rental costs, some looting that occurred and the replacement of lost furnishings and expenses generated in shelters while the homeless victims remained there.

It was reported than in many cases only the head of the household remained on the island while the rest of the family had left to stay with relatives on the mainland. As mentioned earlier, for the most part, persons preferred not to stay in temporary shelters, but to live with friends and family fortunate enough to have homes. Some hotels and property owners opened their doors to the homeless as well.

Table 14

## BELIZE: SUMMARY OF EFFECTS ON THE HOUSING SECTOR

	Thousands of Belize dollars
Total	68,620.8
<u>Direct effects: (a = i + ii)</u>	<u>68,460.6</u>
i. Reparation of damaged houses	21,725.3
ii. Replacement of lost houses	46,735.3
Imported component	14,020.6
<u>Indirect effects</u>	<u>160.2</u>

Source: ECLAC, on the basis of official data.

Reports indicated that the repairs to homes on the islands were very slow to commence. Lack of building materials and a plan that provided alternatives for securing financial assistance may have contributed to this.

It should be noted that the dwellings destroyed completely were generally made of flimsy materials and very precariously built. This poor quality of housing makes persons more vulnerable to hurricanes. Building codes are not adhered to as poor people build wood and thatched roof structures or wood and zinc roof structures without necessary approval. Timber blockhouses are also common. Many housing settlements are in flood prone or low lying districts increasing their vulnerability to the effects of a hurricane. It must be pointed, nevertheless, that reconstruction with some required improvements to reduce vulnerability is a larger figure, as can be seen in Table 15.

Table 15

## BELIZE: ESTIMATED RECONSTRUCTION COSTS

	Thousands of Belize dollars
Total	106,416.9
<u>Direct effects: (i + ii + iii)</u>	<u>93,470.6</u>
i. Reparation of damaged houses	36,989.3
ii. Replacement of lost houses	46,735.3
iii. Cost of furnishings	9,746.0
Imported component	16,757.1
<u>Secondary effects (relocation)</u>	<u>12,946.3</u>

Source: ECLAC, on the basis of official data.

## b) Education

Damage to the education sector was considerable. Particularly hard hit were the schools that suffered damage to their roofs and to their structures due to flooding. Schools in Belize District, particularly the Cayes and Belize City suffered the most damage. Those located in Orange Walk and Cayo District suffered the next highest level of damage. In all some 51 schools, thirty-three at the primary and 18 at the secondary level were damaged both in rural and urban areas. (See Table 16.)

As a result of the hurricane over 2,000 children were unable to attend school for a period of at minimum two and a half weeks. The government attempted to get children back in school as quickly as possible. In some instances children were out for as many as four weeks in order to probably sanitise the facilities, particularly those in the Belize river valley, New River and the Rio Hondo which required flushing, cleaning and disinfecting before the classes could resume. This has a sense of urgency since education is critical for Belize as the recent literacy survey point to a functional literacy rate of only 42.5 per cent and the 1996 poverty assessment identifies a clear relationship between poverty and people's level of education.

The larger amount of total damage corresponds to direct costs; indirect costs were slightly lower (BZ\$810,000). Damage to infrastructure centred on semi-destroyed schools. Schools that were used as shelters also suffered damage in the vicinity of some BZ\$127,000. (See Table 17.) Most were vacated within two weeks of the disaster.

Schools lost newly created computer laboratories, desks, chairs and educational materials, all of which will set back the educational programme of the Ministry of Education which is geared to improving the quality of education offered to its population.

Three libraries, two located in Belize city, the Leo Bradely Library and the North Front Street Library, and one in Belmopan, the Belmopan Library, suffered damage as a result of the rains and flooding. The cost of repairs have been estimated at BZ\$102,000, to which should be added furnishings in the amount of BZ\$622,125.

Sporting facilities have suffered damage due not only to the hurricane but also as a result of their having been used as emergency distribution points and temporary deposits for diverse materials (electric cables, poles, etc.). Those most affected were located in Belize City, San Pedro on the Cayes, and in Orange Walk. The damage is estimated at BZ\$418,000. (See table 18.)

Table 19 summarises the direct and indirect costs of damages to the education sector. Reconstruction and reinforcement of existing structures in order to reduce vulnerability and exposure to risk associated with climatic phenomena could increase costs considerably. This figure will depend on the Government and communities decisions in respect of the mitigation process.

Table 16

## BELIZE: SCHOOLS DAMAGED BY HURRICANE KEITH

(Thousands of Belize dollars)

	District	Rural	Urban	Damages
Total				958.2
Belize District				556.9
All Saints School	Belize City		x	17.0
Buttonwood Bay Nazarene Primary School	Belize City		x	10.3
Central Christian Assembly	Belize City		x	27.3
Excelsior High School	Belize City		x	10.1
Fort George Education Center	Belize City		x	16.6
Gwen Lizarraga High School	Belize City		x	25.1
Ladyville Technical High School	Belize City	x		14.5
Lake -1 Community Center	Belize City		x	7.4
Nazarene High School	Belize City		x	96.3
Pallotti High School	Belize City		x	15.6
Queen Square Anglican School	Belize City		x	5.1
St. John's Primary	Belize City		x	20.1
St. John's Vianney	Belize City		x	1.8
St. Joseph School	Belize City		x	2.5
St. Martin de Porres, (BZE)	Belize City		x	9.1
St. Mary's/Queen's Square/ St. John's Anglican Schools (BZE)	Belize City		x	27.7
Wesley College	Belize City		x	3.0
Caye Caulker RC School	Caye Caulker	x		71.2
San Pedro Adventist	San Pedro	x		67.2
San Pedro High School	San Pedro	x		5.7
San Pedro RC School	San Pedro	x		53.0
San Pedro Seventh Day Adventist School	San Pedro	x		50.3
Corozal and orange walk				185.4
Caledonia School	Corozal	x		0.4
Sarteneja Kindergarten	Corozal	x		1.2
Sarteneja School	Corozal	x		15.0
Schools in the Corozal District	Corozal	x		123.9
OW Schools to date	Orange Walk	x		44.9
Other				215.8
Anglican Cathedral College			x	34.2
Canaan SDA High School			x	6.0
Center for Employment Training (BZE)			x	29.3
Edward P. Yorke High School			x	3.8
Grace Primary School			x	90.0
Maskall RC		x		4.0
Sadie Vernon High School			x	0.3
St. Catherine's Academy			x	44.1
St. Edmond Champion RC School			x	0.4
Stella Maris School			x	3.7

Source: ECLAC, on the basis of official data.

Table 17

## BELIZE: SCHOOLS DAMAGED FROM USE OF SHELTERS

	District	Rural	Urban	Damages (Thousands of BZ\$)
Total schools				127.1
San Pedro Roman Catholic School		x		53.0
Fort George Education Centre	Belize City		x	16.6
Queen Square Anglican School	Belize City		x	5.1
Salvation Army	Belize City		x	1.5
St. John's Middle & Upper School	Belize City		x	20.1
Buena Vista School	Corozal		x	1.2
Caledonia School	Corozal	x		0.4
Copper Bank	Corozal	x		0.2
Corozal Town Health Clinic	Corozal		x	0.4
Progreso School	Corozal	x		0.1
Ranchito School	Corozal	x		3.5
August Pine Ridge	Orange Walk	x		10.0
Fireburn School	Orange Walk		x	10.0
San Felipe School	Orange Walk	x		0.5
San Francisco School	Orange Walk		x	1.8
Yo Creek RWS	Orange Walk	x		2.8

Source: ECLAC, on the basis of official data.

Table 18

## BELIZE: DAMAGES TO SPORTING FACILITIES

(Thousands of Belize dollars)

	District	Rural	Urban	Damages
Sporting Facilities				418.9
MCC Grounds	Belize City		x	14.4
Roger Stadium	Belize City		x	32.3
National Sports Council Office	Belize City		x	3.7
City Center Sporting Facility	Belize City		x	223.1
National Stadium	Belize City		x	50.9
San Pedro Town Football Field	San Pedro	x		9.3
San Pedro Town New Football Field	San Pedro	x		31.0
San Pedro Town Basketball Court	San Pedro	x		13.0
San Pedro Town Five A Side Football Court	San Pedro	x		7.5
Norman Broaster Stadium (Cayo)	Cayo		x	2.5
People's Stadium (Orange Walk)	Orange Walk		x	31.3

Source: ECLAC, on the basis of official data.

Table 19

## BELIZE: SUMMARY OF EFFECTS ON THE EDUCATION SECTOR

	Thousands of Belize dollars
Total	3,038.3
<u>Direct effects:</u>	<u>2,289.1</u>
i. Reparation of schools (without improvement)	958.2
ii. Replacement of school materials and furnishings	810.0
iii. Damages to libraries	102.0
iv. Damages to sport facilities	418.9
Imported component a/	911.5
<u>Indirect effects:</u>	<u>749.2</u>
i. Cost of teachers during class suspension	622.1
ii. Damages for use as shelters	127.1

Source: ECLAC, on the basis of official data.

a/ Includes computers lost during the disaster.

### c) Health sector

i) Health infrastructure. The main damages to the health infrastructure were reported to the National Hospital (Karl Heusner Memorial Hospital) and the Central Medical Laboratory and several clinics in Belize City, Belize rural, San Pedro (Ambergris Caye), Corozal and Orange Walk districts. It is estimated that eleven health centers lost their three-month medical supplies and basic equipment.

The Karl Heusner Memorial Hospital is the national referral hospital in Belize (119 beds), receiving patients from the City and all the Districts as well as being the Accident and Emergency Centre for Belize City and the rest of the country. Immediately before and during Keith, some patients were discharged and sent home from the Hospital, and some were transferred to the District Hospitals in Belmopan and San Ignacio.

The Hospital, therefore, remained functional throughout the storm and this is undoubtedly a tribute to the determination and resilience of the staff as a large amount of water entered the buildings through the roof, windows and doors and also up through the floor. Fortunately no serious damage was reported to equipment, although the immediate and longer-term effects of the water seepage on the floor and ceiling tiles will undoubtedly be a problem.

The Central Medical Laboratory and Blood Bank is the only such facility in the country, and its main activity is the analysis of Safe Blood for transfusion. The hurricane affected the Safe Blood supply as all reagents, all blood units stock (50) and 100 per cent of supplies were lost due to electricity failure (the generator didn't work) and flooding.

Several pieces of furniture and equipment are malfunctioning or damaged following Hurricane Keith. Some of them are essential such as: the Blood Bank Unit (Refrigerator), the



ELISA washer (for HIV, hepatitis and dengue testing) and the autoclave, two large capacity storage refrigerators (bacteriology and chemistry), the Histo-center and two microscopes from the Histology/Cytology Department.

Minor water damage to ceilings, roofs, floors and workstations was reported on the three floors due to leaking and flooding, but damages need to be repaired to ensure correct function.

Availability of safe blood for transfusion is a major area of concern, since blood screening for HIV, hepatitis B and syphilis cannot be performed presently due to the lack of reagents and equipment. Therefore, the restoration of the Central Medical Laboratory and Blood Bank capacity for blood safety is an urgent matter.

ii) Epidemiological and environmental health issues. Water supply systems were greatly affected by Hurricane Keith. The islands and four districts were completely flooded resulting in dumpsites, sewer lagoons and excreta from latrines and septic tanks being washed into residential areas. This also caused contamination of wells used by the residents for drinking purposes. On the basis of available information, approximately 480 water wells were affected, representing a 10 per cent of the total of this kind of facility in the country. In addition, 1,140 excreta disposals were destroyed or partially affected by the hurricane, amounting to approximately 20 per cent.

The poor environmental conditions, poor personal hygiene, together with the unavailability of sufficient safe water also makes food safety a concern, since there is neither an inspection mechanism in place nor equipment to ensure safety standards. Food poisoning cases have already been reported. Due to the existing epidemiological situation, compounded by the environmental conditions and the disruption of public health and primary care services, the potential for outbreaks is high. Communities living in flooded areas are at particularly high risk of being affected by possible outbreaks or diseases such as dengue fever, typhoid, malaria, cholera, gastroenteritis, leptospirosis, Chagas and hepatitis A, which are already endemic in the country. Table 20 indicates the population at risk in the affected districts.

Table 20

BELIZE: POPULATION AT HIGH RISK OF HEALTH  
IMPAIRMENT

Total	72,092
Belize	35,314
Orange Walk	15,536
Corozal	15,419
Cayo	5,823

Source: PAHO/WHO.

Table 21 summarises the direct and indirect damages experienced in the health sector. Reconstruction costs and an indication of import components are included.

Table 21

## BELIZE: SUMMARY OF DAMAGES TO THE HEALTH SECTOR

(Thousands of Belize dollars)

	Damage			Reconstruction costs	Imported components
	Total	Direct	Indirect		
Total	3,888.0	2,558.0	1,330.0	2,855.0	1,600.0
Partial or total destruction of health infrastructure	1,130.0	1,120.0	10.0	2,200.0 a/	
Loss equipment and furnishings	640.0	640.0			1,500.0
Health community education material	70.0		70.0		
Extra spending on drugs and medications	524.0	104.0	420.0	5.0	100.0
Vector control-environmental sanitation activities	674.0		674.0		
Increase cost of inpatient, outpatient and medical care	123.0		123.0		
Epidemiological surveillance	30.0		30.0		
Damages in rural water supply systems (wells, rain water vats)	157.0	157.0		250.0 a/	
Damages in rural sanitation systems (latrines)	537.0	537.0		400.0	
Psycho-social rehabilitation (consultancy and training materials)	3.0		3.0		

Source: PAHO/WHO different reports: "Preliminary Economic Impacts of Hurricane Keith", NEMO, Oct. 2000, *Situation Analysis of Rural Water Supply & Sanitation in Belize*, UNICEF, Ministry of Health, PAHO/WHO, 1995.

a/ Includes some minor improvements.

## **2. Damage in productive sectors**

This section includes estimates of damage to the agricultural, fisheries, tourism, and other productive and services sectors. The extremely severe weather conditions in the wake of Hurricane Keith caused serious disruptions to the country. Some were very brief namely the cuts in basic services that were quickly restored. Others will have more serious implications. The impact on tourism is broken into two aspects. Damages to the infrastructure, which will be repaired and replaced promptly, and the number of visitors, which may be adversely affected in the impending high season. It must be praised that the government and the private sector operators have joined efforts in launching a campaign to dispel a false perception that might affect them negatively. In the case of agriculture and fisheries the effects will be somewhat more lasting, given the seasonal nature of their production and the persevering negative physical conditions associated with slowly receding waters and mud deposits. Crops tend to be the most affected due to excess water, and crop damage depends on various factors, which are described below.

Apart from losses of infrastructure and capital goods (tractors, combine harvesters, etc.), direct damage in the farming sector includes lost harvests and stored produce. The effect of the hurricane on future farming output is considered indirect damage, whereas in the industrial sector (namely sugar processing, rice husking, citrus concentrate), inventories and goods in process affected by the hurricane are counted as direct damage.

### **a) Agriculture, livestock and fisheries sector**

As a result of Hurricane Keith, the agriculture sector experienced major losses. Sugar, citrus and rice crops were affected in the districts of Corozal, Orange Walk, Belize and Cayo. The Orange Walk District was affected the most, accounting for 35 per cent of total estimated losses. It was mainly damages to the sugar cane crop, which is the most important agricultural export commodity for the district and the country. The citrus industry – the second most important export crop – also experienced major losses in the Cayo District. In Blue Creek, which is the main producing area for rice, only 5 per cent of the crop could be harvested, the rest was lost due to the flooding.

Major losses in crops and livestock were experienced as a direct result of floods. In some areas water remained without draining for a significant period of time. During this period most commodities for national consumption were in production and reaching harvesting time. This has increased losses since harvesting could not be carried out in time. This will also affect national consumption and product availability to those who store their crop for home consumption. Rice and beans will have to be imported, in order to attain the necessary food supply for next year.

The livestock sector suffered minimal direct damages compared to total stocks. Major losses in this sector were linked to damage to pastures and to secondary effects resulting from stress and loss of weight in cattle and poultry.

The fisheries sector experienced significant damages especially in the reduction of expected catch, due to silt accumulation. Most affected are areas of lobster production. This is

expected to also reduce the annual catch for some time (up to three years), with the consequent negative impact on the income of the majority of fishermen.

The Ministry of Agriculture, Fisheries and Co-operatives (MAFC) reacted immediately by preparing a comprehensive and well-organised plan, which involved in providing inputs and other supplies to alleviate the present situation. At the same time an immediate plan of action was activated with the assistance of supporting agencies such as IICA, FAO, and the Regional Unit for Technical Assistance in Central America (RUTA, run by IICA and funded by the World Bank), to start the recovery of areas affected. Seed distribution, assistance in preparing loan applications, machinery services were the immediate steps taken by MAFC.

i) Crop Analysis. Sugar Cane: This commodity is a major contributor to the Belizean Economy involving approximately 9,000 farmers. Approximately 22 per cent of total expected production was lost mainly due to flooding along the Rio Hondo and New River. It is estimated that 24,281 hectares were flooded, production being lost in at least 2,835 hectares. A reduction of 15 per cent in yield is expected alongside an increase of transportation cost due to the present road situation. Additionally, some replanting will be necessary due to loss of rootstock under extended period of flooding and reworking will also be needed to replace herbicide and fertilizer washed away and to eradicate new weed seeds most likely to germinate. Being the major commodity exported, these losses in production will not only have a significant effect on the socio-economic standard of the sugar-cane farmer, but will impact the overall economic performance for the period 2000-2001.

Citrus: Approximately 2,553 hectares of citrus were completely lost in the Cayo, Orange Walk, Belize and Stann Creek districts. A reduction of 5 per cent in production is estimated for the remaining planted surface. This will have, added to the decrease in the price of the product, a significant impact to the citrus farmer and the juice extraction industry as a whole. Losses resulted as a consequence of the excessive high winds that affected the coastal areas. Additionally, flooding in some areas prevented harvesting; therefore a loss in production was recorded. An increase of phytophthora disease is expected, so farmers will have to increase investment to prevent major losses in production.

Papaw (Papaya): A total of over BZ\$4.3 million were lost as a result of wind destruction mainly in the Corozal, Orange Walk and Cayo districts. This will decrease expected production by 15 per cent and impact negatively in the exports of this crop. The recuperation and future expansion of papaya plantations could generate major foreign exchange earnings, since CARICOM partners appreciate the quality of the Belizean product.

Other export crops: The Government of Belize has initiated a program to identify new commodities for the export market such as cowpeas, plantains, etc. Some of these crops suffered major losses, totalling approximately, BZ\$20 million. Promotion of these commodities in the CARICOM market is a potential area for future investments. It is also socially important because most farmers involved are very small in size but capable and ambitious.

Rice: This is a major domestic crop widely cultivated in the Orange Walk, Corozal and Belize districts. Major production is concentrated in the Mennonite Community of Blue Creek (in the Orange Walk District) where an intensive production system is carried out. Harvesting of rice



was about to start when the hurricane hit, flooding about 50 per cent of the rice area, part of which is still flooded after several weeks.

Corn: This is also a very important crop in the northern part of the country and is destined mainly for the production of cattle, poultry, pigs and sheep feed. Almost 70 per cent of the corn area was affected (10,994 hectares) with a total cost of BZ\$6.9 millions. It is estimated that in the preparation of feeds, another inputs can be used, in order to avoid imports until the next crop is available in October 2001.

Other crops were also damaged, but losses were not of a significant economic importance as a whole. Soybeans, plantains, beans, vegetables and root crops can be included among these less severely affected productions.

ii) Livestock. Major damage occurred in grazing lands. An area of 17,627 hectares remained under water for over 15 days. Most of the area damaged will have to be replanted, and in the meantime the cattle should be moved to other places to be fed until the new pastures will be ready to be used. The Government is already operating a plan to feed cattle using sugar cane that will not yield sugar since it was blown down by the wind. This cane is to be cut and chopped for animal consumption. This plan and similar initiatives should be considered for implementation while grazing lands and pastures recover. In order to reduce the pressure on the diminished feeding capacity, some cattle could be sold and sent to farmers in other areas of the country.

Commercial rearing of chickens was not significantly affected by the strong winds that accompany the hurricane, but some chicken held by small farmers, practically disappeared in the more severely affected areas. It is estimated that almost 40,000 chicken were lost during Keith.

iii) Fisheries. Lobster catching is the mainly affected activity in the fishing industry. Hurricane Keith came in the area in the middle of the fishing season (Jun 15 – Feb 15), with peaks in the last three months of the year. This not only affected the capture of lobster but also damaged the infrastructure and equipment required by the fishermen. Vessels, motors, piers, traps (cages), and in certain cases the fishermen's dwellings and limited storage facilities were destroyed.

Furthermore, in certain areas the sedimentation of sand, mud and debris over the fishing grounds has made it impossible to catch lobsters after the hurricane. The recovery of these areas is vital for fishermen. Unfortunately rehabilitation is constrained to the evolution of sea currents which will naturally restore fishing grounds by washing away the silt that was deposited by Keith. This natural process will take some time. Furthermore, water pollution by debris pushed lobsters out of the area: they migrated and fishermen will have to wait until they come back. In the meantime they are building and repairing the traps and restoring their infrastructure and gear. The MAFC has been giving these fishermen supplies, such as wood to assist them to recover.

Damage was not reported in shrimp production, most of which is done mainly in ponds which are located in the outskirts of the most severely hit districts. In the last five years shrimp production has increased at a very accelerated rate. Exports grew from BZ\$26 million in 1996 to

close to BZ\$46 million in 1999. This economic activity is expanding and it has a promising future and could partially compensate for the decline in lobster catch.

In addition to crops, animal and fishing resources affected some capital goods, machinery, farm equipment and inputs were damaged or lost during Keith. This includes a substantial amount of in-farm feeder roads. Table 22 summarises the direct and indirect effects on this important sector.

## **b) Tourism**

Damages caused by Keith are particularly harmful to the tourism sector since it is the most important economic activity in the Belizean economy. According to the World Tourism Organization (WTO) in 1996 it represented 14.3 per cent of GDP. It also constitutes the major export item of Belize, generating in 1998 revenues of US\$88 million and almost doubling the second export item (sugar).

Tourism has developed over the last decade as a dynamic sector, which is experiencing rapid growth (see Graph 5 below). Tourist arrivals have almost doubled, tourist infrastructure and tourist activities supply also expanded at a high rate.<sup>9</sup> A most important factor to be considered is that tourism products are related to Belizean culture and the country's natural resources endowment: tropical rain forest, living cultures, historic buildings and marine life.<sup>10</sup> Regarding country of origin, 70 per cent of visitors to Belize are from the United States and Canada and 23 per cent from Europe.

In terms of room revenue,<sup>11</sup> the most important areas of the country are Ambergris Caye (43.1 per cent of total room revenues), Belize District (23.6 per cent) and the Cayo District (10.7 per cent). The high season for tourism in Belize is from December to Easter.

i) Damage caused by Hurricane Keith. Direct damages. Sustained winds and storm surges brought by Hurricane Keith ravaged the northern Cayes of Belize, in particular Ambergris Caye, Caye Caulker, and Caye Chapel. (See Table 23.) Most of the hotels (62 in Ambergris Caye and 37 in Caye Caulker) and other tourist infrastructure and assets suffered damage with varying degrees of severity. Inland, fewer damages to the tourism sector were reported. An important Maya archaeological site, the ruins located in the Lamanai Nature Reserve reported damages caused by strong winds (fallen trees) and flooding. A crevice in the main pyramid structure damaged the cultural landmark.

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<sup>9</sup> Between 1990 and 1999 the number of hotels increased from 210 to 390 and the number of rooms from 2,115 to 3,963. (BTB.)

<sup>10</sup> In a survey conducted in 1997, marine attractions were rated as the highest motivating factor for visitors to Belize. (BTB.)

<sup>11</sup> BTB receives 7 per cent tax based on the sale of hotel rooms.



Table 22

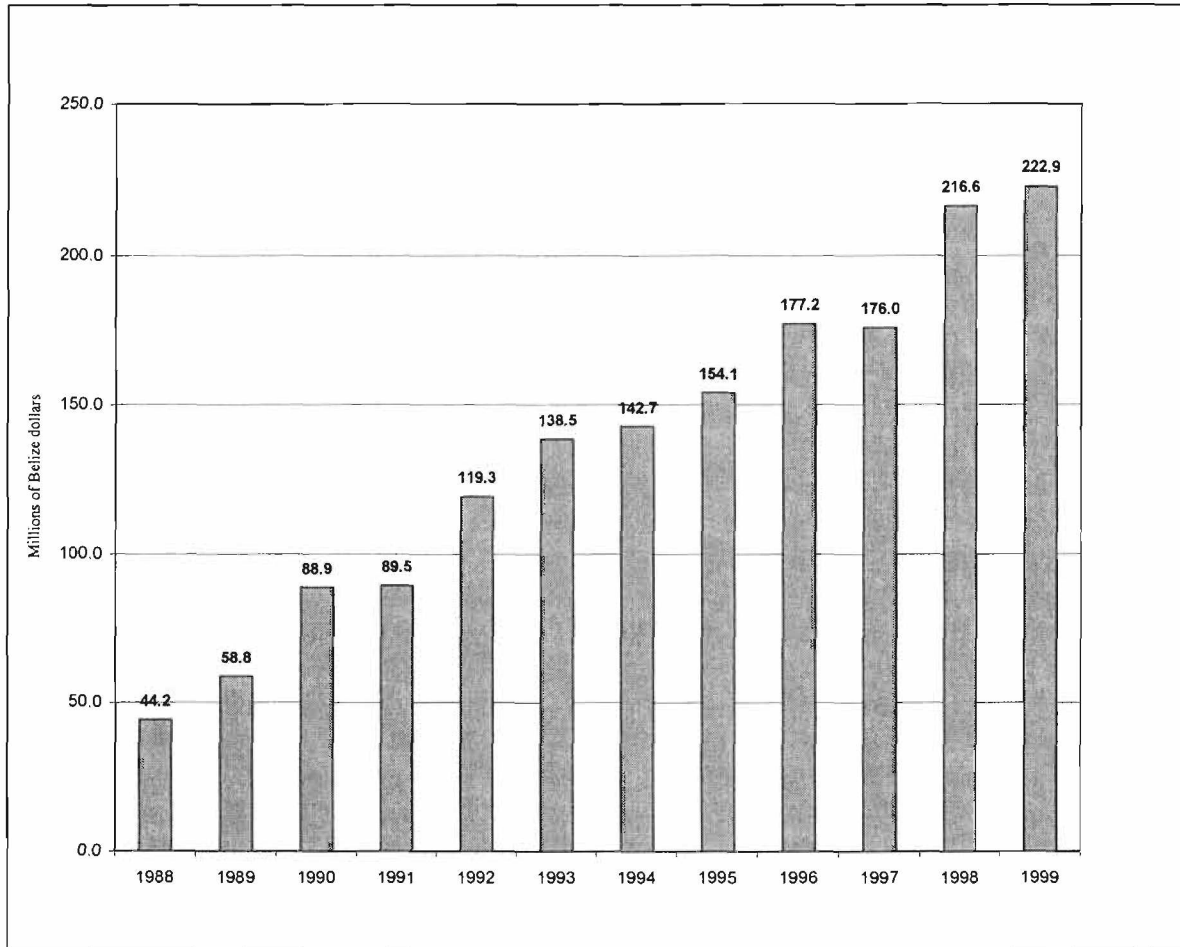
## BELIZE: SUMMARY OF DAMAGES TO THE AGRICULTURE SECTOR

	Total area (Ha)	Affected area (Ha)	Loss of production (t)	Damages (thousands of BZ\$)		
				Direct	Indirect	Total
Grand total	113,370	37,690	266,982	77,469.0	46,889.1	124,358.1
Export crops	49,961	6,434	272,264	20,693.6	31,244.4	51,938.0
Sugar	24,281	3,800	187,800	7,843.9	23,285.3	31,129.2
Citrus	25,528	2,553	81,891	8,023.8	5,976.2	14,000.0
Papaya (papaw)	49	42	2,376	4,294.8	1,775.9	6,070.7
Habanero pepper	22	19	188	331.2	207.0	538.2
Cotton	81	20	9	200.0	0	200.0
Domestic consumption						
crops	21,272	14,594	42,010	20,456.9	4,821.2	25,278.1
Rice	2,837	2,439	8,199	4,699.5	2,164.4	6,863.9
Corn	15,827	10,994	18,485	6,927.6	0	6,927.6
Soybeans	279	184	372	270.6	219.0	489.6
Plantain	490	375	11,067	2,927.8	2,437.8	5,365.6
Beans	182	87	97	156.5	0	156.5
Other fruits	1,342	294	1,451	1,522.9	0	1,522.9
Vegetables	250	180	2,107	3,792.9	0	3,792.9
Root crops	65	41	232	159.1	0	159.1
Livestock (heads/meat)	554,122	38,077	173	14,560.5	4,507.3	19,067.8
Cattle	52,060	288	78	181.1	4,507.3	4,688.4
Pigs	19,000	130	35	24.0	0	24.0
Poultry	479,000	37,635	58	121.1	0	121.1
Horses	3,000	15	-	7.5	0	7.5
Buffaloes	62	2	1.0	1.6	0	1.6
Sheep/goats	1,000	7	0.2	2.4	0	2.4
Pastures (Has.)	42,136	17,627	-	14,222.8	0	14,222.8
Fisheries	-	-	198	9,554.3	6,205.9	15,760.2
Lobster	-	-	100	4,831.5	4,941.3	9,772.8
Conch	-	-	72	1,197.7	1,077.9	2,275.6
Other fish products	-	-	26	167.9	186.7	354.6
Fishing equipment, materials, infrastructure				3,357.2		3,357.2
Beekeeping (Hives/honey)	800	612	37	107.1	110.1	217.2
Capital goods (excluding fisheries)				12,096.6	0	12,096.6
Machinery				148.0	0	148.0
Infrastructure a/				11,689.0	0	11,689.0
Equipment & materials				259.6	0	259.6

Source: ECLAC, on the basis of official data.

a/ Mostly in farm feeder roads and some storage facilities. Lost housing in farms is also included.

Graph 5

**BELIZE: TOURIST EXPENDITURE, 1998-1999**

Source: Belize Tourism Board (BTB).

Table 23

BELIZE: DIRECT DAMAGES IN TOURISM  
(Ambergris Caye/San Pedro, Caye Caulker, Caye Chapel)

	(Thousands of BZ\$)
Total	124,094.0
1. Hotel buildings (including furniture, equipment, damage golf course) a/	84,000.0
2. Gift shops a/	10,000.0
3. Restaurants a/	11,800.0
4. Landscaping b/	2,560.0
5. Piers/marinas c/	1,134.0
6. Seawalls + backshore d/	10,400.0
7. Tourist related boats (140) a/	4,200.0

Source: ECLAC on the basis of official data.

a/ From information provided by the Belize Tourism Board (BTB) and insurance claims.

b/ Based on interviews in San Pedro; approximately BZ\$2,000 per room (1,278 rooms in both Cayes).

c/ Based on dock replacement cost in Mata Chica; BZ\$700 per meter; considering 905 of 45 piers in San Pedro and 15 in Caye Caulker damaged and an average 30 m per pier needing reparation.

d/ It includes BZ\$ 10 million in Caye Chapel for 2,880 m of shoreline and BZ\$0.4 million in Caye Caulker at the split (110 m).

The following damages were reported in the northern Cayes:

- Two hotels in Caye Caulker and one in Ambergris Caye were completely destroyed and several suffered structural damages.
- A great share of hotels suffered roof damages, usually leading to interior damages (ceilings and room furniture).
- Damages to equipment (water pumps, water heaters, washing machines, air conditioners)
- Landscaping damages: losses of trees and ornamental plants, litter.
- Damages to gift shops and restaurants.
- Damages to the golf course of Caye Chapel.
- Piers partially or totally destroyed.
- Seawalls destroyed in Caye Chapel and Caye Caulker.
- Property lost by beach erosion (included in environment damage assessment).
- Losses of boats mainly devoted to tourism activities.

Indirect damages. Indirect damages attempt to capture those losses for Belizean economy related to the drop of tourist arrivals: <sup>12</sup>

- Lost occupancy in hotels (Ambergris Caye and Caye Caulker are considered).
- Drop in tourist expenditure (including meals & drinks, local transport, entertainment, shopping and other).
- Departure taxes lost.

<sup>12</sup> According to BTB there are no losses from cruise ships; neither it has been detected drop in room rates.

Other indirect costs related with tourist sector in the form of additional expenditures are the following:

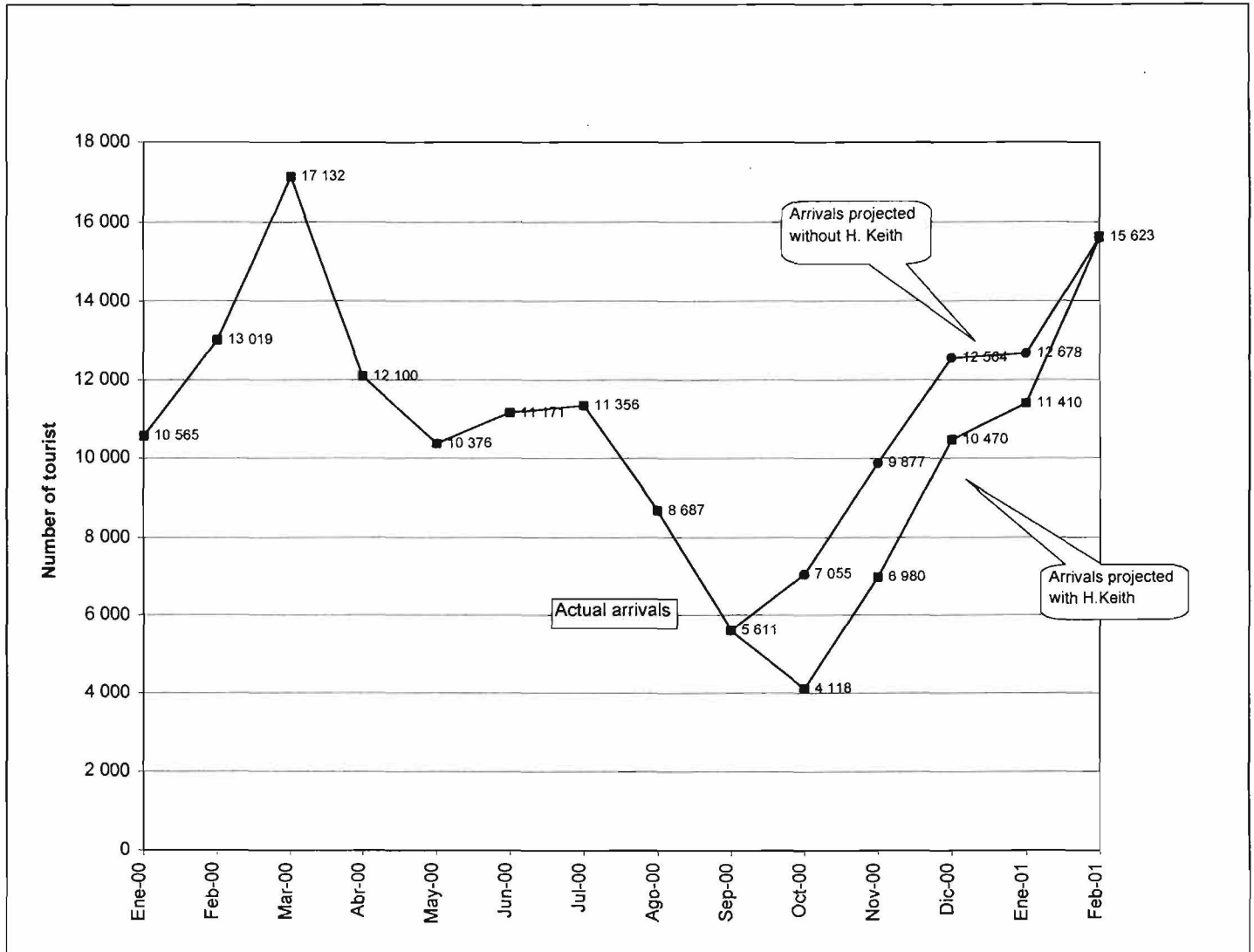
- Additional efforts in tourist promotion to counterbalance sensationalised information of the international media. BTB reacted rapidly to the negative publicity and re-allocated funds to increase marketing efforts in response to Keith. A budget of BZ\$1.2 million is being spend on this extra effort, in addition to the total marketing budget for the biennium 2000-2001 of BZ\$4.6 million.
- Lack of energy supply in the Cayes caused a number of hotels to invest in generators to face the tourism high season.

Until October, when Hurricane Keith hit Belize, tourist arrivals through the main airport (Phillip Goldson International) were reaching record numbers. For the first ten months of the year arrivals were 20 per cent higher than for the same period in 1999.

Graph 6 and Table 24 illustrate the effect of the estimated drop of tourist arrivals after the hurricane. The projected figures are based on the following considerations:

1. If Hurricane Keith would not have occurred, tourist arrivals in the period October 2000 to February 2001 would be 20 per cent higher than in the same period of the last year (the same trend as in the first ten months).
2. BTB considers that Hurricane Mitch affected tourist arrivals to Belize from October 1998 to February 1999. It is assumed that the negative publicity is significantly less in the case of Hurricane Keith. The assumption made here is that tourist arrivals will be affected up to January 2001.
3. Regarding arrivals projected after Hurricane Keith, the figure of October 2000 has been taken from BTB; in November there is information on the six first days (a projection of this month has been based in this information). It is considered that in December tourist arrivals will reach the same figure than in 1999; and that in January 2001 tourist arrivals will be 90 per cent of the figure projected without Hurricane Keith.

**Graph 6**  
**BELIZE: PROJECTED TOURIST ARRIVALS 2000-2001**



Source: Belize Tourism Board (BTB) and own estimations.

Table 24

## BELIZE: PROJECTED DROP IN TOURIST ARRIVALS

Month	Tourist arrivals international airport		Drop of tourist arrivals		
	Total	Without Keith	With Keith	By air	By land and sea a/
Total	15,027			9,196	5,831
October 2000	4,799	7,055	4,118 b/	2,937	1,862
November 2000	4,734	9,877	6,980	2,897	1,837
December 2000	3,422	12,564	10,470	2,094	1,328
January 2001	2,072	12,678	11,410	1,268	804
February 2001		15,623	15,623		

Source: ECLAC.

a/ In 1999, tourist arrivals by air represented 61.2 per cent of total tourist arrivals.

b/ Actual figure.

Since most of the damages suffered were in Ambergris Caye and Caye Caulker, it has been assumed that tourist arrivals will drop in proportion to the number of beds in each island,<sup>13</sup> that is 74.3 per cent in Ambergris Caye and 25.7 per cent in Caye Caulker. Table 25 summarises the estimated indirect damages for the tourism sector.

The estimated drop in visitor arrivals plus the calculations made of direct and indirect damages in tourism do not only cause a drop in the sector and the national economy's activity, but also in the balance of payments, where the sector has a significant influence. Table 26 summarises all direct and indirect damages as well as of their impact in the external sector. Indirect damages impact international trade mainly as service exports lost. In the case of direct damages many of the reconstruction items (cement, equipment, furniture, engines, zinc roofs, etc.) are imported. The local component of the reconstruction process is basically local wood and labour.

### c) Industry and commerce

The damages caused by Hurricane Keith in industry and trade were less severe than in agriculture and tourism. Manufacturing comprises some 13 percent of GDP while commerce accounts for about 21 percent.

The manufacture of agro-industrial products will be adversely affected by the losses in agricultural production and by difficulties in transporting produce to the factories. This had been the case in the sugar and rice mills and citrus processing plants. In the case of citrus, the effect on the manufacturing sector has been a loss in the production of concentrate. The 2000 production of sugar has not been significantly affected adversely, although the next crop and production cycle

<sup>13</sup> In Ambergris Caye the average room rate is the highest of the country. According to the information provided by BTB, due to damages, the available room stock is only 15 per cent during October, 28 per cent during November, 65 per cent during December and 82 per cent in January.



of sugar extending to 2001 will feel the effects of the canes lying in flooded fields for long periods to the detriment of their sucrose content as indicated in the agricultural sector section.

Table 25

## BELIZE: INDIRECT DAMAGES IN TOURISM

(Thousands of Belize dollars)

	October	November	December	January	Total
Total					36,298.9
1 Loss of occupancy in hotels a/					15,633.4
Ambergris Caye b/	4,545.5	4,484.0	3,241.3	1,962.6	14,233.3
Caye Caulker	447.1	441.1	318.8	193.1	1,400.1
2 Tourism services consumption lost c/					19,107.5
Meals & drinks	1,997.1	1,970.0	1,424.0	862.2	6,253.4
Local transport	1,331.4	1,313.3	949.4	574.8	4,168.9
Entertainment	1,331.4	1,313.3	949.4	574.8	4,168.9
Shopping	887.6	875.6	632.9	383.2	2,779.3
Other expenditure	554.7	547.2	395.6	239.5	1,737.0
3 Departure tax revenue lost d/					484.4
Airport tax					367.8
Other					116.6
4 Additional cost of providing energy e/					1,073.5

Source: ECLAC estimates.

a/ Average length stay in Belize is 7.1 days per tourist (source: BTB).

b/ Average room rates in Ambergris Caye and Caye Caulker were BZ\$179.48 and BZ\$51.12 respectively in 1999 (source: BTB).

c/ A visitor expenditure survey carried out in 1997 by the BTB showed the following distribution by category: accommodation (45 per cent); meals and drinks (18 per cent); local transport (12 per cent); entertainment (12 per cent); shopping (8 per cent) and other expenditure (5 per cent).

d/ Departure tax by air: US\$20 and other than by air: US\$10.

e/ Cost per room was calculated at BZ\$2,700 (considering 6 KVA per room at BZ\$450 per KVA); a 20 per cent of rooms in Caye Caulker and Ambergris were estimated to carry out the investment.

Table 26

## BELIZE: SUMMARY OF DIRECT AND INDIRECT DAMAGES

(Thousands of Belize dollars)

	Total	Impact in international trade
Total	160,393.0	115,284.0
Direct damage a/	124,094.0	79,100.0
Indirect damage	36,299.0	36,299.0

Source: ECLAC.

a/ Includes some minor improvements in buildings, piers and marines.

Activities in the Corozal Free zone suffered minimal negative impact. Minor dislocations in production led to indirect damage resulting from loss of business for a period of three days. There were damages to the timber-processing sector in the Orange Walk District, affecting inventory, machinery and some buildings. More importantly, the agroindustrial sector will suffer losses derived from crop production damages. Additionally, commercial activities – mostly in the two main Cayes Caulker and Ambergris – suffered not only a drop in their normal business, but losses in stock and inventory, as reported by insurance claims. See Tables 27 and 28.

Table 27

## BELIZE: SUMMARY OF DAMAGES IN INDUSTRY AND COMMERCE

(Thousands of BZ\$)

	Total damage	Direct	Indirect	Impact on international trade
Total industry	45,829.6	30,659.6	15,170.0	41,165.0
Free trade zone	128.0	60.0	68.0	50.0
Timber processing	3,205.0	2,925.0	280.0	-
Agroindustry commerce	41,115.0	26,293.0	14,822.0	41,115.0
(loss of stock and inventory)	1,381.6	1,381.6	-	-

Source: ECLAC.

### 3. Infrastructure

#### a) Transport

Total direct damages in the transport sector are summarised in Table 28. It encompasses damages to roads, ports, vehicles, airports and all means of transportation, including losses of aircraft and vessels. How these figures were calculated is detailed in this section, where the different components are analysed.

Table 28

#### BELIZE: TRANSPORT DIRECT COST OF DAMAGE

(Belize dollars)

Sub sector	Total damages	Total reconstruction costs	Labour	National	Foreign
Total	46,735,790	32,726,357	5,028,785	14,321,253	13,376,319
Infrastructure (public sector)	43,550,790	28,901,357	4,991,285	14,313,753	9,596,319
Roads network	23,154,392	25,804,990	4,273,806	12,938,160	8,593,024
Airports	75,000	115,000	66,000	27,500	21,500
Ports	516,747	678,857	190,977	196,838	291,042
Villages and town streets and urban infrastructure	19,804,651	2,302,510	460,502	1,151,255	690,753
Equipment (private operators & owners)	3,185,000	3,825,000	37,500	7,500	3,780,000
Vehicles (buses) a/	150,000	150,000	30,000	7,500	112,500
Aircraft	2,395,000	2,875,000	7,500	0	2,867,500
Vessels b/	640,000	800,000	0	0	800,000

Source: ECLAC, on the basis of official data.

a/ Ministry of Works (MOWTC&BI).

b/ Vessels rescued by the Port Authority only.

One of the persistent effects of hurricane Keith – more than the wind force and the severity of the rainfall – is the passive flooding. As the inland area effected by the storm is mainly flat, low terrain, with a very small gradient towards the sea, water remained on the ground and rivers persisted in above normal levels for a long time. This not only affected agricultural land and cattle pastures, but very significantly also caused a breakdown in communications by the interruption of many highways, secondary and feeder roads for an extended period. In fact water was deposited in Belize's flood plains during the storm at much above normal levels than

the terrain's absorption capacity. Clay-based soils were saturated by the rainfall registered (at Philip Goldson Intl. Airport rainfall registered reached 809.9 mm in four days, while September normally registers for the whole month 288.9 mm in spite of seasonally being the second most rainy month). The slow evaporation and filtration to the underground will take in total over 16 weeks by some estimates.

An illustration of the low elevations of the affected continental area is that in the country's western border at Blue Creek – located 40 miles from the coast line – altitude above sea level is of just over 2 meters. This has two effects: on one hand, the water accumulated does not drain and, on the other, water speed does not cause erosion. Thus it does not – per se – have a destructive effect over the road and highway infrastructure. This aspect is to be considered in the further analysis as an important fact.

Indirect costs to the transportation system are shown in Table 29. Given the indicated conditions of the roads and that repairs, once the flooding recedes, should not be very costly, indirect costs are substantially larger than direct ones. This is on account of the economic, social and operating costs increased due to the closing of roads to normal operation. It also bears mentioning that while direct cost are to be borne mainly by the public sector, indirect costs will reflect mainly in the users and operators, mostly private.

Table 29  
BELIZE: TRANSPORTATION INDIRECT COSTS  
(Belize dollars)

Sub sector	Total cost	Government	Private users & operators
Total indirect cost	33,633,646	859,115	32,774,531
Highways	32,240,193	4,025	32,236,168
Cut of roads	22,328,299	4,025	22,324,274
Use of alternative roads	527,612	0	527,612
Roads condition	9,384,282	0	9,384,282
Airport	1,393,453	855,090	538,363
Airport	893,453	855,090	38,363
Airlines lost of income	500,000	0	500,000
Port	0	0	0
Port facilities	0	0	0
Operators lost of income	n.a.	n.a.	n.a.

Source: ECLAC.

i) Main highways direct damage. The storm affected the Western Highway and the Northern Highway. The Western Highway was affected by flooding in the initial section close to Belize City due to the Sibun river overflowing. The road was underwater for a number of days and due to the continuous passage of vehicles erosion loosened the pavement surface and affected the base course. Culverts overflow and blockage contributed to the slow dispersion of the waters. Most of the damage was done by heavy traffic passing over the soaked structure of the road. Additionally, at Roaring Creek Bridge, close to Belmopan, in the Belmopan-San Ignacio section, a major cut occurred due to the river's overflow, causing the road to remain under the water level for a number of days.

The Northern Highway was affected by flooding in the initial section close to Belize City and was under also. A similar situation was observed at Carmelita Toll, the New River overflowed and the highway was under water for some days. Culverts collapsed in many places along the lane but no more damages were reported even the storm passed in the same direction along all the road in its route to the Gulf. Less damage affected some culverts in the Hummingbird Highway was also reported and included in the account.

The total direct cost of damage in these main highways is shown in Table 30. Reconstruction estimated cost of BZ\$2.8 million as shown in the same table. A breakdown in labour needs and national and foreign components is also included.

With regard to the secondary network (public feeder roads, as different from in-farm feeders that are accounted for in the agricultural sector), of a total of 1,515.8 miles of such roads, 740 of them were affected. Most damage occurred in culverts and fill erosion, with a total direct cost of damage of BZ\$20.7 million, as shown in Table 31.

Two bridges collapsed in low standard feeder roads. Estimated damage and reconstruction costs appear in Table 32. Fortunately they were located in an area where many alternatives may be used if necessary.

Table 30

## BELIZE: DIRECT DAMAGE TO MAIN HIGHWAYS a/

(Belize dollars)

Road N°	Road name	Length miles	Activity	Unit	Quantity	Unit price damage	Unit price reconstruction	Value of damage	Value of reconstruction	Labour	National	Foreign
	Total	219.4						1,676,274	2,801,704	519,167	818,608	1,463,929
AR1	Western Highway	73.7	Fill	yd <sup>3</sup>	1,995	30	30	59,850	59,850	8,978	32,918	17,955
			Culvert	foot	5,000	94	134	469,000	670,000	234,500	134,000	301,500
			Base Course	yd <sup>3</sup>	404	38	75	15,162	30,324	3,032	12,130	15,162
			Shoulder Rep.	mile	3.0	11,730	58,650	35,190	175,950	21,114	105,570	49,266
			STD	yd <sup>2</sup>	12,000	12	24	144,000	288,000	14,400	57,600	216,000
AR2	Northern Highway	90.9	Fill	yd <sup>3</sup>	11,970	30	30	359,100	359,100	53,865	197,505	107,730
			Culvert	foot	1,200	94	134	112,560	160,800	56,280	32,160	72,360
			Base Course	yd <sup>3</sup>	2,426	15	75	36,389	181,944	63,680	36,389	81,875
			Shoulder Rep.	mile	3.0	29,325	58,650	87,975	175,950	17,595	70,380	87,975
			STD	yd <sup>2</sup>	27,667	12	24	332,004	664,008	33,200	132,802	498,006
AR3	Hummingbird Highway	54.8	Fill	yd <sup>3</sup>	0	30	30	0	0	0	0	0
			Culvert	foot	267	94	134	25,045	35,778	12,522	7,156	16,100
			Base Course	yd <sup>3</sup>	0	15	75	0	0	0	0	0
			Shoulder Rep.	mile	0	29,325	58,650	0	0	0	0	0
			STD	yd <sup>2</sup>	0	12	24	0	0	0	0	0

Source: ECLAC, based on data from the Ministry of Works (MOWTC&amp;BI).

a/ Unit prices considered for the different activities were calculated by they specialist. Supplies such as culvert pipes, cement, equipment and fuel have to be imported, and were applied to calculate the reconstruction value. To determine the destruction value, a percentage of the total value was applied, depending of the activity. For filling 100 per cent was applied, as earthmovings does not loose value along the service of a route; 70 per cent for culverts and bridges; 50 per cent for base course and STD and 20 per cent for shoulders.

Table 31

## BELIZE: DIRECT COST OF DAMAGE TO FEEDER ROADS

(Belize dollars)

	Length miles	Total destruction	Total reconstruction	Labour	National	Foreign
Total feeder affected roads and estimated cost	740.0	20,709,617	21,152,786	3,468,364	11,117,002	6,567,420

Source: ECLAC, based on data from the MWTC&amp;BI



Table 32  
BELIZE: DIRECT COST OF DAMAGE  
BRIDGES

(Belize dollars)

Road N°	Road name	Length miles	Activity	Unit	Quantity	Unit price destruct.	Unit price reconstruction	Total destruct.	Total reconstruction	Labour	National	Foreign
	Total bridges				156			768,500	1,850,500	286,275	1,002,550	561,675
F3317	Cimaron Sugar Road # 1	3.1	Bridge	Foot	40	5,000	12,500	200,000	500,000	75,000	275,000	150,000
			Access Fill	yd <sup>3</sup>	200	30	30	6,000	6,000	2,100	1,200	2,700
F3318	Nava Sugar Road	1.7	Bridge	Foot	45	5,000	12,500	225,000	562,500	84,375	309,375	168,750
			Access Fill	yd <sup>3</sup>	250	30	30	7,500	7,500	2,625	1,500	3,375
D200	Hattieville Boom Road	8.2	Bridge	Foot	29	5,000	12,500	145,000	362,500	54,375	199,375	108,750
			Access Fill	yd <sup>6</sup>	800	30	30	24,000	24,000	8,400	4,800	10,800
F9068	Billy White Road	8.2	Bridge	Foot	22	2,500	6,000	55,000	132,000	19,800	72,600	39,600
			Repairs	yd <sup>6</sup>	0	30	30	0	0	0	0	0
F33100	Blue Creek Road		Bridge	Foot	20	5,000	12,500	100,000	250,000	37,500	137,500	75,000
			Access Fill	yd <sup>3</sup>	200	30	30	6,000	6,000	2,100	1,200	2,700

Source: ECLAC, based on data from the MWTC&BI.

Table 33 summarises direct damages to the highway system after Hurricane Keith in Belize.

Table 33  
BELIZE: DIRECT COST OF DAMAGE TO THE ROAD NETWORK  
(Thousand of Belize dollars)

N°	Type of road	Total country		Total affected		Total destruction cost	Total reconstruction	Labour	National	Foreign
		Unit	Qty	Unit	Qty					
	Total road network					23,154.4	25,805.0	4,273.2	12,938.2	8,593.0
1	Highways	mile	338.5	mile	164.6	1,676.3	2,801.7	519.2	818.6	1,463.9
2	Feeder Roads	mile	1515.8	mile	740	20,709.6	21,152.8	3,468.4	11,117.0	6,567.4
3	Bridges	foot	n.a.	foot	156	768.5	1,850.5	286.3	1,002.6	561.7

Source: ECLAC.

Additionally, streets in cities and villages suffered damage and interruptions that caused mostly damage to the surface and culverts. Table 34 shows the number of villages and towns areas affected with a total direct cost (estimated on the basis of repairs already completed or underway) of BZ\$19.8 million.

With regard to transportation equipment, some buses reported mechanical damages, with an estimated cost of BZ\$3.7 million.

ii) Highways indirect damages. Three sources were identified for indirect cost in ground transportation system due to damage in highways and roads. Account was made of user delays in buses and light vehicles users delays due to cut roads, increase of vehicle operation cost (VOC) and time expense due to make a trip by an alternative and longer itinerary and increase of VOC due to vehicles run over a poorer condition pavement.

Cost estimation for cut roads was calculated considering the average daily traffic (ADT) at the affected point: <sup>14</sup>

Vehicle type	Time cost per passenger (BZ\$/hour)	Time cost per vehicle (BZ\$/hour) a/
Cars	5.00	10.00
Pickup	3.20	9.60
Buses	1.40	56.00

a/ For all light vehicles, BZ\$10.00 was adopted.

Additionally, lost income was estimated for the operators, i.e. buses and trucks owners. This indirect cost was calculated as the amount of the fare multiplied by number of passengers less the variable cost of operation, in this case, fuel consumption. An average loss of BZ\$4.31 was adopted for buses (estimated as the fare per passenger less fuel consumption). For trucks, the income loss was estimated multiplying the average capacity of the truck estimated by an average transportation distance pondered by a factor of BZ\$1.6 per trip, which is equivalent to transportation fare less fuel consumption.

At the beginning of the emergency service was provided by the government, by means of small motor boats operating at the interrupted points. This implies a cost that was estimated at BZ\$140/boat/day. In relation to Government's costs and/or reduced income, the fares lost Carmelita Toll, the only in Belize, were estimated at a rate of BZ\$400/day. Adding all the above-explained subtotals, the total indirect cost is shown in Table 34.

<sup>14</sup> Taken from *Western Highway Resealing Project*, 1997 by Roughton International Consultant, MWTC&BI and own calculation.

Table 34

## BELIZE: DAMAGES TO STREETS

	Villages affected (No.)	Miles	Total rep. (BZ\$)
Total	95	1,074	2,259,551
Corozal	20	226	454,916
Orange Walk	25	283	469,945
Belize	18	203	448,904
Belmopan	10	113	424,858
Cayo	22	249	460,928
Towns affected (acres)			
Total	19,941	657	17,545,100
Corozal	1,920	63	1,600,000
Orange Walk	4,480	148	2,400,000
Belize City	8,640	285	9,860,000
Belmopan	1,331	44	480,000
San Ignacio	1,305	43	880,000
Santa Elena	768	25	530,000
Benque Viejo	512	17	350,000
San Pedro	640	21	1,140,000
Caye Caulker	345	11	305,100

Source: ECLAC, on the basis of data from the MOW.

It bears emphasising that the Northern Highway, which shows the highest indirect cost is the most important route of the country. The Orange Walk and Corozal Districts that it serves are important sugar, cattle and other agriculture products areas and connects the Belizean-Mexican border where important trade is held. On the other hand, an important traffic is observed between Belmopan, the Capital City and San Ignacio, where most of the government employees live, thus, the main impact in indirect cost is here at this point. Calculation of indirect cost was done determining the vehicle operating cost (VOC) and time expense by the comparison of both by the current rout and the alternative.<sup>15</sup> Another factor of indirect cost was estimated by the comparison of the VOC in the former condition of the road surface and the condition resulted after the damage, for the period of time that is expected to be in the poorer condition before

<sup>15</sup> Only one case was identified and is referred to the Burrel Boom Village. Current rout is 18 miles between Burrell Boom and Belize City, the mainly destination to be considered, by the Northern Highway while alternative is 36 miles, by the Western Highway.

reconstruction.<sup>16</sup> The affected length for the Western Road was estimated in 12 miles, while the same length for the Northern Road was 25 miles. For feeder roads, 740 miles were considered. Increase of time cost was not considered significant for this case.

Table 35  
BELIZE: INDIRECT COSTS DUE OF ROAD INTERRUPTION  
(Belize dollars)

Road N°	Place of interruption	ADT	Boats supply	Toll lost	Number of days	Total indirect costs (thousands)
	Total		3,625	400		22,328,299
AR1	Roaring Creek	2,494	725	0	3	1,290,174
AR2	Carmelita	3,694	725	400	7	12,954,609
D253	Crooked Tree	180	725	0	Undetermined	566,468
D250	Maskall	500	290	0	7	1,253,157
D362	Orange Walk	774	290	0	7	2,504,421
D334	San Felipe	500	290	0	7	1,253,157
D332	San Antonio	500	290	0	7	1,253,157
F3029	San Roman	500	290	0	7	1,253,157

Source: ECLAC

iii) Airports direct damages. The only airport that permits jetliners operation is the Philip Goldson (PG) International Airport located in Belize City. Other national airports feed local services and commute tourism. Of these the one with more commercial traffic is the San Pedro Airport at Ambergris Cay, which has a paved runway and has an intensive daily service of small aircraft. Of similar traffic is the Municipal Airfield of Belize where San Pedro service departs, (unpaved runway).

The PG International Airport reported few damages in buildings and equipment while San Pedro Airport reported some damages, which did not interfere with the provision of services once weather allowed for it. Such is the collapsing of part of the fence surrounding the field and installations. The value of these damages was estimated in BZ\$75,000. Reconstruction of the fence in San Pedro is urgent because it is a safety hazard as the airstrip is in the midst of the city.

<sup>16</sup> Surface condition is characterized by the IRI, then an IRI = 3 was considered for the former condition and an IRI = 6 for the poorer condition. VOCs were determined by using the HDM III (Highway Design and Maintenance Model). This case is applied to the Northern and Western Highway, in those sections near Belize City where the STD wearing coarse was lost. It was applied to the public feeder roads affected by the storm, this mean a poorer gravel surface condition. The ADT for both highways was obtained from the Traffic Census, March 2000, MWTC&BI and an average of 500 was assumed for the feeder roads.

The value for installations and equipment at PG International Airport was valued too. Also considered are damages to aircraft affecting both commercial and private small planes. (See Table 36.)

Table 36

## BELIZE: DIRECT DAMAGE TO AIR TRANSPORTATION

(Belize dollars)

	Damage costs	Repair costs	Labour	National	Foreign
Philip Goldson International Airport	15,000	15,000	6,000	7,500	1,500
San Pedro Airport	60,000	100,000	60,000	20,000	20,000
Subtotal airports	75,000	115,000	66,000	27,500	21,500
Sub total aircraft for public transportation	1,095,000	1,575,000	7,500	0	1,567,500
Sub total private aircraft	1,300,000	1,300,000	0	0	1,300,000
Total aircraft	2,395,000	2,875,000	7,500	0	2,867,500

Source: Director of Civil Aviation, Tropic Air and own estimates.

iv) Indirect cost of airports. Two sources of indirect cost of damages were considered: passenger delays since the airport was closed for three days (with an estimated cost of BZ\$855,090) and the loss of revenue of the local air services (valued at BZ\$38,363).

v) Ports direct cost of damages. The most important damage at the Belize City Port is a breakwater under construction. Also reported were minor damages in lighthouses around the cayes:

Description of damage	Damage	Repairs or reconstruction	Labour	National	Foreign
	516,747	678,857	190,977	196,838	291,042
Breakwater under construction in Belize City Port	151,417	151,417	52,996	30,283	68,138
Equipment and vessels	26,002	32,503	-	-	32,503
Installations	19,865	33,109	13,244	16,555	3,311
Navigation buoys	70,512	88,140	-	-	88,140
Light, warehouse & installation	98,950	123,688	24,738	-	98,950
Miscellanies damage a/	150,000	250,000	100,000	150,000	-

a/ A lump sum estimation was placed for the small private piers wooden maid wide spread around the cays.

vi) Ports indirect cost of damages. The port was closed for three days but no indirect cost was assumed since the pier was in idle time. Loss of revenue of water taxis should also be considered, since their regular service was restarted quickly. The brief interruption was compensated by the increased traffic in the days immediately after the hurricane as more than the regular amount of trips were made on account of visits to the damaged areas, relatives visits and transportation of light cargo for the emergency.

There are no reliable figures of vessels lost; although the Port Authority recovered four private vessels which were completely destroyed, but there is no valuation of the numerous little leisure and transport boats destroyed in the cayes.<sup>17</sup>

## **b) Telecommunications**

Telecommunications services suffered damages all over the country, however the most important failures are concentrated in San Pedro and Caye Caulker's village. In many localities failures were due not only to rain, flood and wind, but also to lightning storm and power failures. The total estimated cost of the damages on the telecommunication systems is show in Table 40.

In Belize City also some lines fell down while in Belize-Rural, power failure caused most of the service's interruption. Flooding caused a manual shutdown of the exchange in Ladyville and in Mile 32-Cell site, two racks and two batteries were lost. Damage in Orange Walk City was minor, as in Blue Creek and Sartaneja. In many instances, emergency generator sets were used to provide energy to restore the service.

In San Pedro the devastation caused by the hurricane damaged the BTL<sup>18</sup> infrastructure, affecting all the services provided by them, which include, local, long distance, international, data, paging, Internet, and mobile communication. The damages primarily were due to the collapse of a 37.5-m self-supporting tower, provoked by intensive wind. The rain and flood affected the Exchange and Transmission equipment, while, rain, wind and flood also affected the overhead network and distribution point cases. Additionally many ancillary equipments, such as, payphones, key systems, private automatic branch exchange, Wireless Local Loop, etc. also suffered intensive damage.

Temporary, BTL is using a BEL tower to support their telecommunication antennas and then to restore at least partially, the telecommunication services in San Pedro. The damaged self-supporting tower must be replaced as well as the external network and most of the electronic equipment, which was irreversible damaged by rain and flood.

In Caye Caulker the devastation caused by the hurricane damaged the BTL infrastructure, affecting all the services provided by BTL, which include, local, long distance, international, data, paging, internet, and mobile communication. The rain and flood affected the Exchange and

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<sup>17</sup> Fishing boats are accounted for in the fisheries valuation.

<sup>18</sup> Belize Telecommunication Limited (BTL). A state owner company, which is in charge to provide local, long distance, international, data, paging, internet and mobile communication to the whole country.



Transmission equipment, while rain, wind and flood also affected the overhead network and distribution point cases. Additionally many ancillary equipment, such as payphones, key systems, etc. were damaged. The damaged external network must be replaced as well as the electronic equipment, which was irreversible damaged by rain and flood. The replacement cost, for exchange, transmission, power and data equipment and customer lines, including some improvement to reduce vulnerability, as is also shown in Table 37.

Table 37

## REPUBLIC OF BELIZE : ASSESSMENT OF DAMAGES ON TELECOMMUNICATION

(Thousands of Belize dollars)

	Total	Direct	Indirect a/ c/	Reconstruction b/	Foreign currency c/
Total	2,422.4	1,536.0	886.4	4,850.0	3,637.5
City					
Caye Caulker	614.4	614.4	-	1,940.0	1,455.0
San Pedro	921.6	921.6	-	2,910.0	2,182.5
Sales (Global)	886.4		886.4		

Source: BTL and own calculations.

a/ Indirect cost includes only the loss of profit from October to December 2000 and technical assistance received from CANTO.

b/ BTL consider to improve the communication networks, switching the actual over head lines to an underground network in both cities.

c/ BTL have an insurance policy which cover interruption business losses and equipment.

c) **Energy**

i) Electricity. The passage of Hurricane Keith resulted in excessive rainfall in the north and wind affecting mainly the eastern part of the country. The electrical system was affected as a whole, but in particular the transmission and distribution lines suffered cuts and loss of poles. Some damages affected the generating system. The most affected area is too concentrated in the island of San Pedro, Caye Caulker's village and in Belize City. Interruptions in the service occurred during the storm, affecting approximately 22,000 customers. The total estimated cost of the damages on the electrical system is show in Table 38.

The total generation capacity was severely affected only in San Pedro and Caye Caulker. Only minor damages affected Belize City. The total demand affected (3.7 MW) represents 7 per cent of the total national installed supply. San Pedro is fed through a submarine line of 34.5 kV interconnected to the Interconnected National System (INS). The power station in the island (2 MW) is a back up station, while the Caye Caulker power station (0.965 MW) is the only source for its inhabitants. The INS did not break down during and after the storm and submarine cable did not suffer any damage.

Table 38

## BELIZE: SUMMARY ASSESSMENT ON THE ENERGY SECTOR

(Thousands of Belize dollars)

	Total	Direct	Indirect	Reconstruction	Foreign currency
Total	4,232.7	3,115.3	1,117.4	4,446.5	3,557.4
Electrical sub-sector					
Generation	823.60	823.60	-	1,420.00	1,136.00
Transmission and distribution	1,538.7	1,538.7	-	2,136.5	1,741.9
Sales	1,455.4	338.0	1,117.4	890.0	722.0
Clean up/Others	415.0	415.0	-	-	-

Source: ECLAC on the basis of official reports and figures from BEL.

Notes: 1) Hydrocarbon sub-sector reported no damages.

The installed generation capacity in the country is 53.1 MW <sup>19</sup> including the isolated systems. The installed capacity of the isolated systems is 5.98 MW and provides energy to Punta Gorda, Caye Caulker, Independence, Big Creek and Sartaneja. Most of the generating capacity is thermal and is owned by BEL, <sup>20</sup> a recently privatized company. A hydroelectric power station of 25 MW is also in service and there is an interconnection link with Mexico operating at 115 kV, also in service.

In San Pedro and Caye Caulker the entire main and secondary distribution lines were affected in some way and many poles fell down or were broken affecting 9.4 per cent of the 34.5 kV transmission lines, 43.2 per cent of the main fallen and 32.7 per cent of the secondary distribution network. In Caye Caulker the damages caused by poles were more severe, affecting 73 per cent of the main and 42 per cent of the secondary distribution networks respectively. The damages on the network were caused by the extreme winds and flooding, while the damage in the power stations was due to the excessive rain and flooding.

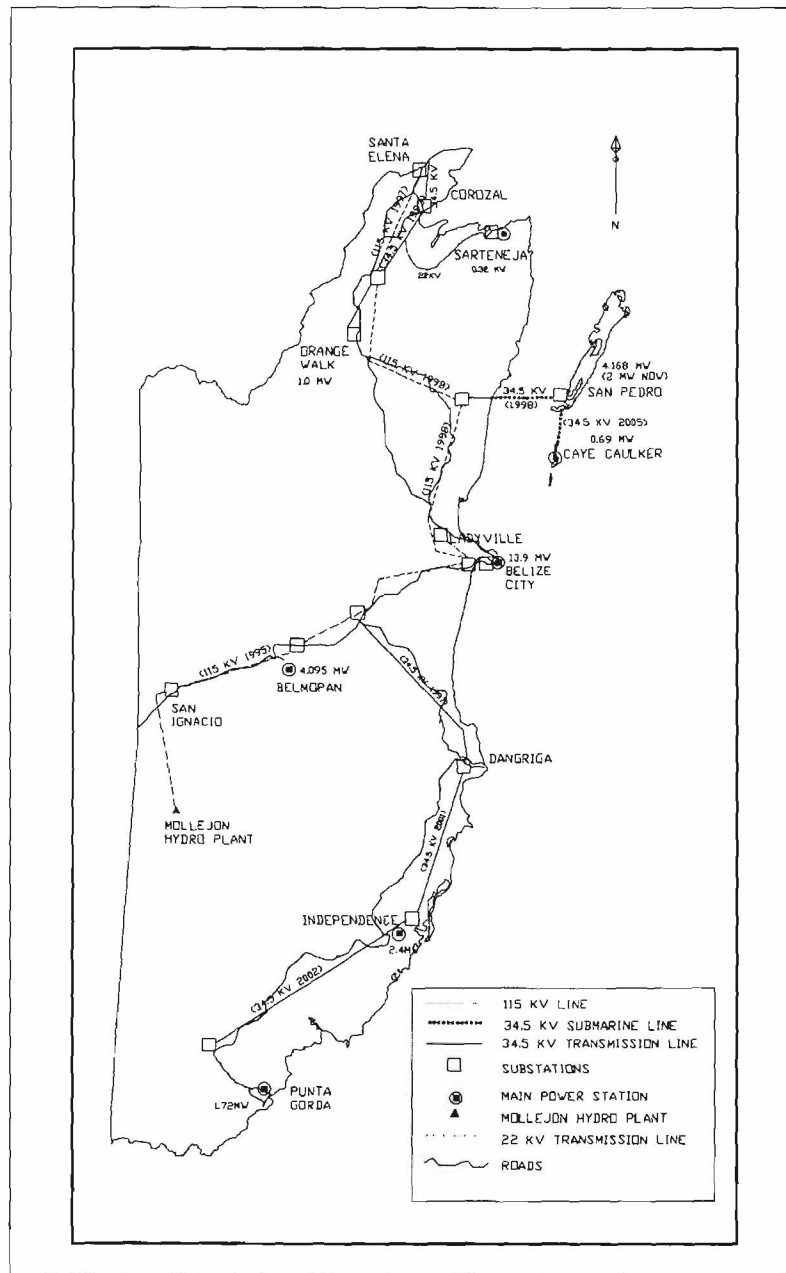
In San Pedro, energy supply was quickly restored using two trailer-mounted generator sets and by repairing the damages on the sub transmission and distribution networks. In the meantime, inspections and testing on the submarine cable were done in order to ensure the energy supply from INS. In Caye Caulker the priority was to recover the distribution network and then to connect emergency generator set.

<sup>19</sup> Information provided by BEL.

<sup>20</sup> Belize Electricity Limited (BEL). A private and state owned company, vertically integrated, providing the electricity supply to the whole country.

Graph 7

## BELIZE: ELECTRIC SYSTEM



Source: BEL.

Note: This map does not ratify national and international boundaries. The only purpose is to show the locations of the electric infrastructure.

The estimated losses of profits are BZ\$1.1 million till the end of the year.<sup>21</sup> These losses assume a gradual recovery of consumption once the rehabilitation and/or repair of the network is made, the power stations reach full capacity and the economic recovery gets demand to its normal levels.

As a part of the reconstruction/rehabilitation of the system, some of the generator sets must be replaced and the affected network repaired or rebuilt. Energy meters must be checked and replaced if necessary. The estimated costs are shown in Table 39.

Table 39

## BELIZE: ASSESSMENT OF DAMAGES BY AFFECTED CITY ON THE ENERGY SECTOR a/

(Thousand of Belize dollars)

	Total	Direct	Indirect b/	Reconstruction c/	Foreign currency
BZ\$		2,690.9	1,117.4	3,802.7	3,126.8
US\$	4,158.2	3,115.3	1,042.8	4,446.5	3,577.7
City					
San Pedro	2,738.2	1,789.9	948.2	2,422.6	1,925.6
Generation	375.0	375.0	-	250.0	200.0
Transmission and distribution	1,112.0	1,112.0	-	1,482.6	1,186.1
Sales	1,086.2	138.0	948.2	690.0	552.0
Clean up/Others	165.0	165.0	-	-	-
Caye Caulker	1,037.9	975.5	62.4	2,023.8	1,651.8
Generation	408.6	408.6	-	1,170.0	936.0
Transmission and distribution	326.9	326.9	-	653.8	535.8
Sales	102.4	40.0	62.4	200.0	160.0
Clean up/Others	200.0	200.0	-	-	-
Belize City	382.1	349.8	32.2	-	-
Generation	40.0	40.0	-	-	-
Transmission and distribution	99.9	99.9	-	-	-
Sales	192.2	160.0	32.2	-	-
Clean up/Others	50.0	50.0	-	-	-

Source: ECLAC on the basis of information provided by BEL.

a/ Energy sector includes only the electric sub-sector. Hydrocarbon sub-sector did not report damages.

b/ Indirect cost includes only losses of profit from October to December 2000.

c/ BEL has an Insurance policy only for the generation equipment.

ii) Oil, gas and gasoline supply. Belize has no oil refining capacity and all the refined products are imported by ship or by truck. There seems to have been no disruption in this supply in spite of the hurricane closing the ports and the roads being interrupted through flooding. The

<sup>21</sup> BZ\$1.08 million for San Pedro and BZ\$0.12 million estimated for Caye Caulker. This amount claimable is under existing insurance, once generating expenses (estimated at BZ\$0.20 million) are deducted.

storage capacity was not affected, and gas stations reported no damages or losses. The only damage reported is two storage tanks located at Caye Caulker power station; however this damage has been included in the total damages corresponding to that power station in the electrical sector.

#### **d) Water and sanitation**

The Belize Water and Sewerage Authority (WASA) is responsible for all urban water supplies in the country and for the only three sewerage systems in the country – in Belize City, Belmopan and San Pedro, Ambergris Caye. However, many rural communities independently operate their own water system with technical support from WASA.<sup>22</sup>

Most damage to drinking water and sewerage systems is in the localities worst affected by the hurricane. One of the greatest challenges posed by the emergency was in reaching areas at the end of near-impassable roads. The short-term aims of the institutions involved were to re-establish damaged drinking water and sewerage systems, and to carry out health and education actions to prevent and reduce the risk of epidemics in affected areas. In the medium term, actions should focus on the total reconstruction and upgrading the now damaged systems. The total estimated cost of the damages on water and sewerage system is show in Table 39.

In Corozal Town the damages were concentrated on the overhead storage tank, pumping station and cover material for the main transmission lines. In San Pedro Town the damages affected the secondary distribution lines and sewer collection system. In Orange Walk Town, the intensive wind collapsed an overhead storage tank and flood affected the electrical system of the pumping station and main distribution lines.

In Belize City, damages were due to flood affecting the transmission lines and sewerage system. Belmopan and other five cities and town reported small damages on the distribution lines as a consequence of flooding.

Before the hurricane passed, some attempt was made at prevention measures were taken. In Corozal Town and Orange Walk City, the storage tanks were filled in order to prevent some water scarcity after the emergency. Unfortunately this measure was not successful because the water weight and intensive winds caused such stress on the structures that they collapsed in both towns. In San Ignacio/Santa Elena a ground storage tank also failed due to ground saturation and ground shifting causing by the rain. All of those three tanks had more than 20 years in operation and must now be replaced. The new tanks ought to be designed whit some improvement in order to reduce vulnerability.

In San Pedro, local and national authorities decided to fill the water storage tank and to stop the energy supply before the hurricane passed in order to avoid major problems. After the hurricane passed, it was not possible to get energy from any source, nor the local power station, nor the submarine cable. Water was then brought from other sources while an accelerated process began to repair works to recovery the energy supply.

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<sup>22</sup> The Water and Sewerage Authority (WASA) is a state-owned enterprise.

The indirect cost due to income losses was estimated over the base of the number of inhabitants living in the affected cities and towns, the time the water supply was interrupted, and the percentage of the damaged systems. The indirect estimated cost does not include the cost associated to transportation, chemical treatment, emergency power supply, etc. The total estimated indirect value is shown in Table 40.

According with a WASA <sup>23</sup> report dated on October 2000, the company produced an estimated 2,284 million US gallons of water in 1999, of which 1,181 million US gallons was sold. This figure reflects a very high rate of losses on the mains and secondary distribution lines (as much as 48.3 per cent of the average water production), which could be associated to lack of maintenance, non-paying connections and the age of the utility's network of supply. There are no reported additional losses after the hurricane, but if the losses are the same or higher, this figure reflects an already very difficult economical situation for the company.

It is worth noting that only three cities in the country have sewerage systems (Belize City, Belmopan and San Pedro). Lack of this basic service represents a potential health problem not only for those that don't have access to it but – in extreme circumstances like the one caused by Keith – will jeopardise the existing facilities capacity to cope and increase the vulnerability of the population at risk. This is certainly an area where mitigation seems to have a high degree of urgency for the inhabitants who have not this service.

Table 40

BELIZE: ASSESSMENT OF DAMAGES ON DRINKING WATER AND  
SANITATION NETWORKS a/

City	Total	Direct	Indirect b/	Reconstruction c/, d/	Foreign currency
Total	1,854.7	1,654.7	200.0	3,403.7	2,866.5
Belize	1,489.6	1,489.6	-	-	-
Belmopan c/	39.7	39.7	-	269.9	202.9
Orange Walk Town d/	140.4	140.4	-	1,371.1	1,165.4
Corozal Town d/	265.1	265.1	-	1,371.1	1,165.4
San Ignacio/Sta. Elena e/	15.1	15.1	-	391.6	332.8
San Pedro	635.6	635.6	-	-	-
Sales (global) f/	200.0		200.0		
Others f/	51.3	51.3	-	-	-

Source: ECLAC on the basis of WASA's data.

a/ Only three cities have sewer collection systems.

b/ Indirect cost associated to water transportation, increase of chemical treatment, emergency power supply, etc were not provided.

c/ Reconstruction include a new back up well, three genset and powerhouse for all of those three.

d/ The new storage tanks include some improvement in order to reduce vulnerability.

e/ Include only estimated loss of profit.

f/ Others include some small cities with minor damages.

<sup>23</sup> Water and Sewerage Authority (WASA). is the state owner company, which is in charge for the water supply and sewerage systems to the whole country.



#### 4. Effects on the environment

Besides destroying or harmfully affecting human life, as Keith influenced natural assets and their productivity. It will affect the ability to provide or sustain environmental services and, additionally, it will increase the costs of enjoyment of services.

There is little doubt that natural disasters and the environment are linked. Environmental degradation intensifies disasters, thereby increasing the potential for secondary disasters. The recent ECLAC assessments <sup>24</sup> of the damages caused by Hurricane Mitch in Central America conclude that the already severe effects of the rains were aggravated by man's previous actions, such as deforestation, inappropriate land use, and settlements on hillsides or on riverbanks and lakeshores. Similarly, most of the damage by Hurricane Lenny in Anguilla was aggravated by the location of tourism infrastructure within a high-risk zone adjacent to the shoreline.

Recognition of the causal links is an important step towards mitigation of the negative consequences of disasters, but needs to be followed by a more detailed understanding of the underlying process and, eventually, a quantification of the impacts and an assessment of the subsequent economic implications. In fact, failure to account for the impact of disasters on environmental systems may seriously undermine the reliability of *ex ante* cost-benefit tests, or the reliability of post-disaster damage estimates.

##### a) Belize environment

Within the Meso-American region, Belize displays one of the most significant habitat diversity (see box 1), with such habitats ranging from coral reef, mangroves and coastal lagoons to savannahs, rainforest and pine forests. <sup>25</sup> Belize's coastal plains and marine zone (the area that was most impacted by Hurricane Keith) contain a wide diversity of ecosystems that are rich in plant and marine resources. This coastal area is a complex system comprising the 220-km barrier reef (one of the most significant ecosystems in the world, see box), three atolls, sea-grass beds, dense mangrove forest and numerous coral islands. Presently about 45.9 per cent of its territory is set aside in protected areas for the preservation and protection of highly important natural and cultural features. Marine reserves represent about 150,000 hectares (6.9 per cent of marine area).

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<sup>24</sup> ECLAC (1999 and 2000).

<sup>25</sup> Central Statistics Office; Ministry of Finance, Belize (2000).

## Box 1

## THE MESO-AMERICAN BARRIER REEF SYSTEM

The Meso-American Barrier Reef System (MBRS) is a unique and extensive coral reef system extending more than 1,000 km along Mexico, Belize, Guatemala and Honduras. In 1997 the Presidents of these four countries signed the Declaration of Tulum which recognised the shared resources and connections between each of the four country's coastal areas and agreed to work towards a regional conservation strategy to ensure the integrity and future management of this system. According to scientists of the four countries, the principal threats to the MBRS are:

*Coastal/Island Development and Unsustainable Tourism*, which includes urban, hotel and resort development and related infrastructure, together with all the direct and indirect impacts that these bring to bear on the MBRS (pollution/contamination, nitrification, sedimentation, physical reef damage, impacts to estuary and lagoons and mangrove destruction, beach erosion, habitat change, etc.);

*Inappropriate Inland Resource and Land Use and Industrial Development*, encompassing a broad range of agricultural, urban and industrial development in inland watersheds which drain into coastal areas, contamination of wetlands, lagoons and estuaries, whether directly or indirectly impacting the MBRS (sedimentation, pollution/contamination, nitrification, habitat and species/abundance changes, mass kills of organisms, etc.);

*Overfishing and Aquaculture Development*, in relation to activities of industrial, artisanal, subsistence and recreational fishing and aquaculture in coastal areas and the real and potential impacts of species and abundance change, local extinction of selected species, habitat change/symbiosis imbalances, reduced subsistence and revenues from fisheries;

*Inappropriate Port, Shipping and Navigation Practices*, including intentional and accidental contamination of waters, reefs and beaches, physical reef damage, impacts to aquatic species and fisheries, degradation of the tourism value of reefs and related coastal environments;

*Natural Oceanographic and Climato-Meteorological Phenomena*, with relevance to the influence of currents and winds, El Niño/La Niña events, hurricanes and tropical storms, global warming, and earthquakes and tsunamis.

Regarding the last point, in 1998 a sequence of catastrophic disturbance events impacted the region. Firstly a bleaching event that affected the entire MBRS region; in late October Hurricane Mitch caused widespread damage across much of the MBRS region. Across larger spatial scales, the greatest degree of damage was observed in Belize (up to 29 per cent of colonies damaged). The cumulative effects of the 1998 impacts are expected to have long-term ecological consequences for the entire MBRS region.

This was the state of the reef before Hurricane Keith. Despite first assessments does not report significant damages (except at Turneffe Cayes) monitoring is needed to assess long-term effects of the impacts.

Sources: Mostly extracted from Kramer P. et al. (2000); *Ecological Status of the Mesoamerican Barrier Reef System (Impacts of Hurricane Mitch and 1998 coral bleaching)* World Bank.

Dulin P. (1999) *Conservation and Sustainable Use of the Mesoamerican Barrier Reef System: Threat and Root Cause Analysis* (Draft).

## b) Environmental impact description

The areas that were most heavily impacted were the northern cayes (primarily Ambergris Caye and Caye Caulker). In comparison, mainland Belize had minimal impact from the windstorm. It was flooding following the storm that caused havoc in low-lying areas along river basins and lagoons. Experts had indicated that full receding of the water to its normal level may last four months more. For example, Crooked Tree Wildlife Sanctuary was seriously flooded. In

certain sections it appeared that the Belize River and the Sibun River had joined and become one body of water.

Graph 7 summarises the environmental impacts and the environmental goods and services involved.

The following description of the environmental impacts has been made mainly from the Environment Committee of the NEMO and from observations of the ECLAC team. It is a preliminary assessment that demands a more in depth assessment (especially in relation to coral reef damages).

#### Coastal erosion

- Caye Chapel was severely impacted on its western coast as evidenced by the collapsing of almost its entire seawall. Specifically, the plastic sheet pile wall that has been used along the entire western length of this shoreline was destroyed. With this wall gone, the beach was severely eroded and the either carried offshore or up onto the golf course in the lee of the seawall. Observations made along this shoreline indicated that in some areas along this western coast, the shore had been eroded approximately 10-15 metres landward of the seawall. A total length of affected shoreline is estimated to be 2,800 metres.
- In Caye Caulker the greatest erosion occurred at the “Split”, which had almost doubled in width, and had been deepened. In particular, the water depth is reported to have increased from 5 m to 8 m, while the width of this feature appeared to have been more than doubled. Inspection of aerial photographs taken both before and after hurricane Keith indicated that there was significant damage to the plastic sheet pile wall, which previously lined the southern bank of the “Split”. A total shoreline loss of more than 11,000 m<sup>2</sup> has been estimated.
- At Ambergris Caye, shoreline erosion was limited to the south-eastern coastline, where water came overland from the west, and eroded the shoreline over a distance of approximately 300-500 m. This occurred at an area where the lagoon came inland, the width of the Caye was diminished and the buffering effect of the mangroves was reduced. A total affected area of approximately 600-1000 m<sup>2</sup> was estimated.

#### Damage to reef, mangrove and seagrass bed ecosystems

- The entire waterbody within the Reef Lagoon from Robinson Point to North Ambergris Caye was extremely turbid during and immediately following the hurricane. This turbidity was observed to extend beyond the Belize Barrier Reef (BBR), some 30 to 50 meters eastward. The impacts of this tremendous amount of silt on the sections of the BBR will need to be assessed in order to determine its immediate, medium and long-term impacts.<sup>26</sup> It is likely that sections of the BBR may suffer long-term damage from the smothering effect of the silt plume. The Coastal Zone Management Authority and Institute carried out an assessment of

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<sup>26</sup> Diving operators observed mechanical damages in the coral reefs of Turneffe Cayes. Despite visibility is not being at 100 per cent, damages in other areas were reported as not being significant.

reef health following hurricane Keith. This was done on the back reef at Caye Caulker and revealed that fine sediments have heavily impacted this area. Further a significant percentage of the corals were observed to have been bleached.

- Seagrass beds within the Reef Lagoon in this area were also been impacted by wave action, due to Hurricane Keith. Observations show that a large fraction of the seagrass beds were ripped up and those seagrass beds that remained will continue to be affected by the smothering effects of the silt, as it is deposited on the seafloor. Many large mats of uprooted sea-grass were observed floating between Caye Chapel and San Pedro Town.
- Mangroves: all cayes suffered moderate to severe (40-80 per cent) mangrove leaf loss. Only few (about 5 per cent) mangrove trees were uprooted (most of these appeared to be isolated trees). Due to differences in species composition, mangroves at the water line of the cayes are expected to recover whereas less salt-tolerant mangroves landward of these, which were exposed to an overflow of sea water. In addition, the rich nutrients that were stored in the mangrove wetlands may have been released into the sea, with the potential medium or long-term negative impacts on the reef ecosystem. Additional sources of nutrients have also been contributed from the overflow of sewerage lagoons and septic tanks on these cayes.

#### Impacts to wildlife

- Birds appeared to be the wildlife that suffered the greatest impacts as reported by the number of dead birds. In addition, birds continue to be affected on these cayes due to the loss of their habitats and feeding grounds. It was reported that the nesting and roosting sites of some of these birds on the atolls were also severely affected. For example, the habitats for the frigate and boobies at Half Moon Caye were heavily impacted.

#### Impacts on water quality

- Contamination of coastal water with faecal coliform was believed to occur resulting from the overflow of sewage lagoons and the inundation of septic tanks.

#### Impacts on fisheries

- Damage to the fisheries sector is significant especially since the lobster season, which extends from 15 June to 15 February, was on its way to being one of the best in recent years. The conch season, scheduled to open on 1 October has been delayed for at least two months (the same will occur for shrimp and finfish).
- In the medium term fisheries could also be affected by the damages suffered by mangroves, sea-grass beds and coral reefs.

### c) **Economic valuation of environmental damages**

Broadly speaking natural hazards may affect use values in two different ways: (i) by inducing temporary or permanent environmental changes thus altering a natural asset's "intrinsic

productivity”; (ii) by altering people’s ability to use the environment (the economic costs people have to afford to exploit available environmental goods and services). Examples of environmental changes include soil erosion, losses of natural habitats, forest fires, etc. The second type of impacts arise from man-made capital’s partial or total disruption which may impede, or make it more costly, to exploit environmental services. For example, the disruption of water-distribution networks or water-treatment facilities would harmfully affect water resources’ use values (loss of agricultural or industrial production; increased health risks; increased public/private averting expenditures).

ECLAC’s definition of *direct damage* gives the direct environmental damage encompasses a disaster’s effects on natural capital and which, in turn, result in changes in service flows of capital. As a proxy of the welfare cost, the capital’s *restoration cost* can be used as a measure of damage, provided the analyst believes that the cost incurred in restoring the asset to its original state is not greater than the benefits the damaged/destroyed assets provide.

*Indirect damages* take into account the changes in the flows of marketable goods and services attributable to the disruption of physical assets, which occur until the assets’ rehabilitation or reconstruction. This definition can be extended to encompass natural capital if is taken into account that (i) the restoration of a natural asset’s original productivity may be technically unfeasible; (ii) many environmental goods and services are not exchanged in normal markets; and (iii) when technically feasible, the natural capital’s rehabilitation and restoration phase may last longer than the average time required to restore man-made capital.

In the case of hurricane Keith, *direct environmental damage* resulted in environmental changes (loss of birds’ habitats, beach erosion, changes in water quality, and damages to mangroves, coral reefs and sea-grass beds). Environmental goods and services flows such as recreation (tourism) and fisheries are impacted from (i) environmental changes described above and (ii) disruption of physical infrastructure such as buildings damages, boats and fishing gear, etc. The changes in these flows constitute *indirect damages* and most of them have been already included in the damage assessment of different sectors (especially tourism). Therefore, to avoid double counting only direct damages will be considered (see Table 41).<sup>27</sup>

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<sup>27</sup> Valuation of the environmental services of coral reefs (Ruitenheek and Cartier, 1999) have been done for Montego Bay in Jamaica as a part of a World Bank project. Values range from US\$7,500 per hectare up to as much as US\$500,000 per hectare. Environmental services considered encompass recreation (linked to tourism), fisheries habitat, coastal protection, maintenance of biodiversity and source of sand for beaches and dunes. In the case of Belize Barrier Reef, a value of US\$200,000 per hectare has been taken and an area formed by 7,000 m length (south part of Ambergris Caye to Caye Caulker) and a plain area of 75 m (53 hectares). As several environmental services were already considered (recreation, fisheries) in different sectors, a percentage of 20 per cent of the value has been used for services as coastal protection, biodiversity maintenance and source of sand.

**HURRICANE KEITH  
(WAVES, WIND, RAINFALL)**

**IMPACTS ON:**

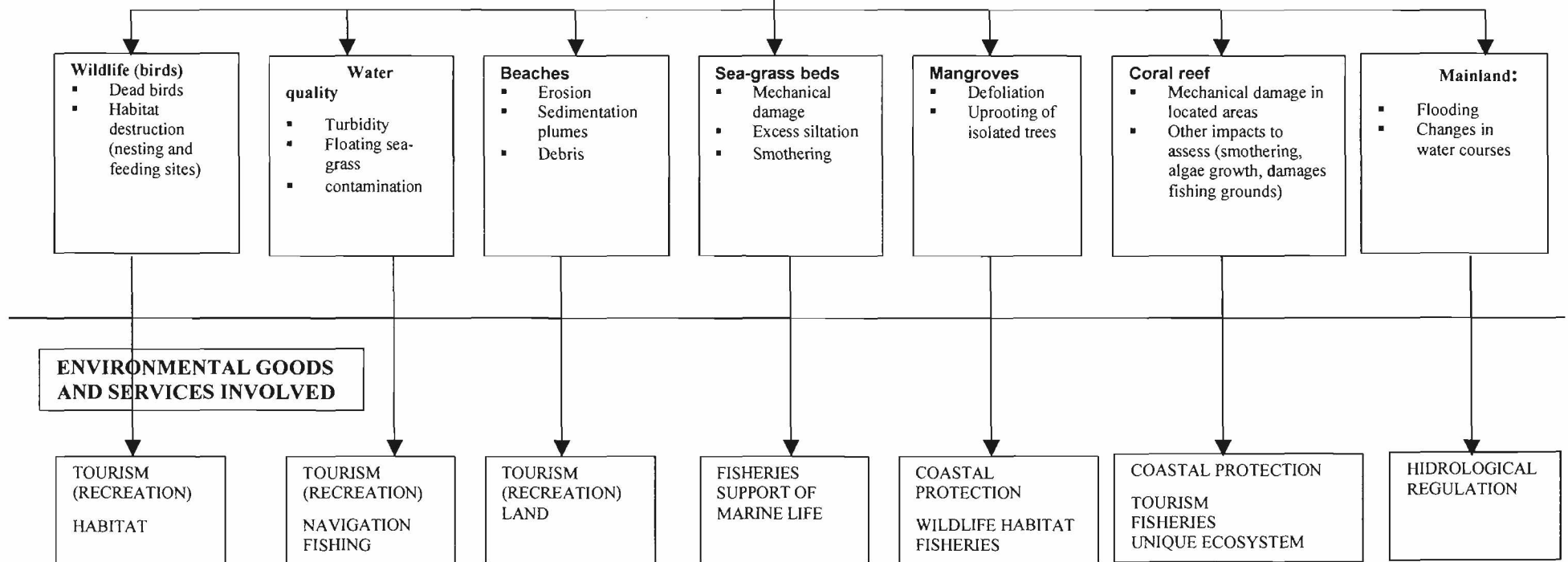




Table 41

## ENVIRONMENTAL DAMAGE ASSESSMENT

Direct damages	(Thousand BZ\$)
Total	49,051
Property loss by beach erosion a/	3,240
Damage to mangroves b/	40,000
Damage to coral reef c/	4,240
Beaches clean up (Caye Caulker and Ambergris Caye)	1,060
Damages to infrastructure of Lamanai (archaeological site) d/	500
Damages to Crooked Tree Wildlife Sanctuary e/	11

Source: ECLAC on the basis of different sources.

- a/ In San Pedro, 8 lots (aprox. 600 m<sup>2</sup>); each lot BZ\$400 per m<sup>2</sup>; in Caye Caulker at split 110 m x 100 m north side of the island; 30 per cent lower price than in San Pedro in correspondence with differences in room rates.
- b/ Restoration/replanting of mangrove in land of fringing belt may be carried out since these organisms provide a good buffer against storm wave action. An area of 5,000 acres is estimated to be suffered damages in the Belize Cayes. Of them, a replanting programme for 500 acres at most vulnerable sites is being considered. Similar work carried out in New Hampshire was completed for approximately US\$80,000 per acre. Applying this factor and assuming that approximately 50 per cent of the damaged mangrove (estimated in 500 acres) will be beyond natural recovery. An estimated for the regeneration of mangroves on the cayes of Belize (Forest Department of Belize) reduces the cost per acre to BZ\$8,821. The first task is to assess natural recovery capacity of mangroves and compare it to the costs of intervention. In the latter case, carrying out such as investment must be carefully studied, in considering financing requirements. As indicated above, restoration cost only can be used as a measure of damage, provided the analyst believes that the cost incurred in restoring the asset to its original state is not greater than the benefits the damaged/destroyed assets provide. Taking into account the differences in the regeneration costs per acre observed and that a decision of carrying out this project have not been made yet, this figure must be taken with care.
- c/ Valuation of the environmental services of coral reefs (Ruitenheek and Cartier, 1999) have been done for Montego Bay in Jamaica as a part of a World Bank project. Values range from US\$7,500 per hectare up to as much as US\$500,000 per hectare. Environmental services considered encompass recreation (linked to tourism), fisheries habitat, coastal protection, maintenance of biodiversity and source of sand for beaches and dunes. In the case of Belize Barrier Reef, a value of US\$200,000 per hectare has been taken and an area formed by 7,000 m length (south part of Ambergris Caye to Caye Caulker) and a plain area of 75 m (53 hectares). As several environmental services were already considered (recreation, fisheries) in different sectors, a percentage of 20 per cent of the value has been used for services as coastal protection, biodiversity maintenance and source of sand.
- d/ Preliminary estimation.
- e/ Infrastructure of the protected are (signals, picnic tables, roofing, etc.)

#### d) Tourism and environment

Environmental damage assessment highlights the linkages between tourism and the environment. Most of the environmental services lost by Hurricane Keith are related to recreation and tourism. Belize is a country that is well positioned in the market of tourism based on natural resources endowment. As a first condition in order for Belize to continue attracting tourist, environment must be preserved. In addition, environmental reputation and environmental performance of the country are of growing importance to increase competitiveness.

Tourism can also become a serious threat in areas where there is insufficient infrastructure and planning to support a large number of visitors. Unregulated coastal building, poor sewage treatment, and potentially damaging visitation strategies can cause serious damage to delicate habitats. Land clearing and construction activities for tourism in coastal areas involve removal of natural vegetation, dredging, water disposal and sand mining in mangroves, dune communities, wetlands, shorelines and adjacent areas. These actions result in a loss of protection from storms and hurricanes. A report of the Cayes states that “it was clearly visible that structurally sound (and even some that were not) buildings that were surrounded or located on the east side of healthy mangrove communities benefited by not incurring major damages, while those that were not, suffered tremendously”.<sup>28</sup>

Many tourist sites are over-saturated with visitors, beyond their carrying capacities, both from biophysical and management perspectives. Immigration induced by the growing tourism sector and availability of employment opportunities can lead to the proliferation of poorly planned residential neighbourhoods with inadequate basic human services (this can be the case of San Pedrito in Ambergris Caye). In the case of Belize, land-use/integrated coastal management plans and zoning related to basic environmental and engineering principles must be strengthened (code/standards for land development, buildings and waste treatment and disposal, weakness in the implementation of environmental impact assessment process).

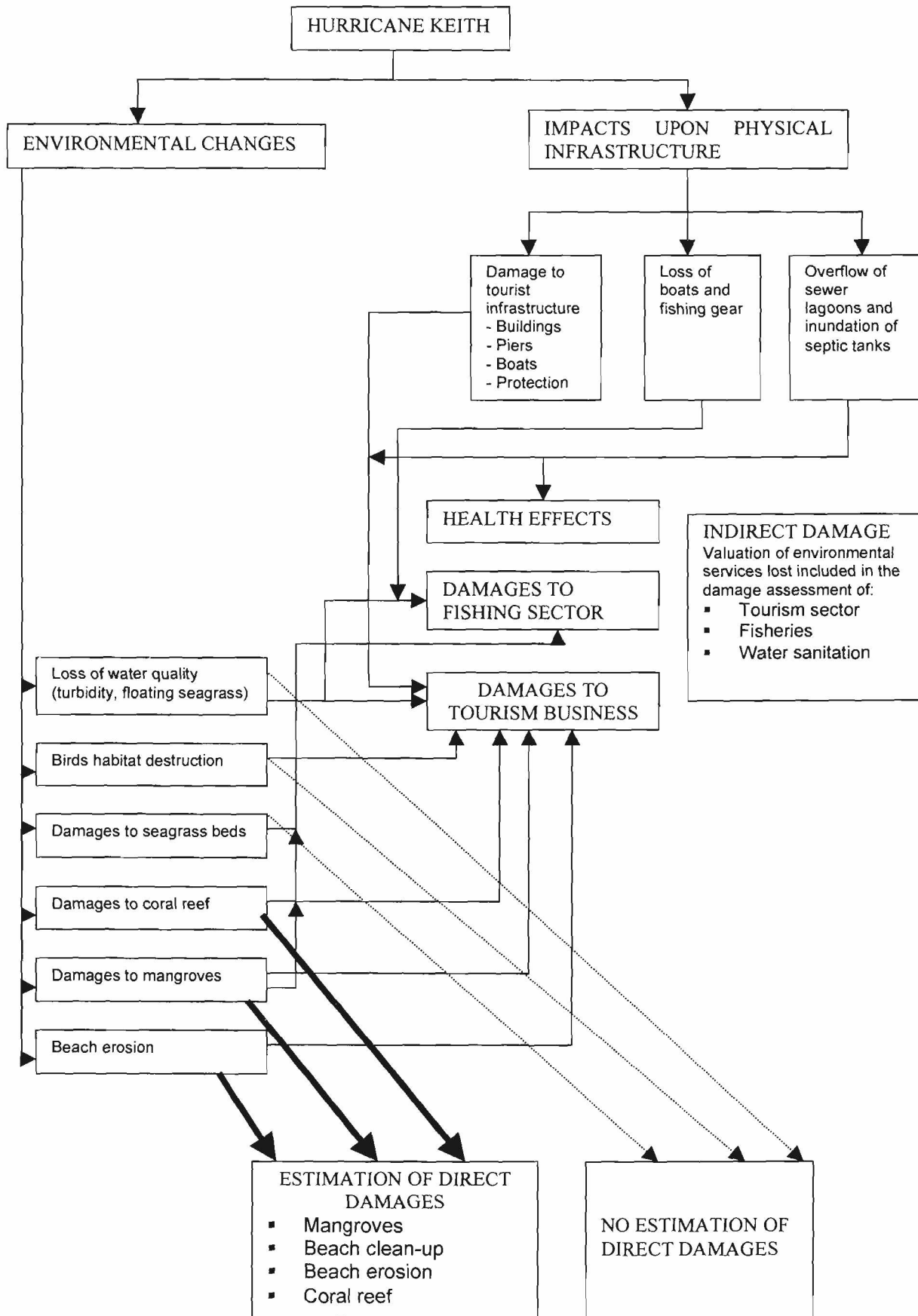
The Environment Committee of the NEMO urges "planning authorities for San Pedro and Caye Caulker to ensure that the construction of piers and sea walls now occur in a planned manner, as opposed to the way in which these structures were permitted to be constructed. The opportunity for reducing the number of piers now exists. The erection of new fuel dispensers on piers and on the islands should be given careful attention, to ensure that they meet new standards and designs that minimise risks of spills and pollution. This would enhance the tourism value of San Pedro and Caye Caulker". In addition, in most countries that border the Caribbean sea, a design condition of 1 in 50 year storm is recommended to be adopted.

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<sup>28</sup> Environment Committee (NEMO).

Graph 8

## ENVIRONMENTAL DAMAGE ECONOMIC ASSESSMENT SCHEME



Besides improvement of regulations and enforcement there is also scope for the initiatives of the private sector and civil society leading a more sustainable tourism. These include, for example, promotion of best practices and ISO 14000 standards and involvement of local communities in tourist activities.

### III. MACROECONOMIC EFFECTS

#### 1. Summary of damage

The totals of direct and indirect damage assessments of the several sectors are presented in Table 42. Total damage is estimated at BZ\$560.1 million (US\$280 million), of which direct damage, estimated at BZ\$423.3 million (US\$211.6 million) constitutes about 75 per cent. Direct damages were valued at present value or replacement cost at current prices — whichever seemed more appropriate for the specific sector. Indirect damages of BZ\$136.8 million (US\$68.4 million) were yielded on the basis of flows affected as the direct consequence of the disaster. Since some assumptions were necessary for these costs, the computed figure in some cases may underestimate the medium or long term impact in the Belizean economy.

The summary data on direct and indirect damage indicates that the most affected sectors are the productive ones: tourism and agriculture represent over 47 per cent of the direct damage measured. Total damage to the economic sectors is estimated to be BZ\$330.6 million, some 59 per cent of total damage estimated. Losses of infrastructure account for about 16 per cent of total damage. Their repair or replacement must be a priority as they perform a generator function to economic and social activity nation-wide.

Damage to the social sectors is almost as large as the damage to infrastructure and, considering that there tends to be some underestimate of the social effects, Keith had stronger negative consequences on societal variables than on physical ones. The most important social damage occurred in housing (over 12 per cent of total direct and indirect damages). Thus the urgency to face the challenge not only of replacing lost housing and other social infrastructure but to do so with new, more resilient criteria and giving full attention to risk reduction since — as Keith made apparent — Belizean society has a high level of exposed vulnerability.

It is clear that damage to housing, infrastructure and tourism must be repaired with urgency. A seriatim approach to repairs will not produce a satisfactory solution. Government should facilitate a broad front approach to rectifying damage in these areas in order to rehabilitate households (people), the tourism industry and the agricultural and agroindustrial activities, to keep economic activity alive. At the same time economic activity will generate income and lead to a recovery in the economy. Damage to the airport and harbour was relatively low.

In the table that follows a number of ratios are presented to complete the appreciation of the damage. The ratios compare damage with GDP, exports, imports, gross capital formation, domestic savings and consumption:

Table 42

## ASSESSMENT OF TOTAL DIRECT AND INDIRECT DAMAGE

(Thousands of Belize dollars)

	Direct damage	Indirect damage	Total damage
Total	423,281.4	136,812.3	560,093.7
<u>Social sector</u>	<u>73,307.7</u>	<u>2,239.4</u>	<u>75,547.1</u>
Housing	68,460.6	160.2	68,620.8
Health	2,558.0	1,330.0	3,888.0
Education	2,289.1	749.2	3,038.3
<u>Infrastructure</u>	<u>53,041.8</u>	<u>35,837.4</u>	<u>88,879.2</u>
Transport	46,735.8	33,633.6	80,369.4
Telecommunication	1,536.0	886.4	2,422.4
Energy & electricity	3,115.3	1,117.4	4,232.7
Water and sewerage	1,654.7	200.0	1,854.7
<u>Economic sectors</u>	<u>232,222.3</u>	<u>98,358.0</u>	<u>330,580.3</u>
Tourism	124,094.0	36,298.9	160,392.9
Agriculture, livestock & fisheries	77,469.0	46,889.1	124,358.1
Industry & commerce	30,659.3	15,170.0	45,829.3
<u>Environment</u>	<u>49,051.0</u>	<u>0.0</u>	<u>49,051.0</u>
<u>Miscellaneous</u>	<u>10,482.9</u>	<u>377.5</u>	<u>10,860.4</u>
Emergency expenditures	-	377.5	377.5
Cost of food	1,844.6	-	1,844.6
Cost of services	8,580.7	-	8,580.7
Cost of services interrupted	57.6	-	57.6
<u>Foreign assistance</u>	<u>5,175.7</u>	<u>0.0</u>	<u>5,175.7</u>

Source: ECLAC estimate.

Total damage as percentage of GDP (nominal estimate after Keith) *see table 45	45.7
Total damage as percentage of exports 1999	78.8
Total damage as percentage of imports 1999	64.3
Direct damage as percentage of gross capital formation 1999	92.0
Indirect damage as percentage of domestic savings 1999	45.5
Indirect damage as percentage of consumption 1999	12.7

Source: ECLAC estimate. All GDP figures used in ratios are current priced for 1999. GDP figures obtained from 18<sup>th</sup> Annual Report of Central Bank of Belize, 1999, Table 5.

Note: GDP expenditure in current prices.



The measure of Keith's effect in Belize may be very well be highlighted by pointing that direct damages (losses or damage to infrastructure) are equivalent to almost 93 per cent of the country's gross capital formation in 1999. Seen from another angle, Keith's indirect damage (negative impact on economic flows) is anticipated to be almost 46 per cent of the 1999 savings of Belizeans. Additionally, these reduced flows are equivalent to more than 12 per cent of 1999's domestic consumption).

## 2. The pre-disaster situation

### a) Overview <sup>29</sup>

The Belizean economy was facing a second year of rapid growth for 2000, after its recuperation of 1999. During the second quarter of 2000, total exports were estimated at BZ\$116.5 million — a 27 per cent increase over the total of the corresponding quarter of 1999. Contributing to this performance were bananas and citrus juices. Gross imports increased by 18.2 per cent to a figure of BZ\$223.6 million over the same comparison period as purchases from abroad of chemicals, manufactured goods and capital equipment impacted the import bill. Although no change in the Consumer Price Index was recorded during the second quarter, the annualized rate of inflation was 0.9 percent, reflecting the opposing effects of rising fuel and general import prices and the reduction of import duties to 20 per cent on more than one thousand items.

Arrivals of stay-over tourists increased by 19.6 per cent in the second quarter to 47,233 as large numbers of arrivals from North America indicated success in the country's marketing thrust. At the end of the first ten months of 2000, tourist arrivals had increased by 20 per cent over those of the corresponding period in 1999.

The net foreign assets of the banking system grew by BZ\$39.4 million as the net foreign assets of the commercial banks increased by BZ\$40.4 million while those of the Central Bank contracted by BZ\$1 million. Net domestic credit contracted by BZ\$24.3 million as net credit to Central Government decreased by BZ\$32.2 million, while credit to the private sector increased by BZ\$7.9 million. Central Government's domestic debt rose by BZ\$2.1 million to BZ\$160.7 million. An expansion of BZ\$2.6 million in its overdraft facility with the Central Bank outweighed amortization payments of BZ\$0.5 million. The public sector external debt increased by \$89 million as disbursements of BZ\$101.6 million outweighed amortization payments of BZ\$11.2 million. The broad money supply (M2) increased by BZ\$41.3 million to BZ\$907.4 million with M1 and M3 growing by BZ\$9.8 million and BZ\$31.5 million, respectively. Table 43 shows the evolution of Belize main economic indicators.

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<sup>29</sup> The present description of main aspects of the Belizean economy was prepared from the second quarter analysis of the Central Bank of Belize with updates so far as the information available outside of published tables could allow. The projections that are addressed later in the chapter have made use of assumptions that are stated.

Government policy continued to be focused on poverty reduction. Social issues such as the following received attention:

- Life expectancy at birth
- Literary rate
- Primary and secondary school enrollment
- Access to safe water
- Immunization rates.

Table 43

## MAIN INDICATORS OF PERFORMANCE

(Millions of Belize dollars)

Item	1997	1998	1999 Provisional	Jan-Jun 1999	Jan-Jun 2000
International trade					
Domestic exports	317.9	310.5	337.0	183.2	240.3
Re-exports	34.8	31.6	32.6	22.1	13.5
Total exports	352.7	342.1	369.6	205.3	253.8
Gross imports	572.4	590.3	734.7	367.7	462.8
Trade balance	-219.7	-248.3	-365.1	-162.4	-209.0
Main domestic exports					
Sugar	91.9	89.0	82.0	57.5	60.2
Bananas	52.2	49.4	54.5	20.4	28.7
Citrus	48.1	43.1	54.9	56.6	101.1
Deliveries of sugar cane (long tons)	...	...	...	1,059,434 a/	1,095,308 a/
Sugar processed (long tons)	...	...	...	107398 a/	119590 a/
Cane/sugar ratio	...	...	...	9.81 a/	9.13 a/
Marine products (exports)	35.6	43.5	55.6	11.6	12.3
Lobster tails	14.9	14.8	16.4	4.1	5.7
Shrimp	15.4	24.5	36.1	6.0	4.4
Conch	3.7	3.4	2.6	1.3	1.6

Source: Central Statistical Office & Central Bank Statistical Digest 1999.

- Dec-June 1998/1999 and 1999/2000.

**Gross Domestic Product.** Although no quarterly estimates of GDP are yet compiled by the Statistical Office or the Central Bank, indicators available suggest that the economy performed well along the projected path up to the time of the hurricane and in some sectors surpassed the expectations for 2000. An estimate puts the GDP at current factor cost to year-end 2000 at BZ\$1,231,000, reflecting a 6.6 per cent increase over 1999.

**Production.** The pre-Keith panorama for the main products of the economy was mixed. Details for particular activities are as follows:

**Sugar and Molasses.** Heavy rains and high mud content in the sugar cane resulted in deliveries to a total of 448,393 tonnes in the second quarter of 2000, some 7.6 per cent below the deliveries

in the corresponding period a year earlier. In contrast, sugar production decreased less steeply by 2.9 per cent to 49,479 tonnes because of improvements in the quality of the cane and in factory efficiency. A lower volume of molasses produced reflected improved factory efficiency as more sugar was extracted from the canes, leaving a lower molasses residual production. Sugar revenues increased in the first half of the year and were expected to continue to increase up to the time of the hurricane. Indeed, revenues increased by 31.2 per cent in the period January to June 2000 to BZ\$240.3 million over the BZ\$183.2 million recorded over the corresponding period in 1999.

**Citrus products.** Citrus deliveries during the second quarter of 2000 increased by 72.6 per cent over the deliveries of the corresponding period in 1999 as young groves came into full production. Sales of citrus juices for export increased by 77.7 per cent in volume and by more than 100 per cent in value when compared with the second quarter of 1999. Sales of orange concentrate more than doubled to 1.1 million gallons (4.2 million litres) with a value of BZ\$17 million, most of which was sold in the United States where prices were more favourable.

**Marine Products.** During the second quarter of 2000, sales of marine products stood at 700 thousand pounds and carried a value of BZ\$5.1 million. This represented increases of 73.1 per cent and 17.7 per cent in volume and value, respectively when compared with sales in the second quarter of 1999. Lobster exports increased by 10 per cent while conch exports grew by 86.3 per cent in volume and an 86.5 per cent in value. Farmed shrimp exports contracted by 9.3 per cent in volume and 8.8 per cent in value as one of the farms was taken out of production.

**Bananas.** Production of bananas was boosted as total acreage under the fruit was expanded by 300 acres. A new marketing agreement has a price mechanism that encourages the shipment of the majority of bananas during the February to September period as a higher price is being offered during this period. The volume and value of bananas exported increased by 40 per cent in the first half of 2000.

**Tourism.** In the first half of 2000, stay-over tourist arrivals increased by 14.8 per cent to 102,927 when compared with arrivals in the corresponding period in 1999. Air arrivals increased by over 25 per cent from the half-year figure of 1999. Cruise ship arrivals increased from 18,245 in the first half of 1999 to 47,765 over a similar period in 2000. The economy was set for an increase of 6 to 7 per cent in 2000 from tourism. Indications are that the tourism industry may end the year with a 4 per cent increase in value added.

**Money supply.** As at June 2000, the money supply (M2) stood at BZ\$907.4 million, reflecting an increase of 4.8 per cent in the second quarter and an increase of 8 per cent over the six-month period, driven substantial inflows derived from foreign loans. The narrow money supply to June stood at BZ\$280.9 million. Quasi-money grew by 7.1 per cent with savings and time deposits increasing by 17.9 per cent and 3.3 per cent, respectively.

**International Trade and Payments.** The trade deficit increased by BZ\$9.6 million in the second quarter of 2000 over the deficit figure of BZ\$97.5 million observed in the corresponding quarter of 1999 as the import bill continued to exceed the value of exports. Imports of materials primarily for construction projects accounted for a large part of the increase in imports. By mid-year 2000, the trade deficit stood at BZ\$209 million, up from a deficit figure of BZ\$164.4 million at half year 1999.

The value of domestic exports increased in the second quarter as banana exports increased in value by 50.4 per cent, attributable to a higher export volume. Sugar revenues increased as a larger proportion of sales went to the EU market. In the first half of 2000, the price of imported fuel more than doubled as the price of crude oil rose from between US\$10 and US\$14 per barrel in 1999 to over US\$28 per barrel in 2000.

Table 44

## FACTORS RESPONSIBLE FOR MONEY SUPPLY MOVEMENTS

(Millions of Belize dollars)

	Position as at June 2000	Changes during		
		Mar 2000 – Jun 2000	Mar 1999 – Jun 1999	Dec 1999 – Jun 2000
Net foreign assets	276.7	39.4	38.5	91.7
Central Bank	191.4	-1.0	44.9	51.2
Commercial banks	85.3	40.4	-6.4	40.5
Net domestic credit	804.8	-24.3	1.1	30.4
Central Government (net)	85.6	-32.2	-0.7	-31.9
Other public sector	57.2	0.0	-9.7	49.7
Private sector	662.0	7.9	11.5	12.6
Central bank foreign liabilities (long-term)	91.0	19.4	-0.6	66.4
Other items (net)	83.1	-45.6	31.4	-11.5
Money supply (M2)	907.4	41.3	8.8	67.2
Money supply (M1)	280.9	9.8	10.7	25.8
Currency with the public	86.8	2.3	-1.1	2.6
Demand deposits	194.1	7.5	11.8	23.2
Quasi-money	626.5	31.5	-1.9	41.4
Savings deposits	177.9	16.2	-0.3	27.0
Time deposits *	448.6	15.3	-1.6	14.4

\* Includes Non-Residents' Foreign Currency Time Deposits of BZ\$34.6 million.

### 3. Economic forecast and outturn during 2000

The Belizean economy will suffer as a consequence of the passage of Keith. Its dynamism will be reduced more severely in 2001 than in the remainder of 2000 and it is expected that by 2002 it could regain its pre-disaster fast pace of growth. Its impact in 2000, though, is not negligible since it will reduce the estimated rate of growth by one percentage point (from a forecasted 6.9 to only 5.9 (at current prices, see table 45).

Table 45

## GROSS DOMESTIC PRODUCT, BY INDUSTRIAL ORIGIN, AT FACTOR COST

(Current prices) (Thousands of Belize dollars)

	1998	1999	2000 (Pre Keith) a/	2000 (Post Keith) a/	2001 a/	2002 a/
GDP (nominal)	1,051,233	1,154,889	1,234,801	1,223,262	1,289,814	1,400,543
I. Primary activities	207,041	224,688	251,965	233,774	240,341	269,713
1.1 Agriculture	150,024	155,090	168,651	156,300	154,210	170,028
Sugarcane	33,138	33,224	32,848	31,300	26,000	27,100
Citrus	15,996	16,660	19,326	20,000	22,800	25,992
Banana	32,776	34,828	40,053	38,000	43,700	50,255
Other cops	45,420	47,274	52,946	49,000	45,000	49,500
Livestock	22,694	23,104	23,478	18,000	16,710	17,181
1.2 Forestry & logging	17,010	20,329	21,167	20,000	20,986	22,583
1.3 Fishing	33,801	42,062	54,681	50,474	58,046	69,655
1.4 Mining	6,206	7,207	7,466	7,000	7,100	7,448
II. Secondary activities	235,316	253,110	271,088	277,148	299,676	329,738
2.1 Manufacturing	139,827	148,603	151,016	155,200	154,100	160,218
Sugar	27,155	26,286	25,421	24,200	19,500	21,000
Citrus	9,431	12,543	14,174	20,000	22,600	25,538
Other manufacturing	103,241	109,774	111,421	111,000	112,000	113,680
2.2 Electricity & water	35,894	31,391	32,333	29,821	30,418	31,330
2.3 Construction	59,595	73,116	87,739	92,126	115,158	138,189
III. Service	653,117	722,562	758,489	759,080	797,581	850,121
3.1 Trade, rests., hotels	199,103	243,475	258,084	256,866	272,278	299,506
3.2 Transport & communications	109,388	121,942	125,600	125,112	128,866	135,309
3.3 Finance & insurance	73,170	76,095	81,802	81,802	87,937	94,533
3.4 Real estate & bus service	69,787	73,276	78,772	78,772	84,680	91,031
3.5 Public administration	133,608	136,758	141,178	142,174	147,268	150,128
3.6 Communications & other services	68,061	71,016	73,053	74,354	76,553	79,614
IV. Imputed bank service charges [deduct]	44,240	45,471	46,741	46,740	47,784	49,028
Per capita GDP (\$)	4,417	4,753	4,881	4,835	4,951	5,216
Annual per cent change in GDP	1.1	9.9	6.9	5.9	5.4	8.6

Source: ECLAC, on the basis of data from the Central Bank of Belize.

a/ Estimates for 2000 and projections for 2001 and 2002 were made available by the Central Bank.

One relevant observation is that the production and other indicators used, linked to the relationships established between sectoral performances have indicated a performance beyond what had been projected for 2000 in some instances. It has further been observed that the large



establishments that suffered significant physical damage and loss of business were insured. Some 60 percent of claims have or are being settled before the end of the year. The inflow of those funds will have effects on the balance of payments. Specific sector impacts are seen to be the following:

- The agricultural sector would suffer moderately in terms of loss of foreign exchange. More loss would have been sustained in subsistence agriculture. Overall, value added in the agricultural sector would fall short of the projected figure for 2000 by 7.7 per cent. The shortfall in the primary sector is expected to be of the order of 7.9 per cent below the projection for 2000.
- Loss of income in electricity and water might well be outweighed by value added outturns in excess of the 2000 projections as sugar and citrus manufacturing performed better than expected in 2000.
- The manufacturing sector which includes the processing of sugar and the extraction of citrus concentrate, is estimated to have performed some 4.7 per cent above the projected figure for 2000. The mission estimates that there was a 1.1 per cent improvement in the secondary activities categorisation over the projected figure for 2000.

The revised estimate based on the revised figures supplied by the Central Bank of Belize was a GDP figure of BZ\$1,223.3 million. Table 46 shows its evolution in constant (2000) prices. As indicated, the annual growth rates in both current and constant prices shows a decline in rate of growth of GDP in 2000, followed by further decline in 2001, with a resumption of an increased rate of growth in 2002.

Table 47 and Graph 7 summarize the GDP evolution, estimates and forecasts for the 1998-2002 period — in US dollar terms — as a means of illustrating the economic growth gap that was caused by Hurricane Keith.

Table 46

## GROSS DOMESTIC PRODUCT, BY INDUSTRIAL ORIGIN, AT FACTOR COST

(Constant 2000 prices) (Thousands of Belize dollars)

	1998	1999	2000 (Pre Keith) a/	2000 (Post Keith) a/	2001 a/	2002 a/
GDP (real)	1,097,612	1,165,242	1,234,801	1,223,262	1,253,490	1,336,331
I. Primary activities	202,451	225,752	251,965	233,774	234,604	259,568
1.1 Agriculture	146,920	157,819	168,651	156,300	148,628	159,537
Sugarcane	32,805	33,671	32,848	31,300	25,156	25,630
Citrus	15,016	17,163	19,326	20,000	21,716	23,837
Banana	32,531	34,947	40,053	38,000	42,698	48,462
Other Crops	45,695	47,788	52,946	49,000	43,648	47,045
Livestock	21,379	23,366	23,478	18,000	16,201	16,315
1.2 Forestry & logging	22,035	20,520	21,167	20,000	20,384	21,524
1.3 Fishing	32,056	42,744	54,681	50,474	56,013	65,534
1.4 Mining	6,830	7,289	7,466	7,000	6,884	7,072
II. Secondary activities	249,301	255,929	271,088	277,148	290,642	313,365
2.1 Manufacturing	143,484	150,502	151,016	155,200	149,196	151,723
Sugar	...	...	25,421	...	...	...
Citrus	...	...	14,174	...	...	...
Other manufacturing	...	...	111,421	...	...	...
2.2 Electricity & water	43,322	31,594	32,333	29,821	29,631	30,031
2.3 Construction	62,495	73,832	87,739	92,126	111,815	131,611
III. Service	699,886	729,434	758,489	759,080	774,685	810,179
3.1 Trade, rests., hotels	234,801	245,745	258,084	256,866	264,496	285,509
3.2 Transport & communications	114,843	123,704	125,600	125,112	124,565	127,730
3.3 Finance & insurance	73,208	76,679	81,802	81,802	85,562	90,403
3.4 Real estate & bus service	70,370	73,888	78,772	78,772	82,337	86,939
3.5 Public administration	136,716	137,579	141,178	142,174	143,524	144,037
3.6 Communications & other services	69,948	71,840	73,053	74,354	74,200	75,561
IV. Imputed bank service	43,796	45,873	46,741	46,740	46,441	46,780
Charges [deduct]						
Per capita GDP (\$)	4,612	4,795	4,881	4,835	4,812	4,977
Annual per cent growth in GDP	1.5	6.2	6.0	5.0	2.5	6.6
Implicit deflator	95.8	99.1	100	100	102.9	104.8

Source: ECLAC, on the basis of data from the Central Bank of Belize.

a/ Estimates for 2000 and projections for 2001 and 2002 were made available by the Central Bank.



Table 47

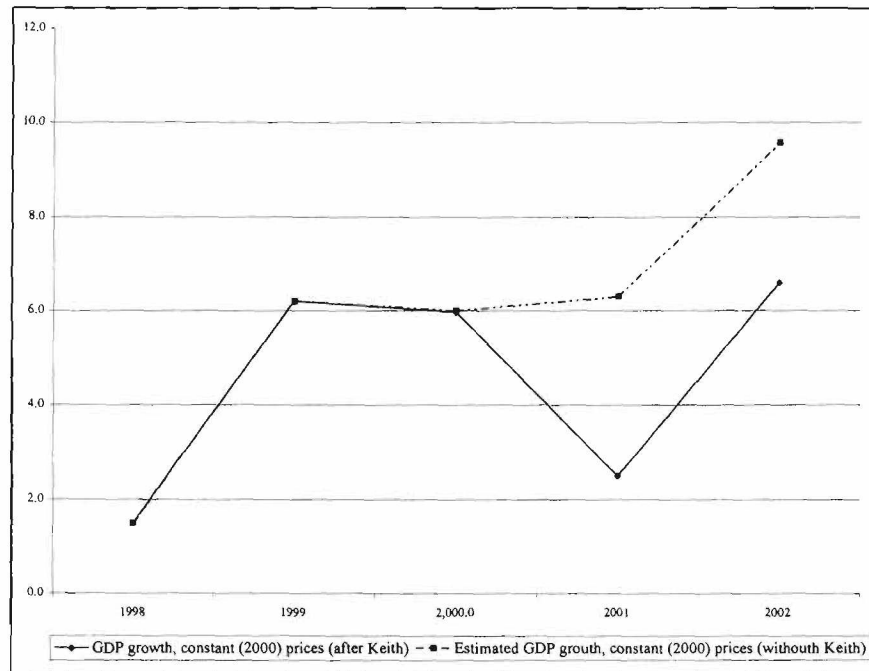
## BELIZE: GDP SUMMARY POST-KEITH

	1998	1999	2000 Pre Keith	2000 Post Keith	2001	2002
(BZ\$ millions)						
GDP at current market prices	1,351.4	1,374.2	1,469.3	1,470.2	1,536.4	1,659.4
GDP by industry at current factor cost	1,051.2	1,154.9	1,234.8	1,223.3	1,289.8	1,400.5
GDP by industry at constant 2000 prices	1,097.6	1,165.2	1,234.8	1,223.3	1,253.5	1,336.3
(US\$ millions)						
GDP by industry at current factor cost	525.6	577.5	617.4	611.7	644.9	700.3
GDP by industry at constant 2000 prices	548.8	582.6	617.4	611.7	626.8	668.2
Percentage change in GDP at current prices	1.1	9.9	6.9	5.9	5.4	8.6
GDP growth, constant (2000) prices (after Keith)	1.5	6.2	6.0	5.0	2.5	6.6

Source: ECLAC.

Graph 9

## BELIZE: ECONOMIC GROWTH GAP GENERATED BY KEITH



#### 4. Fiscal policy and the central government's finances <sup>30</sup>

For fiscal year 1999-2000, the Central Government had budgeted a fiscal deficit of approximately 1.3 per cent of GDP. This reflected a conscious attempt to manage the fiscal deficit, through all of the main determinants of the fiscal balance, namely the tax regime that had been recently modified and through restraint in current expenditure through the introduction of public sector reforms. The divestment policy of government was expected to result in capital revenues that would help reduce the overall deficit. The recurrent surplus was expected to decline from 0.4 percent of GDP to 0.2 per cent, while the operating balance was programmed to swing from a deficit of 1.8 per cent of GDP to a surplus of 0.9 per cent.

At the end of June 2000, the fiscal account appeared headed for a better performance than previously budgeted. The fiscal deficit appeared to suggest an end of year position of 0.6 per cent of GDP, but that was before the hurricane. The tax revenue had performed weaker than had been expected and led to a decline. The estimate of tax revenue is estimated to have dropped from 21 per cent of GDP to 19.2 per cent of GDP. Tax revenues will decline in response to a temporary slowing down in tourist arrivals as reconstruction takes place in tourist areas.

The Government of Belize has switched its debt management strategy to a search for foreign concessional financing amounting to 3 per cent of GDP, and 0.8 per cent of GDP from foreign commercial sources.

Re-estimation of the fiscal deficit is being done at the time of writing. Latest preliminary calculations show that fiscal revenues have increased substantially through the modality of divestment. Indications are that the fiscal deficit, which in November 2000 stands at 3 per cent of GDP, will by the end of the first quarter of 2001 be slightly positive.

#### 5. Effects on population's income

Hurricane Keith's devastation of the remote and rural areas was perhaps in relative terms more tragic than the damage done to the tourism plant and basic services which could be measured in terms of dollars and which for the most part was insured. Most of the flooding associated with the hurricane occurred in districts such as Orange Walk and Cayo, two of the poorest areas. The observation was made that there is a significant percentage of female-headed households (25 per cent to 38.5 per cent) in these areas. The conditions of high female unemployment, a high female-headed household ratio to total households in those districts and a high fertility rate, especially among the female population under the age of 25 years, make for the perpetuation of the vicious circle of poverty and misery. The teenage pregnancy rate in San Pedro is above the national average. There may be a strong correlation between poverty of the type that exists in some areas and the prevalence of communicable diseases.

The main concern of Government on the economic plane is the alleviation of poverty. Data coming out of the Caribbean Development Bank, ECLAC and OAS indicate that about 33

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<sup>30</sup> This section draws heavily from an IDB document entitled BELIZE, Assessment on the sustainability of the Fiscal and External Accounts, written by Jaime Jaramillo-Vallejo. December 1999.

per cent of Belize's population has an annual income of less than US\$645 and thus lives below the poverty line. In rural areas, the figure has been estimated to be as high as 42.5 per cent of the population. Given the constant influx of refugees from neighbouring countries, there results an irresistible tendency towards an increase in the numbers of people below the poverty line. The incidence of poverty in rural and remote districts and among vulnerable groups is also reinforced. A quick estimate indicates that the average income lost among the affected population in these areas was of the order of BZ\$458 per person.

The hurricane has no doubt set back the government's poverty alleviation strategy that had set a target on containment of the Central Government deficit to no more than 2 per cent of GDP. With the new estimate indicating a fiscal deficit of 3 per cent of GDP, the target of poverty alleviation may have moved somewhat, delaying its achievement. Any alternative strategy that keeps the attainment of the poverty alleviation date fixed at the previously targeted date will place the foreign exchange parity at risk.

## **6. External sector and prices**

Hurricane Keith has impacted macroeconomic performance in a number of ways. There has been a fall-off in economic activity as attested to by the loss of property, hours of work, the loss of business and the loss of crops. These have impacted negatively on livelihoods, although the impact has not had an even incidence over the population. As an example, the subsistence farmers in the Orange Walk district and the lobster fishermen operating on Ambergris Caye who, because of the loss of their crops and fishing gear, respectively, are unable to feed their families, merit some consideration for relief. Export earnings from fishing are expected to decline in 2001. Exports and export earnings are estimated to have fallen as much damage was sustained in the tourism areas and in areas that cultivate export crops. Whereas there are no firm figures to quantify the extent of the phenomenon, indications are that the poorer households have been more adversely affected in terms of damage and displacement than other income groups in the population.

The loss of crops due to flooding has impacted negatively the supply of food to the domestic economy. A temporary increase in prices is expected to ensue, as the market mechanism will determine the distribution of the food. In addition, shortfalls in domestic supply will have to be imported, putting some pressure on the current account of the balance of payments.

The damage caused by the hurricane will have implications on the import bill. To the extent that direct damage will have to be repaired by reconstruction of houses and physical plant for which there is a high import content of materials, possibly of the order of 70 to 85 per cent of total cost of materials. To the extent that the damaged properties were insured, the settlement of insurance claims will result in capital inflows – a positive aspect of the country's balance of payments. Further, the reconstruction effort will result in increased activity in construction, which, in turn will create conditions for increased demand. The upsurge in construction activity may, however, require the importation of labour from adjacent countries.

The loss of tourist visitors, when combined with the estimates of direct and indirect damages to the sector will impact the balance of payments in the final three months of 2000 and into 2001. An estimated impact on international trade puts the import figure at BZ\$115.3 million to be spread over the rest of 2000 and 2001.

With well-organized support from friendly donor countries pledging investments in strategic areas and with proper project sequencing, the balance of payments may be able to avoid the pressure that would otherwise be brought to bear on the exchange rate parity of the country.

### **7. Effect on rate of investment**

Statistics from the Central Statistical Office and the Central Bank put the current-priced gross capital expenditure figure for 1999 at BZ\$459.9 million, representing some 33.5 per cent of GDP in current prices for 1999. The net addition to capital formation in 2000 did not appear to have been significant, allowing the analyst to work with the 1999 figure as a guide to 2000. The damage caused by Hurricane Keith resulted in net disinvestment, as a significant portion of the tourist plant was damaged and was taken out of service. To the extent that the investment was covered by insurance, in most cases reconstruction will take place. In the short run, the lower level of capital stock has led to lower returns on capital. This means that whereas the economic projections for the post-2000 years were predicated on the retention of the 1999 capital stock and additions, in fact production and return on investment declined. There are signs that reconstruction, hopefully with mitigation, will take place in 2001. There are also signs that productive capacity in the economy will not have operated at optimum level in 2001 because of the replacement of damaged capital. Existing plant and machinery will either have to be worked beyond specifications or would not be able to respond adequately to demand. The economy will then most likely operate with a resource gap throughout 2001. It is reasonable to expect a replacement of fixed capital investment by the end of the year. It is important, however, that the rate of addition to investment should be matched by a capacity to absorb the investment. If this does not happen, at the stage of construction, migrant workers in the construction sector and later, skilled workers in the relevant industrial or service activities will have to be contracted to service the industry. Investment should be accompanied by a programme for upgrading the skills of Belizeans to take the jobs that will be created by the investment.

### **8. Effect on rate of savings**

Total domestic savings for 1999 have been used as the proxy in the absence of a figure for 2000. The figure stood at BZ\$300.1 million. Given the problems of damage to property, some of which was not insured or in the case of many households, with a deductible that may be higher than the damage, the savings rate is expected to have fallen in 2000 as a result of the hurricane. This figure will continue to be reduced throughout 2001 as the economy seeks to recover from the damage caused by Hurricane Keith in October 2000. The rate of investment is therefore expected to moderate from the 1999 performance.

#### IV. GUIDELINES FOR A REHABILITATION AND RECONSTRUCTION PROGRAMME

Although different emphasis is required in each country depending the type of damage and the vulnerability existing prior to the disaster, the devastating consequences of hurricane Keith in Belize call for the adoption of new rehabilitation and reconstruction criteria to reduce the country's vulnerability. If anything Keith was a timely reminder that Belize is exposed to damages given its fragile ecosystems and geographical characteristics and location. Moreover, since the present development growth is predicated on activities that rely heavily on the environment, its sustainability and preservation – as are tourism and agriculture – the basis for future growth depend on the adoption of a rational management of risk.

Poverty factors and unequal distribution both of resources and income aggravate the country's structural vulnerability and it will only be through a combined effort of government, local authorities, private sector entrepreneurs and society at large that a new approach to development can take place. Physical fragility, health risks, environmental hazards, income differential and social dynamics all combine to determine a country's development pattern.

On occasion an event like Keith – fortunately enough without major losses of lives as has recently occurred in other countries – opens the opportunity for a change of policy and a soul – searching effort to avoid preserving or aggravating presently negative trends. Certainly Keith represents an economic setback in some aspects but it may be just the kind of reminder needed to give a hard look to ongoing processes that may be rectified.

It will be important – on the basis of this occurrence – to set priorities and consider the time frame and the necessary changes to design, construction and land use regulations in keeping with the situation in each country. In any event, reconstruction should be carried out on the basis of a significant qualitative improvement over the previous circumstances. Another fundamental factor regarding the viability of any reconstruction process is a country's internal capacity to conduct the process and programme it so that national capacity is not exceeded. Each country must decide on the time frame and priority of its actions and strike a balance between the urgent task of replacing what has been lost and its capacity to accomplish such works.

Once the emergency phase is over, rehabilitation and reconstruction programmes must be established in order to restore the facilities, assets and services damaged or destroyed by the devastating effects of the hurricane in each country. The content, priorities and scope of such programmes must necessarily be a national, sovereign decision of each country and respond as much to the magnitude of the damages as to a country's pre-existing conditions and economic and social policy criteria. Its foreign debt commitments and stabilisation policies must also be taken into account on determining the content, scope and scheduling of the programmes.

On addressing this topic, it is important to compile and analyse extensive background data so as to draw up investment and management programmes that will make optimum use of available resources while following the country's economic and social development objectives.



One factor to be borne in mind at this stage is that, given Belize's inception in the Central American isthmus, reconstruction cannot be carried out by the country on its own; it requires international cooperation. This section was included in this report to provide an idea of the investment projects deemed pertinent for repair and reconstruction. Some are merely profiles at this stage while others are more developed and still others are already funded. The list of projects neither replaces nor runs counter to the proposals submitted by national authorities to the Advisory Group. It is intended to assist in identifying needs and portraying the priorities that both international players, national actors and the specialists that took part in the evaluation would wish to see highlighted. In the final analysis any strategy must rest on strengthening the basis for sustained, less vulnerable development with growth. Thus any proposed mixture of components to reduce vulnerability to natural disasters must be compatible with sound economic policies and the necessary structural reforms that will in the short and long term allow more effective, and competitive integration into a globalised world. Specially in the case of small developing economies like Belize – not unlike its SIDS counterparts in CARICOM or its Central American neighbours – vulnerability and risk management has a double track meaning. On the one hand facing its physical, environmental and climatic challenges ; and in the other strengthening its resilience and capacity to respond to external shocks associated with financial crises or the world markets.

Consequently, this part of the evaluation is not intended on focusing on a national strategy which, as stated above, must be devised by the country in adequate consultation with those communities more severely exposed to disasters and risks. Its purpose is to develop the guiding principles behind the generation of projects and the basic guidelines to be followed on preparing rehabilitation and reconstruction plans and programmes. We believe this could be of assistance to national authorities on defining their strategy, which should be devised on the basis of consensus-reaching with society, particularly civil society, economic players, academic and non-governmental organisations and local authorities, among others.

### **1. Project generation**

The main aims of the proposed projects are to attend to victims of the disaster, rebuild and improve destroyed and damaged assets, re-establish productive and export processes, and in general help to reactivate the process of economic and social development.

The initiatives presented here are a sample of investment project profiles, currently being developed to provide basic information on their aims, scope, expected results, activities and tasks to be carried out, investment to be made, expected financing, and the special characteristics of each project. These profiles are compiled in addendum 1 to this document.

Each profile should subsequently be analysed in depth in order to draw up definitive projects and prioritise them so as to design repair and reconstruction programmes. This will make it possible firstly to improve the living conditions of disaster victims and recover the material and economic losses stemming from hurricane Keith's devastating effects; secondly to enhance the design standards in use prior to the disaster, and thirdly to carry out works and establish mechanisms to control and mitigate the enormous damage caused by the hurricane's wind and rains.

To carry out the projects efficiently – once they have been definitively assessed and ranked – it will be essential to develop execution programmes so as to bring resources into line with needs. It would first be advisable to draw up a rehabilitation programme part of which is already under way to deal with the emergency situations facing disaster victims, followed by a reconstruction programme to overcome economic and social adversities, restore and improve infrastructure and production facilities, and prevent or reduce the effects of similar events.

## **2. Rehabilitation stage**

This initial phase is focused on normalising the living conditions of victims – while also reactivating the economy – by meeting their vital needs and delivering basic services. The victims' food, health care and employment needs must take priority, and should be met expeditiously through the following actions:

- a) Provision of food.
- b) Provision of potable water.
- c) Medical attention to those at risk.
- d) Control and improve the prevention of diseases, particularly contagious diseases.
- e) Housing repair.
- f) Establishment of improved sanitation services.
- g) Generation of productive jobs.
- h) Provisional repair of access roads to affected areas.
- i) Supply of seeds and basic inputs to affected small and medium-scale farmers and fishers, along with financial support and soft loans.
- j) Repair of different types of infrastructure.

The suggested rehabilitation programme should be implemented as swiftly as possible, partly to meet vital and basic needs that are an ethical imperative, and partly due to the need to control and check the spread of diseases and epidemics in order to prevent hardships from becoming more acute. It is important to remember that the rainy season begins in April, so the rehabilitation programme must be concluded by that time.

Timely implementation of the above actions will bring the victims' living conditions back to relative normality and help to reactivate the country's economy.



### **3. Reconstruction stage**

This is the most crucial stage in economic and social terms, since it will lead to the full re-establishment of normal living conditions and the country's economic and social development momentum prior to hurricane Mitch.

This phase will bring about the implementation of specific projects – duly assessed, ranked, and coordinated – in line with available resources, i.e., fully programmed and provided for in the reconstruction programme, which should be worked out as soon as possible.

The main aim of the reconstruction stage and the projects thereof is to effectively overcome the direct and indirect problems stemming from the hurricane, although hurricane-prevention infrastructure and management deficiencies and flaws will also have to be addressed. For instance, the effects of the hurricane showed that a number of structures were unsafe and that other types of infrastructure, such as roads, bridges, hospitals, potable water systems, schools, etc. were inappropriately located; there is also an absence of watershed, infrastructure and environmental management schemes, and a lack of natural disaster prevention and control facilities – particularly for floods – to manage and mitigate their after-effects.

Moreover, on designing the reconstruction programme it will be important to take into account macroeconomic principles so as to prevent the undesirable consequences of overly ambitious reconstruction programmes. These include inflation, divergences in the exchange rate or in the supply and demand of certain resources such as labour and building materials, or undesired, disorderly migration.

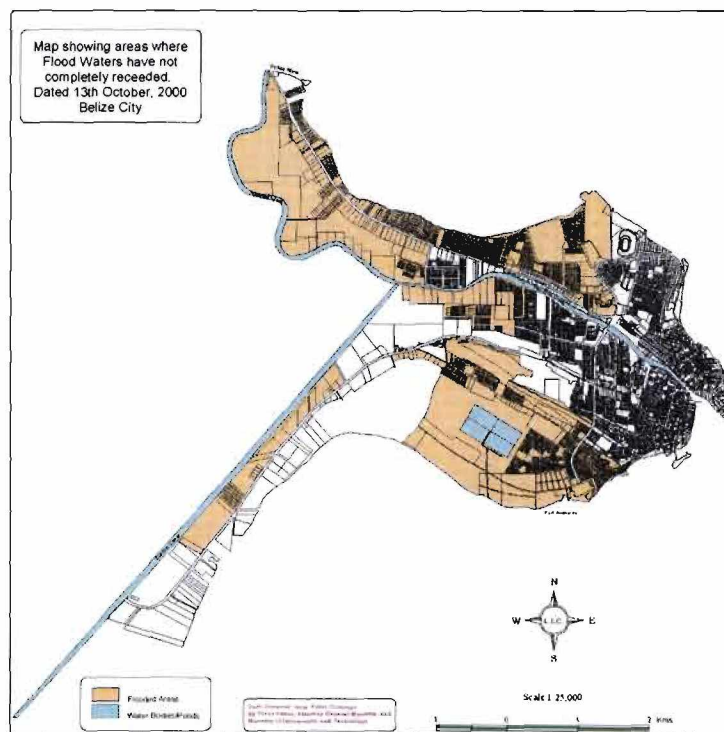


**Photographic Annex**





1. Belize City during Keith



2. Flooded areas in Belize City





3. Floods in Orange Walk District



4. Floods in Belize District



[REDACTED]

1

2

3

4



5. Cattle stranded in flooded pastures



6. New means of transportation during prolonged flooding





7. San Pedro in Ambergris Caye



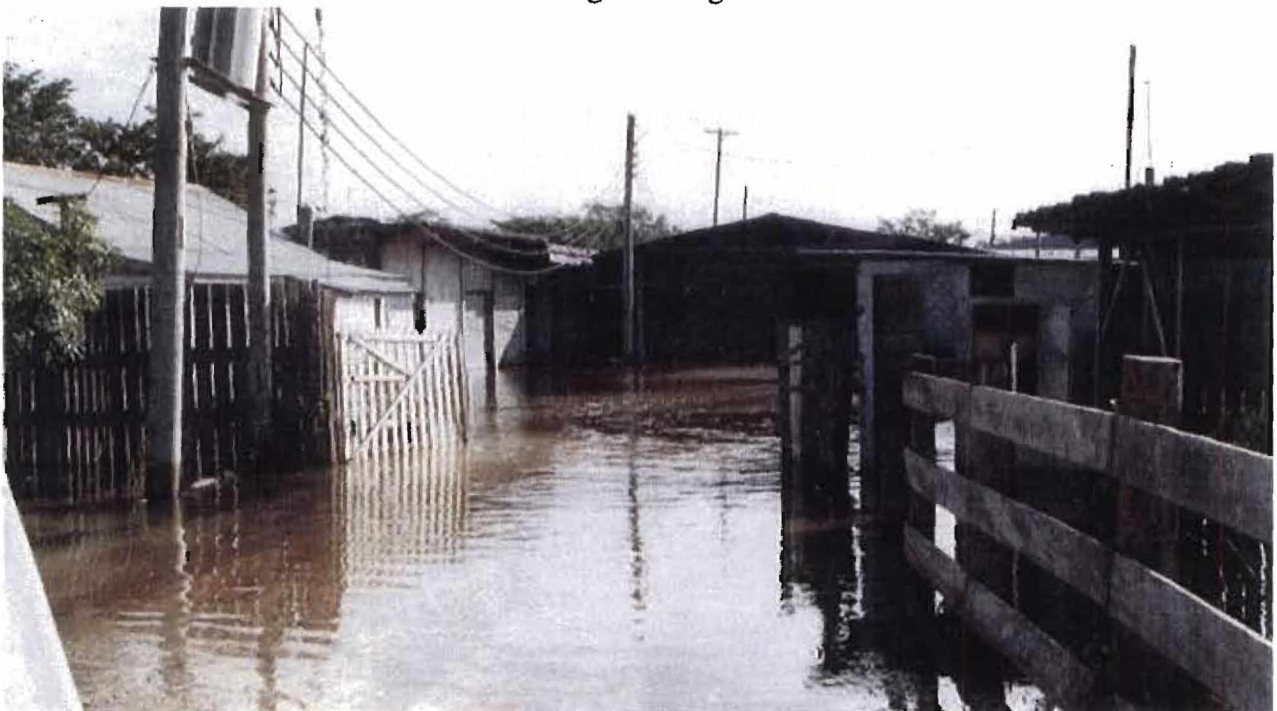
8. San Pedrito, Ambergris Caye: House was displaced from its foundation by water and windforce







9. Flooding in Orange Walk



10. Flooding in Orange Walk







11. Crooked Tree. Roads remained under water for weeks and some will remain for months



11. Damage to vessels: boats were lost due to hurricane winds in the west coast of Ambergris Caye





13. Aircraft were damaged in San Pedro Airport



14. Caye Caulker: The split opened by Hurricane Hattie in the sixties grew wider, damaging existing seawall







15. Flooded plantations in Belize District



16. Papaya crop affected by hurricane







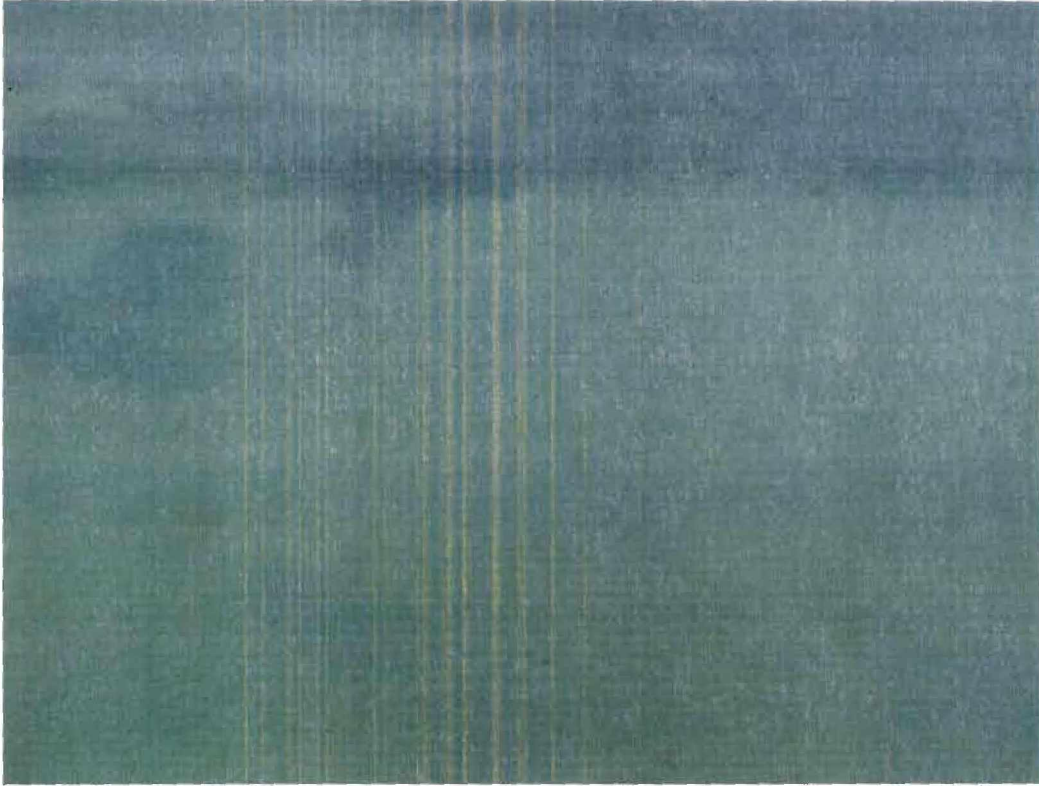
17. Abated sugarcane that was lost to sugar production



18. Major Mayan historic sites suffered little damage: small crevice deepened in Lamanai and visitors were unable to reach the site due to floods







19. Pristine Caribbean waters were temporarily opaque due to mud and silt



20. Wind force damage tourist resorts landscaping, affected mangroves and destroyed palm trees





21. Uprooted trees compounded beach damage where erosion of sand dunes requires beach replenishment in San Pedro



22. Disposal of garbage and debris caused by the hurricane in open dumps and burning of it points to the need for improved solid waste management







