

The heavy rainfall also caused an increase in the water levels of the East Demerara Water Conservancy Dam (EDWC). This structure is not a robust structure and is constructed from sand, clay and some peaty material. In addition, repairs have been carried out in many areas, to address old breaches or recently overtopped sections, using a locally available organic material known as pegas. At the eastern section of the northern dam, about 30% of the dam is considered to be in critical condition. For the rest of the northern sections of the dam and also for the western section of the dam, about 10% is assessed to be in a poor state⁴. The crest of the dam is at approximately 60.0 ft relative to Guyana Datum (GD), which is 1.8 feet above Mean Sea Level. Safe management of the dam requires that the water level in the conservancy should be maintained above 50 feet GD to avoid drawdown failure of the dam inwards, but should not go higher than approximately 57 feet GD to avoid excess pressure on the upper sections of the dam, which could in turn lead to failure, or above 59.0 feet GD, which would lead to breaching of the dam.

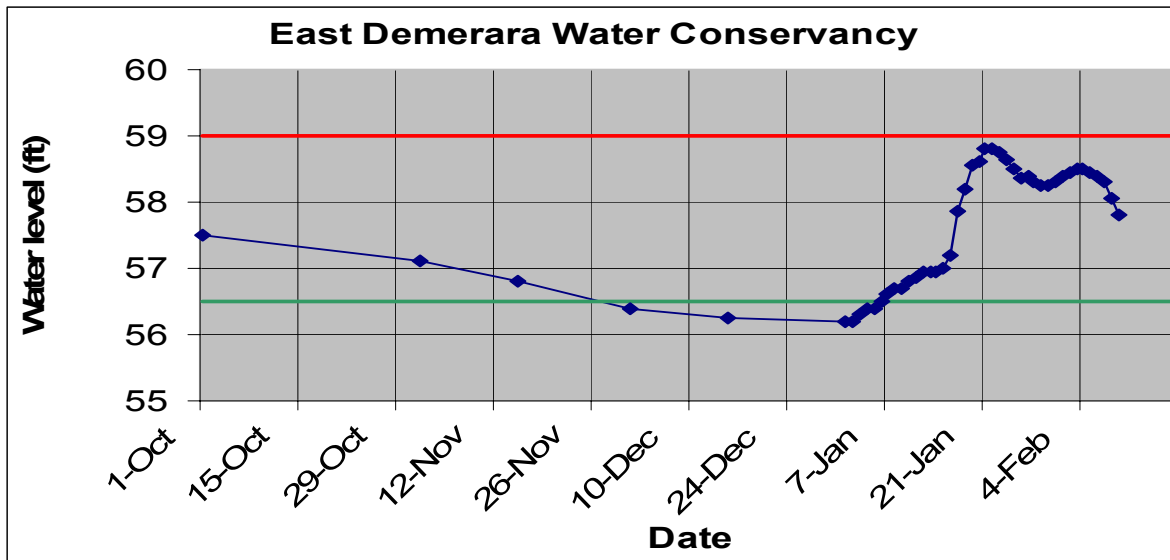


Figure 9 Water Levels in the Conservancy (gauge shown in photo)

As the rains continued, the levels in the dam came dangerously close to a critical level of 59.0 ft GD (Figure 9). This condition was greatly exacerbated by the fact that many of the water level management canals had become inoperable or had severely reduced conveyance capacities. This situation became even more critical as breaches in the dam began to occur, worsening the downstream conditions for the close to 350,000 coastal populations of Georgetown and the East Coast. As the flood waters continued to rise, power and drinking water systems became temporarily inoperable. Latrines were flooded, crops were inundated and livestock stranded in 40 – 50 in. deep water. In many cases, people were trapped on the upstairs floors of their houses. The occurrence of a period of high tides following the heavy rains also prevented the easy drainage of canal water through the seawall kokers.

⁴ Geotechnical and Hydraulic Assessment of Flooding Danger Caused by the East Demerara Water Conservancy Dam. Nisa Nurmahomed and Olaf van Duin, 2005. UNDAC.

The wholesale flooding of the affected population was prevented by two main interventions. First, excess water was discharged to the canals leading to the Mahaica River, thereby easing the build up of water behind the crest of the dam. This action had the unfortunate, but anticipated, impact of flooding many of the communities along the banks of that river (see Photo 3 below). Had this not been done, it is very likely that the dam would have been breached, releasing close to 100 billion gallons of water into the coastal zone.



Photo 3 Sandbagging on the Banks of the Mahaica River

The second intervention was the 24-hour dam repair operation that was carried out by a team of approximately 150 people, who sandbagged the crest of the dam and/or used pegasse material to raise the height of the dam crest in places where overtopping had already commenced (see Photos 4 and 5 below). It is likely that this action, in combination with the planned discharge of water to the Mahaica River, averted what could have been a very disastrous situation.



Sand bags and pegasse to increase crest height



Photos 4 and 5

Sandbags and pegas on the crest of the Conservancy Dam

2. The affected population

2.1 The affected population

Guyana is divided into 10 administrative regions, with a population of 742,041, of which 75% live along the coast. Some 463,300 persons or 62% of the total population of Guyana, reside in Regions 3, 4 and 5, which were the hardest hit by the flood. The disaster claimed the lives of 34 persons, seven directly attributed to drowning by flood waters and 27 due to illnesses arising out of the flood conditions. Table 2 details the affected population by region.

Region	Total Population	Population severely affected	% of Pop Severely Affected	Pop Moderately affected	% of pop moderately affected
Region 1	23,204				
Region 2	48,411			4,841	10%
Region 3	101,920	41,787	41%	66,248	65%
Region 4	309,059	222,522	72%	262,700	85%
Region 5	52,321	10,464	20%	20,928	40%
Region 6	122,849				
Region 7	15,935				
Region 8	9,211				
Region 9	19,365				
Region 10	39,766				
Totals	742,041	274,774		354,718	
Percentages		37%		48%	

Source: ECLAC estimates based on Official GOG data

The flood was concentrated in what are also the most heavily populated regions of the country, as can be seen in Table 2, resulting in some 274,774 persons, or 37% of the national population, being severely affected by the flood waters. In Region 4, a total of 222,522 persons or 72% of the region's population were severely affected. Some 41,787 persons or 41% of the population in Region 3, and another 10,464 or 20% in Region 5 experienced the cruel conditions of the flooding. In all, 37% of Guyana's population could be said to be severely affected by the flood. The secondarily affected population or those who would be considered to be moderately affected by the disaster accounted for 354,718 or 48% of the total population. They could be found not only in the severely affected regions but also in Region 2. The ECLAC methodology allows for a third category of affected population, those who reside outside the affected areas but who may house or support those found in the direct path of the disaster, such as was the case found among the population of Linden, where many affected persons sought refuge.

From one to seven weeks, persons along the Guyana coast lived in three to five feet of water, in deteriorating environmental conditions including proliferation of solid waste, carcasses of livestock and household pets, sewage from pit latrines and septic tanks, and a contaminated water distribution system, all of which heightened the risk for water and vector borne diseases. People in the villages in the region of the Mahaica and Mahaicony Rivers continue to live in flood waters.

It should be noted, however, that not all are equally vulnerable. The poorest are found to be the most susceptible to natural disasters as they possess the least assets to enable them to buffer against the difficulties caused by the disaster, and have less capacities to improve their positions thereafter. Although there has been some improvement in the living conditions of the Guyanese population between 1992 and the last survey of living conditions, which was conducted in 1999, as Table 3 makes evident, a significant proportion of the Guyanese population, 35%, lives below the poverty line, and Guyana continues to be one of the poorest countries in the Western Hemisphere. Unfortunately, poverty data distributed by regions was unavailable.

Geographical Level	Extremely Poor		Poor	
	1992	1999	1992	1999
Georgetown	15.8	9.0	28.9	16.3
Other Urban	12.3	3.7	23.1	15.4
Rural Coastal	27.9	19.6	45.2	36.7
Rural Interior	70.8	88.0	78.6	92.5
Guyana	28.7	21.3	43.2	35

Source: Guyana poverty Reduction Strategy Paper

Table 3 indicates that there is a substantial difference in the chance of being poor within the rural setting, dependent on whether a person lives on the rural coast or in the interior. In addition to the quantitative difference between rural and urban poverty, there is also a marked difference between the qualitative experience of poverty, as has been suggested by data from a 2000 survey, which found that the prevalence rate for moderate-to-severe malnutrition in children, in the interior rural areas was only 4%, while coastal rural areas suffered 13% and coastal urban areas suffered 9%⁵. It was suggested that the disparities could have been explained by a number of factors. Central among them were the differences between agricultural and non-agricultural areas, conditions in sanitation and water quality and by differences in areas of very high and very low malaria rates. However, the study indicated that 27% of all Guyanese children are at least moderately anemic.

⁵ MICS (2001). Table 14. Page 58.

The December/January floods increased the health/nutritional risk of those persons living in the coastal region and, no doubt, exacerbated the health conditions of the most vulnerable in the society, particularly children, as the subsistence or backyard gardens managed by their families, which supported their nutritional intake, were damaged.⁶

2.2. Vulnerability of women and children

Women head approximately 30% of the households, although it has been argued that this figure may be underestimated in light of the heavy out migration of men who go in search of employment in other parts of the Caribbean and North America. When the significant proportion of women who have responsibility for household management is combined with women's low labour force participation rate, some 39% compared to the male rate of 81%, and the high levels of female unemployment - the female unemployment rate is more than twice that of the male rate, 18% and 8% respectively - an appreciation of the extent of the vulnerability of women in Guyana can be had. If consideration is given as well to the fact that many of the poor households, an equal proportion of which are headed by women, have larger households to care for than non poor households, the difficult position of women and their children becomes clear.⁷

Large proportions of these women can be found at work in the informal sector, and are not captured among the employed. Those who work in agriculture are often a forgotten group and are invisible to agricultural planners, agricultural extension providers and their productive efforts may fall outside of the national accounts. They carry the burden for the rearing of children, and care for the elderly; but like their sisters across the region, because they possess few titles to farm lands are unable to access credit, training or benefits from technological advancement.⁸ They work supporting family farms, and in the marketing of domestic produce, or selling goods from their backyard gardens. The other group of women in Guyana's informal sector can be found in the commercial/retail sector, selling clothing, engaged in the home-based sewing of garments, running little shops and engaged in light vending on the streets. Both groups of women have suffered from the devastation caused by the flooding. One group, found in the agricultural sector lost their produce and their poultry and other animals and is without the necessary capital to reinvest; and the other group found in the commercial/retail sector has lost goods, which may have been taken on credit and they now need access to new credit for additional goods, in order to turn over a subsistence income and repay their debts.⁹

When the full picture of the damage caused by the flood is told it will be that poor, single female-headed households, of all ethnicities and their children, have suffered immense hardship.

⁶ Corroboration of this information appears in the Agricultural analysis of this assessment.

⁷ See the Guyana Poverty Reduction Strategy Paper (2002) which discusses the demographic characteristics of the poor.

⁸ Information on women small farmers can be found in the IICA Study on "Women Small Farmers in the Caribbean", ed. By Brenda Kleysen 1996.

⁹ This information was substantiated at a meeting of over 200 women organized by Red Thread, on March 3, 2005. Women came from villages such as Good Hope: Phase 1 and 2, Buxton, Lusignan, Sophia, Better Hope and Strathspey.

2.3. Psycho social trauma

The vast majority of the population of Guyana would not have ever experienced flooding of this magnitude. The last major flooding to affect Georgetown and the East Coast occurred in the mid- 1930s, which suggests that intense flooding may only be a real memory for possibly 2-3% of today's population. This absence of memory seems to have intensified the psycho-social trauma of the population. Another factor which may influence the psycho-social impact of the disaster is the notion held among the average Guyanese, that they 'know' and 'understand' flooding. This false sense of knowledge/safety seemed to have lulled the population into a position of disbelief about the gravity of the situation as the December/January rains turned out to be far more insidious than expected. One senses that as a result of the flooding, a greater sense of anxiety and some fear of the next rainy season, expected in May/June, is widespread.

Disasters have differing impacts on people. It is clear that the heavily burdened health sector, although knowledgeable about the possible psycho-social trauma that may have resulted as a consequence of the phenomenon of the floods, was not in a position to pay the level of attention to the issue as desired. This became evident through the major medical campaign which was waged in order to attend to the physical needs of the population and to ensure that outbreaks of diseases were quickly addressed and kept under control.

It is not surprising that the evidence of psycho-social trauma rehabilitation has not been strong. However, it is clear that the affected population has been traumatised by the event. A team of observers¹⁰ who met with persons resident in shelters noted the sense of despair and hopelessness that existed, evident through questions asked by the shelter residents. Questions asked were: "how will I be able to start over?", "when will it end?", "what can I do, I have lost my job and all my possessions?", and "I feel angry, helpless, hopeless and totally confused... I worry all the time?".

Research on disaster management, indicates that there are varying responses to disasters including abuse of alcohol and abusive behaviours in men and bouts of crying and deep depression in women, as each attempts to cope with the distress which disasters bring. Anecdotal evidence of such behaviours was reported.

2.4. Emergency action

The unprecedented heavy rainfall which inundated the coastal regions of Guyana in mid-January resulted in a limited emergency being declared by the President of Guyana and Commander-in-Chief. The emergency took effect in Regions 3, 4 and later 5 and a number of emergency committees were established to coordinate a response to the disaster. On 3 February, the CDC of the Government of Guyana assumed responsibility for disaster planning and coordination from the JOC (Joint Operations Command).

¹⁰ These comments come from a team of observers led by Dr. Desrey Caesar-Fox on behalf of the Guyana Citizens Initiative, a civil society organization involved in supporting relief and recovery efforts. The observations were part of a rapid assessment undertaken on 11 Feb 2005.

At the peak of the disaster, more than 5,000 persons were housed in 45 shelters run by the GDF, the Relief Council and other private organizations. They were supported by agencies such as the World Food Programme (WFP), the Red Cross, and religious and civil society organizations, such as the Rotary Clubs and the Guyana Citizens Initiative. By 2 February, the numbers in shelters had been reduced to just over 2,500 as Table 4 indicates. Nearly 50% of the residents of shelters were children. By 8 March 2005, 21 days after the rains began, only one shelter, housing a family of five, run by the Guyana Relief Council was still operational. All others had been closed.

Table 4
Shelters run by the GDF, occupied as at 2 February
2005

Name	Persons housed	Children
Graham Hall primary, Industry	90	43
St. Paul primary, Plaisance	62	27
LBI Primary	59	36
BVI Community High	86	20
Mon Repos primary	116	80
Buxton Primary	210	58
Paradise primary	304	135
Guysuco Coldigen	4	0
Enmorre	65	21
Haslington Nursery	86	46
Golden Grove	143	83
Cove & John	79	43
Victoria primary	39	42
Victoria Nursery	30	15
Ann's Grove	88	49
Annandale	55	26
Lusignan	42	20
Gibson Primary, Unity Mahaica	115	75
Sophia primary	253	135
Colonbrook Primary	61	32
Mocha	167	73
Strathspey	75	41
Vryheid lust	194	104
Golden Grove Secondary	63	24
Albouystown	67	42
Guyana Relief Council	64	0
Total	2617	1270

Source: GDF Report, 8 March 2005

The JOC, also referred to as Joint Services, also provided more than 146,458 cooked meals during the period of the flooding and the Government of Guyana distributed more than 78,327 food hampers. The Central Islamic Organization distributed food hampers to 22 Masjids across the East Coast, totalling some 6,000. Potable water was not available initially in the flood-affected communities, in response the Ministry with responsible for water, Joint Services, private contractors and international agencies such as OXFAM were successful in supplying potable water to most affected communities through a network of tanks, supply of bottled water, water in jerry cans and community stand pipes. In the aftermath of the flooding, the GDF and the Red Cross distributed a total of 32,613 cleaning kits which included soap powder, a hard brush, washing soap and bleach.

Finally, in response to the disaster, in the Budget speech of 21 February 2005, the Government indicated that it would undertake the following: allocate GY\$220,000, for the procurement of goods and services; waive the duty and consumption tax on food supplies that were imported for the flood victims; and waive duties and taxes on specified food items that were imported for commercial use.

The response of the international community has been swift and generous. By 18 January the United States Agency for International Development/Office of Foreign Disaster Assistance (USAID/OFDA) had deployed a team to Guyana to assess the emergency needs and coordinate its relief efforts. On 8 February the United Nations issued a consolidated appeal for more than US\$2.9 million. Their targeted areas included: access to food, potable water, and adequate sanitation; disease surveillance; waste disposal; community clean-up; health and education services; and livelihoods. Table 5 details the relief assistance received by the Government from regional governments and the international donor community, which amounted to some US\$3.7 million.

Table 5
Relief Assistance
By Agency and Amount as at February 25, 2005

Donor	Amount US \$
U. S. Government	50,000.00
USAID	653,000.00
DFID	263,200.00
IDB	200,000.00
European Union	910,000.00
CIDA	37,240.00
UNDP	100,000.00
UNICEF	116,269.00
PAHO	100,000.00
CDB	50,000.00
France	62,500.00
People's Rep. China	100,000.00
Alumina & Bauxite Co. Ltd.	100,000.00
Japan	120,000.00
OAS	15,000.00
Guyanese in N.Y.	48,573.00
Atlantic Tele Network	150,000.00
GBTI	15,000.00
South American Mining	10,000.00
Kriskor	3,000.00
Others	14,884.00
South Korea	30,000.00
Trinidad and Tobago	384,000.00
Cuba	not costed
Brazil	not costed
Chile	not costed
Venezuela	not costed
Germany	100,000.00
IICA	40,000.00
Total	\$3,742,666.00

Source: ECLAC based on official data from the Office of the President

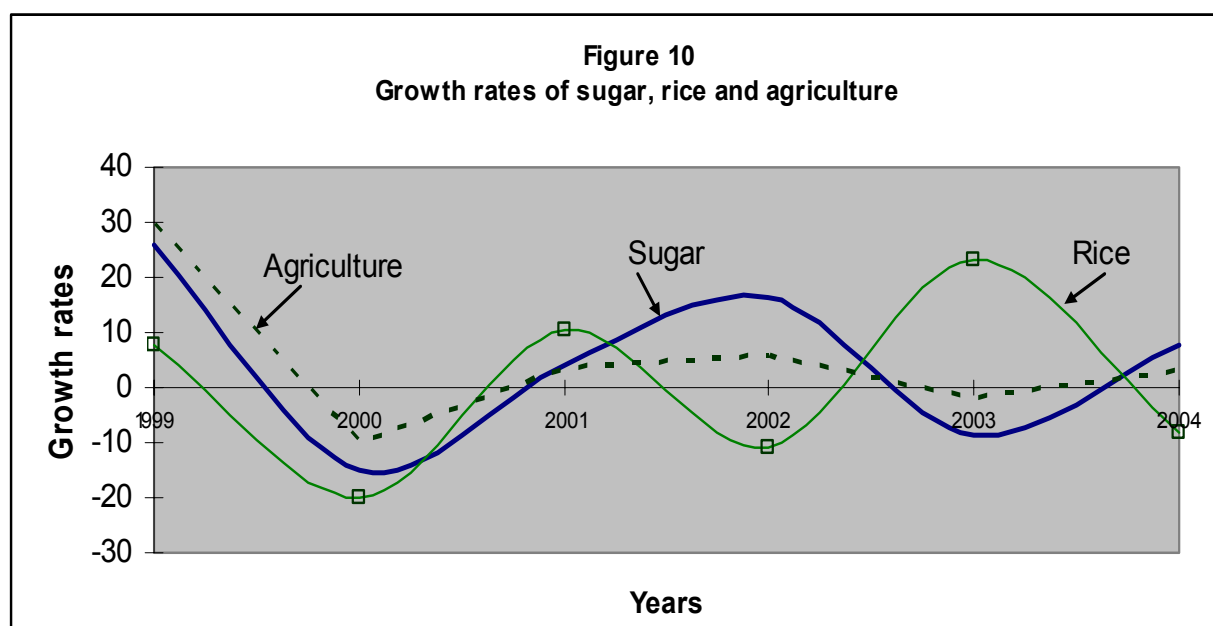
3. Description of damage and losses by sector

3.1 Productive sectors

3.1.1 Agriculture, livestock, fisheries and forestry

(a) Overview

The agricultural sector plays an important, though fluctuating, role in the economy of Guyana. This is underscored by the sector's contribution to foreign exchange earnings, employment and GDP. In 2004, for instance, the agricultural sector accounted for approximately 35.4% of total GDP, compared with a corresponding 36.4% in 1999.



The performance of the sector for the period 1999 to 2004 may be described as mixed. The high positive growth of 29.7% achieved in 1999 was followed by a negative growth rate of 10.2% in 2000. In the ensuing two years, 2001 and 2002, the sector registered positive growth rates of 3.7% and 6.0%, respectively. The short period of positive growth was, however, followed by a negative growth rate of 1.7% in 2003. In 2004, the sector recovered and registered a positive growth of 3.2%. These changes in the sector's rate of growth are closely related to the fortunes and outputs of the principal crops sugar-cane and rice. The growth rates of these commodities for the period 1999 to 2004 are presented in Figure 10.

Growth in the livestock subsector has been fairly steady since 1998, registering only positive growth, while the fishing industry has registered positive growth rates, with the exception of 2002 and 2004, when the subsector declined by 3.6% and 1.3%, respectively. Growth in the forestry subsector has fluctuated over the period under review with a tendency to decline. A wide range of non-traditional crops are grown in Guyana. These range from fruits

and vegetables, roots and tubers, herbs and spices and legumes. The non-traditional commodities play a significant role in ensuring some element of food security in the country.

Prior to the flood disaster, the sector was expected to register positive growth in, at least, the medium run. In 2005, the sector was expected to expand by 5.2%, fueled by projected growth in sugar (3.9%), rice (13.0%), livestock (5.3%), other agriculture (5.0%), fishing (5.7%) and forestry (2.2%).

(b) Description, analysis and estimation of the flood damage

The impact of the flood damage was concentrated within the coastal administrative regions of West Demerara/Essequibo Islands, Demerara/Mahaica, and Mahaica/West Berbice. These areas comprise approximately 62.4% of the population of Guyana. The damage to the agricultural sector was most severe in Region 4 accounting for 55.0 % of the total damage, followed by Region 2 with 23.2% and Region 5 with 18.8 %. Significant losses were recorded in the sugar, rice, livestock and crop subsectors.

The ECLAC methodological framework for estimating the socio-economic and environmental effects of disasters was utilized in assessing the flood damage to the agricultural sector. Within this context, damage to the sector was categorized under two broad headings: direct and indirect damages. In assessing the direct damage to the sector only losses to capital assets were considered. The direct losses were identified under four broad headings:

- Damage to farmland;
- Damage to physical Infrastructure and to machinery and equipment;
- Losses of crops that are ready to be harvested; and
- Losses of stock (livestock, inputs, harvested products, etc.)

In assessing production losses, only production ready to be harvested at the time of the flood was taken into consideration. However, for affected annual crops that were still growing at the onset of the flood, losses were assessed based on investment in labour and input.

In the case of losses of stock, where total losses occurred, damages were estimated at farm prices and inputs at replacement value. Assessments for partial loss and damage were effected on a prorated basis.

Direct damages caused by the flood disaster that will have a negative impact on production throughout the recovery period were assessed as indirect losses. In the case of the rice industry, the flooding of the rice fields is expected to impact negatively on the future harvesting as well as on the planting of rice. As well, livestock production was to decrease in the future as a result of stress and animal disease.

Table 6										
Overall Damage to Agricultural Sector by crop and Region										
Region	Sugar	Rice	Other crops	Livestock	Fisherie s	Forestry	Farm roads	Nari	GSA	Total
Direct damage										
2	-	44,632,000	159,811,000	-	-	-	3,525,000	-	-	207,968,000
3	475,473,719	185,040,000	1,598,412,000	38,707,300	-	-	9,306,000	-	-	2,306,939,019
4	1,606,191,140	69,859,200	3,337,318,000	445,275,670	194,925	56,000,000	38,540,000	26,992,000	12,691,300	5,593,062,235
5	-	1,087,752,798	584,694,000	92,567,920	-	-	75,576,000	-	-	1,840,590,718
6	-	55,287,200	-	-	-	-	14,946,000	-	-	70,233,200
Total	2,081,664,859	1,442,571,198	5,680,235,000	576,550,890	194,925	56,000,000	141,893,000	26,992,000	12,691,300	10,018,793,172
Indirect damage										
2	-	6,595,160	11,447,785	-	-	-	-	-	-	18,042,945
3	77,463,963	30,385,300	118,644,615	2,119,230	-	-	-	-	-	228,613,108
4	177,207,739	11,591,804	144,245,371	23,659,605	34,200	14,000,000	-	22,140,500	10,218,343	403,097,562
5	-	183,920,746	23,539,365	5,167,685	-	-	-	-	-	212,627,796
6	-	13,074,500	-	-	-	-	-	-	-	13,074,500
Total	254,671,702	245,567,510	297,877,136	30,946,520	34,200	14,000,000	-	22,140,500	10,218,343	875,455,911
Total damage										
2	-	51,227,160	171,258,785	-	-	-	3,525,000	-	-	226,010,945
3	552,937,682	215,425,300	1,717,056,615	40,826,530	-	-	9,306,000	-	-	2,535,552,127
4	1,783,398,879	81,451,004	3,481,563,371	468,935,275	229,125	70,000,000	38,540,000	49,132,500	22,909,643	5,996,142,297
5	-	1,271,673,544	608,233,365	97,735,605	-	-	75,576,000	-	-	2,053,218,514
6	-	68,361,700	-	-	-	-	14,946,000	-	-	82,857,700

Table 6 provides a summary of the direct, indirect and total damage to sugar, rice, livestock, other crops, fisheries and forestry subsectors, as well as to farm roads, the National Agricultural Research Institute (NARI) and the Guyana School of Agriculture (GSA).

The sugar industry

The sugar industry which accounts for approximately 18.0% of Guyana's GDP (2004), 25% of its foreign exchange earnings and affects the lives of over 10% of the country's population, directly and indirectly, was heavily impacted upon. Total damage to the industry is put at G\$2,336,336,561.00 which represents approximately 16.3% of that subsector's GDP. The major line item of losses was crop loss, accounting for approximately 84.4% of total loss. While large acreages of crop have not been swept away, it is anticipated that the sugar content of the harvested cane will be lower than usual.

Details on damage assessment of the sugar industry is presented in Table 7

The rice industry

The rice industry was also heavily impacted by the flood disaster, with some 1,000 farmers occupying some 19,680 acres affected.

Total loss to the industry is estimated at G\$1,688,138,708.00 or 27.8% of the subsector's GDP. The affected areas were the Mahaica/Abary and West Berbice (Region 5) representing approximately 75.3% of total damage to the industry. The rice industry accounts for approximately 3.6% of the Guyana's GDP and contributes approximately 9% of export revenues. Details on damage assessment for the rice industry is presented in Table 8.

The other crop subsector

The category "other crops" which includes fruits, vegetables, roots and tubers, and herbs and spices suffered severely, with loss estimated at G\$5,978,112,136.00. While on the surface the estimate may seem high, it may, however, reflect a high level of previously unreported backyard gardening in the affected areas. Crop production in Region 3 and Region 4 were heavily impacted by the flood disaster, accounting for 28.7 % and 58.2%, respectively, of total damage to the "other" crop subsector.

Details of damage estimate for the subsector are presented in Table 9.

The livestock subsector

The livestock subsector was also severely affected by the flood disaster with total estimated loss to the industry put at G\$607,497,410.00. This figure represents approximately 18.8% of livestock GDP. Region 4 was the area mostly affected with loss estimated at G\$468,935,275.00 or 77.2% of total loss to the livestock subsector. Details of damage estimate for this vital subsector are presented in Table 10.

The fisheries industry

The impact of the flood disaster on the fisheries subsector has been minimal. The floods have had some impact on the Mon-Repos Aquaculture station, resulting in the loss of Red Tilapia fingerlings and some marketable Hassar. There has been some impact on the Department of Fisheries' building in Brickdam, with damage to the generator. The total flood damage to the subsector is assessed at G\$229,125.00 (Table 11).

The forestry industry

The forestry industry also suffered very little effects from the flood disaster. Approximately 20 lumberyards along the East Coast were affected with loss of lumber assessed at one million board ft at an estimated cost of G\$70,000,000.00 (Table 12).

The farm roads

Approximately 180.95 miles of earthen farm roads were assessed to be damaged. The value for repairs and reconstruction is assessed at G\$141,893,000.00 (Table 13).

The agricultural institutions

NARI and the GSA were also impacted by the flood disaster. Damage estimates for these two institutions are presented in Tables 14 and Table 15, respectively.

Table 7: Damage Assessment - Sugar Industry						
Item	Region					Total Cost
	2	3	4	5	6	
Direct Damage						
1. Crop Loss	-	457,842,000	1,514,370,000	-	-	1,972,212,000
2. Agricultural Land	-	4,808,458	3,589,040	-	-	8,397,498
3. Infrastructure	-	2,250,834	6,621,056	-	-	8,871,890
4. Machinery/Equipment	-	214,231	25,403,920	-	-	25,618,151
5. Chemical Loss	-	9,120,028	690,590	-	-	9,810,618
6. Loss of Stock	-	1,238,168	50,376,787	-	-	51,614,955
7. Buildings	-	-	5,139,747	-	-	5,139,747
Total	-	475,473,719	1,606,191,140	-	-	2,081,664,859
Indirect Damage						
1. Crop Rehabilitation	-	69,877,600	90,888,754	-	-	160,766,354
2. Machines deployed to assist	-	1,651,859	14,985,520	-	-	16,637,379
3. Pumping cost (above normal)	-	985,377	60,547,448	-	-	61,532,825
4. Cleaning/fumigation	-	-	1,911,636	-	-	1,911,636
5. Medical Outreach	-	3,125,798	364,800	-	-	3,490,598
6. Others	-	1,823,329	8,509,581	-	-	10,332,910
Total	-	77,463,963	177,207,739	-	-	254,671,702
Grand Total	-	552,937,682	1,783,398,879	-	-	2,336,336,561

Table 8
Damage Assessment - Rice Industry

Region	No. of Farmers	Acres	Direct Loss Crop Loss		Dams/Meres	Total Direct Loss	Indirect Loss			Total Indirect Loss	Grand Total Loss
			Rice Eq (MT)	G\$			Labour	Harvesting	Transportation		
2	70	572	709	39,704,000	4,928,000	44,632,000	2,991,560	2,402,400	1,201,200	6,595,160	51,227,160
3											
Wakenaam	39	283	304	17,024,000	2,464,000	19,488,000	1,485,750	1,839,500	735,800	4,061,050	23,549,050
Leguan	54	643	584	32,704,000	5,632,000	38,336,000	3,375,750	3,536,500	1,414,600	8,326,850	46,662,850
Hog Island	2	37	30	1,680,000	352,000	2,032,000	194,250	185,000	74,000	453,250	2,485,250
West Demerara	263	1,511	1,984	111,104,000	14,080,000	125,184,000	7,932,750	7,208,550	2,402,850	17,544,150	142,728,150
Sub Total Region 3	358	2,474	2,902	162,512,000	22,528,000	185,040,000	12,988,500	12,769,550	4,627,250	30,385,300	215,425,300
4	80	894	1,107	61,992,000	7,867,200	69,859,200	4,082,004	4,827,600	2,682,200	11,591,804	81,451,004
5											
Mahaica/Abary	311	11,631	13,425	751,800,000	102,352,798	854,152,798	53,107,146	58,525,920	32,514,400	144,147,466	998,300,264
West Berbice	101	3,280	3,656	204,736,000	28,864,000	233,600,000	14,976,480	15,940,800	8,856,000	39,773,280	273,373,280
Sub Total Region 5	412	14,911	17,081	956,536,000	131,216,798	1,087,752,798	68,083,626	74,466,720	41,370,400	183,920,746	1,271,673,544
6											
Frontlands	13	212	221	12,376,000	1,865,600	14,241,600	1,696,000	1,060,000	530,000	3,286,000	17,527,600
Black Bush											
Polder	67	617	636	35,616,000	5,429,600	41,045,600	4,936,000	3,085,000	1,767,500	9,788,500	50,834,100
Sub Total Region 6	80	829	857	47,992,000	7,295,200	55,287,200	6,632,000	4,145,000	2,297,500	13,074,500	68,361,700
Grand total	1,000	19,680	22,656	1,268,736,000	173,835,198	1,442,571,198	94,777,690	98,611,270	52,178,550	245,567,510	1,688,138,708

Table 9
Damage Assessment - Crop Sub Sector

Region	Acreage Affected	Direct Loss	Indirect Loss	Total Loss
2				
Fruits	24.15	51,049,000	3,828,675	54,877,675
Vegetables	85.25	98,940,000	6,925,800	105,865,800
Seasonings	1.01	1,307,000	104,560	1,411,560
Ground Provision	10.5	5,190,000	389,250	5,579,250
Others	3.5	3,325,000	199,500	3,524,500
Sub Total Region 2	124.41	159,811,000	11,447,785	171,258,785
3				
Fruits	403.45	839,716,000	62,978,700	902,694,700
Vegetables	492	572,688,000	45,815,040	618,503,040
Seasonings	40.15	52,280,000	3,136,800	55,416,800
Ground Provision	247.1	128,193,000	6,409,650	134,602,650
Others	6.15	5,535,000	304,425	5,839,425
Sub Total Region 3	1,188.85	1,598,412,000	118,644,615	1,717,056,615
4				
Fruits	446.5	929,314,000	37,172,560	1,301,039,600
Vegetables	1,407.00	1,637,786,000	73,700,386	1,711,486,386
Seasonings	390.75	509,820,000	20,392,800	530,212,800
Ground Provision	486.35	252,343,000	12,617,150	264,960,150
Others	8.95	8,055,000	362,475	8,417,475
Sub Total Region 4	2,739.55	3,337,318,000	144,245,371	3,816,116,411
5				
Fruits	141.25	293,703,000	11,748,000	305,451,000
Vegetables	196	228,144,000	11,407,200	239,551,200
Ground Provision	3.15	1,557,000	62,280	1,619,280
Sub Total Region 5	388.25	584,694,000	23,539,365	608,233,365
Grand total	4,441.06	5,680,235,000	297,877,136	5,978,112,136

Table 10
Damage assessment to the livestock subsector

Region	Number of Animals	Direct Loss	Indirect Loss	Total Loss
Region 3				
Cattle	182	13,986,000	938,080	14,906,080
Sheep	184	3,106,000	124,400	3,230,400
Goats	84	1,670,000	75,350	1,745,350
Pigs	213	1,940,000	112,520	2,052,520
Horses	2	88,000	5,280	93,280
Poultry	20,058	17,082,000	854,960	17,936,960
Products	-	177,800	-	177,800
Supplies	-	604,800	-	604,800
Infrastructure	-	70,700	8,640	79,340
Sub Total Region 3	20,723	38,707,300	2,119,230	40,826,530
Region 4				
Cattle	1,088	99,252,000	5,955,120	105,207,120
Sheep	3,671	78,310,000	4,307,050	82,617,050
Goats	1,362	28,282,000	1,470,664	29,752,664
Pigs	3,045	51,819,300	2,590,965	54,410,265
Horses	155	9,200,000	496,800	9,696,800
Poultry	164,307	146,748,720	8,071,180	154,819,900
Products	-	8,228,450	-	8,228,450
Supplies	-	6,372,400	-	6,372,400
Infrastructure	-	17,062,800	767,826	17,830,626
Sub Total Region 4	173,628	445,275,670	23,659,605	468,935,275
Region 5				
Cattle	708	44,568,000	2,451,240	47,019,240
Sheep	985	15,160,000	909,600	16,069,600
Goats	1,008	13,714,000	745,270	14,459,270
Pigs	177	1,425,000	85,500	1,510,500
Horses	28	696,000	35,496	731,496
Poultry	17,415	15,676,320	940,579	16,616,899
Products	-	1,206,000	-	1,206,000
Supplies	-	122,600	-	122,600
Infrastructure	-	-	-	-
Sub Total Region 5	20,321	92,567,920	5,167,685	97,735,605
Region 6	-	-	-	-
GRAND TOTAL	214,672	576,568,890	30,946,520	607,497,410

Table 11				
Damage assessment to the fishery industry				
Region	Unit Affected	Direct Loss	Indirect Loss	Total Loss
2	-	-	-	-
3	-	-	-	-
4	Marketable Fish and Fingerlings	104,925	34,200	139,125
Mon Repos Aquaculture Station Department of Fisheries and Hydro Met Buildings	Repairs to generator	90,000	-	90,000
Sub-total Region 4		194,925	34,200	229,125
5	-	-	-	-
6	-	-	-	-
Grand Total		194,925	34,200	229,125

Table 12: Damage Assessment to the forestry industry				
Region	Unit Loss (Board Ft)	Direct Loss	Indirect Loss	Total Loss
2		0	0	0
3		0	0	0
4	800,000	56,000,000	-	56,000,000
5	200,000	14,000,000	-	14,000,000
6		0	0	70,000,000

Table 13
Damage Assessment - Farm Roads

Region	Estimated Miles Earthen Farm Roads Affected	Direct Loss	Indirect Loss	Total Loss
2	3.75	3,525,000	-	3,525,000
3	9.90	9,306,000	-	9,306,000
4	41.00	38,540,000	-	38,540,000
5	80.40	75,576,000	-	75,576,000
6	15.90	14,946,000	-	14,946,000
Grand total	180.95	141,893,000	-	141,893,000

Region	Direct Loss	Indirect Loss	Total Loss
2	-	-	-
3	-	-	-
4 (NARI)			
Land	650,000	-	650,000
Physical Infrastructure	12,049,500	17,365,000	29,414,500
Machinery and Equipment	2,270,000	-	2,270,000
Office Furniture	350,000	-	350,000
Nursery Plants	7,500,000	2,715,000	10,215,000
Ant Bait	17,500	-	-
Stock (animals)	4,035,000	1,560,500	5,595,500
Crops	120,000	-	120,000
Delay in Research Results	-	500,000	500,000
Sub-total Region 4	26,992,000	22,140,500	49,115,000

Table 15
Damage Assessment - Guyana School of Agriculture

Region	Acreage Affected (Acres)	Direct Loss	Indirect Loss	Total Loss
2	-	-	-	-
3	-	-	-	-
4 (GSA)	-	-	-	-
Crop Loss	50	3,831,800	3,731,250	7,563,050
Livestock Loss	-	2,238,000	2,295,000	4,533,000
Building and Infrastructure	-	6,621,500	4,192,093	10,813,593
Sub-total Region 4	-	12,691,300	10,218,343	22,909,643
5	-	-	-	-
6	-	-	-	-
Grand total	50	12,691,300	10,218,343	22,909,643

3.1.2 Commerce, manufacturing and tourism

Commerce includes the wholesale and retail sectors, as well as informal sector activities such as traders, vendors and micro businesses. Performance of the sector reflects developments in the economy, and growth has been somewhat indifferent since 2001. At 4%, the apparent contribution of distribution to GDP is low, but this could possibly be explained by a large informal sector component.

Manufacturing contributes around 10 % of GDP. However, sugar and rice account for most of this contribution. The impact on sugar and rice has been accounted for in the section on agriculture. Other manufacturing contributes about 3% of GDP. Like the commerce sector, other manufacturing includes informal sector activities, which may or may not be included in the GDP estimate.

Because of the concentration of economic activities in the coastal zone, the floods affected many commercial and manufacturing establishments. Direct damages included damage to machinery and equipment, loss of inventory (ranging from raw and semi processed materials to stocks ready for sale), damages to buildings, furniture and vehicles. Indirect losses mainly comprised the loss of sales and increased operating costs to businesses.

Following the floods, the Private Sector Commission carried out a survey of 324 establishments to get an impression of the damages and losses incurred by commerce and manufacturing. The survey also provided insight into the actions to be taken from the perspective of the private sector. Not surprisingly, given the low level of flood insurance, over 53 % of the respondents identified financial assistance as a top priority. If combined with other financial instruments, such as access to low cost finance, tax waivers, help with debt repayments or flexibility in the payment of bills, the percentage increases to almost 73%. Improvements in drainage and irrigation, seen by 17 % of the respondents as a top priority, was the second priority.

The survey indicated that planned investment of the 324 businesses declined by 23% as compared with the pre-flood situation. Of the 324 establishments, 270 were engaged in commerce, 43 in manufacturing and 11 in both manufacturing and commerce. Because of the different nature of the damages the commerce and small manufacturing sector was analyzed separately from the manufacturing sector.

Commerce and small manufacturing

The survey of the commerce sector ranged from micro and small enterprises to large business. To facilitate the analysis, the commerce sector was split into two categories. The first group of 227 establishments comprised businesses with an annual pre-flood turnover of less than G\$20 million per year. The second group of 28 establishments included those businesses with an annual turnover of over \$20 million. Table 16 summarizes the effects of the flooding on the sample.

Table 16			
Summary of impact on sampled commercial businesses			
G\$ million			
Turnover	< 20	20 +	all
Number of businesses	227	28	255
Total impact	378.86	374.72	753.58
Direct damages	266.22	276.96	543.18
Repairs/rebuilding/relocation	32.51	12.27	44.78
Repair machinery and equipment	50.37	13.02	63.39
Furniture + vehicles	16.91	4.43	21.34
Inventory	166.43	247.24	413.67
Losses	112.64	97.76	210.40
Loss of revenue	103.05	84.10	187.15
Increased expenditures	9.59	13.66	23.25
Averages			
Total impact	1.67	13.38	3.08
Direct damages	1.17	9.89	2.22
Losses	0.50	3.49	0.86
Source: ECLAC estimates based on Private Sector Commission survey			

We note that the total impact for the 28 larger establishments (G\$374.7 million) is almost the same as the total impact for the smaller establishments (G\$378.9 million). For both categories inventory losses, as expected, dominate. This is followed by loss of revenue as the second largest impact.

Estimates of the total number of businesses in affected areas vary. A lower estimate by the Bureau of Statistics states the number of businesses in Region 4 at 1874. This estimate excludes Georgetown and the other affected regions. On the other hand, estimates by IPED, based on their database of small businesses, number 8000 businesses in Region 4 alone. While not all of these businesses would have been affected, the estimate still excludes Georgetown and the other areas. For the assessment we assume a range between 4000 and 8000 small businesses. This number, however, will also include small manufacturing. While the structure of damages in the small manufacturing sector differs from the small commercial sector the error, given the larger number of small enterprises engaged in commerce, will be small. Furthermore, the average total impact per establishment in small manufacturing (G\$1.9 million) is not much higher than that of small commerce (G\$1.7 million)

The estimated coverage of the sample of the large commerce sector is assumed to be one third of the total commerce sector. For both the large and small business sector, the total impact will change if further information changes the two crucial assumptions.

Therefore the impact on the commerce sector would be between G\$7.8 and G\$14.5 billion or between US\$39 and \$72 million as is shown in Table 17 below.

	Turnover \$ <20	Turnover \$ <20	Turnover \$ >20	Total Commerce	Total commerce
number of business	4000	8000	84	4084	8084
total impact	6675.95	13351.89	1124.16	7800.11	14476.05
direct damages	4691.10	9382.20	830.88	5521.98	10213.08
repairs/rebuilding/relocation	572.86	1145.73	36.81	609.67	1182.54
repair machinery and equipment	887.58	1775.15	39.06	926.64	1814.21
furniture and vehicles	297.97	595.95	13.29	311.26	609.24
inventory	2932.69	5865.37	741.72	3674.41	6607.09
				0.00	0.00
losses	1984.85	3969.69	293.28	2278.13	4262.97
loss of revenue	1815.86	3631.72	252.3	2068.16	3884.02
increased operating expenditures	168.99	337.97	40.98	209.97	378.95

Source: ECLAC based on Private Sector Commission data.

Given the disparity between the establishment data as provided by the Bureau of Statistics (1874) and other sources (8000+), an unknown proportion of the losses would have affected the informal sector only and may not necessarily be reflected in the GDP.

Manufacturing

Based on the same survey as for the commercial sector, the total impact of the flood for the sampled manufacturing sector is estimated at G\$1.03 billion as shown in Table 18.

We note that in the manufacturing sector the lost or spoiled inventories, while still significant, are proportionally not as large as in the commercial sector. We also note that all small business were included in the commercial sector and invariably will include small manufacturing. To avoid double counting for the manufacturing estimate, therefore, the small manufacturing subsector is excluded.

This poses a problem since the total number of manufacturing enterprises with an annual turnover of G\$20 million or more is not known. Indications are that the sample is fairly comprehensive in terms of the number of large manufacturers. However since aggregate sales

data were not available for the manufacturing sector there is more uncertainty with regard to the proportion of the sample to total sales. Therefore, we will use the sample size bearing mind that the value is an underestimate.

	Manufacturing	Manufacturing and commerce	Manufacturing	Manufacturing and commerce	Total
	Turnover \$ <20	Turnover \$ <20	Turnover \$ >20	Turnover \$ >20	
Number of business	34	6	8	2	50
Total impact	64.72	5.48	883.22	78.26	1031.68
Direct damages	47.02	2.67	656.10	10.00	715.79
Repairs/rebuilding/relocation	8.46	0.47	262.90	0.00	271.83
Repair machinery and equipment	15.75	0.54	248.02	1.00	265.31
Furniture and vehicles	6.51	0.26	7.20	0.00	13.97
Inventory	16.30	1.40	137.98	9.00	164.68
Losses	17.70	2.81	227.12	68.26	315.89
Loss of revenue	14.58	2.36	213.87	60.00	290.81
Increased operating expenditures	3.12	0.45	13.25	8.26	25.08

Source: ECLAC based on Private Sector Commission data.

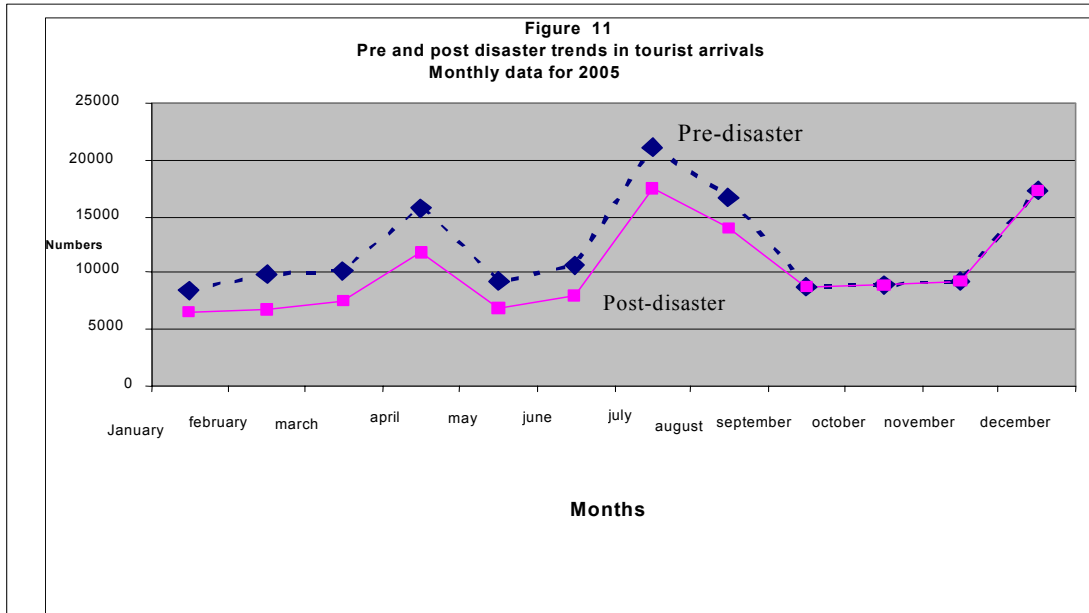
The impact on large manufacturers is then estimated at G\$961 million or US\$4.5 million as shown in Table 19.

total impact	961.48
direct damages	666.1
repairs/rebuilding/relocation	262.9
repair machinery and equipment	249.02
furniture and vehicles	7.2
inventory	146.98
losses	295.38
loss of revenue	273.87
increased operating expenditures	21.51
Source: ECLAC based on Private Sector Commission data.	

Tourism

At 121,989 arrivals in 2004, the tourism sector experienced an increase of 20.8% over the arrivals of 2003 and a similar growth rate was projected for 2005. The 2004 arrivals generated US\$28.3 million in tourist expenditures, equivalent to an average expenditure of US\$231 per tourist visit. Using the same expenditure per tourist visit the projected tourist expenditure for 2005 would have reached almost US\$34 million. The floods changed this outlook. Following the floods, Canada, the United Kingdom and the United States issued travel advisories and the popular Mashramani Festival (23 February) was postponed until further notice. Tourist arrivals in January 2005 fell by 7.6% as compared with January 2004 (and by 23 % as compared with projected arrivals in January 2005). Arrivals fell by almost 18% in February 2005 as compared with 2004 and by almost 32% as compared with projected arrivals in 2005. Tourism officials in the public and private sector do not expect that the sector will recover before August/September 2005. The Guyana Tourism Authority will undertake additional promotional efforts to counteract the negative impact of the travel advisories.

Tourist arrivals in Guyana show two peak periods. The period July–August, corresponds with the North American summer holiday season, while December corresponds with Christmas. This pattern may indicate arrivals by Guyanese living abroad whose travel plans are presumably less affected by the travel advisories. We will therefore assume that arrivals in July and August will remain at the same level as in 2004 and for the period thereafter that the targeted growth rate of 20% will be achieved. For the period March to June 2005 we estimate that tourist arrivals will gradually increase averaging a drop of 10 % in arrivals. Figure 11 below shows the difference between the projected pre-flood arrivals and the projected post-flood arrivals.



Source: ECLAC

The loss in tourist arrivals amounts to 22,800 visitors for 2005 as compared with the projected arrivals. When the same average tourist expenditure of US\$231 per visit is applied, the loss in tourism receipts amounts to US\$5.2 million.

Direct damages to the hotel sector were minimal, but also underreported because many hotels did not provide data on cleaning of premises and swimming pools, replacement of carpets or similar expenses. The Lusignan Golf Course suffered damages because of the need to landscape the course after the flooding.

The Ogle airport was closed during the flooding. Estimates for direct damages are not available but are likely to be minor. Aircraft based at the airport had to be relocated.

The impact in the tourism sector, therefore, will largely take the form of losses in tourism receipts and in increased marketing expenditures as shown in Table 20.

	US 000	G\$ mln
Total Impact	5634.1	1126.8
Direct damage	235.1	47.0
Accommodation	77.6	15.5
Golf course	157.5	31.5
Losses		0.0
Losses	5399	1079.8
Loss in tourist receipts	5280	1056.0
Additional marketing	116	23.2
Aircraft relocation	3	0.6

Source: ECLAC based on data from the Guyana Tourism Authority

The total impact in the commercial, manufacturing and tourism sectors is estimated at G\$16.6 billion or US\$83 million as shown in Table 21.

	Direct damages	Losses	Total
Commerce and small manufacturing	10213	4263	14476
Large manufacturing	666	295	961
Tourism	47	1080	1127
Total	10926	5638	16564

Source: ECLAC

In terms of recovery the large number of small and micro business that have been affected by the floods is of particular concern, as in many cases the businesses lost their already limited assets, working capital or both. Particularly in the micro sector where 70% of the businesses are headed by women, creative forms of assistance are needed to assist in restoring businesses as quickly as possible.

3.2 Infrastructure

3.1 Drainage and irrigation

Introduction

Drainage and irrigation issues for Guyana are overseen by the Drainage and Irrigation (D&I) Board. All conservancy commissions, even though directly responsible for the day-to-day operation of their respective conservancies, are in principle subject to policy set by the D&I Board. Recently enacted legislation governs the actions and mandate of the D&I Board. Over the past several years, the drainage and irrigation sector has received significant financing from the Inter-American Development Bank (IDB), and recently, this institution has approved a US\$30 million loan for the rehabilitation of drainage and irrigation infrastructure along the coastline.

In the general area where the January 2005 floods were concentrated, Regions 3, 4 and 5, there are two water conservancies, which are divided by the Demerara River. The Region 4 Conservancy lies on the eastern side, while the Region 3 Conservancy borders the western side of the river. The combined water storage capacity of the two conservancies is approximately 130 billion gallons.

The East Demerara Conservancy Dam, which is located in Region 4, lies between the Demerara and Mahaica rivers (Figure 12). The total capacity of this conservancy is estimated at roughly 100 billion gallons. This Conservancy Dam traps surface water flowing to the coast, thereby attenuating potential flood conditions that would otherwise affect the coastal areas. It also was designed to allow inflow from the Mahaica and Demerara Rivers to the east and west, respectively, during times of high river flow. Outflow from this conservancy was intended to be through a number of canals (Figure 12) discharging to:

1. The Mahaica River – Through ‘Stop-off’ to the Lama River, and ‘Maduni’ to the Maduni River.
2. The Demerara River – Through ‘Cunha’, ‘5-Gates’, ‘Kofi’ and ‘Diamond’ Canals.
3. To the Atlantic Ocean – Through ‘Plaisance’, ‘Nabaclis’ and ‘Shanks’ Canals.

These discharge canals served as the control structures that allowed for management of the water levels behind the conservancy dam. Actual discharge through these canals was controlled by sluice gates. Over time, this system of outflow gates and canals has fallen into disrepair, seriously limiting the ability to appropriately control water levels behind the dam. Presently, only 5-Gates is properly operational to the Demerara River, Shanks to the sea and the two outlets to the Mahaica River.

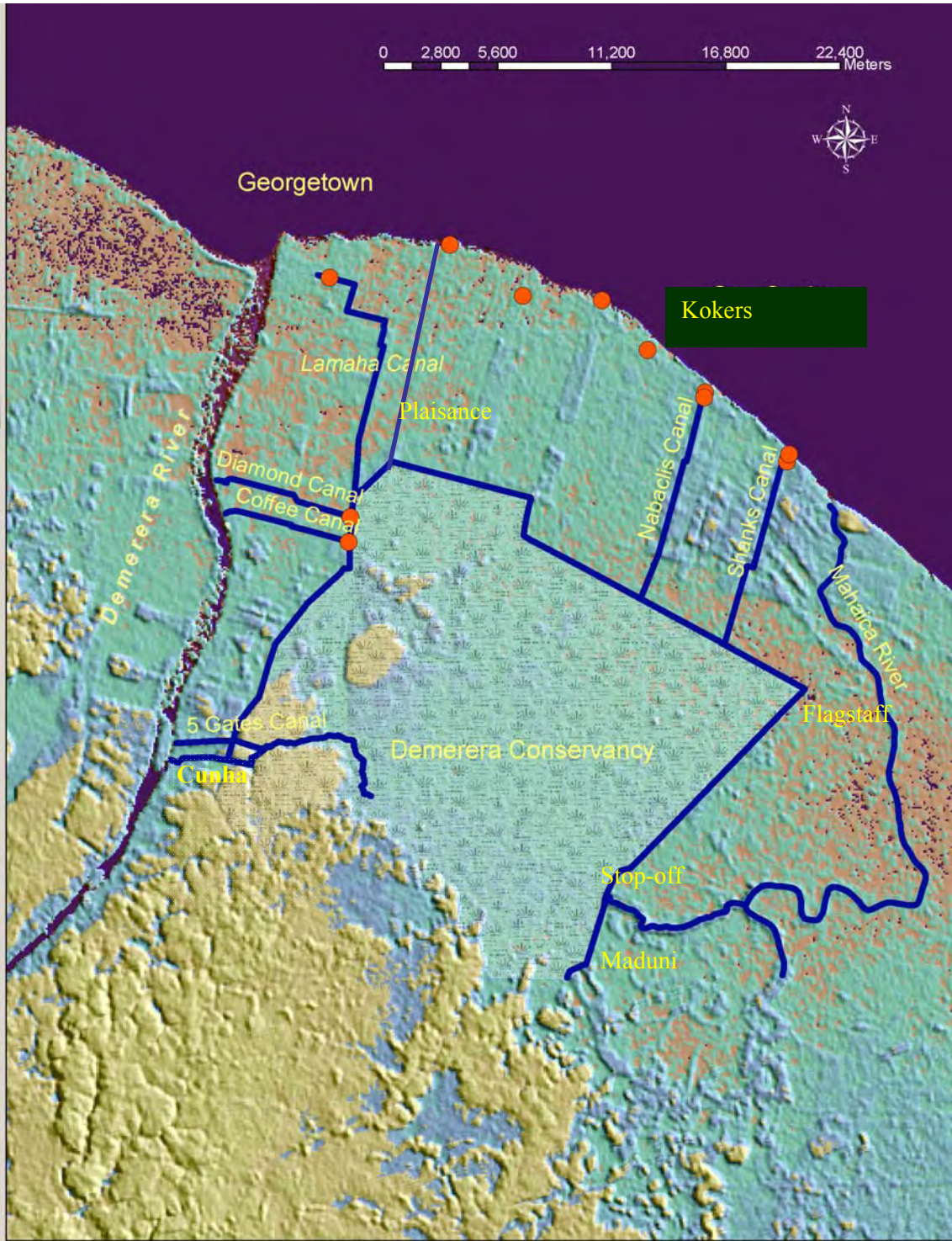


Figure 12 East Demerara Water Conservancy Dam and Associated Structures
 (Background image source: World Bank Guyana Damage Assessment Report)

Drainage from the conservancy dam flows north into the coastal lowlands, providing irrigation water to agricultural crops during the dry seasons. Through a series of sluices, this flow is restricted during the rainy seasons, thereby protecting the coastal areas from flooding. At the coastline, channeled surface water is drained to the sea through a series of sluices or ‘kokers’, that facilitate drainage through the canals at low tide conditions.



Photo 6 Koker at GUYSUCO Canal

Development has therefore been facilitated on the low-lying coastal plains of Guyana by the presence of this well-designed system of reclaimed lands (polders), drainage and irrigation canals, conservancy dams and seawalls.

The flood event

The actual meteorological mechanism of the floods has been described in Section I of this report. The worst hit area of flooding was between Sparendam to Enmore, where over 40” of water fell within a five-day period. This situation was exacerbated by the fact that the abatement of the rains coincided with a period of high (spring) tides, which prevented the proper drainage of the ponded water. In order to address this situation, the D&I Board brought in mobile pumps to bring relief to these communities.

At the conservancy dam, a combination of previously saturated ground conditions, high water levels on the south side of the conservancy embankment and malfunctioning sluice gates and/or outlet structures, led to a near catastrophic situation whereby the dam was almost breached. Had breaching occurred, it could have led to the release of a significant volume of water, and could have resulted in an additional 24" of water being added to the 40" that was recorded in the worst hit areas. This situation could have resulted in significant loss of life in the most populous belt of Guyana, making this disaster much worse than it was. Breaching of the dam was averted primarily by two initiatives.

First, excess water was discharged from the conservancy dam to three outlets: the 5-Gates canal, where 750,000 gallons per minute (gpm) were discharged to the Demerara River; the Maduni outlet, where 265,000 gpm were discharged to the Maduni River; and the Stop-Off outlet, where another 265,000 gpm were discharged to the Lama River. As a result of the latter two discharges, however, the communities on the banks of the Mahaica River were flooded out.

The second initiative was taken at the conservancy embankment itself, where a team of approximately 150 rangers worked through the day and night to place sandbags and/or pegasse on the crest of the embankment (Photo 7). This action was taken at locations where the water in the conservancy was seen to be overtopping the embankment and was a constant struggle until some measure of control was achieved.



Photo 7 **Embankment locations that were at risk from breaching**

The following damage to drainage and irrigation was inventoried following the event:

- Damage to sluice gates and associated equipment.
- Damage to intake structures and kokers.
- Damage to culverts and canals.
- Damage to the embankment of the Crown Dam.
- Damage to the embankment of the Conservancy Dam.
- Extensive siltation of canals.

Agency response actions

Coming out of this disaster, the President of Guyana has appointed an Infrastructure Recovery Task Force, chaired by the Director of the D&I Board and staffed by a number of experienced engineers, to oversee the speedy recovery of the drainage and irrigation sector. To date, the task force has obtained funding from a number of donor agencies in the amount of US\$3.5 million, to immediately commence rehabilitation works before the onset of the May/June rainy season. Medium-term funding (one to three-year horizon) has also been earmarked, in the amount of approximately US\$50 million, and longer-term (10-15 year horizon) funding is being sought in the amount of US\$200-300 million.

In order to facilitate this schedule, interviews have already been held with qualified contractors, to carry out the required rehabilitation works, in a design-build manner. The work to be done in the **short term** (i.e. before the May/June rainy season) will be:

1. Rehabilitation of Canals to the Demerara River – Cunha, Kofi and Diamond.
2. Rehabilitation of Canals to the Atlantic Ocean – The Shanks Canal will be excavated and the outlet structures to the sea for this canal rehabilitated.

In the **medium term**, the work to be done will include:

1. Rehabilitation of Canals to the Atlantic Ocean – Plaisance to be cleared; Nebaclis to have a new sluice; reconstructed culverts at the main road and new pumping station.
2. Construction of a proper road at Flafstaff running from the nearest public road to the conservancy dam.
3. Excavation of cross canals within the East Demerara Water Conservancy to increase storage and to channel water to the designated outlet structures.
4. Repairs to the conservancy dam embankment.
5. Hydraulic and hydrologic modeling of the East Demerara Water Conservancy system, sluice gates, water pumps and discharge canals.
6. Repair of critical outlet structures (kokers) in the seawall.