

ASSESSMENT OF THE SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACT OF TROPICAL STORM GUSTAV ON JAMAICA



**Planning Institute of Jamaica
October, 2008**

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Executive Summary

As at September 19, 2008 the preliminary estimate of the damage and losses incurred by the Jamaican economy due to the passage of Tropical Storm Gustav between August 28 and 29, 2008 was \$15.51 billion (US\$213.99 million)¹, 2 per cent of nominal Gross Domestic Product in 2007. See Table 1.

Table 1: Preliminary Costs of Damage and Losses caused by Tropical Storm Gustav

Sector and Sub-sector	\$million				
	Damage	Loss	Total	Private	Public
Total	14,507.92	1,006.64	15,514.56	2,842.58	12,671.98
Social	1,326.87	329.89	1,656.76	1,026.47	630.29
Housing*1	906.47	120.00	1,026.47	1,026.47	
Education and Culture	200.05		200.05		200.05
Health	213.94	209.89	423.83		423.83
Correctional Facilities	6.41		6.41		6.41
Productive	1,757.44	33.75	1,791.19	1,708.11	83.08
Domestic Crop	519.10		519.10	519.10	
Livestock	16.70		16.70	16.70	
Greenhouse/Protected Cultivation	19.70		19.70	19.70	
Agricultural Crops	1,063.50		1,063.50	1,063.50	
Fisheries	89.11		89.11	89.11	
Irrigation	49.33	1.75	51.08		51.08
Mining			0.00		0.00
Manufacturing			0.00		0.00
Relief Assistance (Agriculture)		32.00	32.00	0.00	32.00
Infrastructure	11,410.38	630.00	12,040.38	108.00	11,932.38
Electricity	108.00		108.00	108.00	
Water Supply and Sanitation	197.10	200.00	397.10		397.10
Transport/Roads and Bridges *2	7,500.00	30.00	7,530.00		7,530.00
Parish Council Roads	3,600.00	400.00	4,000.00		4,000.00
Telecommunications*3	5.28		5.28		5.28
Environment	13.23	0.00	13.23	0.00	13.23
Forestry					
Waste Management	13.23		13.23		13.23
Emergency Operations	0.00	13.00	13.00		13.00
Government Relief Assistance*4		1.50	1.50		1.50
ODPEM Recovery Activities		11.50	11.50		11.50

Source: Compiled by the PIOJ with data from various agencies

*1 Total amount be required for rehabilitation of damaged houses (MLSS)

*2 Includes \$15 million allocated for rental of equipment to assist in clearing critical farm roads

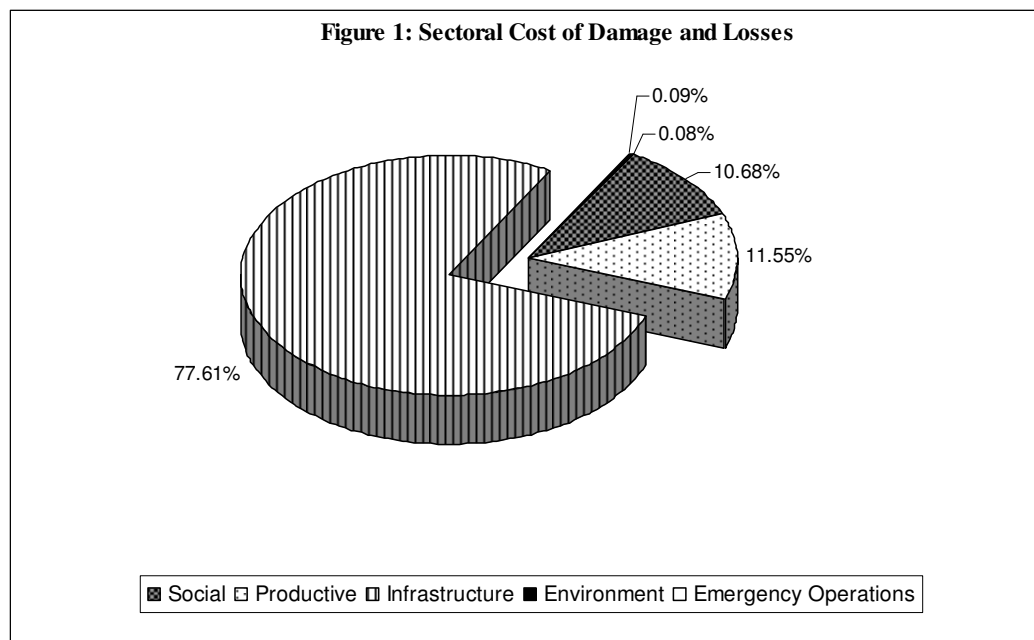
*3 Represents Damage to Post Offices only

*4 Allocated to assist in the burial of 10 persons confirmed dead

Damage and losses in the infrastructure sector represented the greatest portion of impact

¹ Exchange rate \$US 1.00= \$J72.50

accounting for over 77.61 per cent of the estimated total. See Figure 1. As in the case of previous hurricane and tropical storm events, the country's infrastructure took a battering from Tropical Storm Gustav. There was extensive damage to the road network, bridges, water mains, and to a lesser extent some electricity and telecommunication facilities. Damage was estimated at \$11,410.38 million while losses stood at \$630 million.



There was also widespread damage to agricultural crops and loss of livestock across the island. Preliminary estimates of damage totalled \$1,757.44 million. The most heavily impacted crops were bananas and plantains with an estimated loss of between 70 per cent and 85 per cent of the existing crop estimates. The most affected parishes were Portland, St. Thomas, St. Mary, St. Andrew and St. James. The western end of the island did not experience as much damage as the east with St. Ann and Trelawny being the least affected. Substantial damage to agriculture infrastructure including farm roads serving coffee producing areas was also experienced.

Affected Population

While the entire population experienced some impact from the storm, close to 450,000 residents in 76 communities were most directly affected with the impact ranging from isolation of communities due to damaged bridges and impassable roads; destruction of property including houses, crops and livestock; loss of livelihood; and loss of life². At the peak of the event, a total of 102 shelters were opened across all parishes housing 1,952 persons. The parishes with the highest number of persons in shelters were Kingston and St. Andrew, St. Thomas and Clarendon with 387; 346; and 331 persons respectively. By September 1, four days after the event, 248 persons remained in 10 shelters in 5 parishes.

There was some dislocation in the provision of utility services; however, these were restored in a relatively short time. As at Tuesday, September 2 all of the National Water Commission's major

² Of the 20 persons who reportedly died, 10 have been confirmed by the MLSS

facilities were restored with the exception of the Rio Cobre system and transmission main from the Hope Water Treatment Plant. For those areas without water, the Rapid Response Units and private trucks were utilized especially to facilitate institutions that provide essential services. Service was restored to all Jamaica Public Service customers by September 15, 2008 and the main telephone providers indicate that there was very little disruption to their services.

Farmers, as a group, were particularly affected with 22, 710 domestic crop farmers and 1,545 livestock farmers suffering damage and loss amounting to approximately \$550 million. Banana producing communities and workers in the banana industry are among those expected to experience the greatest long term impact from the passage of Tropical Storm Gustav. This is as a result of the Jamaica Producers Group Ltd decision to cease production of bananas for export to the United Kingdom and to make 460 workers redundant. Workers in the construction industry were also affected as the industry was disrupted up to September 12 since heavy duty vehicles transporting construction materials from the eastern end of the island into Kingston were unable to cross the Hope River.

In the most affected communities, there was considerable damage to the housing stock with approximately 7, 000 units being damaged. Close to 40 per cent of the houses assessed (as at the end of September), have been verified as being either severely damaged or totally destroyed. These housed an estimated 2,115 families (6,154 persons) see Table 2.

Table 2: Families and Individuals Affected by Damage to Housing, by parish

Parish	Totally Destroyed		Severely Damaged	
	Families	Individuals	Families	Individuals
Clarendon	4	16	6	26
Hanover			38	152
KSA	205	797	371	1339
Portland	106	282	687	2268
St. Ann			9	38
St. Catherine	32	76	173	379
St. James	1	1	11	45
St. Mary	20	74	101	363
St. Thomas	33	99	302	905
Westmoreland	2	10	14	64
Total	403	575	1712	5579

Source: MLSS

The estimated cost of the damage based of replacement cost for a starter unit of 216 sq. ft., is \$ 1,080 million. It is to be noted that some communities will have to be relocated. The exercise will require significant outlays for land and support infrastructure.

The storm struck just before the beginning of the new school year, as such school children island-wide were affected as the re-opening of school was delayed by two days to facilitate clean up and emergency repairs. Children enrolled in the 56 primary and secondary schools that were damaged were particularly affected. Once schools re-opened, children travelling the Bog Walk

Gorge were affected by higher fares, longer waiting time and lengthened commute. In some communities in the Hope River Valley, parents reported that children lost school books, supplies and uniforms when houses were flooded.

Lessons Learnt

There was evidence that the country has continued to improve its handling of hazard events. However, the experiences of Tropical Storm Gustav showed that the already fragile ecosystems provided little resilience to the above normal rainfall intensity experienced during the storm. Close to 20 collection stations on the south coast recorded rainfall levels of between 100 and 400 per cent above the 30-year mean and Mavis Bank, with 495 percent above the 30-year mean also recorded 306 mm of rainfall in a 12-hour period. This fact coupled with the continued degradation of the watershed and settlement along the banks of rivers and gullies contributed to much of the flooding and associated devastation seen.

While the direct result of Tropical Storm Gustav was for the most part localized and its impact on the affected families is obvious, there are long term implications for the entire society. The combination of natural hazards, poor planning decisions, and abuse of the natural environment will continue to increase vulnerability, particularly among the poor, and adversely affect the country's goals towards economic development. In this regard, some previously recommended measures bear repeating. These include the need to:

1. Declare and enforce "No Build Zones" across the island
2. Develop and implement a comprehensive and integrated watershed management plan
3. Prohibit removal of natural coastal barriers such as sand dunes, especially in areas prone to flooding, and to rehabilitate coastal buffer systems including mangroves, seagrass beds and coral reefs
4. Effect forced relocation of communities along gully and river banks
5. Preserve the natural drainage systems and retrofit and maintain man-made drainage systems to accommodate increased run-off and debris flow
6. Effect preventative maintenance of civil structures to preserve the structural integrity
7. Have strict monitoring and stringent enforcement of environmental standards and rules; and
8. Review, update and enforce setback standards.

PREFACE

This report is prepared to document impact on affected population; estimate costs of damage and losses; identify geographically affected areas; and identify the financial priorities for rehabilitation and reconstruction.

The assessment was prepared by the Planning Institute of Jamaica in close collaboration with the Office of Disaster Preparedness and Emergency Management (ODPEM), and the National Environmental Planning Agency. Data and information were provided by various ministries and agencies of the Government of Jamaica as well as several non-government institutions and private sector entities. These include, among others:

- The Meteorological Office
- Ministry of Labour and Social Security
- Ministry of Health and Environment
- Ministry of Education
- National Works Agency
- Ministry of Water and Housing
- Ministry of National Security
- Ministry of Agriculture and Lands
- RADA
- National Water Commission
- Jamaica Public Service

The assessment was made following the standard ECLAC methodology for Estimating the Socio-economic and Environmental Effects of Disasters. The information supplied in the report is preliminary and subject to revision. The cut-off point for data used in the report was September 26.

I. INTRODUCTION

1. Description of the Event

Meteorological Phenomenon

Tropical Storm Gustav which affected Jamaica from August 28-29, 2008, developed from a westward moving tropical wave which was located southwest of the Cape Verde Islands.

Initially, the development of this system was slow but this quickly changed when it entered the warm waters of the Caribbean. Tropical Depression Number Seven was formed on August 25 at about midday. Later in the afternoon the system strengthened to become Tropical Storm Gustav.

Initial projections placed the system north of Jamaica (Fig.1.1); however, the expected distance from the island meant that some rainfall and winds were likely to affect the island. This prompted the

issuance of a News Release at 5:00 p.m. by the Meteorological Service.

At 10:00 p.m. a Tropical Storm Watch was issued for the island in Bulletin #1 while Gustav was 530 km east south-east of Morant Point, Jamaica. Due to the rapid strengthening of the system it was upgraded to a hurricane by 5:00 a.m. on Tuesday, August 26. This meant that a Hurricane Watch was now in effect for Jamaica, as contained in Bulletin #2, which also gave an immediate Evacuation Order for the fishers from the cays and banks.

On Wednesday morning, the forecast track, although still north of Jamaica (see Fig 1.2), brought the system closer to the island and further strengthening to

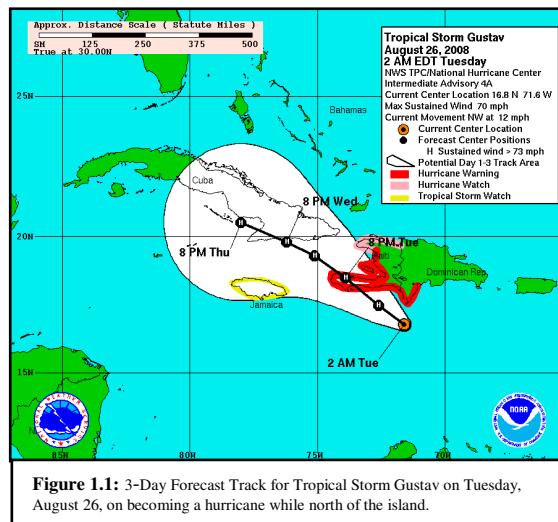


Figure 1.1: 3-Day Forecast Track for Tropical Storm Gustav on Tuesday, August 26, on becoming a hurricane while north of the island.

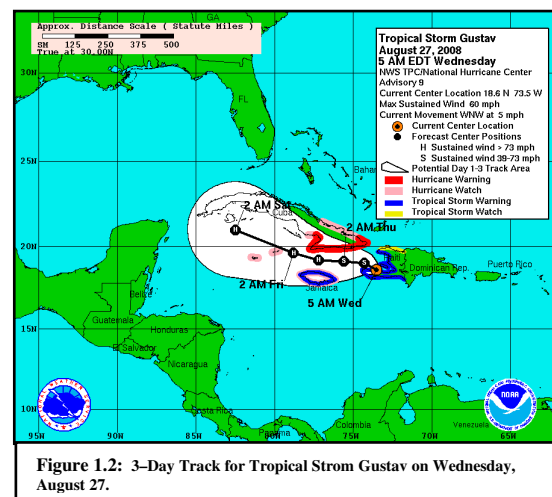


Figure 1.2: 3-Day Track for Tropical Storm Gustav on Wednesday, August 27.

hurricane strength was still expected. Gustav continued to encounter hostile conditions, this time from north easterly shear, which prevented development. By 5:00 a.m. on Thursday, August 28, Gustav had made a dramatic relocation of its centre to just east of Morant Point and the predictions were now bringing the system along the south coast of Jamaica.

By a special Intermediate Bulletin released at 6:00 a.m. on Thursday, the Meteorological Service issued a Hurricane Warning for the island, since Gustav was just below hurricane strength at a distance of 50 km from Morant Point. Figure 1.3 shows the satellite and the accompanying radar images from the local Meteorological Service Doppler radar, located at Cooper's Hill. They show the Tropical Storm near the eastern end of the island and indicate shower activity offshore as well as some sections of northern and south-eastern parishes.

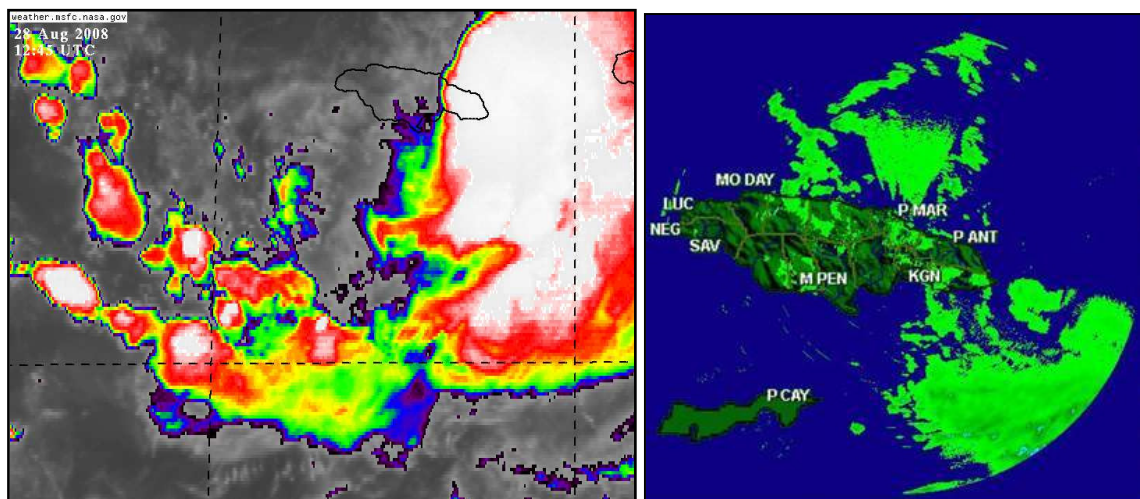


Figure 1.3: Satellite and Radar images of Gustav at 7:50 am Thursday, August 28, while the system was near the eastern tip of the island.

At 2:00 p.m. on Thursday, August 28, Gustav began moving along the south coast of Jamaica with maximum winds of 110 km/h. By 11:00 p.m. Gustav was near central Jamaica with its centre located 20 km south-southwest of May Pen, Clarendon. At 8:00 a.m. on Friday, August 29, Gustav was located near latitude 18.1°N, longitude 78.1°W, in the vicinity of Negril Point, as it prepared to move away from the island. The Hurricane Warning was downgraded to Tropical Storm Warning at 11:00 a.m. on Friday, while Gustav continued to move away from the island. Gustav regained hurricane strength at 5:00 p.m. on Friday while located 170 km northwest of Negril Point and further strengthening was forecast for the system. The Tropical Storm Warning

for Jamaica was lifted at 5:00 a.m. on Saturday, August 30, when Gustav was located at 370 km northwest of Negril Point. Conditions were expected to gradually improve across the island during the day.

The Severe Weather Event

The Meteorological Service's Doppler radar remained operational during the approach and passage of Tropical Storm Gustav, defining the areas of rainfall activity associated with the system. The radar showed that showers and thunderstorms began affecting sections of St. Thomas, Portland, Kingston as well as St. Catherine and St. Ann from about midday on Wednesday August 27, 2008. The activity spread to sections of other parishes throughout the day. As the system drew closer to the island, an increase in rainfall and thunderstorms was detected over most parishes. Moderate to heavy showers were reported for all parishes on the morning of August 29 and continued until late in the afternoon. Gustav's centre travelled along the south coast of the island and the position of the centre was given by the radar throughout the passage of the system.

Meteorological Data Analysis

Wind/Atmospheric Pressure Analysis

Tropical Storm Gustav travelled across the south coast of the island and a wind gust of 64 knots or 118 km/h was recorded at the Norman Manley International Airport (NMIA) in Kingston at 2237Z (Table 1.1). The maximum wind recorded at NMIA was 46 knots, or 84 km/h, while at Sangster International Airport (SIA) in Montego Bay, the winds peaked at 41 knots, or 76 km/h. The minimum pressures recorded at NMIA and SIA were 990.4 and 992.0 mb, respectively.

Table 1.1: Wind: Extreme Values during passage of Tropical Storm Gustav, August 27- 29, 2008

	Maximum Wind (degrees/knots)	Maximum Gust (knots)	Lowest Pressure (millibars)
NMIA, Kingston	109/46 (28/2317Z)	64 (28/2237Z)	990.4 (28/2005Z)
SIA, Montego Bay	072/41 (29/0916Z)	-	992.0 (29/0858Z)

Source: The Meteorological Service

Rainfall

The Meteorological Service monitors a network of over 250 rainfall stations across the island; each of which is required to record the accumulated rainfall over each 24-hour period, from 7 a.m. of one day to 7 a.m. the following day. This facilitates a quantification of flooding events, estimation of return periods for such events, comparative analyses with prior events, and established climatic averages. This analysis involves a number of parameters which are presented in Tables 1.2 to 1.3. In Table 1.2, the highest 1-day totals at specific stations in the same parishes are measured against amounts for significant rainfall return periods.

Table 1.3 is a presentation of the highest rainfall intensities for selected rainfall rates for Mavis Bank, located in the hills of the Blue Mountains. This rainfall station is close to the sources of several of the rivers that flow through the parishes of Portland, St. Thomas, St. Mary and Kingston & St. Andrew.

Table 1.2: Comparison of Highest One-Day Rainfall Totals (mm) on August 28-29, 2008 with Climatological Return Periods for Selected Parishes

Parish/Station	Highest 24-hour Total	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
St. Mary							
Castleton	234.3	175	270	335	415	475	535
Portland							
Moore Town	262.3	232	340	412	502	569	635
Shirley Castle	238.0	269	381	455	548	618	687
Fruitful Vale	277.9	187	288	355	439	501	564
St. Thomas							
Duckenfield	320.7	146	219	268	329	375	420
Ramble	298.4	148	249	317	402	465	527
Kingston/St. Andrew							
Stony Hill	256.9	155	233	308	401	471	540
Lawrence Tavern	290.0	120	196	250	322	374	427
Mavis Bank	419.0	139	242	313	400	465	529
Norman Manley Int'l	264.9	132	190	245	316	368	420
St. Catherine							
New Works	243.0	133	185	234	296	342	388
Wakefield	243.0	135	189	240	305	353	400
Worthy Park	225.0	118	187	233	291	334	376
Clarendon							
Beckford Kraal	214.0	107	154	186	226	255	285
Vernamfield	112.0	85	128	156	192	219	245

Source: The Meteorological Service

Table 1.3: 12-hour Rainfall Intensities for Mavis Bank Rainfall Station, during the passage of Tropical Storm Gustav on August 28, 2008

Duration	5 MIN	10 MIN	15 MIN	30 MIN	60 MIN	2 HRS	6 HRS	12 HRS
Amount (mm)	11.6	22.2	30.2	48.8	80	94.2	210	362

Source: The Meteorological Service

Analysis of the data reveals that the three-day total rainfall recorded at most stations exceeded their 30-year mean by more than 100%. For example, close to 20 stations on the south coast recorded rainfall levels ranging from 161.1% above the 30-year mean at Sangster International Airport to 444.3% at Langley in St. Andrew. See Appendix 1.1

The station which recorded the highest exceedance of the 30-year mean was Mavis Bank with a value of 495 %. Mavis Bank recorded 306 mm of rainfall over a 12-hour period, this occurred on August 28. The station was the only one which exceeded its 25-year return period, the excess was five percent.

There was no record of the 100-year return period being exceeded during the period, however, some stations exceeded their 10-year return period. These were Beckford Kraal in Clarendon, Duckenfield in St. Thomas, Lawrence Tavern, Norman Manley International Airport, KSA, New Works and Wakefield in St. Catherine.

During the passage of Tropical Storm Gustav, NMIA reported a storm total rainfall of 338 mm (13.3 inches), with the maximum one day total of 265 mm (10.4 inches). The total storm rainfall for this station represents 417 % of the 30-year mean rainfall for the month of August for that station. The maximum 6-hour rainfall recorded at NMIA was 154.2 mm (6.1 inches) between 7:00 pm and 1:00 am Thursday night August 28; this was during the period 0000 to 0600 GMT Friday, August 29 (Table 1.4).

Table 1.4: Rainfall associated with Tropical Storm Gustav from Norman Manley International Airport (Rainfall in mm) August 28-30, 2008

Station	Thu. August 28, 2008					Fri. August 29, 2008					Sat. August 30, 2008			Storm Total
Time (GMT)	00	06	12	18	Sum	00	06	12	18	Sum	00	06	Sum	
Norman Manley	0.4	0.9	2.2	tr	3.5	65.3	154.2	45.4	50.8	315.7	9.1	4.9	14.0	333.2

Source: The Meteorological Service

In terms of exceeding the 30-year mean rainfall levels, a comparison was made between Tropical Storm Gustav and Hurricanes Ivan and Dean. The data show that next to Hurricane Ivan, Tropical Storm Gustav had the highest variations from the 30-year mean in most stations. Southern parishes in general reported in excess of 200 % of the mean rainfall for the month of August during the passage of Gustav. This is a similar pattern to that of Hurricane Ivan.

Table 1.5: List of the available stations with rainfall in excess of 300 mm (11.8 inches) associated with the passage of Gustav

STATION	PARISH	Gustav Total Rainfall (mm)	Gustav Total Rainfall (inches)
Lawrence Tavern	Kingston	491.0	19.3
Craig Head	Manchester	416.6	16.4
Swansea	St. Catherine	403.5	15.9
Charm Hole	St. Catherine	397.0	15.6
Sherwood Forest	Portland	359.4	14.1
Worthy Park (Climo)	St. Catherine	349.0	13.7
Norman Manley International Airport	Kingston	338.0	13.3
Savanna-la-mar	Westmoreland	328.0	12.9
Richmond	St. Mary	310.0	12.2
Ingleside	Manchester	301.5	11.9
Mountainside	St. Elizabeth	301.0	11.9

Note *: 1 inch is approximately 25.4 mm

Source: The Meteorological Service

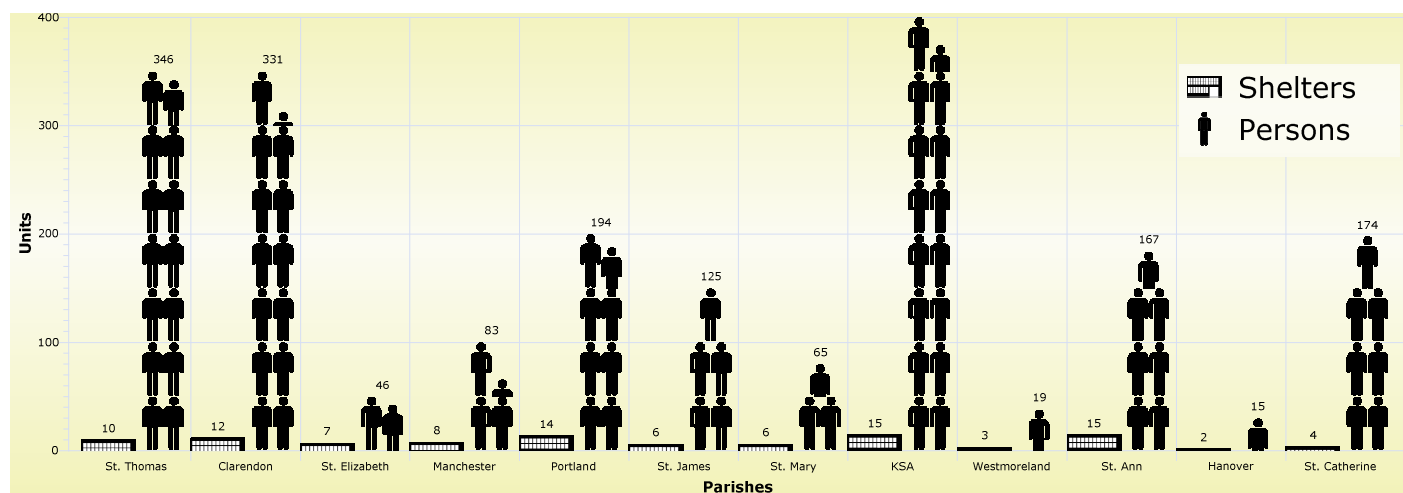
Actions and Expenditure

Two days prior to the event, an emergency meeting was held with a wide cross section of representatives of organizations within the development community to discuss the immediate short term needs of Jamaica should the system affect the island, and to determine the type of

resources, assistance and response the International Development Partners would be able to offer. Meetings of the National Disaster Committee (NDC) and subcommittees of the National Response Team (NRT) were also held to discuss preparatory and response plans. The National Emergency Operations Centre (NEOC) was fully activated on August 28. A total of 140 priority shelters were identified and prepared for activation. Evacuation orders were issued for 43 coastal and inland flood prone communities in the parishes of Trelawny, St. Catherine, KSA, St. Thomas, Clarendon, Westmoreland, St. Elizabeth and Manchester. Welfare and shelter relief supplies were deployed to all regions on August 27, 2008, a day before the event.

At the peak of the event, a total of 102 shelters were opened across all parishes housing 1952 persons (Figure 1.4 and 1.5). The parishes with the highest number of persons in shelters were Kingston and St. Andrew, St. Thomas and Clarendon with 387; 346; and 331 persons respectively. By September 1, four days after the event, 248 persons remained in 10 shelters in 5 parishes, down from the 1 823 persons in 95 shelters in the days immediately following the event.

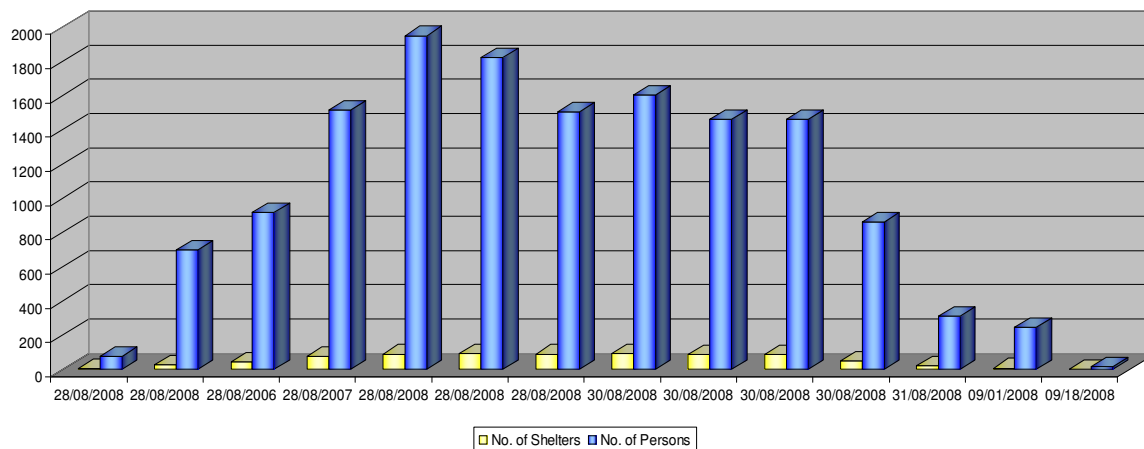
Figure 1.4: Number of Persons in Shelters, August 28, 2008



Source: ODPEM Situation Report

At September 18, 2 shelters were still open with 16 persons whose houses were totally destroyed or severely damaged. These shelters were at the Manchioneal Community Centre and Mount Pleasant City Mission Church in Portland.

Figure 1.5: Shelter Status August 28 - September 18, 2008



Source: ODPEM Situation Report

During the event several rescue operations were carried out by the Jamaica Defence Force (JDF), Jamaica Fire Brigade, National Works Agency and the Cadet Force. These were conducted for residents of Judgement Yard in St. Andrew, Windsor Road in Spanish Town, St. Catherine, and Hordely Crossing in St. Thomas. A medical evacuation was also conducted for a stroke victim in Hagley Gap, St. Thomas. Within a day of the event, Initial Damage Assessment Teams were deployed in St. Thomas and two Rapid Damage Assessment Flights deployed to St Ann, St. Catherine, St. Mary, Portland, St. Thomas, Kingston and St. Andrew. This was conducted with the assistance of Digicel, a private telecommunications provider, which donated a helicopter for 3 flights. Shelter supplies were also airlifted by the JDF to shelters cut-off in eastern parts of St. Andrew and care packages dispatched to shelterees and residents of marooned communities. Assistance was also received from International Development Partners and local private sector organisations (See Appendix 3). The total cost for emergency activities following Tropical Storm Gustav was estimated at approximately \$11.5 million.³

The Caribbean Catastrophe Risk Insurance Facility (CRIF) made no payouts for damage associated with the event as the wind speed must exceed 111 to 130 miles per hour in order to trigger payout.

³ This does not include the cost of food and assessment flights.

3. Affected Population

The projected population when Tropical Storm Gustav struck the island was 2.69 million. Approximately 6.03 per cent of the total population or some 446, 008 persons from 76 communities were directly and indirectly affected by the natural disaster⁴. The impact ranged from loss of life, destruction of property, loss of livelihoods, and inconveniences and isolation of communities due to damaged bridges or impassable roads. Table 1.6 and Figure 1.6 indicate the most severely impacted parishes

Table 1.6: Jamaica: Estimated Population Affected by Tropical Storm Gustav

	End of Year Population 2004	%	End of Year Population 2005	%	End of Year Population 2006	%	End of Year Population 2007	%	Projected Population At the time of Tropical Storm Gustav	Estimated Population Affected during Tropical Storm Gustav
Jamaica	2,644,100	100.0	2,656,700	100.0	2,669,500	100.0	2,682,100	100.0	2,690,884	446,008
Kingston and St. Andrew	655,000	24.8	657,800	24.8	660,600	24.7	663,600	24.7	665,773	126,156
St. Thomas	92,800	3.5	93,100	3.5	93,400	3.5	93,900	3.5	94,208	20,011
Portland	81,000	3.1	81,300	3.1	81,500	3.1	81,900	3.1	82,168	11,827
St. Mary	112,700	4.3	113,000	4.2	113,400	4.3	113,900	4.2	114,273	23,504
St. Ann	170,100	6.5	171,000	6.4	172,000	6.4	172,800	6.4	173,366	23,446
Trelawny	74,200	2.8	74,600	2.8	75,000	2.8	75,300	2.8	75,547	10,392
St. James	180,100	6.8	181,500	6.8	182,800	6.8	183,700	6.9	184,302	15,096
Hanover	68,400	2.5	68,900	2.6	69,300	2.6	69,600	2.6	69,828	9,633
Westmoreland	141,900	5.4	142,800	5.4	143,800	5.4	144,400	5.4	144,873	19,788
St. Elizabeth	148,500	5.5	149,100	5.6	149,800	5.6	150,600	5.6	151,093	34,218
Manchester	187,900	7.3	188,600	7.1	189,300	7.1	190,200	7.1	190,823	13,660
Clarendon	242,000	9.1	243,200	9.2	244,400	9.2	245,600	9.2	246,404	25,712
St. Catherine	489,400	18.4	491,800	18.5	494,200	18.5	496,600	18.5	498,226	112,566

Source: Economic and Social Survey Jamaica, 2007

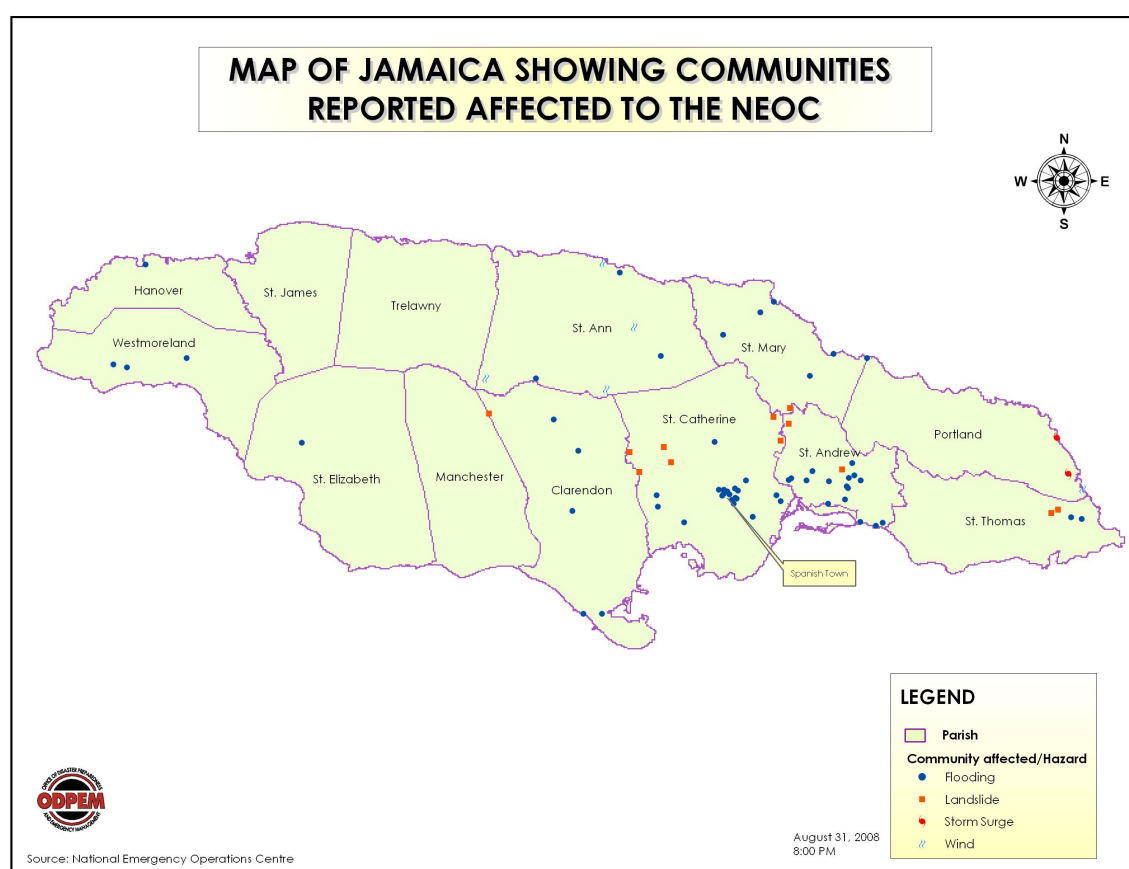
The majority of communities were located in the parishes of Kingston and St. Andrew. The main cause of the impact on communities was flooding and a few cases of storm surge, wind damage, and landslides. The highest level of impact to housing was evident in the Hope River Valley, especially in the communities of Tavern and Kinytre. Several houses collapsed and some

⁴ Note: Population Projection by the Social Policy, Planning and Research Division, PIOJ.

Estimated population affected during Tropical Storm Gustav data based on communities reported to be affected in each parish (Appendix 2). This includes farming and livestock communities.

persons lost their lives as the river flooded and washed the structures downstream (Figure 1.7). Approximately 200 houses were destroyed in this area and a similar number is assessed as very vulnerable⁵.

Figure 1.6: Tropical Storm Gustav Affected Communities



Source: ODPEM

Other communities in St Andrew namely, Harbour View, Bull Bay, Gordon Town, Papine, August Town, and Guava Ridge suffered extensive damage to property and reported loss of lives as a result of flooding of the Hope River and in other cases by landslide. The Kingston and St. Andrew Corporation (KSAC) received reports of bodies being washed out of graves at the August Town cemetery, and that at least two family plots were compromised at Cane River.⁶ In Broadgate, St Mary, two houses on the banks of the Wag Water River, were also washed away.

⁵ ODPEM Initial Damage Assessment Report

⁶ Jamaica Observer, September 11, 2008

The Georgia Bridge which links the Highgate community to Junction was also destroyed. Persons in East Harbour View and the parish of St. Thomas were completely cut off due to the breakaway of a large portion of the bridge at Harbour View (See Figure 1.8). The Harbour View bridge crosses the Hope River and is the major corridor linking Bull Bay, eastern Jamaica and the corporate area.

Figure 1.7: Houses destroyed along the banks of the Hope River



Figure 1.8: The Harbour View Bridge

left - Immediately After the Storm, right - Three Days After



By September 3 a temporary Bailey Bridge was erected to accommodate light to moderate weight vehicles as well as pedestrians. By September 12 a fording was constructed by private quarry operators to facilitate trucks and vehicles carrying load over 10 tonnes. Communities within the Hope River Valley and, those east of the Hope River also experienced difficulties as three (3) bridges were reported damaged. In addition, at September 2, thirteen communities in St. Thomas, Portland, St. Andrew, and St. Catherine remained marooned because of landslides and breakaways.

4. Impact on livelihoods and women and children

The sustainable livelihoods and assets of several groups were significantly affected by the passage of Tropical Storm Gustav, these included retailers, small shop-keepers, truckers and haulers, farmers, and market vendors. In St. Thomas the collapse of sections of the Harbour View Bridge had far reaching impact on various groups. Both large and small retail operators (shops and supermarkets) were unable to stock up on supplies due to the damaged bridge which was inaccessible for 3 days after the event. Persons working in the transportation sector also experienced losses as a number of buses and taxis that travel between St. Thomas and Kingston were unable to travel the route up to September 3, when the Bailey Bridge was constructed. In the interim “human ferries” shuttled men, women, children and produce across the river as persons tried to return to work, catch flights, or obtain food and supplies. (See Figure 1.9)

Figure 1.9: Persons being ferried across the Hope River



As large buses were not allowed to use the bridge, the Jamaica Urban Transit Company set up makeshift ticket offices on either side where persons living in St. Thomas could purchase tickets and board buses to transport them into Kingston.

The construction industry was at a halt up to September 12 as heavy duty vehicles transporting construction materials from the eastern end of the island into Kingston were unable to cross the Hope River. The Cement Company, one of the major suppliers of cement indicated that while production levels were not affected, the ability to distribute products to the eastern end of the island was being seriously impacted⁷. In the interim the Cement Company decided that it would transport cement to the eastern end of the island by sea.

Up to 4 days after the event most of the gas stations in the western side of St. Thomas had run out of petrol resulting in loss of income to petrol station operators. Cambios were also among those losing revenue as they ran out of money. Market vendors were unable to transport their goods from Kingston and the persons in the hills of St. Thomas who produce carrots and other vegetables were unable to go to Kingston⁸. Market vendors who were unable to take their goods into Kingston set up make-shift markets in areas close to the banks of the Hope River where the bridge was damaged (See Figure1.10). Sand and aggregate companies who serve a large percentage of the island's construction sector were also affected by the destruction of the Harbour View Bridge.

Figure 1.10: Market vendors at the Harbour View Bridge



⁷ Jamaica Observer "Construction Woes", September 12, 2008

⁸ Interview with Clinton Gordon, Secretary Manager of St. Tomas Parish Council (Jamaica Information Service)

In St. Catherine, fruit vendors along the Bog Walk Gorge were affected by the damage sustained to the Flat Bridge and sections of the main road from Bog Walk to Spanish Town. Already ripened fruits had to be sold at cheaper prices after the storm and with the closure of the Gorge many vendors had to relocate to a less lucrative location closer to Spanish Town near to the Angels housing scheme⁹. The closure of the Gorge also impacted bus and taxi fares as commuters reportedly had to pay up to 150% more to travel from Spanish Town to Bog Walk. Many mothers had to increase the amount of money given to their children attending school in order to accommodate the higher fares. In addition to the increased fares students also had difficulty getting to and from Bog Walk as they experienced long waiting periods (up to 2 hours) before they could find a taxi driver willing to make the trip. The long waiting periods also has a negative impact on students preparing for exams as they either arrive at school late or do not get the rest required for them to perform at their best. On the other hand, students in Sligoville, the alternative route, were forced to take cabs to school as the usual walk had become dangerous due to increase vehicular traffic.¹⁰ At September 24, the Gorge was still closed to vehicular traffic.

Supreme Ventures Ltd, a local Lottery and Gaming company reported \$150 million in lost sales when it shut down its system for the storm's passage. Commercial establishments in Port Maria also reported losing approximately \$100 million in stocks and sales due to the effects of flooding.

The livelihoods of approximately 22,710 domestic crop farmers and 1,545 livestock farmers (including 172 inland fish farmers) and by extension their families, were affected due to the devastation caused by Tropical Storm Gustav. Domestic crop farmers experienced damage to the value of \$519.1 million while livestock farmers lost \$29.39 million worth of animals. Due to the extensive damage to banana farms in the eastern section of the island, the Jamaica Producers Group (JP) Limited decided that it would cease the production of bananas for export to the United Kingdom. This directly affected some 460 persons at the Eastern Banana Estates in St. Thomas who were made redundant. Some 25 workers at the Maroon Pride Banana Chips factory were also impacted by the storm as operations were scaled down to one day per week due to the damage to the banana sector in St. James.

⁹ "Roving with Lalah" Jamaica Gleaner, September 4, 2008

¹⁰ The Jamaica Observer, Sept 12, 2008

In communities impacted by the storm, many persons lost personal items, back-to-school supplies and uniforms that were bought in preparation for the new school year. At the peak of the event over 264 children were in shelters¹¹. The Tavern Community Centre, in KSA, one of the hardest hit parishes, reported 70 children present while the Old Harbour High school reported that there were 79 children present.

5.0 Casualties

Twenty persons reportedly lost their lives as a result of the storm, ten of whom have been confirmed, 3 females and 7 males (Table 1.7). Among those who died were four persons who drowned in Kintyre and Lawrence Tavern when their houses collapsed into the Hope River in St. Andrew; four persons who were swept away in a vehicle in Bull Bay, St. Andrew and three children from the Mustard Seed community who died from trauma. One man reportedly suffering from asthma who was unable to get medical attention, collapsed near the Hope River Bridge and was later pronounced dead. Other deaths occurred in Llandewey, St. Thomas and Gordon Town, St. Andrew. The government has allocated \$150,000.00 to assist with the burial of each confirmed dead.

Table 1.7: Summary of Confirmed Deaths Related to Tropical Storm Gustav

Parish	Age	Gender
St. Andrew	50	Female
St. Andrew	25	Male
Kingston	54	Female
Kingston	24	Male
Kingston	5	Female
St. James	3	Male
St. Thomas	68	Male
St. Catherine	73	Male
Manchester	50	Male
St. Elizabeth	19	Male

Source: MLSS Status Report, Tropical Storm Gustav, September 18, 2008

¹¹ Not all shelters recorded the number of children present. The figure shown was collected from 17 of the 102

II. SOCIAL SECTORS

1. Education

Damage to the education sector (public institutions), while not as extensive as in previous weather systems, was significant. Preliminary reports from the Ministry of Education (MoE) indicated that 56 primary and secondary schools sustained damage estimated at \$200.05 million. In dollar value, Kingston and St. Andrew and St. Mary accounted for 31.34 and 28.44 per cent of the damage respectively (Figure 2.1 & table 2.1). Over 30 schools sustained damage to roof and structures, while 8 had damage to retaining walls and fences from land slippage, the latter occurring primarily in St. Mary and Portland. Some schools also sustained damage to school furniture from flooding. Jericho All Age in Hanover and New Work All Age & Infant in Westmoreland sustained damage to their pit latrines which collapsed and the electrical supply in 3 schools was also damaged. In order to allow administrators and teachers, as well as parents, time to undertake clean-up activities at their schools and homes, the reopening of the school year scheduled for September 1 was delayed to September 3. The MOE also reported that the weather system had affected the delivery of furniture and equipment to some schools.

Figure 2.1: Cost (\$ million) of Damage to Primary and Secondary Schools by Parish

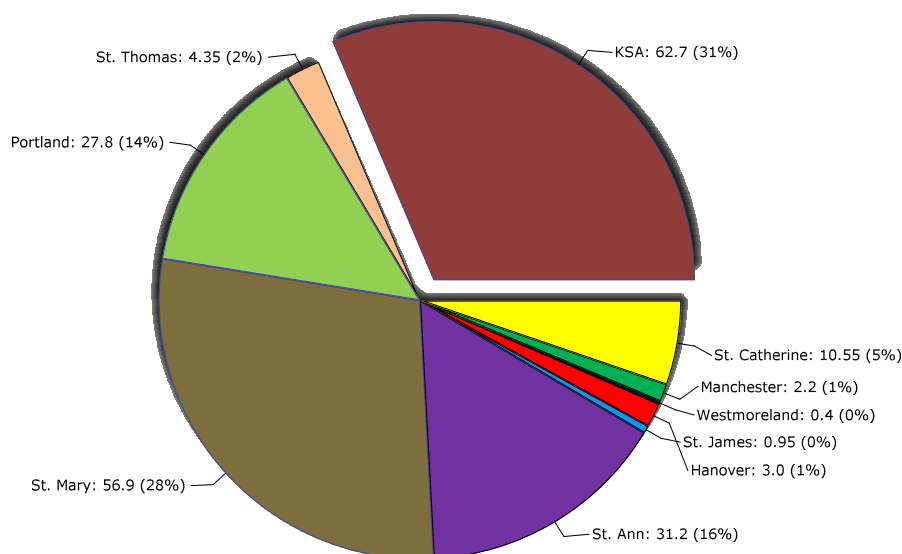


Table 2.1: Damage to Primary and Secondary Schools

Parish	No. of Schools	Total Estimated Cost (\$Million)
KSA	10	62.70
St. Thomas	6	4.35
Portland	9	27.80
St. Mary	12	56.90
St. Ann	7	31.20
St. James	4	0.95
Hanover	1	3.00
Westmoreland	1	0.40
Manchester	2	2.20
St. Catherine	4	10.55
Total	56	200.05

Source: Ministry of Education

2. Housing

There was considerable damage to the housing sector. The Ministry of Labour and Social Security (MLSS) has estimated that approximately 6,971 houses have been damaged which is equivalent to per cent of the housing stock of the country. As at September 17, 4,599 houses were assessed (Table 2.2). Of the houses assessed, 8.3 per cent were totally destroyed; 33.07 per cent were severely damaged while 47.03 per cent had minor damage. The parishes with the largest number of houses damaged were Kingston and St. Andrew, Portland, St. Catherine, St. Mary and St. Thomas. These five parishes combined accounted for 96.11% of the houses damaged. In addition to damaged homes, a total of 435 households reportedly lost household effects due to flooding.

Estimating the value of the houses damaged has proven difficult highlighting the obvious need for having better baseline data of the size and quality of the housing stock. For the purposes of the assessment however, the estimates of a totally destroyed unit are calculated on the replacement cost per square foot of a concrete starter unit.¹² The costs for the other levels of damage are pro rated accordingly.¹³ Applying this formula, to the number of houses assessed to date, the cost of damage to the housing sector is estimated at \$906.47 million (Table 2 .2)

¹² Based on information from the Incorporated Master Builders Association of Jamaica:
12x18 f² starter house @ \$5000 per f² = \$1,080,000

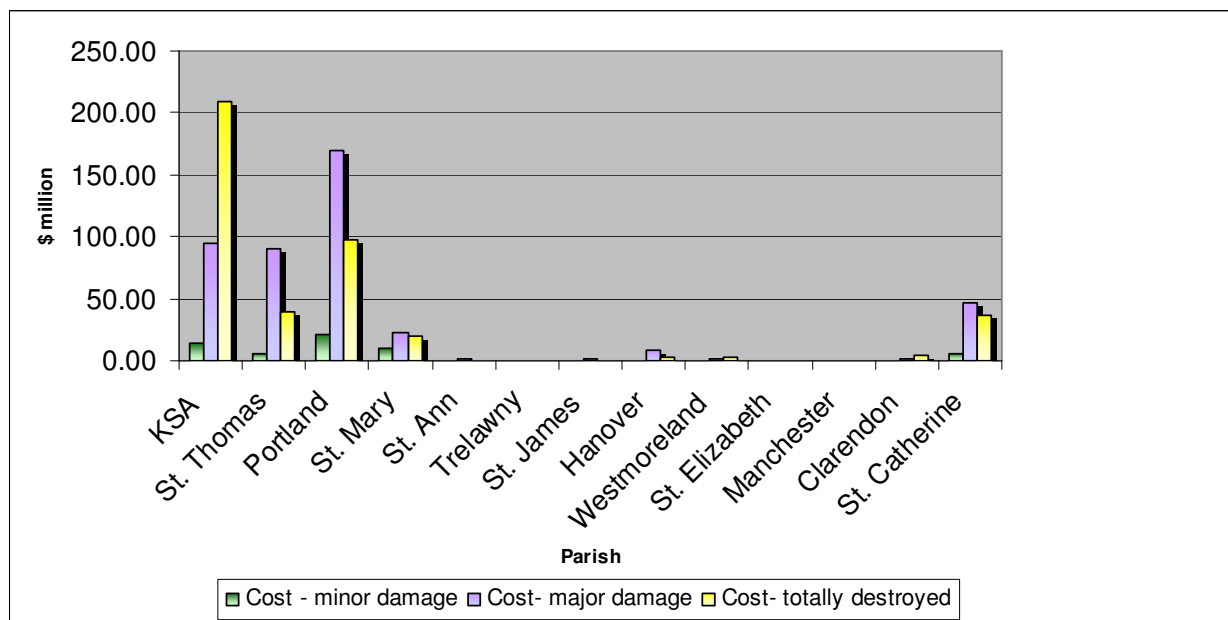
¹³ Major/severe damage calculated at 25% of totally destroyed (assumes loss of an entire roof or equivalent damage)
Minor damaged calculated at 2.5%

Table 2.2: Summary of Damage to the Housing Sector as at September 17, 2008

Parish	Estimated Number of Houses Damaged	Number of Houses Assessed to date	Estimated Value of Damage of Houses Assessed \$million	Totally Destroyed	Severely Damaged	Minor Damage	Household Effects
KSA	2,000	1,295	317.14	193	352	506	244
St. Thomas	700	560	135.24	37	334	189	
Portland	1,700	1,579	288.44	90	630	783	76
St. Mary	800	574	52.52	18	86	365	105
St. Ann	30	22	1.32		3	19	
Trelawny	30	18	0.97		2	16	
St. James	40	27	1.67		5	12	10
Hanover	55	44	10.58	2	30	12	
Westmoreland	20	14	3.21	2	3	9	
St. Elizabeth	35	12	0.57		1	11	
Manchester	21	2	0.05			2	
Clarendon	40	22	5.54	4	3	15	
St. Catherine	1,500	430	89.21	34	172	224	
Total	6,971	4,599	906.47	380	1,521	2,163	435

Source: MLSS

Figure 2.2: Cost of Damage to the Housing Sector by Type of Damage



The MLSS has completed assessment and verification of 66 percent of the houses damaged and has recommended that the Government provide assistance to help persons with repairs and reconstruction. The level of benefit recommended is the same as granted after Hurricane Dean (Table 2.3). Based on the number of houses verified as at September 17, the proposed benefit would amount to \$74.83 million. This would however, increase to \$120 million assuming that all the houses which reported initial damage are verified as damaged, and assuming that the damage profile is similar to those already verified.

Table 2.3: Proposed Benefits for Persons Suffering Damage to Homes

Category of Damage	Number of Houses	Proposed Benefit \$	Total (\$ million)
Totally Destroyed	380	60,000.00	22.80
Severely Damaged	1,521	20,000.00	30.40
Minor Damage	2,163	10,000.00	21.63
Total			74.83

Source: MLSS

Government expenditure in housing will also be affected by the need to relocate some residents who live in vulnerable areas.

3. Public Buildings

a) Correctional Facilities

Total damage to correctional facilities was estimated at \$6.41 million. The Department of Correctional Services reported damage to 5 correctional institutions which included damage to the sewage system at the St. Andrew Juvenile Remand Centre and loss of poultry, pig pens and crops at the Richmond Farm Adult Correctional Centre and the Rio Cobre Juvenile Correctional Centre.

b) Police Stations

The Jamaica Constabulary Force (JCF) and the Island Special Constabulary Force (ISCF) reported that an estimated 35 police stations islandwide were damaged during Tropical Storm Gustav. The damage was mainly to roofs and structures. Almost all stations reported leaking roofs some of which resulted in flooding, damage to furniture and

equipment.

The Jamaica Fire Brigade and Jamaica National Heritage Trust reported that they sustained little or no damage due to the passage of Tropical Storm Gustav.

4. Health

Damage to the health sector was estimated at of \$147.84 million by the Ministry of Health and Environment (MOHE) (Table 2.4). Damage to infrastructure (roofs and structure) accounted for 90.44 per cent with the Linstead and Spanish Town Hospitals in St. Catherine sustaining extensive roof damage. Other hospitals experienced minor leaks and there was severe flooding on all medical wards of the Kingston Public Hospital. Despite these challenges, all health facilities remained operational throughout the duration of the storm. Three MOHE critical facilities, namely the Kingston School of Nursing, National Blood Transfusion Services and the Ken Royes Centre, were damaged with estimates of \$7.89 million, while the children's home in Muirton, Portland sustained roof damage of \$500,000.00.

In addition losses to the tune of \$209.89 million were incurred, with vector control requiring \$151.51 million or 72.2 per cent of the total, vehicles 17.5 and health education 5.3 per cent respectively. The MOHE estimated that \$70.0 million will be required for latrine replacement.

Table 2.4: Summary of Damage to the Health Sector

Regions	Hospitals		Health Centres		Health Departments			MOH&E	
	Structural	Damage to Equipment and Supplies	Structural Damage	Damage to Equipment and Supplies	Structural Damage	Damage to Equipment and Supplies	Other	Critical Facilities	Total Estimated Damage
	(\$million)								
Western Regional Health Authority	4.95		5.55						10.50
Southern Regional Health Authority	7.80		8.00				2.60		18.40
South East Regional Health Authority	48.55	2.35	23.87		2.95		0.80	7.89	86.41
North East Regional Health Authority	26.65		1.48				0.50		28.63
Grand Total J\$	87.95	2.35	38.90	0.00	2.95	0.00	3.90	7.89	143.94
Grand Total US\$									1.99
Other:									
Children's Homes	0.50								
RHAs	0.80								
Health Departments	2.60								
Total	3.90								

Source: Emergency, Disaster Management and Special Services Branch, MOH September 9, 2008

III. PRODUCTIVE SECTORS

There was widespread damage to agricultural crops and loss of livestock across the island due to the passage of Tropical Storm Gustav. Preliminary estimates of damage totalled \$1,678.3 million (Table 3.1). The most affected parishes were Portland, St. Thomas, St. Mary, St. Andrew and St. James. The western end of the island did not experience as much damage as the east with St. Ann and Trelawny being the least affected. The most heavily impacted crops were bananas and plantains with an estimated loss of between 70% and 85% of the existing crop. Substantial damage to infrastructure was also experienced.

Table 3.1: Estimated Damage in the Agriculture Sector

Sector and Subsector	Total Damage
Total	1,678.3^r
1 Agriculture	
1.1 Domestic consumption	519.1
Legumes	18.0
Vegetables	89.3
Condiments	23.4
Cereals	10.9
Fruits	9.0
Ground Provision	51.2
Bananas	222.7
Plantains	83.8
Fruit Tree crop	4.8
Others	16.0
1.2 Green House	19.7
1.3 Traditional Exports production	
Bananas (estate)	505.5
Coffee	108.0
Sugar cane	450.0
2 Livestock	16.7
Broilers	7.4
Layers	1.0
Goats	4.9
Cattle	0.4
Pigs	2.0
Sheep	1.0
Bee Colonies	0.06
3 Fish	10.0

r – revised

Source: Ministry of Agriculture

1. Domestic Crop and Livestock Sub Sector

Approximately 2 777 hectares of crops were lost or damaged, with Portland sustaining the highest loss of 650 hectares (23.40%) of the total area affected. Among the domestic crops affected, banana sustained the heaviest loss with 1 208 hectares, followed by plantains (586 hectares) and vegetables (366 hectares) Table 3.2. Some 22 710 domestic crop farmers were affected, with combined losses of approximately \$519.1 million. Clarendon, St. Elizabeth and St. James were among the parishes with the highest number of farmers affected with 5 100, 2 700, and 1 930 farmers respectively. Consistent with the area of greatest impact of the Tropical Storm, St. Mary and Portland suffered damage estimated at \$132.0 million and \$93.0 million respectively.

Table 3.2: Preliminary Estimates of Damage to Domestic Crops by Parish

					C	R	O	P	S				
PARISH	Legumes	Vegetable	Cond.	Cereals	Fruits	G/Prov.	Plantain	Banana	Orchard	Others	Total Hectare	Farmers	Total Value \$M
St. Catherine	5	30	15	8	0	10	5	15	0	8	96	750	27
St. Andrew	20	15	10	5	0	20	25	0	4	2	101	1,500	20
Portland	0	10	0	0	0	5	200	435	0	0	650	2,500	93
St. Ann	9	60	11	16	0	3	5	7	0	0	111	1,650	8
St. Mary	5	21	7	2	1	17	70	240	1	1	365	850	133
St. Thomas	14	22	8	0	5	4	90	40	0	2	185	1,850	32
Clarendon	7	35	7	3	0	25	18	21	1	0	117	5,100	71
St. Elizabeth	5	70	26	33	40	70	0	0	4	0	248	2,700	25
Manchester	5	40	15	0	20	15	0	0	0	0	95	660	14
Hanover	7	15	5	5	0	30	90	80	2	0	234	900	30
Trelawny	0	10	0	0	0	0	5	5	0	0	20	800	5
St. James	0	30	14	4	0	20	50	350	1	3	472	1,930	46
Westmoreland	5	8	5	8	0	7	28	15	7	0	83	1,520	18
TOTAL	82	366	123	84	66	226	586	1208	20	16	2777	22710	522

Source: RADA

Vegetable/horticultural farmers who were affected by the storm benefited from the distribution of machetes, files and seeds valued at \$7 million which were also distributed by the Ministry. The Ministry also provided a \$25 million fertilizer subsidy to production and marketing organizations.

Estimates of damage to livestock amounted to \$29.39 million. Over 1 545 farmers were affected with Clarendon having the highest number of farmers affected sustaining the highest damage of \$12.83 million (Table 3.3).

Table 3.3: Estimated Damage to Livestock

	L		I	V	E	S	T	O	C	K
PARISH	Broilers	Layers	Goats	Cattle	Pigs	Fish	Sheep	Bee	Farmers	Value \$M
St. Catherine	2,000	300	120	2	50	50 Tons	30		172	12.83
St. Andrew	4,000	1400	70		145				77	3
Portland	1,000	250	20		10			30 colonies	90	0.73
St. Mary	2,600	800	40	2	45				100	1.05
St. Thomas	2,500								100	0.63
Clarendon	5,000		100	2	150				338	3.1
St. Elizabeth	2,000	1,500	250		180		40		280	3.54
Hanover	2,000		25					20 colonies	80	1.37
St. James	2,500	500	40						60	1.14
Trelawny	200		30						35	0.25
Westmoreland	3,400		50		45				213	1.75
TOTAL	27,200	4750	745	6	625	50 Tons	70	0	1545	29.39

NB. Calculated rates vary based on maturity or remainder of productive life

Source: Ministry of Agriculture

2. The Banana Industry

The intense rainfall and winds associated with Gustav inflicted heavy damage to the parishes devoted to the production of bananas. This damage comes at a time when the industry was just rebounding from losses associated with Hurricane Dean in 2007. The Jamaica Producers Group reported that a total of 552 hectares of estate bananas were damaged, 57.97% of which occurred at the EBEL Estate. Damage was estimated at \$728.2 million which comprised \$505.5 million for estate bananas and \$222.7 million for domestic crop. Initial assessments revealed that some 30-40% of the potential loss can be salvaged. This will entail reaping of fruits that were ready for harvest, protecting others that are near to harvest and cutting back of broken plants. To facilitate this process the Ministry of Agriculture in collaboration with Food for the Poor distributed 8000 machetes and files. The Ministry also accelerated the release of \$188 million worth of supplies which were in the process of being procured for banana farmers as part of an EU Grant to the sector. This should facilitate the rehabilitation of the damaged fields to allow for reaping within 7 to 8 months.

3. The Sugar Industry

The cost of damage to sugar cane cultivation was estimated at \$450.0 million. Approximately 120,000 tonnes of cane or 6.0 per cent of net crop production was lost. Major effects from Tropical Storm Gustav were extensive stalk breaking, lodging, scouring and flooding in St.

Thomas and St. Elizabeth and localized flooding and lodging in the Frome and Worthy Park areas. Damage to sugar cane varied by location based on the age of the canes since last reaped and the wind effect on some varieties. The following was observed:

1. cane less than three months old suffered minimal damage with some broken tops and leaf shredding
2. canes 3 – 5 months old experienced severe stalk breakage but with varying degrees depending on the cane variety being grown. The continued growth of cane is usually affected.
3. canes 5 – 8 months old were lodged with little stalk breakage. These will continue to grow but will cause the development of suckers which will affect cane quality at harvest.

In St. Thomas stalk breakage was very pronounced on canes at the 3-5 month stage of growth. This will impact significantly on the production for 2009. The extent of damage to next crop's production in St. Thomas was estimated in the range of 20 per cent. In St. Elizabeth, an estimated 500 hectares of sugar cane was flooded, the impact of which will depend on how long the water takes to subside from flooded areas of Appleton, Raheen, Holland, Casa Maranta and Elim. The potential exists for canes to be lost from flooded fields and considerable cost to be incurred from pumping. Damage to the next crop's production was estimated at 7 per cent. Approximately 300 hectares of cane was also flooded in Frome. The effect on other areas was minimal.

4. The Coffee Industry

Preliminary estimates suggest that there was \$108 million worth of damage to coffee industry. The Coffee Industry Board (CIB) reported that approximately 5 – 10% of the crop was damaged by the storm. Scarring of coffee beans will also result in a reduction of the production of premium coffee beans. Several roadways, drains and waterways were severely damaged. These were located mainly in western Portland, western St. Thomas and East Rural St. Andrew areas. The CIB reported that the damage to farm roads were more extensive than that which occurred in Hurricane Dean. The cost of clearing the roads in order to provide access to the Blue Mountain regions was estimated at \$30 million, while the cost of repairing private farm roads probably

equals this figure¹⁴. Some \$15 million was allocated for rental of equipment to assist in the clearing of coffee roads. Coffee growers also have to deal with high resuscitation cost as there is no crop insurance available for coffee farmers.

5.0 Fisheries

Tropical Storm Gustav had devastating impacts on the Fisheries sector amounting to app. \$ 89.11 million. The marine fisheries sub-sector sustained losses of \$13.98 million, related mainly to the loss of fishing gears, particularly fish traps and pots that were at sea during the passage of the storm. The Aquaculture sub-sector reported losses totalling approximately \$67.89 million. The heaviest impacts were the loss of close to 550 000 lbs of food-fish, fingerlings and damage to dykes and access roads primarily in St. Catherine which has the largest cluster of fish farmers in the island. There were no significant damage were reported from Clarendon. The Ornamental Fish Farmers Association reported loss of ornamental fish valued at approximately \$7.25 million.

The effect of the impact of the storm on the livelihood of fisher-folk was demonstrated by the extent of damage to and loss of equipment in some areas. A total of 2185 fish pots were reported lost, 1,500 of these were lost to fishers operating from the Manchioneal fishing beach. These fishers also lost 39 informal gear sheds. Overall, Manchioneal suffered 67.6 per cent (\$ 9.45 million) of the total cost of damage to the marine fishing industry. Loss incidental to the storm was reported by the Old Harbour Bay Fisherman's Cooperative Office whose office was broken into and materials and supplies worth approximately \$ 1.1 million reportedly stolen.

There was no reported damage of any significant nature to the eighteen operational Fisheries Division sub-offices island-wide. Heavy beach erosion at the Frenchman's Bay, Calabash Bay, Billy's Bay and Half Moon Bay fishing beaches was by reported of the Calabash Bay and Half Moon Bay Fishermen's Cooperative.

¹⁴ Financial Gleaner, September 26, 2008. "how hurricanes are undermining Jamaica's coffee industry" – Christopher Gentles

Table 3.4: Summary of Estimated and Reported Losses to the Marine Fishing Industry

Fishing Beach / Location	Parish	Type of Damage/Loss		Estimated Cost (\$)
		Fish Pots Lost	Other	
Hellshire / Port Henderson	St. Catherine	105	Heavy erosion	525,000**
Manchioneal	Portland	1500	39 gear sheds destroyed	9,450,000
Buff Bay, Prospect	Portland	160		800,000
All beaches in parish	St. Mary	150		750,000
All beaches in parish	St. Ann	150		750,000
All beaches in parish	Trelawny	120		600,000
Old Harbour Bay Fishermen's Cooperative	St. Catherine		Larceny	1,100,000
Total		2185		13,975,000

*** For fish traps only. Engineering Estimate needed for remediation work to address erosion of beach
 Cost Estimates: Gear sheds - J\$50,000 each (Informal construction made of wood, ply, cement and zinc)
 Fish traps/pots - J\$5,000 per trap

Source: Fisheries Division

Damage to the aquaculture sector was reported for the Hill Run, Bushy Park and Hartland Areas. A total of 34 farmers reported loss of 549,803 lbs of food fish and 669,000 fingerlings. Hill Run sustained 78.13 per cent of the total cost of damage to the sub-sector (Table 3.5)

Table 3.5: Summary of Estimated and Reported Losses to the Aquaculture Sector

Area/Location	Food Fish (lbs)	Fingerlings	Other Damage/Loss	No. of Farmers Reporting Loss	Cost
Hill Run	424,300	608,000	Broken dykes, damaged roadways, loss of brood-stock and mature Koi, damaged pond	15	52,962,000.00
Bushy Park	110,833		Loss of dykes, damage to roadway	9	11,683,300.00
Hartland	14,670	61,000	Loss of material for ornamental building shed, shade cloth	10	3,143,000.00
Grand Total	549,803.00	669,000.00		34	67,788,300.00

Source: Fisheries Division

6.0 Irrigation

The National Irrigation Commission (NIC) estimated damage to the island's irrigation network in the amount of \$49.33 million and losses of \$1.75 million (cost of this includes repairs to pipeline and canals, access and pipe line flushing, and cleaning up siltation,). In St. Catherine, flooding in sections of the lower main canal including parts of Tawes Pen and De La Vega City from storm flows entering the canal affected surrounding inner city communities. There were also canal leaks on the Old Harbour Canal and Wash Out Gate damage at the Rio Cobre River. The Yallahs pipeline was also washed out.

Damage to the Manufacturing, Mining and Services sectors was minimal or negligible.

IV. INFRASTRUCTURE

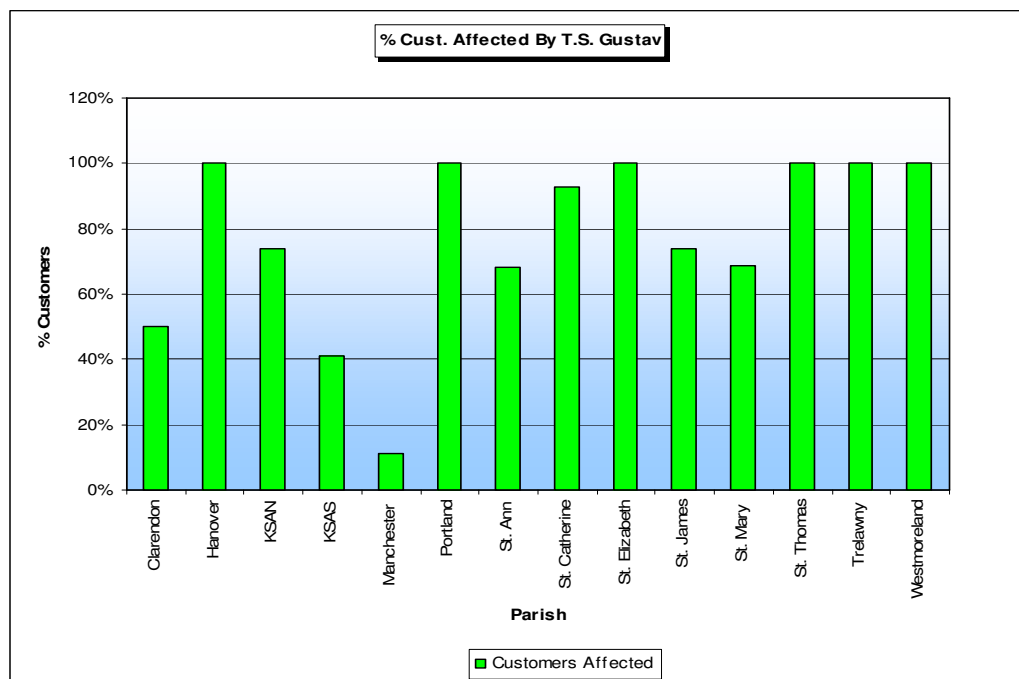
As in the case of previous hurricane and tropical storm events, the country's infrastructure took a battering from Tropical Storm Gustav. There was extensive damage to the road network, bridges, water mains, and to a lesser extent some electricity and telecommunication facilities. Damage was estimated at \$11.41 million while loss stood at \$630 million.

1. Public Utility Systems

a) Electricity

Preliminary estimates indicate that total damage to the electricity sub-sector was approximately \$108 million. An assessment by the Jamaica Public Service Company revealed that approximately 70.0 per cent of customers were affected by the storm, losing power supply for limited periods of time during and after the storm (Figure 4.1). The parishes that experienced the most significant distribution network damage were Portland, St. Thomas, St. Andrew (north and eastern), St. Catherine (northern) and St. Mary. There were isolated cases in other parishes.

Figure 4.1: Customers Affected by Tropical Storm Gustav by Parish



Source: JPS

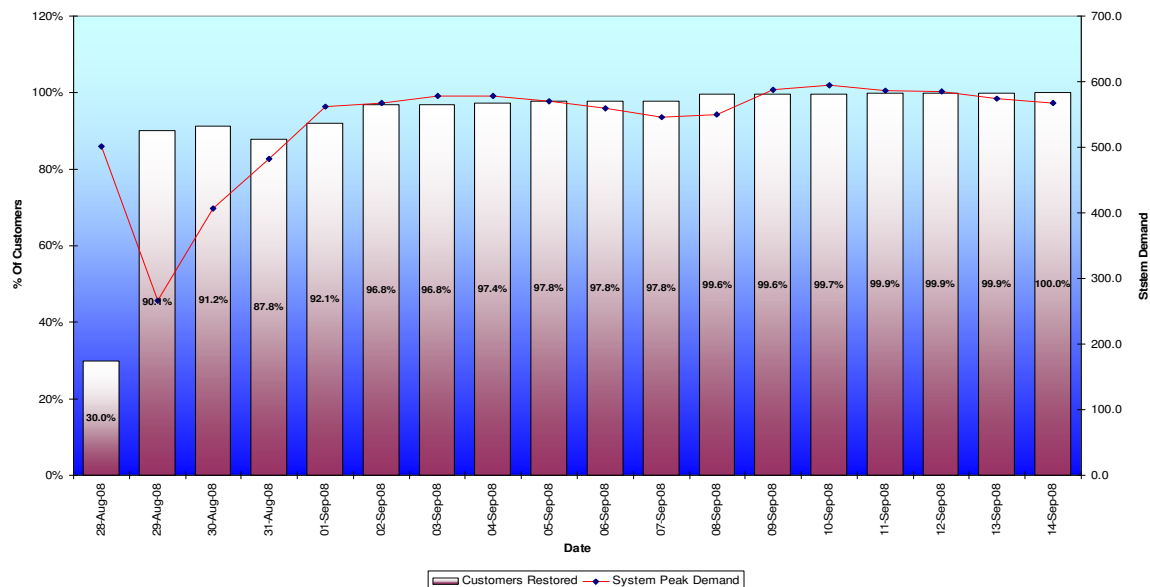
The outage was due to damage sustained on some transmission and distribution lines. There was no significant damage to the generating infrastructure as available capacity remained at normal levels. Among the major damage were:

- 40 transformers;
- 161 broken poles;
- 122 other pole damage;

Minor damage was sustained on three transmission lines (one washed out pole and dislodged insulators); the D&G substation due to a transformer fire caused by flying debris; and four customer pad-mounted transformers including the Kingston Public Hospital.

Restoration response was carried out according to the usual JPSCo protocol with critical customers such as hospitals, telecommunications and water supply facilities were given priority. Restoration efforts in some parishes were impeded by road inaccessibility, flooding and hilly terrain. However, by August 31, 2008, a reported 92.0 per cent of customers were restored (Figure 4.2). Service was restored to all customers by September 15, 2008.

Figure 4.2: JPS System Conditions During and After Tropical Storm Gustav



Source: JPS

2. Water Supply and Sanitation

Damage to the National Water Commission (NWC) facilities associated with the passage of Tropical Storm Gustav totalled \$397.12 million, reflecting an estimated \$197.1 million and \$200.0 million in damage and losses, respectively (Table 4.1).

Table 4.1: Breakdown of Estimated Cost of Restoration of NWC Facilities

PRIORITY 1 - Requiring Immediate attention		
Parish	Types of Damage	Total
Clarendon	Damage to access roads leading to facilities; pipeline dislocations; heavy silting of water intakes	14,300,000
Hanover	Blocked intake	200,000
KSA	Damage to intakes; dislocation of major trunk mains due to landslides; excessive silting of intake; restoration of aspects of protective works for Hermitage Dam	91,600,000
Manchester	Clogging of pumping equipment; excessive silting	4,680,000
Portland	Silting of water catchment facilities; sections of pipeline dislocated	3,900,000
St. Ann	Flooding and damage to some water intakes; burnt motor; blocking of sewers to streets resulting in occasional overflows	4,550,000
St. Catherine	Extensive damage to Rio Cobre pipeline in the Bog Walk Gorge; damage to intakes; pipeline dislocations	17,600,000
St. Elizabeth	Blocked intake wet motors	425,000
St. James	Excessive silting; pipeline dislocation	1,100,000
St. Mary	Damage to major trunk main; pipeline dislocation due to land slippage	12,125,000
St. Thomas	Blocked intakes; excessive silting; numerous pipeline dislocations	11,700,000
Trelawny	Excessive silting	500,000
Westmoreland	Dislocated pipeline	900,000
	Sub-total - PRIORITY 1	163,580,000
Islandwide	Trucking and additional operational cost; revenue loss	200,000,000
	Sub-total - Commercial Losses	200,000,000
PRIORITY 2 - Requiring Attention; to be commenced within 1 month		
Clarendon	Damage to sections of access roads to some facilities	500,000
KSA	Building damage; repair to sections of Yallahs Pipeline	28,610,000
Portland	Building damage	330,000
St. James	Drying motor; replacement provided in the interim	850,000
St. Mary	Remove debris from buildings	295,000
	Sub-total - PRIORITY 2	30,585,000

PRIORITY 3 - To be commenced within 3 months		
Clarendon	Damage to sections of buildings	540,000
KSA	Debris in intakes; damage to buildings	1,750,000
Manchester	Damage to plants	50,000
St. Mary	Damage to buildings	310,000
Westmoreland	Damage to sections of plant	300,000
	Sub-total - PRIORITY 3	2,950,000
	TOTAL	397,115,000

Source: National Water Commission (NWC)

This emanated from damage sustained mainly in the Eastern region – in the parishes of Kingston, St. Andrew (east and west rural) St. Thomas, Clarendon and sections of St. Catherine. Of significance was the damage to the 20 inch diameter Rio Cobre pipeline in the Bog Walk Gorge and the 16 inch diameter transmission line which traverses the Hope Water Treatment Plant. The Commission’s facilities in the Western region sustained no major damage, structural or otherwise.

Prior to the storm, precautionary measures were taken to protect and mitigate against damage to the assets and facilities. Among these were:

- the protection of the intake of some water sources;
- the relocation of pumps from booster stations that are susceptible to flooding;
- the containerization of some Genset units in preparation for deployment of areas in greatest need;
- the filling of storage facilities to ensure reliability of water supply throughout the storm; and;
- other operational preparatory steps.

In addition, an electronic document detailing the NWC’s “priority systems for restoration” was provided to the JPSCo. This includes maps showing the precise location of each of these critical facilities.¹⁵

Service was maintained throughout the storm at the following treatment plants – Martha Brae (Trelawny), Bogue (St. Ann), Great River (St. James), Logwood (Hanover), Roaring River Old and New (Westmoreland) and Mona (St. Andrew).

¹⁵ Source: NWC Report on the status of Water Supply Systems Due to Tropical Storm Gustav, September 2, 2008.

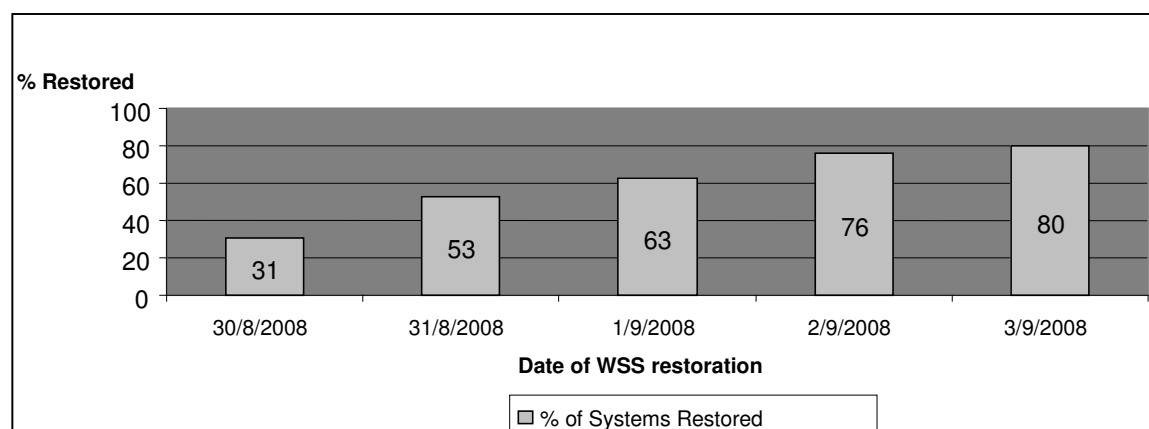
The NWC's water supply systems were primarily affected by the:

- absence of electricity;
- blocked and damage intake structures;
- dislocated and broken mains;
- blocked access to critical facilities; and
- extremely high turbidity levels.

Restoration activities started immediately after the passage of the storm facilitated by the use of standby generators in areas designed to be supplied by gravity flows. Though at reduced levels, the Hope, Seaview and Constant Spring Water Treatment Plants (WTPs) were reactivated to service and operational within two hours of the storm's passage. Other facilities in the parishes of St. Ann, Westmoreland, Clarendon and St. Catherine also resumed operation immediately after the storm. By Saturday (August 30, 2008), approximately 31.0 per cent of the NWC's facilities were restored into operation. The remaining 60.0 per cent were awaiting the resumption of JPSCo's power supply. As a consequence there was coordinated effort with the JPSCo as well as close collaboration with NWA with regard to access to the communities.

As at Tuesday, the 2nd September, all of the NWC's major facilities were restored (Figure 4.3) with the exception of the Rio Cobre system and transmission main from the Hope Water Treatment Plant. In the meantime, water trucking operation using the services of the Rapid Response Units and private trucks were utilized to facilitate institutions that provided essential services and experienced any kind of difficulty with supply as well as those affected because of extensive damage to the NWC's systems.

Figure 4.3: Progress of Restoration of Water Supply Schemes



Source: National Water Commission

2. Telecommunications Service Providers

a) Telecommunications Service Providers

On August 29,, 2008 Cable & Wireless Jamaica reported that all its core networks—mobile, fixed and Internet – remained operational before, during and after the storm. They reported that their fixed network was showing a 98 per cent service; while their mobile network registered just above 95 percent. Service was disrupted in some areas as some of the cell sites lost electrical power due to the passage of the storm. Most of these were back in service by August 30. Worst affected were cellular customers in St Thomas, where Tropical Storm Gustav caused extensive damage, leaving roads blocked and loss of electricity. Restoration efforts were hampered by inaccessibility to locations and power outages¹⁶.

b) Post Offices and Postal Agencies

Approximately \$5.3 million¹⁷ worth of damage was sustained by the island's Post Offices due to Tropical Storm Gustav. This resulted mainly from damage to roofs (Table 4.2)

¹⁶ Jamaica Observer, August 30. Cable & Wireless Jamaica Service Update

¹⁷ Estimated cost of damage is based on the reports submitted by regional Inspectors and not actual measured estimates.

Table 4.2: List Of Post Offices Damaged By Tropical Storm Gustav On August 28, 2008

Parish	Post Office	Nature of Damage	Estimated Cost of Damage
Kingston / St. Andrew	Liguanea	Sections of roof and electricals	300,000.00
	Bull Bay	Windows	100,000.00
	Western District	Roof	800,000.00
	Half Way Tree	Sections of roof	400,000.00
	Mavis Bank	Sections of roof	150,000.00
	Mona	Sections of roof	150,000.00
	GPO	Sections of roof	200,000.00
	Windward Road	Windows	100,000.00
	Hagley Park	Sections of roof	150,000.00
	Grants Pen	Sections of roof	150,000.00
	Pembroke Hall	Sections of roof	200,000.00
Clarendon	Race Course	Sections of roof	400,000.00
	Lionel Town	Sections of roof	100,000.00
St. Mary	Carron Hall	Sections of roof	150,000.00
	Guys Hill	Sections of roof	150,000.00
	Hampstead	Sections of roof	150,000.00
St. Catherine	Waterford	Sections of roof	150,000.00
Westmoreland	Negril	Flooding	300,000.00
	Grange Hill	Sections of roof	250,000.00
	Ramble	Sections of roof	250,000.00
St. James	Jericho	Sections of roof	600,000.00
	Cascade	Sections of roof	150,000.00
	Little River	Defective Door	30,000.00
		Grand Total	5,280,000.00

Source: Post & Telecommunications Department

3 Transport, Roads and Bridges

Damage to the road infrastructure was estimated at \$7.5 billion, which included \$800 million for river training and protective works islandwide. Disaggregation of the remaining \$6.7 billion are outlined below (Table 4.3).

Table 4.3: Summary of Estimates of Damage to Road Infrastructure

PARISH	Road Rehab.	Repairs to Scoured Surface	Damaged Gullies/Drains	Retaining Walls	Cost to Clear and Clean Roads/Drains and open to traffic (\$)	Bridges (\$)	TOTAL (\$)
	\$	\$	\$	\$			
St. James	14,800,000	-	2,400,000	12,224,580	23,715,500		53,140,080
Trelawny	-	5,840,000	10,500,000	16,040,000	6,000,000		38,380,000
Hanover	35,200,000	12,350,000	3,531,000	17,962,350	5,950,000		74,993,350
Westmoreland	-	4,450,000	3,300,000	6,588,000	7,400,000		21,738,000
Portland	-	46,200,000	3,850,000	300,000,000	51,335,000		401,385,000
St. Thomas	558,600,000	58,575,000	75,700,000	88,305,000	109,450,000		890,630,000
St. Ann	-	26,640,000	1,500,000	-	36,450,000		64,590,000
St. Mary	26,400,000	70,000,000	6,350,000	161,400,000	60,000,000	1,000,000,000	1,324,150,000
St. Catherine	418,300,000	94,160,000	20,400,000	174,900,000	87,000,000		794,760,000
St. Andrew	144,995,000	73,260,000	-	240,900,000	53,000,000	1,000,000,000	1,512,155,000
Kingston	2,900,000	9,350,000	750,000,000	8,350,000	21,322,000		791,922,000
Manchester	60,000,000	1,800,000	12,600,000	3,600,000	3,160,000		81,160,000
Clarendon	249,200,000	198,600,000	44,194,500	56,880,000	32,500,000		581,374,500
St. Elizabeth	2,200,000	6,000,000	-	8,000,000	4,550,000		20,750,000
TOTAL	1,512,595,000	607,225,000	934,325,500	1,095,149,930	501,832,500	2,000,000,000	6,651,127,930

Source: National Works Agency

The damage resulted from landslides, breakaways, scouring and flooding to primary ground routes as well as damage to bridges due to the scouring of the piers. The highest expenditure was estimated for the parish of St. Andrew and St. Mary and included the cost associated with the loss of the Harbour View and the Westmoreland bridges. Other major road infrastructure damage included the Bog Walk Gorge where the main road leading to Flat Bridge from the Sligoville intersection was severely damaged. There was major land slippage, splits and gaps in the roadways and water erosion of the retaining wall (Figure 4.4). Apart from some land slippage and water erosion against retaining wall, there was no major damage to the southern side of the

bridge, that is, the section leading to Kingston.

Figure 4.4: Sections of the Flat Bridge damaged by Tropical Storm Gustav



Some of the other roads that sustained damage and interruptions included:

- New Castle main road;
- Long Bay to Manchioneal;
- Windsor Forest;
- Junction main road;
- Spur Tree;
- Chapelton to Frankfield

The NWA started clearing roads and restoring access to communities immediately after the storm. Priority was given to the erection of a temporary Bailey Bridge connecting Kingston to St. Thomas to accommodate pedestrian and moderately weighted vehicles at the site of Harbour View bridge. By September 1, 2008, approximately 44.0 per cent of roads were cleared or provided single lane access, while 151 roads remained blocked by debris or breakaway and another 40 due to inundation (See Figure 4.5).

Damage to Parish Council Roads was estimated at approximately \$4,000 million. This includes cost of gully and drain repairs, resurfacing and repairs to retaining walls estimated at \$3,600 million and temporary repairs and reopening, estimated at \$400 million.

4. Airport, Ports, and Industrial Facilities

While there was some flooding on the road leading to the Norman Manley International Airport, there was no damage to the island's airports facilities and both were open immediately after the storm.

Likewise, there was no damage to the facilities (property, plant and equipment) of the Port Authority of Jamaica.

Figure 4.5: Status of Roads after Tropical Storm Gustav



Source: National Works Agency (NWA)

V. IMPACT ON THE ENVIRONMENT

1. General

a) Overview

Although natural hazards have been an important feature of Jamaica and the wider Caribbean, the occurrence of storm events over the last decade has grown in frequency and intensity. Changing climatic conditions are leading to more frequent and intense weather events and their effects are made worse by anthropogenic factors which increase vulnerability. These events usually disrupt economic activities and lower the quality of life of many people. The destruction wrought by Tropical Storm Gustav exemplifies this.

Although the natural environment may not suffer as extensive wind damage from tropical storms as from hurricanes, the former can result in significant flooding, landslides, loss of vegetation and animals and erosion and siltation of riverine and coastal ecosystems. In addition, high volume and velocity water flow can cause destruction of coastal infrastructure, especially in areas that already have some level of vulnerability. Coral reefs and seagrass beds which act as storm buffers, habitat and feeding and nursery areas for many marine species are especially vulnerable to siltation.

b) Pre-Existing Environmental Conditions

Pre-existing environmental conditions can determine the potential impact of natural hazards such as tropical storms on the environment. Pre-existing conditions before the passage of Tropical Storm Gustav included the following:

- The inappropriate location of formal and informal settlements in inland and coastal areas which are highly vulnerable to landslides, flooding and storm surge (Figure). This problem is exacerbated by poor design and quality of the housing stock in some of these areas;

- Coastal ecosystems were already being degraded by human-induced factors such as marine and land-based pollution, habitat degradation, over-fishing and the effects of natural factors such as previous storm events (Hurricane Dean, 2007 & Hurricane Ivan, 2004);
- Traditional agricultural crops such as bananas and sugar cane are grown on low lying plains making them susceptible to coastal flooding and wind damage;
- The denudation of hillsides and continued removal of vegetative cover can accelerate erosion due to rapid runoffs. This leads to increased sedimentation and turbidity in riverine and coastal areas which threaten marine resources;
- Vulnerability of beaches and critical coastal infrastructure (such as roads at Roselle, St. Thomas, and Palisadoes, Kingston) located on the coast placing them at risk to wave action and storm surges;
- Accumulation of solid waste in water channels due to indiscriminate disposal increased the potential for flooding in some areas;
- Saturated ground conditions resulting from rainfall in the weeks leading up to the Tropical Storm Gustav.

2. Impact of Tropical Storm Gustav

The lack of good quality data on environmental characteristics and conditions prior to the passage of Tropical Storm Gustav limited the analysis of environmental impacts. Hence, the assessment of environmental damage and loss was primarily qualitative.

The wind strength, direction and forward speed of the tropical storm; and the amount and intensity of rainfall associated with the event were major factors in determining the type of ecosystems impacted and the magnitude and location of the impacts. Flooding caused by heavy rainfall from Tropical Storm Gustav was the major source of impact. Both terrestrial and marine environments were impacted. Some specific areas of damage included: erosion of beaches and river banks; landslides; vegetation damage, damage to coastal infrastructure and sedimentation of aquatic ecosystems.

The environmental impact of the tropical storm was categorized broadly to included direct Damage and Loss. The assessment was based on field visits undertaken by NEPA, PIOJ, and the

Fisheries Division, Ministry of Agriculture. NEPA also carried out a rapid ecological assessment (REA) to ascertain the likely impact of the storm on the game bird population.

Direct Damage

a) Ecosystem and Habitat Damage

Coastal and Marine Ecosystems.

Seagrass beds and coral reefs not only act as coastal buffers but they provide coastal stability and habitat and nursery for many fish species and other marine organisms. The major impact by the storm on seagrass and coral reefs were sedimentation and deposition of solid and other types of wastes and debris in the coastal waters. Sedimentation increases turbidity and therefore decreases the amount of sunlight on which seagrass and coral reefs depend resulting in death or stunted growth. This could impact negatively on fish catches. Additionally, excessive nutrient pollution from land through increased runoff can affect coral reefs leading to excessive growth of algae which stifles reef growth. The impact of the storm on the offshore cays was not assessed.

A considerable quantity of debris such as solid waste, silt and wood were deposited on beaches. For example, the beach along the Palisadoes was heavily littered by debris brought down by the Hope River in St. Andrew and washed ashore by waves (Figure 5.1). Solid waste and other debris may also reduce penetration of sunlight or smother marine organisms within coastal waters. Deposition of debris also adds to the clean up cost of beaches. Unlike the extensive impact observed after Hurricane Dean in 2007, damage caused by the storm to mangrove forests was negligible across the island.

Figure 5.1: Debris deposited on the beach along the Palisadoes



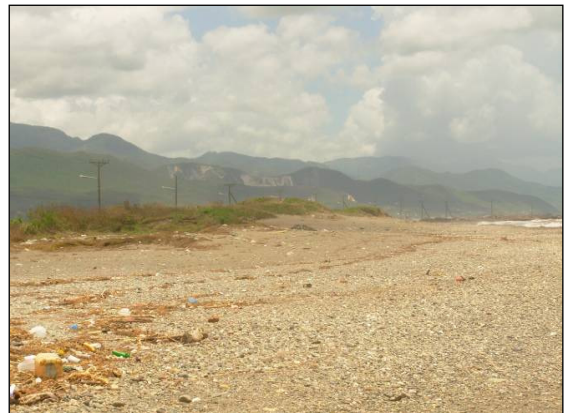
In addition, the following observations were made along the Palisadoes:

- the stone-wall shoreline defence being constructed by the NWA did not appear to have been impacted by the waves (Figure 5.2).
- the dunes covered by pioneer species such as Beach Morning Glory (*Ipomoea pes-caprae*) and other coastal vegetation, for example Seaside Mahoe (*Thespesia populnea*), (*Acacia sp.*, and *Gomphrena sp.*), showed no evidence of being impacted by the storm.(Figure 5.3)

Figure 5.2: NWA constructed groyne on seaward side



Figure 5.3: Dune covered with vegetation



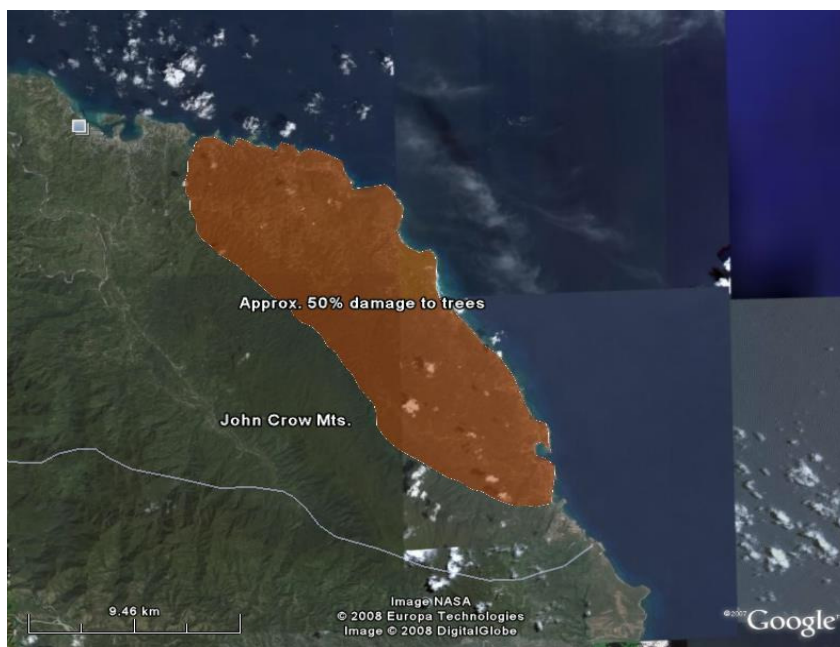
Terrestrial Ecosystems

The main impact on marshlands such as the Black River and Negril Morass were elevated water levels caused by the intense rainfall. This could affect wildlife such as roosting and nesting birds through entrapment or drowning. Inland forests across the island experienced moderate, little or no damage, probably due to the characteristics of the storm, lower wind speed and mostly rainfall. However, the greatest impact was observed in Portland and St. Thomas where there was incidence of broken branches. For instance, approximately 50 per cent of the trees of the secondary forests near Boston Bay, Portland showed signs of broken branches (Figure). Mangrove forests across the island were not significantly impacted by Tropical Storm Gustav.

Habitat Loss.

There was moderate to little terrestrial habitat loss due to the storm. The major threat would have been to riverine and coastal habitats due to sedimentation, pollution and erosion. The possible impacts of sedimentation were mentioned earlier while beach or river bank erosion can destroy the habitat for organisms living in these areas. This may make them more vulnerable, especially to predators. Furthermore, accretion or deposition of sand may smother some species or alter their habitat making it inhospitable.

Figure 5.4: Eastern Portland, area most affected by Tropical Storm Gustav



Source: Google Earth (modified)

b) Coastal Erosion

Except for the eastern end (Portland and St. Thomas) storm surge did not significantly impact the island. In Manchioneal, Portland there was evidence of storm surge approximately 15-20m inland from the coastline at Manchioneal Fishing Beach. Sand deposition approximately 10 m inland was observed. Additionally, several fishing sheds along the fishing beach were destroyed. This was one of the areas that were severely affected by storm surge from Hurricane Dean in 2007. Unlike what happened last year to the Palisadoes, during Hurricane Dean, there was no evidence that waves traversed from the seaward side to the harbour side. However, in two areas along the main road, there was accumulation of sand which had apparently blown onto the road from the seaward side (Figure 5.5).

Figure 5.5: Sand on a section of the Palisadoes main road (going to Port Royal)



Beach erosion caused by the storm appeared to have been minimal throughout the island. Most of the impact was again mainly confined to the eastern portions of the country. Assessment of five sites in Long Bay Portland by NEPA, revealed that there was accretion of sand in all but one of these areas following the passage of Tropical Storm Gustav (Figure 5.6).

Figure 5.6: Erosion Assessment Sites in Long Bay Portland.



c) Flooding

Flooding was a major impact of the storm and several areas experienced flooding along the coast, especially in Portland, St. Thomas, Kingston & St. Andrew, St. Catherine and Clarendon. Flooding was evident at the entrance to the Norman Manley International Airport (Figure 5.7). Many residents situated near to the banks of rivers and gullies suffered major flooding resulting in significant destruction of houses and other personal property.

Figure 5.7: Flooding along the entry road to the Airport



The Bannister (Big Pond) community in St. Catherine experienced extensive flooding resulting in the main road from Old Harbour to Red Ground becoming impassable for several days. The section of the roadway that was flooded is located in a depression mid-way between two elevated areas. There is a pond about 2.5 km westward of the main road which serves as a natural retention area for water that comes from the hilly surrounding areas. There were no earth drains or culverts to allow for the drainage of water from the roadway to the pond. Run-off was significantly impeded by the embankment and developments along the roadway as well as the lack of maintenance of shrubbery along the road. The western side of the roadway was being used to store scrap metal which impeded the free flow of water. Flooding was also observed in the Nightingale Grove and Old Harbour Bay communities. However, in Old Harbour Bay, Rocky Point and Portland Cottage wind damage was negligible. Some of the other impacts included wind damage to houses mainly in the eastern end of the island.

Solid Waste

A considerable quantity of debris was generated by Tropical Storm Gustav. The debris produced consisted mainly of household articles, white goods, tree limbs, leaves and silt deposits. The National Solid Waste Management Authority (NSWMA) is the agency responsible for the removal of debris from public places and households after a storm or any other related event. The private sector is usually responsible for removal of its own debris. The cost for this clean up is estimated at \$13.23 million (Table 5.1). The clean up cost for the private sector was not ascertained.

Table 5.1: Summary of clean up and debris removal costs following Tropical Storm Gustav as at September 16, 2008 (\$M)

Agency Region	Relief Operations		J\$ (million)
	Trips	hrs (front end loader)	
MPM WM Ltd.	833	80	3.49
WPM WM Ltd.	155	80	1.05
NEPM WM Ltd.	264	140	4.97
SPM WM Ltd.			3.72
Subtotal			13.23

Source: NSWMA

Indirect Loss

The reduction or loss of the protective effect of coastal ecosystems such as coral reefs, and seagrass can lead to significant erosion of coastline threatening coastal infrastructure and livelihoods. The loss of these ecosystems will also affect marine fish production and disrupt the livelihoods of fishers and other individuals and businesses that directly or indirectly benefit from fishing since these areas act as habitat and nursery areas for fish and other marine organisms. Although fish abundance may increase shortly after a storm, this is short-lived because the coastal and marine ecosystems have been damaged which may eventually lead to migration (fish look for better locations) or death of fish.

Other sectors such as tourism could be potentially impacted from changes in beach morphology, beach erosion and loss of beach due to loss of coral reefs and the sand binding property of seagrass beds. The high turbidity of coastal waters and debris on beaches affect tourism by reducing aesthetic appeal. Runoff bearing diverse pollutants including sewage not only affects coastal ecosystems but also threatens the health of people living near the coast.

Changes in habitats resulting from natural hazards threaten the lives of organisms dependent on these habitats for survival. Wind damage to trees even if moderate can lead to loss of roosting, foraging and nesting areas for organisms.

Recommendations

Anthropogenic and natural factors continue to impact negatively on the country's natural environment, increasing vulnerability and reducing resilience. Some of the measures required to reduce vulnerability include:

1. Development of comprehensive and integrated watershed management plan
2. Prohibition of removal of natural coastal barriers such as sand dunes, especially in areas prone to flooding.
3. Development of community disaster preparedness and mitigation plans to empower communities to respond to natural hazards.
4. Assessment of the impact of storm events on coastal ecosystems with a view to designing rehabilitation strategies.
5. Preservation of natural drainage systems, maintenance of man-made drainage systems and construction of drainage in areas where necessary
6. Review, update and enforce setback standards.

VI. SUMMARY OF DAMAGE AND LOSSES AND MACROECONOMIC EFFECTS

Preliminary assessment the impact of Tropical Storm Gustav on Jamaica amounted to \$15,514.56 million. Of this total, \$14,507.92 million refers to damage while \$1,006.64 million refers to losses. (Table 6.1)

Table 6.1: Preliminary Costs of Damage and Losses caused by Tropical Storm Gustav

Sector and Sub-sector	\$million				
	Damage	Loss	Total	Private	Public
Total	14,507.92	1,006.64	15,514.56	2,842.58	12,671.98
Social	1,326.87	329.89	1,656.76	1,026.47	630.29
Housing*1	906.47	120.00	1,026.47	1,026.47	
Education and Culture	200.05		200.05		200.05
Health	213.94	209.89	423.83		423.83
Correctional Facilities	6.41		6.41		6.41
Productive	1,757.44	33.75	1,791.19	1,708.11	83.08
Domestic Crop	519.10		519.10	519.10	
Livestock	16.70		16.70	16.70	
Greenhouse/Protected Cultivation	19.70		19.70	19.70	
Agricultural Crops	1,063.50		1,063.50	1,063.50	
Fisheries	89.11		89.11	89.11	
Irrigation	49.33	1.75	51.08		51.08
Mining			0.00		0.00
Manufacturing			0.00		0.00
Relief Assistance (Agriculture)		32.00	32.00	0.00	32.00
Infrastructure	11,410.38	630.00	12,040.38	108.00	11,932.38
Electricity	108.00		108.00	108.00	
Water Supply and Sanitation	197.10	200.00	397.10		397.10
Transport/Roads and Bridges *2	7,500.00	30.00	7,530.00		7,530.00
Parish Council Roads	3,600.00	400.00	4,000.00		4,000.00
Telecommunications*3	5.28		5.28		5.28
Environment	13.23	0.00	13.23	0.00	13.23
Forestry					
Waste Management	13.23		13.23		13.23
Emergency Operations	0.00	13.00	13.00		13.00
Government Relief Assistance*4		1.50	1.50		1.50
ODPEM Recovery Activities		11.50	11.50		11.50

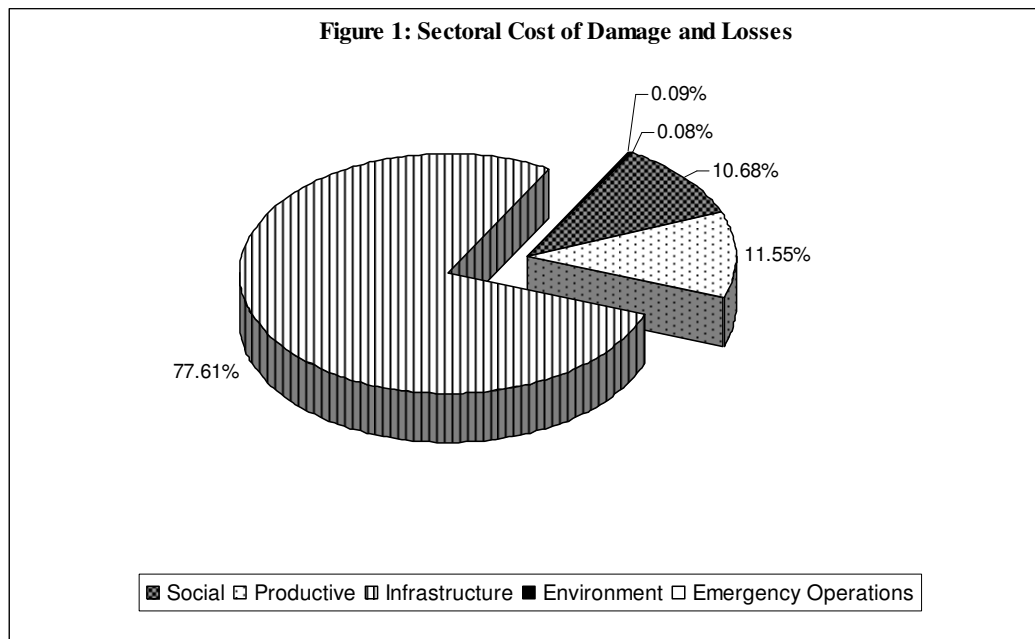
Source: Compiled by the PIOJ with data from various agencies

*1 Total amount be required for rehabilitation of damaged houses (MLSS)

*2 Includes \$15 million allocated for rental of equipment to assist in clearing critical farm roads

*3 Represents Damage to Post Offices only

*4 Allocated to assist in the burial of 10 persons confirmed dead



1. The Macro Economy

The Government's medium term economic targets for Fiscal Year 2008/09 included:

- A fiscal deficit of 4.5 per cent of GDP;
- Inflation of 10.0 per cent; and
- Real GDP growth of 3.0 per cent.

For Fiscal Year 2008/2009, the Central Government's budget targeted expenditure of \$489.5 billion, approximately 21.5 per cent above the revised estimates for FY2007/08. Central Government's recurrent and capital programmes was projected at \$349.2 billion. Debt Servicing accounted for \$263.9 billion or 54.0 per cent of planned expenditure.

Performance of the Economy Prior to Tropical Storm Gustav

Fiscal Accounts

Central Government activities for the first quarter of Fiscal Year 2008/09 generated a deficit of \$8 615.7 million, approximately \$4 138.9 million better than was programmed. Inflows from

Revenue & Grants were \$823.7 million higher than expected. Total expenditure at \$76 238.5 million was \$3 315.1 million lower than budgeted. Recurrent Expenditure and Capital Expenditure were \$1 970.4 million (2.8 per cent) and \$1 344.8 million (16.5 per cent) lower than planned, respectively.

Inflation

At the end of the first quarter of FY 2008/09 (April– June, 2008), the inflation rate was 6.0 per cent. The inflation outturn realized for the three-month period was largely a consequence of: (i) movements in the international prices of commodities which heavily influenced domestic food and energy prices; and (ii) administrative price adjustments, specifically increases in rural and some urban areas. Based on the first quarter performance, it was projected that inflation for the fiscal year would approximate 15.0 per cent.

The initial inflation projection for FY2008/09 has since been revised to 16.0 per cent – 17.0 per cent. This revision was necessary *not because* of the effects of the passage of Tropical Storm Gustav, but occurred based on ongoing international economic developments. Such developments included the continued sharp increases in prices of oil and grains. The effects of Gustav are expected to be limited to shortage of a few starchy food items, in particular bananas and plantains.

Balance of Payments & External Trade

During January–April 2008, the Current Account balance widened by US\$392.8 million to reach a deficit of US\$1 148.9 million compared with the corresponding period of 2007. The larger deficit on the Current Account was due mainly to deterioration in net earnings from the Goods and Income sub-accounts as well as contraction in surpluses on the services balance by US\$405.9 million, US\$23.8 million, and US\$22.7 million respectively.

During the four-month period, the value of total goods exported grew by US\$78.7 million or 10.4 per cent to US\$835.3 million. This level of exports reflected increased earnings from Non-Traditional (up US\$34.3 million or 15.4 per cent) and Traditional Exports (up US\$34.6 million or 6.7 per cent). The value of merchandise imports increased during January - April to US\$2 531.4 million from US\$1 975.0 million during the corresponding period of 2007.

Exchange Rate

At the end of June 2008, the monthly average nominal exchange rate was \$71.70 per US\$1.00 from \$68.42 per US\$1.00 and \$71.23 per US\$1.00 at the end of June 2007 and end of March 2008, respectively. This reflected nominal depreciations of 4.8 per cent per cent and 0.7 per cent, respectively. There was a real exchange rate appreciation of 2.7 per cent during April – June 2008.

At the end of June 2008, the stock of Net International Reserves (NIR) was US\$2 228.80 million, enough to cover approximately 13.61 weeks of goods and services imports.

Gross Domestic Product

For the first six months of 2008, real GDP was estimated to be flat compared with January - June 2007 (Table 6.2). The Services sector grew by an estimated 0.8 per cent, representing increased output levels for all components except Electricity & Water and Transport, Storage & Communication. The main areas of growth in the Services sector were Miscellaneous Services (4.4 per cent) and Finance & Insurance (1.3 per cent). The Goods-producing sector declined by 1.5 per cent for January - June 2008 due largely to the downturn recorded by Agriculture, Forestry & Fishing (9.9 per cent), Mining & Quarrying (2.3 per cent) and Manufacturing (0.5 per cent). The Construction & Installation sub-sector recorded growth of 2.8 per cent during the period.

Table 6.2: Year on Year Change In Gross Domestic Product in Producers' Values,
At Constant 1996 Prices (Per Cent)

	Jan-Mar	Apr -Jun	Jan-Jun
	2008	2008	2008
	<i>Estimates</i>		
GOODS PRODUCING SECTORS	-2.1	-0.9	-1.5
Agriculture, Forestry & Fishing	-12.6	-6.8	-9.9
Mining & Quarrying	-3.2	-1.5	-2.3
Manufacturing	-0.2	-0.8	-0.5
<i>of which: Food, Beverages & Tobacco</i>	-1.6	-1.0	-1.3
<i>Other Manufacturing</i>	1.5	-0.6	0.5
Construction & Installation	2.5	3.0	2.8
SERVICES SECTORS	1.4	0.2	0.8
Electricity & Water	-1.3	-1.9	-1.6
Transport, Storage & Communication	-1.2	-2.3	-1.7
Distributive Trade	0.9	0.8	0.8
Finance & Insurance Services	1.4	1.2	1.3
Real Estate & Business Services	3.0	2.5	2.7
Producers of Government Services	0.6	0.5	0.6
Miscellaneous Services (incl. Household & Private Non-Profit Institutions)	7.4	1.5	4.4
of which: Hotels, Restaurants & Clubs	8.8	1.3	5.0
Less Imputed Bank Service Charge	0.8	0.9	0.8
TOTAL GDP AT CONSTANT PRICES	0.2	-0.2	0.0

Source: Statistical Institute of Jamaica and Planning Institute of Jamaica

Given the performance of the economy to the end of June, and prior to Tropical Storm Gustav, it was anticipated that the economy would grow by between 1.2 per cent and 2.1 per cent during the Fiscal Year 2008/09 if there was no major shock to the economy. This projection was made with the awareness that there were clearly identifiable risks that warrant very close monitoring. One major risk was that of weather related events (hurricane, extensive flooding or a prolonged drought). Other risk factors included:

1. A slowing in the US economy;
2. An increase in non-oil commodity (import) prices;
3. Higher domestic interest rates; and

4. Global oil prices ranging between US\$95 and US\$125 per barrel;

Within the context of Tropical Storm Gustav and reported damage to some sectors, particularly agriculture and infrastructure (electricity, water, roads), the growth projections were revised. The economy was now anticipated to expand between 0.7 per cent and 1.5 per cent. Within the Goods producing sectors, all sectoral growth prospects were revised downwards with the exception of the Construction & Installation sector. A higher than anticipated growth rate in the Construction & Installation sector was predicated on reconstruction activity, primarily of roads and bridges. The best case scenarios for pre and post Gustav are presented in Table 6.3 and were predicated on contributions from each sector as presented below.

Table 6.3: Projections for Year on Year Change in Gross Domestic Product
In Producers' Values, At Constant 1996 Prices (Per Cent)

	FY 2008/09 Pre Gustav	FY 2008/09 Post Gustav
GOODS PRODUCING SECTORS	2.3 - 3.3	1.7 - 2.7
Agriculture, Forestry & Fishing	2.5 - 3.5	1.0 - 2.1
Mining & Quarrying	6.8 - 8.0	4.5 - 5.5
Manufacturing	0.1 - 0.9	-0.6 - 0.3
<i>of which: Food, Beverages & Tobacco</i>	0.0 - 0.6	-0.5 - 0.2
<i>Other Manufacturing</i>	0.2 - 1.2	-0.7 - 0.4
Construction & Installation	2.5 - 3.5	3.4 - 4.4
SERVICES SECTORS	0.7 - 1.5	0.3 - 1.0
Electricity & Water	1.0 - 2.0	0.7 - 1.3
Transport, Storage & Communication	-1.0 - -0.1	-1.5 - -0.7
Distributive Trade	1.0 - 1.8	0.6 - 1.3
Finance & Insurance Services	1.0 - 2.0	1.2 - 1.7
Real Estate & Business Services	2.4 - 2.9	2.0 - 2.5
Producers of Government Services	0.2 - 0.8	0.3 - 0.7
Miscellaneous Services (incl. Household & Private Non-Profit Institutions)	1.5 - 2.4	0.5 - 1.4
<i>of which: Hotels, Restaurants & Clubs</i>	1.4 - 2.2	0.5 - 1.5
Less Imputed Bank Service Charge	1.5 - 1.8	1.3 - 1.6
TOTAL GDP AT CONSTANT PRICES	1.2 - 2.1	0.7 - 1.5

Source: PIOJ and STATIN

APPENDIX

Appendix 1: Comparison of Gustav's Cumulative Point Rainfall (August 27-29, 2008) with Climatological Means.

Rainfall Data (mm) for Tropical Storm Gustav August 27-29, 2008								
Station	Parish	27th	28th	29th	max	Total	30 Year Mean	% Of Mean
Mavis Bank	KSA	18.0	419.0	97.6	419.0	534.6	108.0	495.0
Norbrook	"	7.0	126.5	73.6	126.5	207.1	N/A	
Constant Spring	"	0.0	10.0	155.0	155.0	165.0	182.0	90.7
Lawrence Tavern	"	40.0	290.0	199.0	290.0	529.0	228.0	232.0
Norman Manley Int'l Airport	"	8.6	264.9	64.5	264.9	338.0	81.0	417.3
Langley	"	62.3	239.1	236.2	239.1	537.6	121.0	444.3
Stony Hill	"	39.7	256.9	149.3	256.9	445.9	197.0	226.3
Quickstep	Trelawny		130.8	124.4	130.8	255.2	287.0	88.9
Gayles Valley	"		375.4	100.0	375.4	475.4	138.0	344.5
Hampden	"		250.6	32.2	250.6	282.8	108.0	261.9
Hampshire	"	6.8	72.4	84.5	84.5	163.7	91.0	179.9
Warsop	"	3.0	170		170.0	173.0	255.0	67.8
Holland	St. Elizabeth		119.7	146.0	146.0	265.7	228.0	116.5
Casa Marantha	"		95.0	140.0	140.0	235.0	N/A	
Burnt Savannah	"		88.9	76.2	88.9	165.1	147.0	112.3
Appleton	"		114.2	157.2	157.2	271.4	307.0	88.4
Ft. Charles	"		158.7		158.7	158.7	84.0	188.9
Pepper	"	36.4	71.4	148.0	148.0	255.8	N/A	
Mountainside	"		100.8	200.2	200.2	301.0	133.0	226.3
Accompong	"		241.5		241.5	241.5	478.0	50.5
Raheen	"		76.5	131.5	131.5	208.0	261.0	79.7
Sangster Int'l Airport	St. James	Tr	153.0		153.0	153.0	95.0	161.1
Green Pond	"	0.8	55.4	89.0	89.0	145.2		
Montpelier	"		160.0	36.2	160.0	196.2	248.0	79.1
Kempshot	"	9.5	118.5	90.8	118.5	218.8	213.0	102.7
Mt.Horeb	"		70.3	210.1	210.1	280.4	254.0	110.4
Duckenfield	St.Thomas	74.3	320.7	10.3	320.7	405.3	178.0	227.7
Hordley Estate	"	50.0	160.0	40.0	160.0	250.0	N/A	
Bowden	"		78.5	225.8	225.8	304.3	487.0	62.5
Spanish Wood	"	51.5	250.5	11.6	250.5	313.6	158.0	198.5
Serge Island	"		110.0	122.0	122.0	232.0	204.0	113.7
Norris	"		284.5		284.5	284.5	N/A	
Ramble	"	28.9	298.4	42.3	298.4	369.6	246.0	150.2

Rainfall Data (mm) for Tropical Storm Gustav August 27-29, 2008 (cont'd)

Richmond (NWA)	St. Mary	26.2	125.3	184.8	184.8	336.3	100.0	336.3
Boscobel	"		177.8	76.2	177.8	254.0	99.0	256.6
Castleton Gardens	"		234.3	162.4	234.3	396.7	216.0	183.7
Long Road	"	31.4	176.8	52.8	176.8	261.0	N/A	
Orange River	"	30.0	167.6	286.6	286.6	484.2	111.0	436.2
Brimmer Hall	"		410.9		410.9	410.9	N/A	
Hampstead	"		392.5		392.5	392.5	100.0	392.5
Marshalls Pen (Alcan)	Manchester		230.2	200.3	230.2	430.5	N/A	
Windalco (J J Gagnon)	"		450.5	284.4	450.5	734.9	N/A	
Marshalls Pen (Sutton)	"		293.4	301.5	301.5	594.9	184	323.3
Craighead	"		166.0	250.6	250.6	416.6	247	168.7
Hermitage	"	42.5	37.4	74.8	74.8	154.7	157	98.5
Ingleside (Mandeville)	"		301.5		301.5	301.5	N/A	
Knockpatrick	"	6.5	260.1	80.6	260.1	347.2	160	217.0
Evergreen	"		61.2	53.3	61.2	114.5	175	65.4
Non-Pariel	Westmoreland		17.0	198.0	198.0	215.0	198.0	108.6
Little London	"		130.6	75.4	130.6	206.0	194.0	106.2
Darliston	"		33.7	294.3	294.3	328.0	402.0	81.6
Seaford Town	"		24.6	318.8	318.8	343.4	302.0	113.7
Retreat	"		306.0		306.0	306.0	243.0	125.9
Negril Point	"		123.7	71.9	123.7	195.6	175.0	111.8
Savanna-La -Mar	"	1.9	35.3	292.7	292.7	329.9	178.0	185.3
Kendal	Hanover		80.0		80.0	80.0	329.0	24.3
Lucea	"		14.0	100.5	100.5	114.5	157.0	72.9
Askenish	"		127.7	206.0	206.0	333.7	373.0	89.5
Shettlewood	"		102.0		102.0	102.0	312.0	32.7
Cacoon Castle	"		65.9	109.7	109.7	175.6	234.0	75.0
Mt. Peto	"	3.1	56.0	139.6	139.6	198.7	360.0	55.2
Jericho	"				0.0	0.0	N/A	
Mammee Ridge	St. Ann	4.2	164.3	130.6	164.3	299.1	114.0	262.4
Brown's Town	"	19.1	31.8	101.6	101.6	152.5	92.0	165.8
Tivey Penny	"	6.0	170.0	180.0	180.0	356.0	N/A	
Discovery Bay	"		8.4	56.6	56.6	65.0	64.0	101.6
Faith's Pen	"	21.0	58.0	246.0	246.0	325.0	N/A	
Moneague	"	130.0	172.0	42.3	172.0	344.3	121.0	284.5
Colegate	"	47.6	197.2	64.7	197.2	309.5	N/A	
Cave Valley	"		86.5	57.8	86.5	144.3	163.0	88.5

Rainfall Data (mm) for Tropical Storm Gustav August 27-29, 2008 (cont'd)

Comfort Castle	Portland	19.4	302.7	57.8	302.7	379.9	N/A	
Moore Town	"		157.4	262.3	262.3	419.7	382.0	109.9
Passley Gardens	"	24.2	104.6	6.8	104.6	135.6	238.0	57.0
Bybrook	"	39.6	183.4	36.6	183.4	259.6	123.0	211.1
Shirley Castle	"	60.0	238.0	30.0	238.0	328.0	212.0	154.7
Fruitfulvale	"			277.9	277.9	277.9	211.0	131.7
Sherwood Forest	"		359.4		359.4	359.4	N/A	
Worthy Park Estate	St. Catherine	15.0	225.0	115.0	225.0	355.0	152.0	233.6
Swansea	"	21.0	285.0	105.0	285.0	411.0	134.0	306.7
Charm Hole	"	24.5	280.0	104.0	280.0	408.5	151.0	270.5
Corn Ground	"	25.0	269.5	97.5	269.5	392.0	211.0	185.8
Caymanas (north)	"		268.8	179.2	268.8	448.0	119.0	376.5
Bodles (Agromet)	"	16.5	40.1	121.2	121.2	177.8	97.0	183.3
Bybrook	"	12.0	150.0	243.0	243.0	405.0	187.0	216.6
Damhead	"	8.4	166.6	232.0	232.0	407.0	N/A	
New Works	"	17.5	150.0	243.0	243.0	410.5	188.0	218.4
New Hall	"	20.0	152.0	242.0	242.0	414.0	186.0	222.6
Palmers Hut	"	150.0	243.0	7.0	243.0	400.0	N/A	
Mocho	Clarendon	6.2	135.1	152.2	152.2	293.5	191.0	153.7
Frankfield	"		178.8		178.8	178.8	191.0	93.6
New Yarmouth	"		3.0	85.0	85.0	88.0	77.0	114.3
Caswell Hill	"		11.0	120.0	120.0	131.0	114.0	114.9
Beckford Kraal	"		214.0	84.1	214.0	298.1	165.0	180.7
Quarry	"			125.0	125.0	125.0	N/A	
Fisher	"			95.0	95.0	95.0	N/A	
Sheckles	"		12.0	110.0	110.0	122.0	168.0	72.6
Rowington	"		8.0	85.0	85.0	93.0	N/A	
Vernamfield	"		6.0	112	112.0	118.0	69.0	171.0

Source: The Meteorological Service

** Note: 1 inch is approximately 25.4 mm. N/A mean data not available for that station.

Appendix 2 - List of Communities Reportedly affected by Tropical Storm Gustav

Hazard	Community	Comments	Parish
Flooding	Vineyard Town	McGregor Gully off Langston Road	KSA
Flooding	Bull Bay	Nine Miles	KSA
Landslide	Johnson Mountain	1 house destroyed	St. Thomas
Landslide	Spring Bank	3 houses destroyed and roadway collapsed	St. Thomas
Storm Surge	Manchioneal		Portland
Storm Surge	Long Bay		Portland
Wind	Happy Grove	2 houses reported roof damage	Portland
Flooding	Havendale	East Great House Circle,	KSA
Flooding	Barbican	Barbican Lane	KSA
Flooding	Molynes Gardens	Valentine Gardens	KSA
Flooding	Mammee River		KSA
Flooding	Kintyre		KSA
Flooding	August Town		KSA
Flooding	Tavern		KSA
Flooding	Gordon Town	Houses being flooding across from the police station	KSA
Flooding	New Haven		KSA
Flooding	Red Light		KSA
Flooding	Wickie Wackie		KSA
Flooding	Caribbean Terrace		KSA
Flooding	Duhaney Park		KSA
Landslide	Maryland		KSA
Flooding	Big Pond		St. Catherine
Flooding	Dublin Castle		KSA
Flooding	Cave Valley		St. Ann
Landslide	Kingweston		St. Mary
Flooding	Port Maria	Pagee	St. Mary
Flooding	Moneague		St. Ann
Flooding	Tawes Pen		St. Catherine
Flooding	Cromarty		St. Catherine
Flooding	Nightengale Grove	Serenity Park	St. Catherine
Flooding	Ensom City		St. Catherine
Flooding	Eltham Villas		St. Catherine
Flooding	Waterloo		St. Catherine
Flooding	Frazers Content		St. Catherine
Flooding	Inswood Village		St. Catherine
Flooding	Job Lane		St. Catherine
Flooding	Fairfield Road		St. Catherine
Flooding	St Johns Road		St. Catherine
Flooding	Featherbed Lane		St. Catherine
Flooding	Thompson Pen		St. Catherine
Flooding	Windsor Road		St. Catherine
Flooding	Bog Walk		St. Catherine

Hazard	Community	Comments	Parish
Flooding	Dunbeholding		St. Catherine
Landslide	Ginger Ridge		St. Catherine
Landslide	Watermount		St. Catherine
Landslide	Point Hill		St. Catherine
Landslide	Bellas Gate		St. Catherine
Landslide	Glengoffe		St. Catherine
Landslide	Above Rocks		St. Catherine
Landslide	Spaldings		Clarendon
Flooding	Portland Cottage		Clarendon
Flooding	Rocky Point		Clarendon
Flooding	Chapelton		Clarendon
Flooding	Trout Hall		Clarendon
Flooding	Baileys Vale		Clarendon
Flooding	Annotto Bay		St. Mary
Flooding	Broadgate		St. Mary
Flooding	Red Ground		St. Catherine
Landslide	Unity		KSA
Flooding	Windsor Heights		St. Ann
Wind	Fort George		St. Ann
Wind	Beechamville		St. Ann
Wind	Cascade		St. Ann
Flooding	Wood Park		St. Mary
Wind	Priory		St. Ann
Flooding	Four Paths	Clarendon Park	Clarendon
Flooding	Windsor Castle		Portland
Flooding	Wheelerfield		St. Thomas
Flooding	Hordley		St. Thomas
Flooding	Waterford	Mystic Way, Dohiti Way, Timbrell Way	St. Catherine
Flooding	Gregory Park	Dover Avenue	St. Catherine
Flooding	Middle Quarters		St. Elizabeth
Flooding	McNeil Land		Westmoreland
Flooding	Petersfield	Carawina	Westmoreland
Flooding	Little London		Westmoreland
Flooding	Kew		Hanover

Appendix 3



Relief and Recovery : Sector Needs / Donor Pledges

Date: September 17,
2008

Organization / contact name and #	Sector	Estimated cost of Damage (J\$)	Prioritized needs	Cost / description of need	Value of pledge	Gap	Receiver / Implementing Agency	Additional comments
CIDA	RECOVERY	J\$12B	Infrastructure		C\$200,000		NWA	
DFID								
FAO								
Gov of Brazil	RECOVERY		Bedding, Roofing, Houses		US\$50,000		ODPEM	Received
Government of Jamaica								
Government of Spain	Immediate Relief		Temporary Roofing, Hygiene, Water supply, Emergency Shelter Needs		US \$50,000		ODPEM	Received
Government of Venezuela								
IDB								

OXFAM								
PAHO	Health		Vector Control and Repair to Hospital Plant				MOH	Technical Assistance Pledged
Scotia Bank								
UNAID								
UNDP								
UNESCO								
UNFPA	Health and Social Ammenities		Hygiene Kits		US\$		RED CROSS	Received
UNICEF	Children, Health, Education		Tarpaulins, Water Bottles, Purification tablets		US\$ 15,000		ODPEM, MOH	Received
USAID/ OFDA	Emergency Relief Needs		Tarpaulins, Water Bottles, Hygiene Kits, Blankets, Other Supplies and Transportation Costs		US\$300,000		ODPEM	Received
Jamaica Biscuit Company	Emergency Relief Needs		Food		US\$		ODPEM	Received
Pepsi	Emergency Relief Needs		Water		US\$505,000		ODPEM	Received
DHL	Logistics Support							Vehicles and Manpower to deliver relief supplies to affected areas
CHINA	Emergency Relief Needs		Food, Tarpaulin, Hygiene		J\$50,000		RED CROSS	Received

Supreme Ventures	Emergency Relief Needs		Tarpaulin, Blankets etc.		J\$4,000,000			
PADF/CHEVRON	Emergency Relief Needs		Matresses and Sheets		US\$20,000		ODPEM	
DIGICEL	Emergency Relief Needs		Food, Tarpaulin, Hygiene		J\$2,000,000		ODPEM	Received
DIGICEL	RECOVERY	J\$15B	Roofing, Rehousing, Education, Infrastructure Repair, Agriculture		J\$16,000,000		ODPEM/GOJ	
Supreme Ventures	RECOVERY	J\$15B	Roofing, Rehousing, Education, Infrastructure Repair, Agriculture		J\$6,000,000		ODPEM/GOJ	Received
RBTT Bank	RECOVERY	J\$15B	Roofing, Rehousing, Education, Infrastructure Repair, Agriculture		J\$1,000,000		ODPEM/GOJ	Received
NCB	RECOVERY	J\$15B	Roofing, Rehousing, Education, Infrastructure Repair, Agriculture		J\$6,000,000		ODPEM/GOJ	
Government of Trinidad	RECOVERY	J\$15B	Roofing, Rehousing, Education, Infrastructure Repair, Agriculture		US\$1,600,000		ODPEM/GOJ	Received
Government of Columbia	RECOVERY	J\$15B	Roofing, Rehousing, Education, Infrastructure Repair, Agriculture		US\$		ODPEM/GOJ	
Government of China	RECOVERY	J\$15B	Roofing, Rehousing, Education, Infrastructure Repair, Agriculture		US\$100,000.00		ODPEM/GOJ	Received
Latin American and Caribbean Women's Association	RECOVERY	J\$15B	Roofing, Rehousing, Education, Infrastructure Repair, Agriculture		¥ 250,000.00		ODPEM/GOJ	

Japanese Red Cross	RECOVERY	J\$15B	Roofing, Rehousing, Education, Infrastructure Repair, Agriculture		US \$ 53,400.00		Jamaica Red Cross	
White Oak Hills Baptist Church, Georgia	RECOVERY	J\$15B	Roofing, Rehousing, Education, Infrastructure Repair, Agriculture		US \$700.00		ODPEM/GOJ	Received
Caribbean Women's Association of Tokyo	RECOVERY	J\$15B	Roofing, Rehousing, Education, Infrastructure Repair, Agriculture		US \$2,324.94		ODPEM/GOJ	
National Coouncil for Indian Culture in Jamaica	RECOVERY	J\$ 15B	Roofing, Rehousing, Education, Infrastructure Repair, Agriculture		J\$100,000.00		ODPEM/GOJ	Received
		Presently the account contains J\$ 7,168,000.00 . The US Account has US\$ 1.7 M. Several other pledges have been made but are yet to be reflected in the account.						