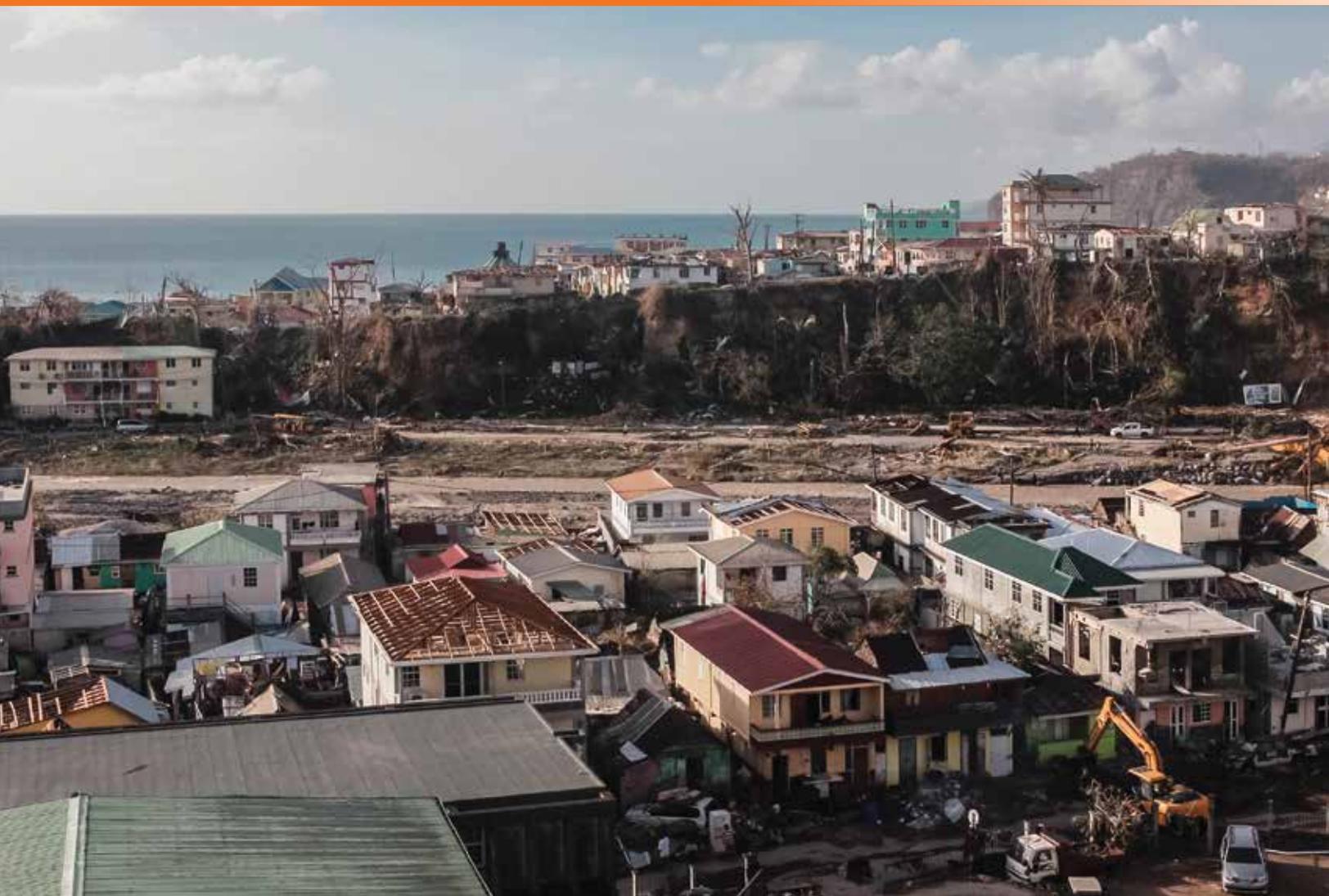




# Post-Disaster Needs Assessment Hurricane Maria September 18, 2017

A Report by the Government  
of the Commonwealth of Dominica





Based upon an assessment of impacts to each affected sector, the Post-Disaster Needs Assessment concluded that Hurricane Maria resulted in total damages of EC\$2.51 billion (US\$930.9 million) and losses of EC\$1.03 billion (US\$380.2 million), which amounts to 226 percent of 2016 gross domestic product (GDP).



# PDNA

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A Report by the Government  
of the Commonwealth of Dominica

November 15, 2017

With technical support from



**WORLD BANK GROUP**

With financial support from



**GFDRR**  
Global Facility for Disaster Reduction and Recovery

**ACP-EU Natural Disaster Risk Reduction Program**

An initiative of the African, Caribbean and Pacific Group, funded by the European Union and managed by GFDRR



## ACKNOWLEDGEMENTS

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## ACRONYMS/ABBREVIATIONS

<b>AID Bank</b>	Dominica Agricultural and Industrial and Development Bank
<b>AST</b>	Atlantic Standard Time
<b>BBB</b>	Build back better
<b>CARDI</b>	Caribbean Agricultural Research and Development Institute
<b>CBI</b>	Citizenship-by-Investment
<b>CCA</b>	Climate Change Adaptation
<b>CDB</b>	Caribbean Development Bank
<b>CDEMA</b>	Caribbean Disaster Emergency Management Agency
<b>CIMH</b>	Caribbean Institute of Meteorology and Hydrology
<b>COW</b>	Cell on wheels
<b>CPA</b>	Country Poverty Assessment
<b>CCRIF</b>	Caribbean Catastrophe Risk Insurance Facility
<b>DASPA</b>	Dominican Air and Seaports Authority
<b>DFID</b>	United Kingdom's Department for International Development
<b>DGDC</b>	Dominica Geothermal Development Company Limited
<b>DOMLEC</b>	Dominica Electricity Service Limited
<b>DOWASCO</b>	Dominica Water and Sewage Company Limited
<b>DRM</b>	Disaster risk management
<b>DRR</b>	Disaster risk reduction
<b>DSS</b>	Dominica Social Security
<b>DSWMC</b>	Dominica Solid Waste Management Cooperation
<b>ECCB</b>	Eastern Caribbean Central Bank
<b>ECD</b>	Early Childhood Development
<b>ECN</b>	Emergency Communications Network
<b>ECTEL</b>	Eastern Caribbean Telecommunications Authority
<b>EIA</b>	Environmental impact assessment
<b>EM</b>	Environmental Management
<b>EOC</b>	Emergency Operation Centre
<b>EU</b>	European Union
<b>EW</b>	Early warning
<b>FAO</b>	Food and Agriculture Organization
<b>FDI</b>	Foreign Direct Investment
<b>FY</b>	Fiscal year
<b>GBV</b>	Gender Based Violence
<b>GDP</b>	Gross Domestic Product
<b>GFDRR</b>	Global Facility for Disaster Reduction and Recovery
<b>GIS</b>	Geographic information system
<b>HIS</b>	Health Information System
<b>HoHs</b>	Head of household
<b>ICT</b>	Information and communications technology
<b>IFRC</b>	International Federation of Red Cross and Red Crescent Societies
<b>IICA</b>	Inter-American Institute for Cooperation on Agriculture
<b>IUCN</b>	International Union for Conservation of Nature
<b>km/h</b>	Kilometers per hour
<b>kV</b>	kiloVolt

<b>kWh</b>	kilowatt hour
<b>LGBTIQ</b>	Lesbian, Gay, Bisexual, Transgender, Intersex and Questioning
<b>MIS</b>	Management information system
<b>mm</b>	Millimeters
<b>MOAF</b>	Ministry of Agriculture and Fishery
<b>MoE</b>	Ministry of Education
<b>MOI</b>	Ministry of Information, Science, Telecommunications and Technology
<b>mph</b>	Miles per hour
<b>MSME</b>	Micro, small and medium enterprises
<b>MTP NP</b>	Morne Trois Pitons National Park
<b>MWs</b>	Megawatts
<b>NBD</b>	National Bank of Dominica
<b>NEOC</b>	National Emergency Operations Centre
<b>NEP</b>	National Employment Program
<b>NEPO</b>	National Emergency Planning Organization
<b>NNH</b>	New National Hospital
<b>NPL</b>	Non-performing loans
<b>NTRC</b>	National Telecommunications Regulatory Commission
<b>ODM</b>	Office of Disaster Management
<b>OECS</b>	Organization of Eastern Caribbean States
<b>OESS</b>	OECS Education Sector Strategy
<b>PA</b>	Public Advisory
<b>PAHO</b>	Pan American Health Organization
<b>PDNA</b>	Post-Disaster Needs Assessment
<b>QLI</b>	Quality of Life Index
<b>RRM</b>	Regional Response Mechanism
<b>SLC</b>	Survey of living conditions
<b>SP</b>	Social Protection
<b>T&amp;D</b>	Transmission and distribution
<b>TB</b>	Tuberculosis
<b>UN</b>	United Nations
<b>UN-OCHA</b>	United Nations Office for the Coordination of Humanitarian Affairs
<b>UNDP</b>	United Nations Development Program
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>UNICEF</b>	United Nations Children's Fund
<b>USAID</b>	United States Agency for International Development
<b>VSATs</b>	Very small aperture terminals
<b>WASH</b>	Water Sanitation and Hygiene
<b>WBG</b>	World Bank Group
<b>WFP</b>	World Food Programme
<b>WHO</b>	World Health Organization

EC\$ Eastern Caribbean Dollar

US\$ United States Dollar

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# Executive Summary

On September 18, 2017, Hurricane Maria hit Dominica with catastrophic effect. Hurricane Maria was one of the most rapidly intensifying storms in recent history, intensifying to a category 5 hurricane, roughly 24 hours after being upgraded from a tropical storm. As the hurricane passed over the center of the island, Dominica was exposed to extraordinary winds for more than three hours. This was accompanied by intense rainfall, which provoked flashfloods and landslides. The impacts of Hurricane Maria were severe for both the country's economy as well as the human development of its citizens. As of November 8, 2017, 30 persons had lost their lives as a result of Hurricane Maria (26 identified and 4 unidentified), and 34 were declared missing. A significant proportion of the labor force is unemployed as an immediate consequence of Maria, with estimates that the decline in the production of goods and services may continue for one to two years.

On October 9, 2017, the Government of the Commonwealth of Dominica presented an official request for a Post-Disaster Needs Assessment (PDNA), coordinated by the World Bank in conjunction with the UN, ECCB, the CDB, and the EU to assess the disaster impact to inform recovery and reconstruction needs. The main objective of the PDNA is to produce a reliable estimate of the disaster effects and impact of Hurricane Maria, and define a strategy for recovery. Specifically, the assessment aims to: (i) quantify damages and losses, including physical damages and socio-economic aspects; (ii) evaluate the overall impact of the disaster on the macro-economic and human development context of a country; and, (iii) identify recovery needs, priorities, and costs for a resilient recovery strategy.

The Post-Disaster Needs Assessment concluded that Hurricane Maria resulted in total damages of EC\$2.51 billion (US\$931 million) and losses of EC\$1.03 billion (US\$382 million), which amounts to 226 percent of 2016 gross domestic product (GDP). The identified recovery needs for reconstruction and resilience interventions, incorporating the principle of 'building back better' (BBB) where possible, amount to EC\$3.69 billion (US\$1.37 billion).

A summary of the damage, loss and needs by sector is detailed in Table 1. Disaster impacts are categorized into four groups: productive sectors, infrastructure, social sectors as well as cross-cutting themes.

**Table 1: Summary of damage and loss by sector (in millions (M))**

	DAMAGES (M)		LOSSES (M)		NEEDS (M)	
	US\$	EC\$	US\$	EC\$	US\$	EC\$
<b>PRODUCTIVE SECTOR</b>	<b>177.95</b>	<b>480.47</b>	<b>202.49</b>	<b>546.73</b>	<b>188.52</b>	<b>509.03</b>
Agriculture	55.27	149.23	124.37	335.80	88.46	238.83
Fisheries	2.41	6.52	0.50	1.35	2.54	6.87
Forestry <sup>1</sup>	29.72	80.24			14.87	40.15
Commerce and Micro Business	70.40	190.08	6.85	18.50	73.01	197.14
Tourism	20.15	54.40	70.77	191.08	26.19	70.72
<b>SOCIAL SECTOR</b>	<b>444</b>	<b>1199</b>	<b>42</b>	<b>112</b>	<b>638</b>	<b>1724</b>
Housing	353.96	955.70	28.50	76.94	519.75	1403.34
Education	73.98	199.74	3.21	8.66	94.20	254.33
Health	10.90	29.50	6.95	18.80	22.14	59.75
Culture	5.07	13.68	2.91	7.85	4.67	12.63
<b>INFRASTRUCTURE SECTOR</b>	<b>306</b>	<b>826</b>	<b>135</b>	<b>365</b>	<b>509</b>	<b>1375</b>
Transport	182.15	491.82	52.62	142.09	302.00	815.00
Electricity	33.18	89.59	32.94	88.94	80.68	217.84
Water and Sanitation	24.00	64.79	39.73	107.27	56.26	151.90
Telecommunication	47.74	128.88	8.31	22.43	47.84	129.17
Airports and Port	18.89	51.00	3.26	8.79	22.67	61.20
<b>CROSS-CUTTING</b>	<b>3</b>	<b>8</b>	<b>1</b>	<b>2</b>	<b>13</b>	<b>34</b>
Disaster Risk Management	3.00	8.11	0.80	2.17	10.22	27.60
Environment <sup>2</sup>					1.78	4.80
Gender <sup>3</sup>					0.79	2.12
<b>TOTAL</b>	<b>931</b>	<b>2513</b>	<b>380</b>	<b>1026</b>	<b>1368</b>	<b>3693</b>

1 Losses for Forestry were quantified under Tourism.

2 Losses and Damages for Environment were not quantified.

3 Losses and Damages for Gender were not quantified.



## Human and Social Impact

Hurricane Maria will have direct negative impacts on employment, livelihoods, and consequently, poverty in Dominica. A total of EC\$94.9 million in income and 3.1 million work days is estimated to be lost as a result of the disaster. Critical employment sectors such as agriculture and tourism will take up to 12 months to resume regular operations and therefore restoring livelihoods in these sectors will face significant time constraints. As a result, it is likely that there will be a 25 percent reduction in overall consumption, which will result in an increase in the poverty head count from 28.8 percent to 42.8 percent; while the number of indigent individuals will double from 2,253 to 4,731. Furthermore, almost 2,800 individuals considered vulnerable prior to Maria will fall below the poverty line. The Government of Dominica provides regular safety nets to poor and vulnerable populations and announced plans for programs to restore livelihoods, including a cash grant to subsistence farmers. Given the immense scale of the event however, current coverage of the regular safety net will need to be further expanded to help restore reduced consumption and lost income to pre-disaster levels. Approximately EC\$22.11 million (US\$8.19 million) is needed to finance a recovery for social

protection to address these poverty impacts, including temporary scale-up of cash safety nets, expanding cash-for-work, and increasing school feeding access. For increased resilience in the medium to long terms, measures to build household resilience; modernize service delivery, and ensure contingency financing for rapid scale up of the safety net system would be critical.

## Macroeconomic Impact

The economic impact scenario is based on the damages and losses of about US\$ 1.37 billion, which is approximately 226 percent of the 2016 GDP. It is estimated that output would decline sharply in the last quarter of 2017 and by as much as 16 percent in 2018, which in turn will reduce the tax base that could worsen the fiscal balance to deficits of near 3 and 13 percent of GDP in FY2017/18 and FY2018/19, respectively. The external current account balance could deteriorate sharply, to a deficit of 21 percent of GDP in 2018. Hurricane Maria has thus resulted in significant negative impacts on the overall performance of the economy, and hence a full economic recovery will require a large effort from Dominica and support from the international community.

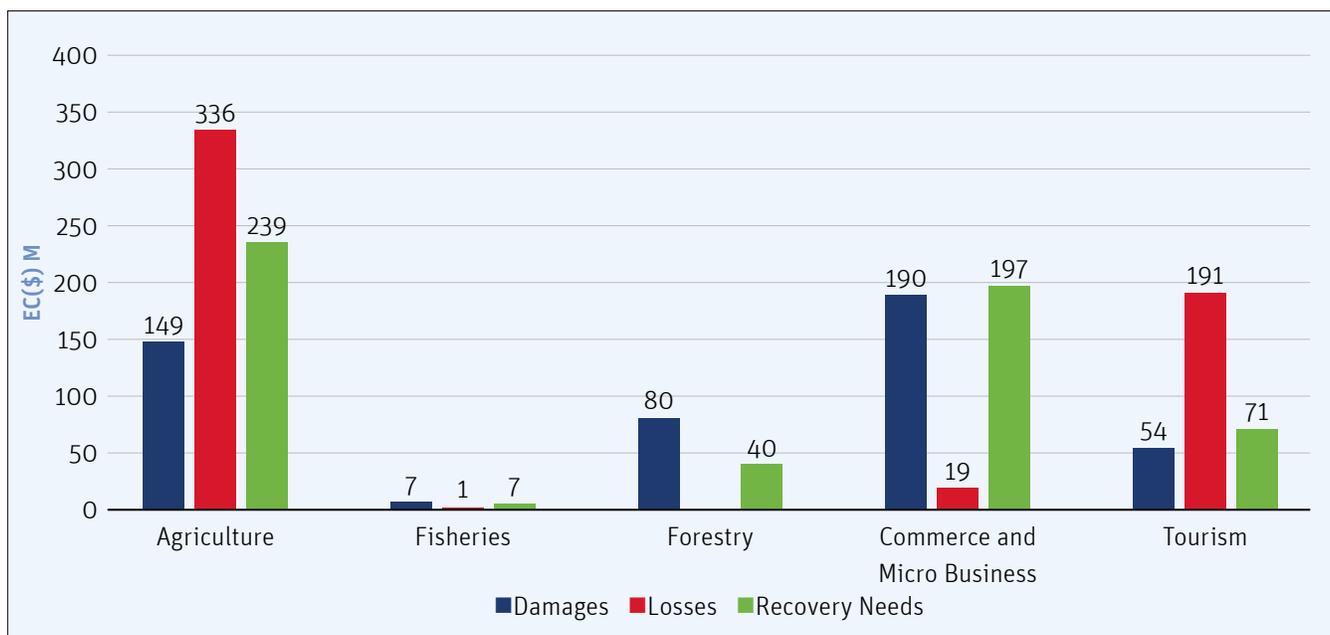
## Sector Summaries

The following sector summaries present a brief review of sector impacts and damage profile resulting from the passage of Hurricane Maria. Most damages were sustained in the housing sector (38 percent), followed by the transport

(20 percent) and education sector (7 percent). The greatest losses, as defined by changes in economic flows, were sustained in the agriculture sector (33 percent), followed by the tourism (19 percent) and transport sector (14 percent).

## PRODUCTIVE SECTOR

**Figure 1: Damage, Losses and Recovery Needs by Productive Subsectors (in EC(\$) M)**



### AGRICULTURE

**Damage and losses: EC\$ 485M (US\$ 179.6M)**

**Recovery Needs: EC\$ 238.83 (US\$ 88.46M)**

The agricultural sector in Dominica is largely composed of small family farms and subsistence production from small plots locally referred to as kitchen gardens. Exports are limited and much of the agricultural production serves the local markets. Subsistence farmers augment their income through local sale of limited excess production.

Damage and losses in the agriculture sector were extensive affecting all aspects of agricultural production including crops, infrastructure, equipment and croplands. Livestock damage includes 45 percent of cattle, 65 percent pigs and over 90 percent chickens with an estimated value of EC\$ 8.68M (US\$3.21M). Crop losses were similarly

high particularly with respect to basic foodstuffs such as root crops, vegetables, banana and plantain where crop destruction ranged from 80 to 100 percent. Tree crops, mango, avocado, citrus, bay and others. Total estimated damage and losses to crops is estimated at EC\$ 350.6M (US\$ 129.9M)

Much of the agricultural infrastructure and equipment was damaged or destroyed including buildings, animal husbandry facilities, agricultural roads and croplands. Sector recovery will depend heavily on the reconstruction of infrastructure in order to rehabilitate the sector and reestablish the farm to market transportation network. The ability of small farmers to recover will depend heavily on their access to funding resources as they rehabilitate their properties and re-establish their crop cycles. The estimated damage to infrastructure as a result of the storm is EC\$ 95.6M (US\$ 35.43M)

## FORESTRY

**Damage and losses: EC\$ 80.24M (US\$ 29.72M)**

**Recovery Needs: EC\$ 40.15M (US\$ 14.87M)**

Compared to other Caribbean islands, Dominica is rich in forest resources. Steep topography limits access and timber processing is largely for local consumption. Approximately 27 percent of Dominican forest is designated as protected by a network of two forest reserves, three national parks and a protected forest. Dominican forests support the only population of the endemic parrot *Amazona imperialis* (Imperial Parrot) which is recognized as critically endangered with an estimated population of 250-350. The national park Morne Trois Pitons has been declared a UNESCO world heritage site. These forest resources are an important component of the Dominican tourism economy.

Hurricane winds and intense rainfall produced widespread damage to the forest system. Much of the forest was stripped of leaves and damaged and downed trees were widespread throughout the island. Selected tree removal will be required to reopen trails and protect property and water resources. Slope stabilization may be required to protect downstream assets and infrastructure. As much of the forest is under protected status, eco-tourism is a major contributor to the island's economy. Damage and losses to timber stocks and wildlife habitat is estimated to be EC\$ 67.1M (US\$ 24.84M). This does not include activities related toward assessing and recovering the Imperial Parrot population.

Damage to forestry support facilities such as trails, nurseries, public contact facilities and other structures was significant. Much of the infrastructure supports public use of protected areas and is a major component of the tourism industry. Infrastructure damage and losses is estimated to be EC\$ 13.17M (US\$ 4.87).

## FISHERIES

**Damage and losses: EC\$ 14.39M (US\$ 5.32M)**

**Recovery Needs: EC\$ 6.87M (US\$ 2.54M)**

The fisheries sector has been severely damaged affecting the basic livelihoods of fishers and others dependent on the sector. This is a vulnerable population as fisheries activities are largely artisanal in nature and fisheries

exports are limited with much of the catch is sold for local consumption. This sector was recovering from significant damage and losses experienced in 2015 with the passage of Tropical Storm Erika.

In total 128 vessels are estimated to be damaged or destroyed. The total costs for repair and replacement of vessels and engines is estimated as EC\$ 4.52M (US\$ 1.68M). Other losses include fishing gear and vendor equipment estimated EC\$ 0.87M (US\$ 0.32M). Market vendors are mostly women and many have lost their basic tools such as cutting boards, coolers, knives, etc.

Infrastructural damages to the sector (both the government fisheries buildings as well as the fisheries cooperatives) are estimated to be EC\$ 1.14M (US\$ 0.42M). This includes damages to roofs, fuel pumps, ice-machine rooms, freezer storages and other supporting infrastructure.

## COMMERCE/MICRO-BUSINESS

**Damage and losses: EC\$ 208.4M (US\$ 77.18M)**

**Recovery Needs: EC\$ 197M (US\$ 72.96)**

This sector represents an entrepreneurial economy comprising small businesses, vendors and service providers. Direct damages to infrastructure were significant and as many of these businesses are home based, damages are also reflected to a degree in housing impacts. In many cases, vendors are reliant on production from other sectors such as fisheries and agriculture and will remain unemployed until production resumes. Those employed in sale of goods will rely on the reestablishment of supply chains and a general stabilization of the economy. Damage and losses relate principally to loss of infrastructure, supplies and lost trade opportunity due lack of supply and changes in demands as customers re-focus their purchasing priorities.

## TOURISM

**Damage and losses: EC\$ 245M (US\$ 116.66)**

**Recovery Needs: EC\$ 70.72M (US\$ 20.1M)**

The heaviest damages linked directly to the tourism sector lies in hotel room stock. Out of a total of 909 rooms, 243 rooms are currently serving the market, 39 percent (358) are considered severely damaged and will not be

back in service at least for a year, while 34 percent (308) may come back little by little within the year. The cruise season is currently considered lost, an EC\$25 million source of spend in 2016, and tour operators, vendors, and other support services, such as taxis, have suffered EC\$4.3 million (US\$1.59 million) in damages. Hotel staff and support personnel are directly impacted as they deal

## EDUCATION

**Damage and losses: EC\$ 208.4M (US\$ 77.19M)**

**Recovery Needs: EC\$ 254.33M (US\$ 94.20M)**

Educational facilities on the island, including daycare centers, suffered varying degrees of damage as a result of the storm. Of a total of 163 facilities, 67 (41 percent) suffered major damage and will require reconstruction. A total of 52 facilities will require major repair and 17 facilities will require minor repair. The remaining 27 facilities are reported without damage. Overall 83 percent of schools reported some level of damage. Additionally, some 20 schools are being used as shelters and will not return to service until people are relocated and the facilities are cleaned and repaired. An additional 73 preschools were affected with varying degrees of damage.

Damages include destruction of teaching materials, furniture and equipment and other educational resources. Overall some 13,575 students representing 100 percent of student population are affected. Apart from the damage and losses suffered, there is urgent need to restore educational services to salvage the current school year.

with the strain of unemployment and the concurrent need to rehabilitate their own properties.

Damage to destinations, particularly parks and natural areas will significantly impact the recovery of the tourism sector. Dominica has adopted an eco-tourism based marketing strategy as the “Nature Island” and is known as a diving destination.

## HEALTH

**Damage and losses: EC\$ 48.3M (US\$ 17.85M)**

**Recovery Needs: EC\$ 59.75M (US\$ 22.14M)**

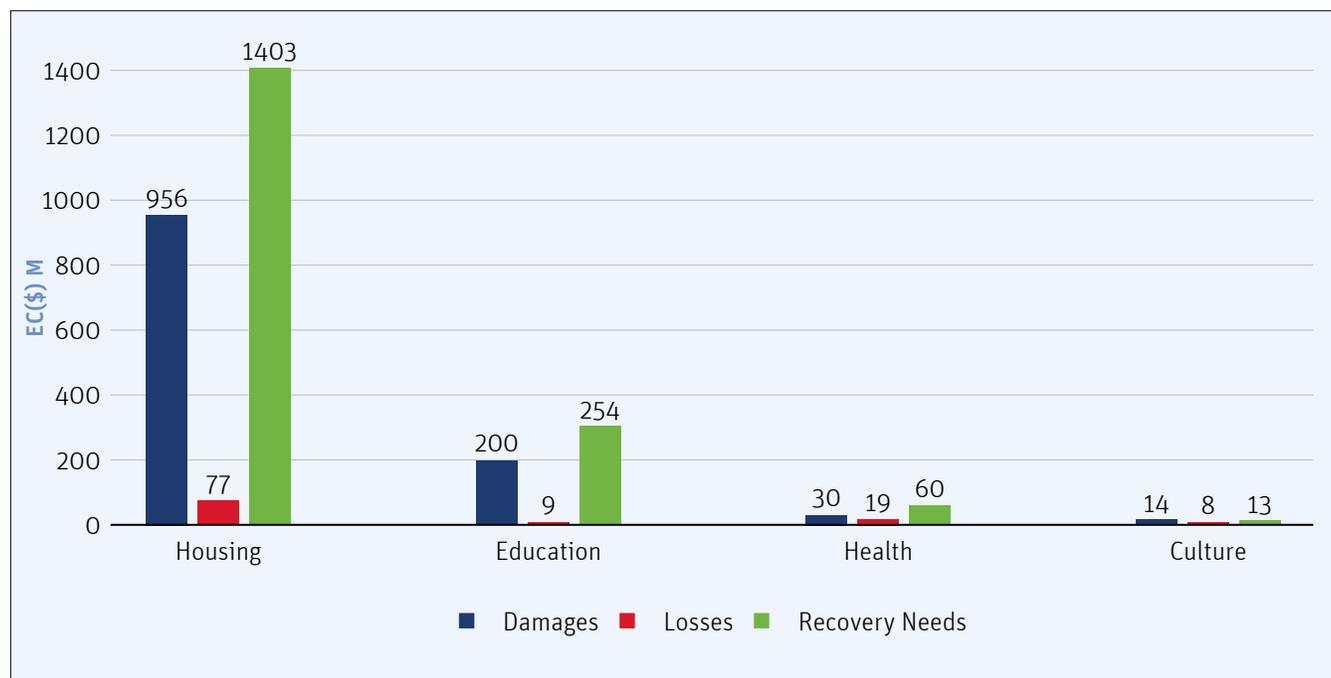
Princess Margaret Hospital, Roseau, the only referral hospital in the health care system, sustained severe damage with 15 percent of its buildings totally destroyed leaving 53 percent able to function. Central medical stores lost the majority of medical supplies due to water damage but most medications were spared. Bed capacity was decreased by 95 beds. Medical equipment such as fluoroscopy, portable x-ray and all blood bank equipment were lost.

In La Plaine, a type III facility (health center) and 17 of 48 of the type I facilities, health clinics, were severely damaged. In Marigot, the health center and 12 of 49 of the satellite clinics were moderately damaged.

The Environmental Health Office sustained damage and some equipment was compromised. Water quality laboratory equipment was lost. The HIV program office has sustained damage, however most supplies and drugs are available and patients continue to access the nutrition program.

## SOCIAL SECTOR

Figure 2: Damage, Losses and Recovery Needs by Social Subsectors (in EC(\$) M)



### HOUSING

**Damage and losses: EC\$ 1,032,64M (US\$ 382.46M)**  
**Recovery Needs: EC\$ 1,403.34M (US\$ 519.75M)**

Damage in the housing sector was extensive with damage to approximately 90 percent of the housing stock. Of the 31,348 homes comprising the Dominican housing stock, a total of approximately 4,700 houses (15%) were identified as destroyed, approximately 23,500 of homes, (75%) were estimated to have incurred different levels of partial damage, and 3,135 (10%) were considered as not affected by the event.

Total damage to the housing sector is estimated at EC\$956 million (US\$354 million). This includes the replacement cost of destroyed houses, repair cost of partially damaged houses, and the replacement cost of household goods destroyed. Losses are estimated at EC\$77 million (US\$28.5 million) and include expected loss of rental income, the cost of demolition, rubble removal, and shelter expenses.

### CULTURE

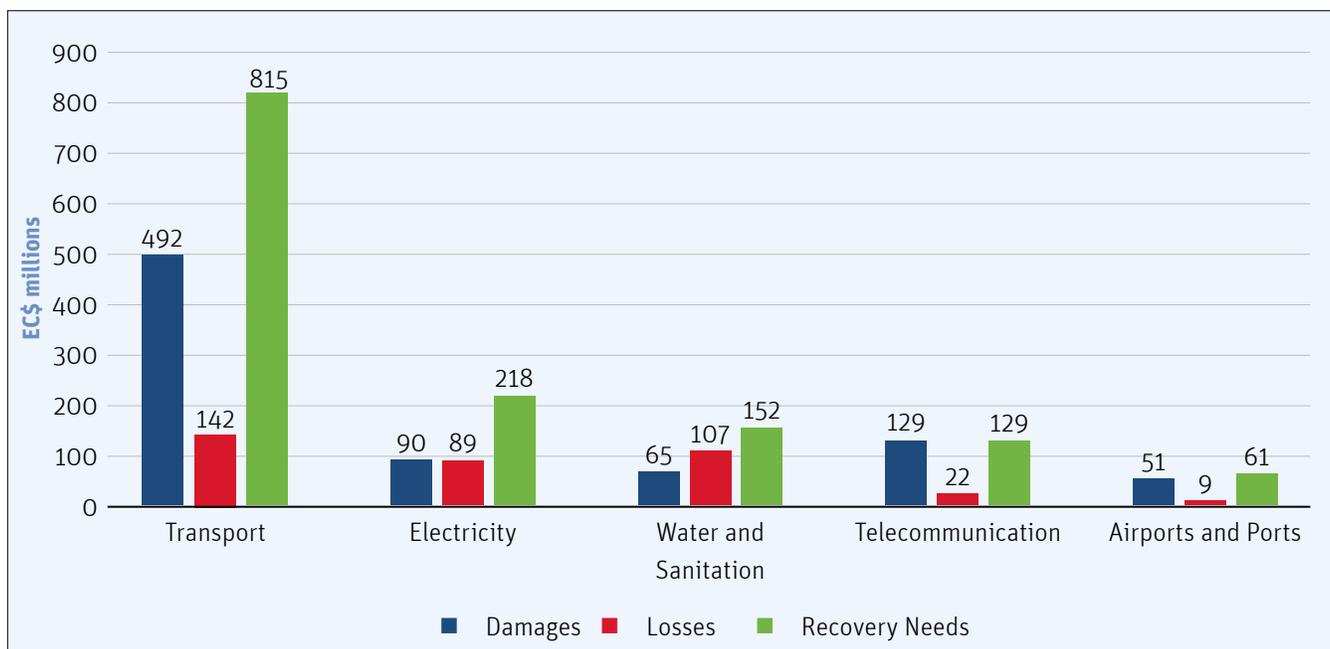
**Damage and losses: EC\$ 21.53M (US\$ 7.98M)**  
**Recovery Needs: EC\$ 12.63M (US\$ 4.67M)**

Heritage spaces such as the Dominica Museum, the Old Mill Cultural Centre and its outer buildings, and the Arawak House of Culture sustained damage such as roof, ceiling, window and other building elements as well as damage to equipment and collection holdings. The National Free Library lost all of its roofing with 98 percent of books sustaining water damage. Two important monuments around Roseau were impacted including *Neg Mawon*, which was damaged and Cecil Rawle which was partially destroyed. Other facilities damaged by the hurricane include sporting facilities such as soccer fields, cricket fields and ball courts. Other damage to structures include the High court/registry, Parliament building, Physical Planning building.

With respect to livelihoods, of the approximately 500 artisans in the *Kalinago* Territory, around 98 percent have sustained damages or total destruction of their work spaces, and in some instances, their craft stock. In most cases these families only depended on craft sales

## INFRASTRUCTURE SECTOR

Figure 3: Damage, Losses and Recovery Needs by Infrastructure Subsectors (in EC(\$) M)



### TRANSPORT

**Damage and losses: EC\$ 633.91M (US\$ 234.77M)**

**Recovery Needs: EC\$ 815M (US\$ 302M)**

Damage and losses to the transportation sector included damage to roadways, bridges and adjacent structures. Ports and airports suffered structural damage to both primary and support facilities.

#### Roads

Roads across the island were covered by substantial amounts of tree and flooding debris, and a relatively moderate number of landslides or embankment failures were identified. The major damages were incurred at river crossings, where strong flash flooding carried substantial debris damaging crossings and bridges. In valleys and steep gullies, especially in the south and west, some structures were blocked and overtopped by 1-2 meters (m) of floodwater. Debris deposits of 1-4 m depth filled the riverbeds causing rivers to change course and erode abutments or approaches. The pavements, especially on improved roads with lined surface drainage, were generally undamaged, but more extensive damages were incurred on

the less improved secondary and feeder road networks.

Six major bridges were seriously damaged and closed – three on the west coast and three in the south – and major erosion or washouts occurred over an estimated 19 km combined length. Vehicles were damaged by flooding and flying tree and building debris, with an estimated one to four percent destroyed and seven to ten percent damaged.

#### Ports and Airports

DASPA, the Dominican Air and Seaports Authority, has suffered damages to all of its assets, both in the Roseau area, at Douglas Charles International Airport, and in Portsmouth.

At the port of Woodridge Bay, all sheds lost their roofs and suffered other damages. The security fencing was compromised, windows in the main office building were blown out, the maintenance shed was destroyed, and electrical equipment and electronics were damaged. In Roseau, besides Woodridge Bay, the ferry terminal was severely damaged, both by heavy seas and river flooding. The damage incurred includes all electronic equipment, furniture, and vendor shops. The Roseau Cruise Ship Berth

was also rendered inoperable, with railings, lighting, and the walkway being destroyed.

In Portsmouth, the cargo shed had similar damages, with the roof destroyed, though the main pier remained intact. Security fencing has been compromised. The Cabrits cruise ship berth, which features a full-fledged terminal building, was badly damaged, with the walkway of the pier destroyed, and the terminal building lost most of its roof.

At Douglas Charles Airport the terminal building was flooded resulting in the loss of all electronics, such as x-ray machines. The airport also suffered some damage to its tower, and related communications and navigation equipment.

At Canefield Airport, debris had to be cleared from the runway. The terminal lost a substantial part of its roof (as well as the building housing fire and ambulance services). The tower was more severely damaged than at Douglas Charles, and the fencing has come down in several places.

The shipping sector losses are related primarily to the loss of traffic, some of it due to infrastructure damages and the government moratorium on charges for non-commercial activity. Since most of the port's shipments are now related to the relief and rebuild efforts after Maria, revenues are 25 percent of the baseline, indicating a 75 percent revenue loss. There is no income from cruise ships since there is no infrastructure to receive them.

Airport losses will accrue over time as reflected in the reduced tourism demand. With damage to tourism infrastructure and destination sites, reduced tourism demand is expected to reduce airport income from fees and taxes.

## WATER AND SANITATION

**Damage and losses: EC\$ 172.06M (US\$ 63.73M)**  
**Recovery Needs: EC\$ 151.9M (US\$ 56.26M)**

The 41 water supply areas were damaged by strong winds, flooding, landslides, falling trees and power outage, 16 were heavily damaged and 21 moderately damaged. Production and distribution pipelines were damaged or washed away, intake systems were blocked with sand and debris, and storage tanks, pumps, physical structures and access roads were damaged. Estimated damage to water supply infrastructure is EC\$53.6 million (US\$19.85M).

Damage to sanitation infrastructure amounted to an estimated EC\$9.8 million (US\$ 3.62M). Damage to the Roseau wastewater treatment plant affected 5,190 households and included lift stations, fore mains, manholes, interceptor pipes, sewer lines, three major bridge crossings, gravity mains and about 3,000 service connections. The Canefield and Jimmit sewerage systems were blocked by flood debris. On-site septic tank systems and latrines have been damaged and assessment is ongoing.

In solid waste management, the depleted infrastructure suffered further damage and the service has been interrupted. Two collection trucks were damaged and many private contractors stopped collecting waste. The DSWMC administrative facilities and roof of the office building were heavily damaged and the disposal site was severely damaged. Currently, irregular service has been established in Roseau but damages in road infrastructure, reduced capacity in DSWMC and a lack of available private contractors is restricting the recovery service countrywide.

## ELECTRICITY

**Damage and losses: EC\$ 178.53M (US\$ 66.12M)**  
**Recovery Needs: EC\$ 217.84M (US\$ 80.68M)**

Electricity service failed due to widespread damages to the transmission and distribution network. At least 75 percent of the network is down, although part may be recoverable, 80 to 90 percent of the transformers inspected are badly damaged and cannot be repaired. Damages to generation sites vary from moderate to severe. Specifically, at Fond Cole there are damages to the building structures and three generation units must be inspected and repaired (enclosures were lost). Sugar Loaf also suffered some damages to the building structures and to the electrical equipment (in the latter case caused by flooding).

The hydropower plant at Padu was damaged by 3 - 4 feet of mud and debris filling the power house. There is visible damage to control equipment, and there may be damage to hydromechanical equipment of the power house and to the electro-mechanical equipment.

The Trafalgar hydro-generation plant experienced only minor damages to the building structure and Laudat is intact. The water pipeline feeding the three hydropower

stations from Freshwater Lake suffered damage at different sections along its length. There is severe damage at the beginning of the pipeline due to landslide and rock impacts, and valves were also damaged. Severe damage is suspected due to landslide along the road from Padu to Trafalgar, affecting a 10-15m section of the pipeline. Minor damage was observed near Padu including fractured support structures and misplaced pipeline sections. Losses in the sector relate to lost revenues from sales. These are estimated to be EC\$ 88.94M (US\$ 32.94M)

## TELECOMMUNICATIONS

**Damage and losses: EC\$ 151.31M (US\$ 56.05M)**  
**Recovery Needs: EC\$ 129.17M (US\$ 47.84M)**

Telecommunications services are managed by two service providers, Digicel and Flow. Much of the network provided by Flow is underground. Hurricane Maria resulted in extensive and widespread damages to the telecommunications network and public ICT resources. All telecommunication services, except for amateur radio, were disabled from September 19 to 21. A total of 33 cellular sites were destroyed or severely damaged and the fiber-optic backbone was severed in several locations, leading to a nationwide loss of connectivity.

Damages to the network were caused by high winds and flooding. In Roseau, Flow headquarters was flooded with water, mud and debris, causing service outages and loss of equipment. Flooding and wind also destroyed support buildings, notably the main technical engineering building as well as exchange buildings owned by Flow. The satellite farm and the main television building for Flow were also heavily damaged by wind. Digicel did not report major damage to any building assets. However, Digicel operates a network based on overhead lines running on poles owned by DOMLEC, which were damaged extensively island-wide. Underground cable was damaged by flooding and scouring of trenches, but this damage is far more localized. Flow has restored much of the northern fiber backbone a month after Maria. For both providers, the southern backbone will pose a greater challenge to restore since the level of damage is much greater.

## CROSS-CUTTING SECTORS

### DISASTER RISK REDUCTION

**Damage and losses: EC\$ 10.28M (US\$ 3.8M)**  
**Recovery Needs: EC\$ 27.6M (US\$ 10.22M)**

Damage to the police stations and their contents represents the largest impact with 11 of 17 police stations experiencing damage. Five of these 11 stations received significant damage and in two instances, the officers had to be relocated. There was also moderate damage to vehicles used by the officers.

Damage to the Fire and Ambulance Service as well as the meteorological and seismic stations was moderate to significant. Five out of the eight Fire and Ambulance stations and their contents suffered damaged, with four of them being classed as significant damage. All the seismic stations across the island have been reported as completely damaged and the hydro-meteorological stations across the island suffered moderate damages.

Losses relate primarily to the increase in operational expenses for the NEPO/EOC relating to the rental of additional vehicles for the security forces. The losses for the other agencies mainly comprise the additional costs incurred by the government to purchase generators and the associated fuel cost for their operation.

### ENVIRONMENT

**Damage and losses: Not Available**  
**Recovery Needs: EC\$ 4.8M (US\$ 1.78M)**

The damage to the environment is very high, with 80-90 percent of environmental resources significantly affected. Damage to forest resources was particularly severe and there is concern regarding the status of critical habitat supporting the highly endangered Imperial Parrot, endemic to Dominica.

The impact of pollution from chemicals and fuels has not yet been assessed but likely low. There were no reports of leaking fuel storage facilities and other sources of pollution are associated with wastewater management and end user commodities such as fertilizers, agriculture chemicals and other commodities sold retail to consumers. There is no heavy industry on Dominica.

Natural resource damage will likely have high impacts to other economic sectors. Ecological services relating to water production, erosion control, land stabilization may require interventions. Tourism and agriculture will experience significant impacts as forest resources are integral to both sectors.

The recovery needs presented relate primarily to the execution of studies and monitoring programs to assess the storms impacts, monitor recovery and develop interventions as needs are identified.

## GENDER

**Damage and losses: Not Available**

**Recovery Needs: EC\$ 0.79M (US\$ 2.12M)**

Since Hurricane Maria 1,862 persons are in 63 shelters, observational evidence suggests that there is a predominance of women, elderly persons, and children in the shelters. Site visits indicate that elderly women are doing the majority of the care work especially in the shelters. Respondents indicated that they were spending at least 18 hours per week on unpaid care work, which represents a significant increase since the hurricane. Most of these elderly women (over 65) are also the head of household (HoHs), with households comprising on average five persons. Most of the elderly men in the shelters were on their own. In Marigot, St Andrew, many of the infirm were elderly men. There were concerns raised in shelters and by those who were able to move back to their communities in St David and St Andrew, that special care was needed for the elderly, persons living with disabilities and the mentally unstable.

With most primary schools closed, there have been reports of primary caregivers, who are mainly women, leaving children in the shelters under communal care, usually that

of an elderly woman. Most secondary schools in Roseau have been opened but only for 4<sup>th</sup> and 5<sup>th</sup> formers, leaving adolescents 11-14 outside of schools.

As previously mentioned women represented 39 percent of the HoHs in Dominica. Site visit interviews highlighted that many women, particularly the elderly women HoHs, did not have housing insurance because they were living in family homes which were built by their parents. These women indicated they were unable to move out of the shelters because they did not have access to housing material or knowledge of where to source the material. In spite of this, their main concern was being able to pay for the labor needed to assist them in rebuilding.

76 percent of the women farmers interviewed reported that they were significantly impacted by the severe loss of tools and crops. However, in Marigot (St Andrew) and Warner (St. Paul) women reported having some root crops remaining, which they shared among the community and in shelters. Women reported that although they lost some livestock, the lack of feed, shelter and water is resulting in increased losses every day.

Access to health care has been compromised since the hurricane because all health centers around the island have been impacted. Since the Hurricane primary health services continue to be offered in buildings with only emergency repairs or in alternate premises. Many women interviewed indicated that increased communication was needed to make sure everyone was aware of where and how to access critical health services.

Recovery needs reflect the need for targeted assistance, particularly for single parent families headed by women, including material support for reconstruction needs; livelihood assistance, particularly for women farmers; gender training and psychological support.

## Summary of Identified Priority Actions for Recovery

### ESTIMATING RECOVERY NEEDS

Recovery needs are estimated based on the PDNA sectorial results for disaster effects and disaster impacts considering the following four components:

- ▶ Reconstruction of physical assets;
- ▶ Resumption of production, service delivery and access to goods and services;
- ▶ Restoration of governance and decision-making processes;
- ▶ Reduction of vulnerabilities and risks.

The short and medium-term recovery needs refer to measures required to address the current crisis while also providing access to basic services, temporary shelter and bringing communities' life and national and local institutions to normality. The longer-term recovery needs include measures to reduce the risk associated to weather related hazards and its possible impact in Dominica,

including those of Climate Change, particularly in view of the likely increase in the frequency and severity of this type of phenomena.

The proposed needs also take into consideration the issues of governance, particularly those measures required to strengthen the capacity of national and local authorities across all sectors to implement and manage the recovery program, through additional expertise and human resources, equipment and information management systems to facilitate monitoring and inter-institutional coordination.

The identified needs include disaster risk reduction measures to build resilience and reduce the impact of future adverse hazards in the country. The proposed resilience interventions are integrated within each of the sectors as part of the proposed sectoral long-term measures, and are reflected as such in the matrix below outlining the recovery needs and budget.

Table below presents the proposed budget for recovery, totaling EC\$ 3,693 million or US\$ 1,368 million. The greatest needs are in the housing sector with 38% of all estimated needs, followed by transport with the 22% of the

Sector	short term (>1 year) EC millions	medium term (1-3 years) EC millions	long term (3-5 years) EC millions	TOTAL EC Millions	TOTAL US Millions
Agriculture	145	50	44	239	88
Fisheries	5	1		7	3
Forestry	33	6	2	40	15
Commerce and Micro Business	192	6	1	198	73
Tourism	6	22	43	71	26
Housing	48	1354	1	1403	520
Education	5	25	224	254	94
Health	44	4	12	60	22
Culture	10	2	1	13	5
Transport	287	334	195	815	302
Electricity	118	100		218	81
Water and Sanitation	68	64	19	152	56
Telecommunication	33	66	30	129	48
Airports and Port	37	14	11	61	23
Disaster Risk Management	0	15	13	28	10
Environment	3		1	5	2
Gender	1	1	0	2	1
<b>TOTAL</b>	<b>1035</b>	<b>2063</b>	<b>597</b>	<b>3693</b>	<b>1368</b>



total. Other sectors with significant needs are Education, Electricity, Agriculture and Commerce.

The recovery needs include measures required in the short-term (up to 1 year), medium-term (1 to 3 years) and long-term (3 to 5 years).

## RECOVERY CHALLENGES OF A SMALL ISLAND DEVELOPMENT STATE

Dominica, as any other Small Island Development State (SIDS), is particularly vulnerable to natural and manmade hazards, including those related to climate and its variability. The recovery strategy should consider realistic solutions to address specific capacity gaps with the view to reducing the frequency and magnitude of future disasters. Some of the key aspects relating to SIDS context that need to be considered include the following:

- ▶ Climate change could disproportionately magnify disaster risk in Dominica, due to rising temperatures and sea level and associated coastal erosion, flood and storm surge. Further, Dominica is also exposed to geological hazards (volcanoes, earthquakes, tsunamis and landslides).
- ▶ Economic growth driven by the tourism sector has led to an increase in hazard exposure, as private and public investments are concentrated in hazardous

areas, such as cyclone prone coastlines. Small size, geographic dispersion and isolation from markets poses additional challenges to Dominica including the development of economies of scale, limiting its potential for diversification. A single disaster event can affect the entire territory or economy and cause a disproportionately high loss of GDP and capital as has been the case of Hurricane Maria that has affected all the economic and social sectors in Dominica.

- ▶ People's livelihoods are highly dependent on a healthy eco-system (coastal, marine, forests, wetlands), Hurricane Maria has caused a widespread destruction of these habitats, resulting in loss of livelihoods.
- ▶ Local governance mechanisms have a critical role to play to facilitate effective community risk management. However, the interface between local government and communities needs to be strengthened and national policies facilitate this

## A TAILORED STRATEGY FOR DOMINICA

The issues discussed in this section are preliminary and based on the findings and recommendations made in the sector reports based on the PDNA, they will need to be further discussed and developed into a disaster recovery

framework that would consider detailed planning and implementation of a comprehensive recovery intervention in Dominica.

All the 17 sectors assessed after the disastrous event of Hurricane Maria in Dominica are important and contribute in different ways to support the socio-economic development of the country. They have been clustered in four main categories: social sectors, productive sectors, infrastructure sectors and the cross-cutting issues. As indicated earlier, some of them have been heavily impacted and may need to be looked at in a prioritized manner:

### HOUSING RECONSTRUCTION

Housing is the most affected sector and one of the most important and challenging areas for recovery as this provides shelter and security to the families, but also, quite often they also include small businesses that are part of the income generation mechanism. The Government plan for the recovery and rebuilding of the housing sector, outlined by the Prime Minister on October 16, 2017 comprises: (i) waiver of duties on construction materials for six months; (ii) convening power to ensure faster insurance payouts and lower bank charges; and, (iii) repair and rebuilding of schools, clinics, hospitals and homes in a climate-resilient way.

It is critical that a comprehensive National Housing Reconstruction Program is developed and implemented to replace what was damaged and lost. The options for post-disaster housing programs that have been adopted elsewhere include a cash approach, owner-driven reconstruction, community-driven reconstruction, and agency-driven reconstruction. Depending on the selected alternative, the homeowner, community and agency would have different levels of control on funds and management of the project. This could be linked to different capacity building processes to incorporate not only the affected community but also small to medium locally based enterprises who could be integrated to the reconstruction program thus offering them an opportunity for income generation.

### INFRASTRUCTURE

Reconstruction of damaged infrastructure such as roads, water and sanitation, electricity will focus in the short run in quickly providing access to the communities to markets,

schools, health centres and repairing basis services such as provision of water, sanitation and electricity. The geographical setting and the widespread location of small towns and infrastructure pose an additional burden in the recovery planning and implementation as it would be difficult to benefit from economies of scale by clustering different communities in a single reconstruction scheme. In the intermediate and long run, focus should be in making the necessary studies and assessments to make sure that detailed engineering designs of major interventions will be undertaken as a pre-requisite to procuring civil works making all infrastructure disaster resilient.

For solid waste management services, recovery and improvement are needed in both facilities and processes. This includes reestablishing services throughout the island, re-building and strengthening what was an already depleted service to an adequate level, and introducing cost saving and resilient systems that allow for decentralized public and private sector waste storage, transfer, and operation, especially in hard to reach areas.

### LIVELIHOODS

Gender-responsive livelihoods programs will focus on empowering men and women through national and community-level training for climate resilient agriculture and by supporting the creation of value chains that reduce food insecurity among vulnerable groups. The recovery programme provides the opportunity to prepare agricultural workers to engage in value-added activities, based on the restoration of the natural environment.

Some 10,000 persons were involved in micro businesses in the formal and informal sector, their economic activity ranged from such activities as barbering, baking of goods, seamstresses, cosmeticians, mechanics and the repair of household items. They would require support to refinance their businesses as part of the recovery programme.

### DISASTER RISK REDUCTION

With climate change on the rise, Dominica will be faced with disasters of increasing magnitude and intensity thus ex-ante preparedness for recovery is a must. Focus should be in proactively building regional and national institutional arrangements, communication, coordination

and planning capacities to ensure timely and resilient recovery, including contingency planning to assure business continuity not only from the private sector but most importantly from the public sector.

Resilient reconstruction requires strengthening the interface between national and local governments and the communities to enhance community risk management and design strategies that are more responsive to community needs. The growing urban centres in Dominica need also dedicated attention to make sure that risk sensitive land use and plans are used for and orderly and safe growth of the cities.

The long-term recovery strategy proposed includes disaster risk reduction measures to build resilience and reduce the impact of future hazards. The proposed disaster risk reduction interventions are integrated within each of the sectors as part of the proposed sectoral long-term measures.

## GUIDING PRINCIPLES

- ▶ Key aspect of the recovery strategy should be underpinned by approaches that will retain skilled people within the country.
  - ▶ Use the opportunity which the disaster presents to prepare persons to engage in value-added activities, based on the restoration of the natural environment.
  - ▶ Support entrepreneurial activity that kick-starts the agricultural production for niche markets and adds value in the production process, such as in the development of specialty bananas or other fruits.
  - ▶ Engage the people in the development of the recovery strategies and measures, through consultative processes
  - ▶ Seek the support of the diaspora community for the recovery process – they are a rich source of both human and financial resources
  - ▶ Ensure that resilience to climate change is built into all new development initiatives and into the reconstruction of damaged infrastructure, public or private.
- ▶ The disaster should provide an opportunity for the regulation of land use adopting measures for conserving energy and strengthening the management of forest resources.
  - ▶ Most vulnerable people (low income, women headed households, people living with disabilities) will be given priority in recovery assistance.
  - ▶ Gender sensitive and participatory approaches promoted in all interventions.

## IMPLEMENTATION ARRANGEMENTS

Recovery is multi sectoral in nature. It includes reconstruction of physical assets, restoration of livelihoods, and re-establishment of social and community services. This work requires the collective efforts of all governments' ministries, private sector actors, the civil society and national and international organizations.

While it is recognized that recovery should be implemented under the strong leadership of the national government, other partners can bring technical skills and experiences that will improve the quality of recovery. The recovery strategy should be inclusive and participatory, integrating national and local authorities, the affected communities, community organizations, women's groups, traditional authorities and other relevant local actors.

To this end, establishing a recovery agency that has a short-term mandate, strengthens the country's public service, and has credible leadership is a good alternative to be considered by national authorities. This agency could improve the following aspects:

- ▶ Overall coordination to maximize the impact of new resources avoiding overlap, duplication of efforts and conflicting projects.
- ▶ Sequencing of projects to bring benefits earlier than otherwise.
- ▶ Ensure a smooth roll out of projects as all supporting activities could be handled by one, focused body
- ▶ Ensure that all donor-funded rebuilding activities are carried out to a high standard of transparency and financial accountability.





# INTRODUCTION

## Country Profile

The Commonwealth of Dominica is part of the Windward Islands in the Lesser Antilles archipelago in the Caribbean Sea. Dominica is an upper-middle-income small island state, with an estimated population of 71,293 (2011 census) and a gross development product per capita of US\$7,144. The country's land mass is 750 sq. km consisting primarily of mountainous terrain with 90% of the country's inhabitants residing along the coastal areas. The population is mostly of African and mixed African/European descent, with European, Syrian and Indigenous minorities. Dominica ranks as one of the top five countries in the world with the highest nets of emigration, with the size of the Dominican diaspora more than double the country's existing population. The Dominican diaspora is an active set of individuals and organizations that are instrumental to the development of the island.

Dominica produces a narrow range of goods and services for export namely, agricultural products and educational services through the establishment of international medical schools. In 2016, the top exports of Dominica were refined petroleum, soap, medical instruments, low-voltage protection equipment and gravel and crushed stone. Dominica's main export agricultural goods include bananas, cereal and pellets, tropical fruits, cassava, citrus, beer, pasta, spices, and vegetables. Although the economy is described as predominantly agricultural, the country is actively exploring prospects in tourism, and is also developing the production of geothermal energy.

The 2015 United Nations Development Program Human Development Index ranked Dominica as 96 of 187 countries – poverty remains a pervasive development issue. Dominica continues to work towards improving the social conditions of its citizens through infrastructural investments, economic diversification and employment generation, yet its population and economy remains highly exposed to natural disaster events and catastrophic risk. Disasters stemming from natural hazards such as high wind exposure, floods and landslides have destroyed or damaged critical infrastructure and set back hard earned development gains – disaster recovery and reconstruction have absorbed an increasingly large share of annual budgets imposing substantial costs on the country's economy.

## Disaster Risk Profile

Dominica is vulnerable to numerous natural disasters arising from meteorological events (high wind, excess rainfall and hurricanes) and geophysical events (earthquake, volcano and tsunami). Recurrent events have significantly harmed both the population's socioeconomic well-being and the country's general economic and fiscal stability. Particularly damaging are events associated with excessive or prolonged rainfall, which provokes flooding and landslide activity. Between 1925 and 2015, 35 people lost their lives due to landslides. Slide clearance and road repair has a long-term cumulative economic impact<sup>4</sup>.

A significant proportion of Dominica's population as well as assets are highly vulnerable to hurricanes, as well as high-intensity rainfall, wind and storm surge events. The island's mountainous, rugged landscape presents significant engineering challenges. Nine volcanic mountains, each with their own radial drainage system, pose a challenge for the construction of a safe build environment, particularly for road construction. In addition to the island's steep topography, underdeveloped and damaged infrastructure has been a key challenge to reducing vulnerability to disasters. This vulnerability arises, in part, from the failure to consider natural hazard and disaster risk in infrastructure design and construction.

With regards to physical vulnerability, the steep topographic conditions and rugged interior mean human settlements and physical development are highly concentrated along narrow coastal areas (particularly in the south and west). Additionally, Dominica is geologically young and almost completely volcanic in origin, with nine active volcanoes: Morne au Diable, Morne Trois Pitons, Morne Diablotins, Morne Watts, Morne Anglais, Wotten Waven Caldera, Valley of Desolation, Grande Soufriere Hills and Morne Plat Pays. There have been two steam explosions in the Valley of Desolation, in 1880 and 1997.

## Storm Summary: Hurricane Maria

On September 18, 2017, Hurricane Maria hit the Island of Dominica with catastrophic effect. The effects of the storm began to be felt around 11:00 Atlantic Standard Time (AST), with rainfall and light winds, which then intensified throughout the afternoon and into the evening. At 21:00 Hurricane Maria made landfall as a category 5 storm (Saffir-Simpson scale), packing winds exceeding 170 miles per hour (mph) or 274 kilometers per hour (km/h). As the storm passed over the center of the island, Dominica was exposed to extraordinary winds for more than three hours. This was accompanied by intense rainfall, which provoked flashfloods and landslides. Data acquired from the Caribbean Institute of Meteorology and Hydrology (CIMH) indicates the heaviest rainfall began the evening of September 18 and lasted into early morning of September 19. Total recorded rainfall for the event was 452.8 millimeters (mm) at Canefield Airport. The Cophall station, at a higher elevation in the Roseau Valley, recorded 579 mm. In addition to winds and

rainfall, the coastline was pummeled by strong waves, causing major damage in the south-west. The tide gauge in Marigot, on the east coast, recorded storm surge about one meter above predicted tide levels.

Hurricane Maria was one of the most rapidly intensifying storms in recent history. On 17 September at 17:00 AST, Tropical Storm Maria was reported as a category 1 hurricane (Table 2). Some 18 hours later, the storm was upgraded from category 1 to category 3. The storm remained at category 3 for three hours, until it was upgraded to a category 5 hurricane, roughly 24 hours after the storm was upgraded from a tropical storm. Public Advisory (PA) 10 was issued 1 hour 15 minutes prior to the storm's landfall, warning the system had reached category 5 strength. Landfall was at approximately 21:00 AST. The storm progressed over Dominica with the eye exiting the island at approximately 22:45 AST. While residents of the region had over 24 hours of notification of an impending hurricane, the potential intensity of Hurricane Maria was not realized until less than two hours before landfall in Dominica.

**Table 2: Maria Development Summary**

Public Advisory #	Date	Local Time (AST)	Elapsed Time (Hours as Hurricane)	Hours Before Landfall	Category	Max Sustained Wind Speed (mph)	Note
6	Sept. 17, 2017	17:00	0	28	1	75	Upgraded from Tropical Storm
7	Sept. 17, 2017	23:00	6	22	1	85	
9	Sept. 18, 2017	11:00	18	10	3	120	Upgraded from Category 1
9A	Sept. 18, 2017	14:00	21	7	3	125	Expected to become major hurricane
10	Sept. 18, 2017	17:00	24	4	4	130	Upgraded from Category 3
10 update	Sept. 18, 2017	19:45	26:45	1:15	5	160	Upgraded from Category 4 (source: Aircraft reconnaissance)
Landfall Dominica	Sept. 18, 2017	21:00	28	Landfall	5	160+	

Figure 4: Rainfall Total at Canefield Airport (10 minute intervals)

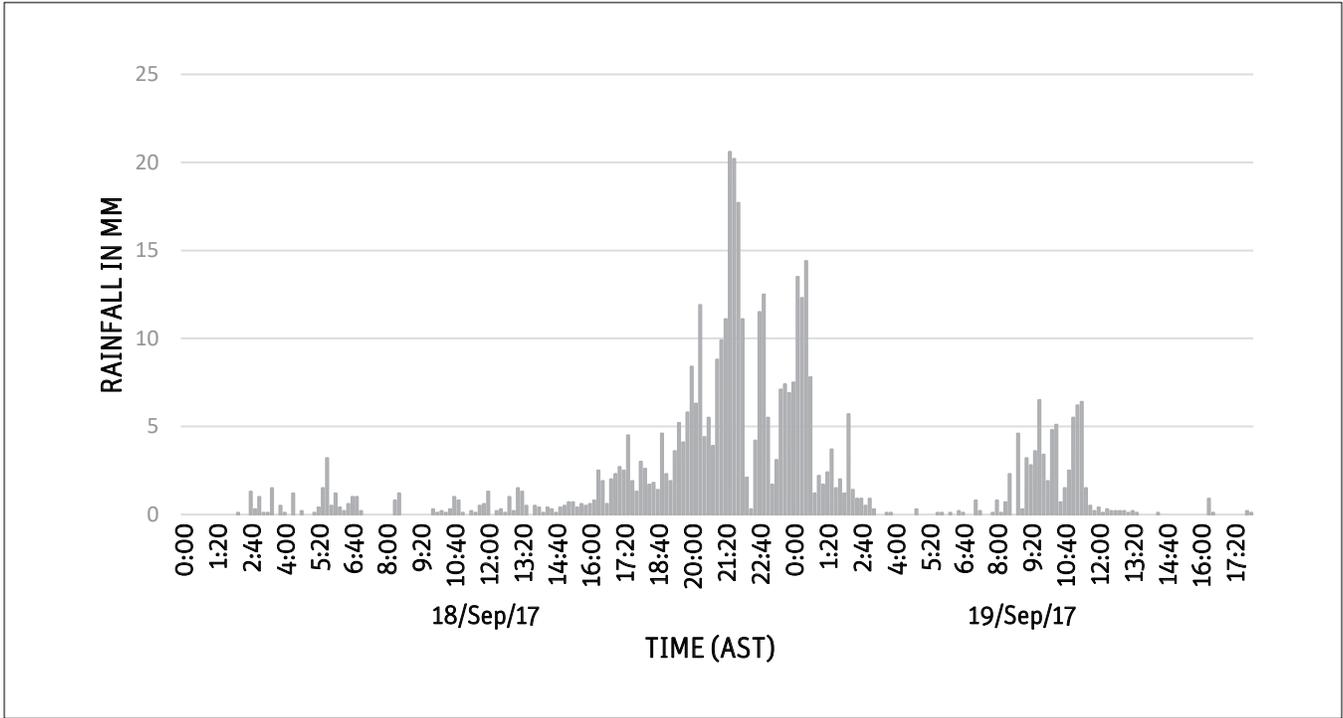
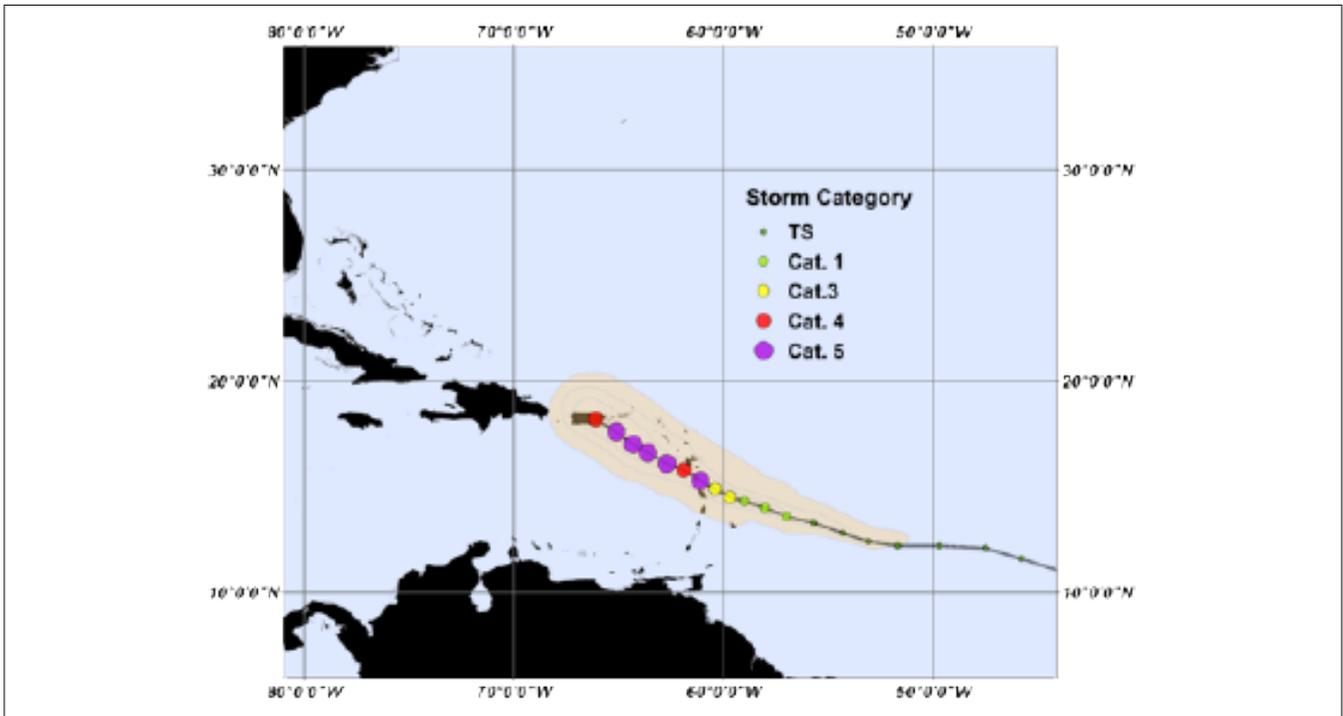


Figure 5: Maria Storm Track History



## Response from the Government and Development Partners

On September 19, 2017, the Regional Response Mechanism (RRM)<sup>5</sup> was convened, coordinated by the Caribbean Disaster Emergency Management Agency (CDEMA) through its Regional Coordination Centre in Barbados. The Government's National Emergency Operation Centre (NEOC) was active with weekly meetings of national response committees and international organizations, and is supported by CDEMA and the United Nations Office for the Coordination of Humanitarian Affairs (UN-OCHA). Coordination meetings were held at the NEOC and sector groups are meeting on early recovery; education and protection; emergency telecommunications; food security and livelihoods, health; logistics; shelter/camp coordination and camp management; and water sanitation and hygiene (WASH). Upon request of the Prime Minister, the UN established a Crisis Management Unit led by the UN Development Program (UNDP) and UN-OCHA to support the government coordination efforts from relief to recovery. Seven UN agencies, 13 non-governmental organizations, the United States Agency for International Development (USAID), Pan American Health Organization (PAHO) and the International Federation of Red Cross and Red Crescent Societies (IFRC) are providing humanitarian assistance in Dominica. The EU Civil Protection Mechanism was activated, bringing emergency support and relief supplies from France, the United Kingdom, Belgium and the Netherlands.

## Assessment Methodology

On October 9, 2017, the Government of the Commonwealth of Dominica presented an official request for a Post-Disaster Needs Assessment (PDNA), coordinated by the World Bank in conjunction with the UN, ECCB, the CDB, and the EU to assess the disaster impact to inform recovery and reconstruction needs.

The main objective of the PDNA is to produce a reliable estimate of the disaster effects and impact of Hurricane Maria, and define a strategy for recovery. Specifically, the assessment aims to: (i) quantify damages and losses, including physical damages and socio-economic aspects<sup>6</sup>; (ii) evaluate the overall impact of the disaster on the macro-economic and human development context of a country; and, (iii) identify recovery needs, priorities, and costs for a resilient recovery strategy.

The PDNA process is government led and owned. The assessment targets the sectors the Government identified as the most critical: health; transport; tourism; agriculture; housing; commerce and industry; employment, livelihoods and social protection; education; water and sanitation; telecommunications and energy. The EU, WBG, UNDP and ECCB provided technical support as determined and requested by the Government<sup>7</sup>. The PDNA process involves the participation of the affected population, local authorities, NGOs, donors, civil society, and the private sector.

The Government of the Commonwealth of Dominica has

5 The RRM is an arrangement for the coordination of disaster response among CDEMA Participating States, and Regional and International Agencies.

6 Damage to infrastructure and physical assets is the quantification of public and private sector infrastructure and assets destroyed in the disaster. Damage includes either total or partial destruction of the assets. The assessment assumes that a certain level of damage will occur to flooded buildings, given that the exposure of wood or other traditional materials to floodwaters will require the building's repairs or replacement. The PDNA estimates include damages to building content. Losses due to disruption of access to goods and services are defined as changes in economic flows and higher costs in production arising from the disaster. They occur until full economic recovery and reconstruction is achieved, in some cases lasting for several years. Typical losses include the decline in output in productive sectors. Governance can also be affected. Disaster effects also include a qualitative assessment of the increased risks and vulnerabilities resulting from the event.

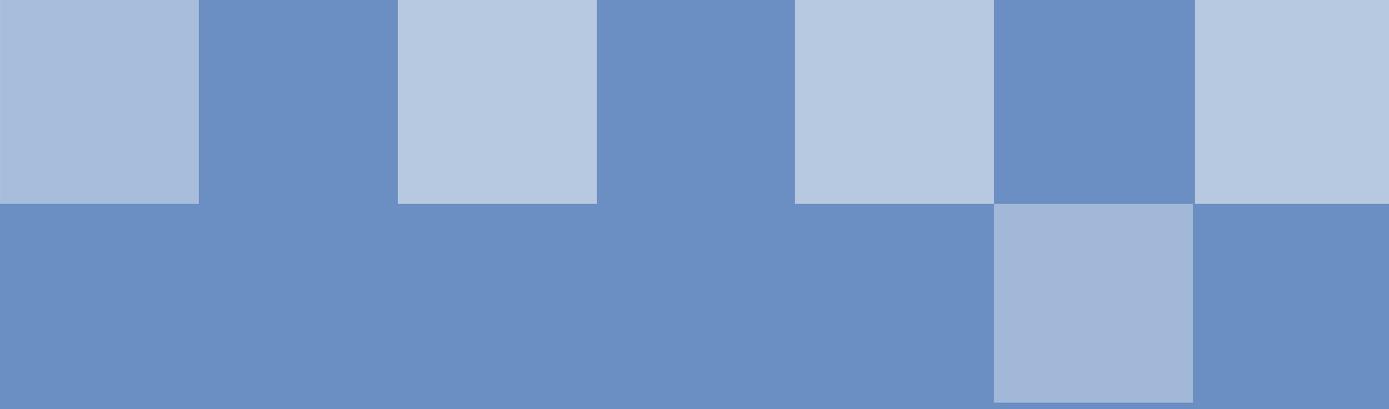
7 The PDNA is the result of a commitment articulated in the joint agreement on post-crisis cooperation, signed between the European Union, the World Bank Group, and the United Nations Development Group in 2008. Through the agreement, PDNA partners commit to supporting government ownership and leadership of the post-disaster needs assessment process

publicly reiterated the importance of “building back better” (BBB) and climate resilience in the reconstruction and recovery process. BBB has been applied where relevant across and within sectors to support a cost-optimized, resilient reconstruction. Accordingly, this PDNA hopes to assist the government in produce an actionable and sustainable recovery strategy for mobilizing financial and technical resources.

Data and information for this PDNA was gathered between October 17 and October 27, 2017. Much of the data is derived from figures provided by the government and incorporated into the analysis by the sector teams, following discussions with government officials and other stakeholders<sup>8</sup>. The figures presented in this report should be considered the best estimate possible, given the available data and time constraints. The assessment synthesizes information on damages, losses, and related needs, with the report serving as a basis for a comprehensive recovery framework that guides the design and implementation of early and longer-term recovery plans.

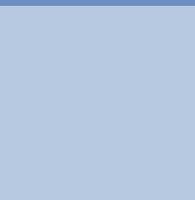
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<sup>8</sup> Information was obtained through strategic interviews, and took into account expert opinion, as well as feasibility and other implementation considerations.



# ECONOMIC AND SOCIAL IMPACTS

Impacts of Hurricane Maria are consequences of the event on both the economy of the Commonwealth of Dominica, as well as on human development of its citizens. Assessing these impacts requires analyses on the disaster impact on gross domestic product (GDP), future growth estimates, as well as the fiscal position. An additional assessment relates to impact on employment, livelihood and social protection, including impacts on personal or household income, which leads to the assessment of impacts on Dominica's human development.



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## Macroeconomic Impact<sup>9</sup>

**On impact, the economy came to a halt with the destruction of roads, bridges, and public utility systems.** The agriculture sector was devastated, with 100 percent loss of crops and substantial destruction to trees and livestock, which disproportionately affected the most vulnerable segments of Dominica’s population. Other key sectors, including tourism, sustained substantial losses, with all hotels reporting serious damages and room availability down to near half the pre-storm level. The rainforests, the main tourist attraction, were destroyed. Public services and transport activities were severely hampered. Most secondary roads, critical to access arable land and transport labor and agricultural products to markets and ports, were left inaccessible.

**The government’s response, and aid from donor countries, was critical to support the population after the storm.** The government focused on supporting displaced families, cleaning debris, and restoring basic public services. Surviving public buildings were recommissioned for use as shelters. Just days after the storm, all seaports were back in operation, and the airport was re-opened –critical for the arrival of foreign aid. Electricity and telecommunication services are being slowly reinstated but are still substantially below pre-storm levels. Schools opened about a month after the storm –including with use of temporary structures. Partner governments, international organizations, and relief agencies provided support in kind, including potable water, food, blankets, roofing materials, medical

supplies, and air transport equipment. Some Caribbean countries have temporarily opened their borders to help shelter Dominicans. Dominica received US\$28.8 million (5 percent of GDP), including a payout of US\$19.3 million from the Caribbean Catastrophe Risk Insurance Facility (CCRIF), and pledges for grants of US\$9.5 million.<sup>10</sup>

**The government has outlined key aspects of its initial recovery plan.** The arrival of heavy-duty machinery provided by development partners will facilitate clean-up and rehabilitation activities. The authorities plan to maintain pre-storm levels of government employment and spending on goods and services to support basic needs which, in the near term, is possible with government deposits of near 21 percent of GDP. They have announced tax exemptions for six months on food and construction material imports, in-kind grants of roofing materials to assist residents to rebuild their homes, and will maintain the temporary shelters while communities continue to rebuild. To help finance home rehabilitation, the government announced voluntary advances on government salaries and on non-contributory pension payments from the Social Security Fund. The government’s decision to establish a consumer protection agency is aimed at preventing price gouging by wholesalers and retailers.

**Banks and credit unions have resumed their services to enable transactions, and plan to minimize the storm’s impact on banks’ credit portfolios.** The National Bank of Dominica (NBD) announced a 3-month loan

<sup>9</sup> The IMF country team on Dominica is making this preliminary assessment based on early information received from a World Bank team conducting an impact assessment after Hurricane Maria, and telecommunications’ contact with selected authorities. The staff hopes to field a mission to Dominica shortly when conditions permit. The expectations expressed in this note should be seen as a scenario, given current limited information. They do not necessarily represent the views of the staff, management, or the Board of the IMF.

<sup>10</sup> Includes grants and donations from the ECCB, DFID, CDB, and USAID, EU Commission, Royal Bank of Canada, the governments of Antigua and Barbuda, Grenada, St. Kitts and Nevis, New Zealand, and the Bahamas.

moratorium, which would relieve financing constraints during a transition. Substantial private insurance payout is expected to facilitate the repair and reconstruction of private housing and structures, tempering the risk of an increase in non-performing loans NPLs in the bank's mortgage portfolios.

## An Economic Impact Scenario for 2018

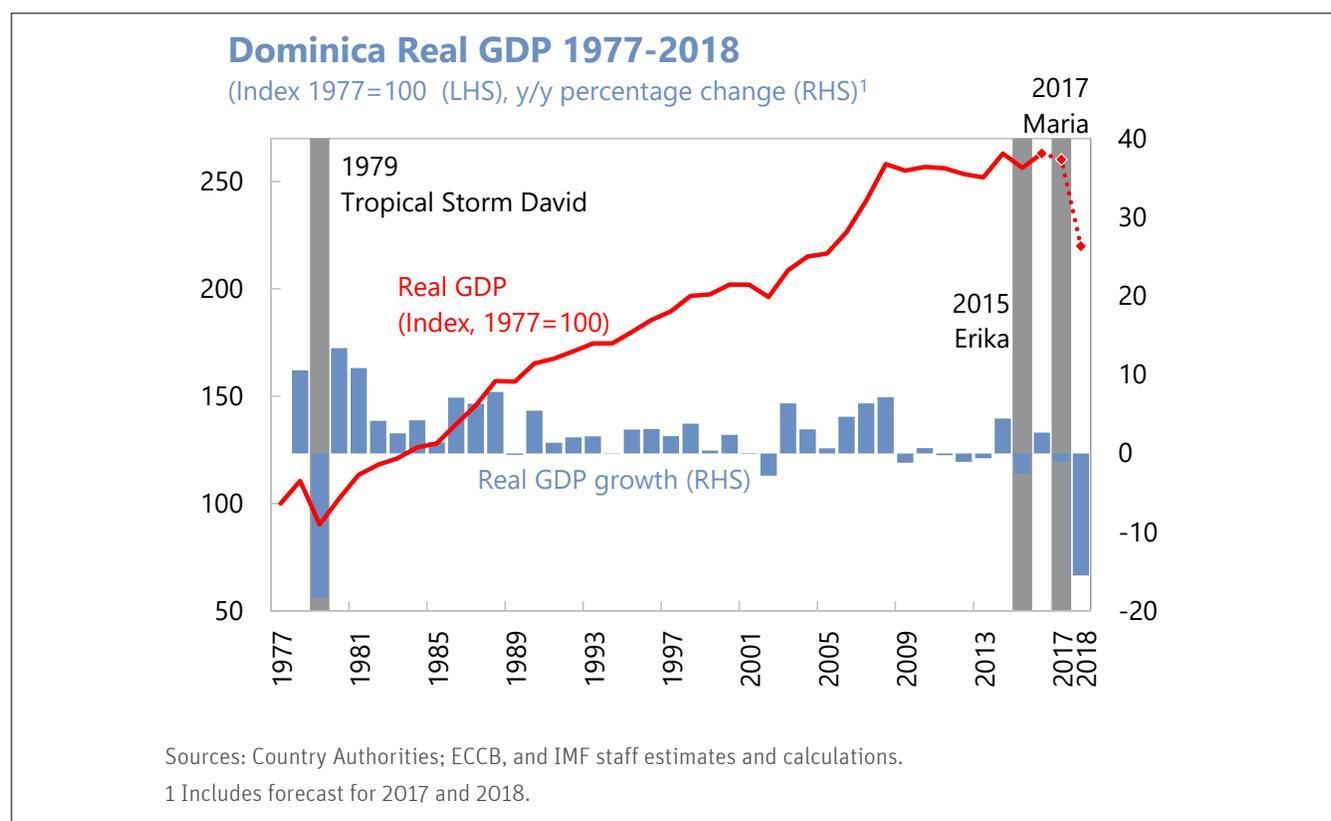
**The economic impact scenario is based on the damage assessment by The World Bank, which points to damages and losses of about US\$ 1.37 billion, or 226 percent of 2016 GDP.** The damage assessment estimates rehabilitation and reconstruction costs of public and private structures, and the likely impact on the productive capacity of the different economic sectors. The economic impact estimates also draw on the experience of previous natural disasters in Dominica.<sup>11</sup> These estimates will be revised in a future Fund staff mission.

**Output would decline sharply in the last quarter of 2017 and by as much as 16 percent in 2018.** Agriculture,

livestock and fisheries are expected to show the steepest declines, as their output could slide to under ¼ of the pre-storm levels with the devastation of the stock of plants and animals.

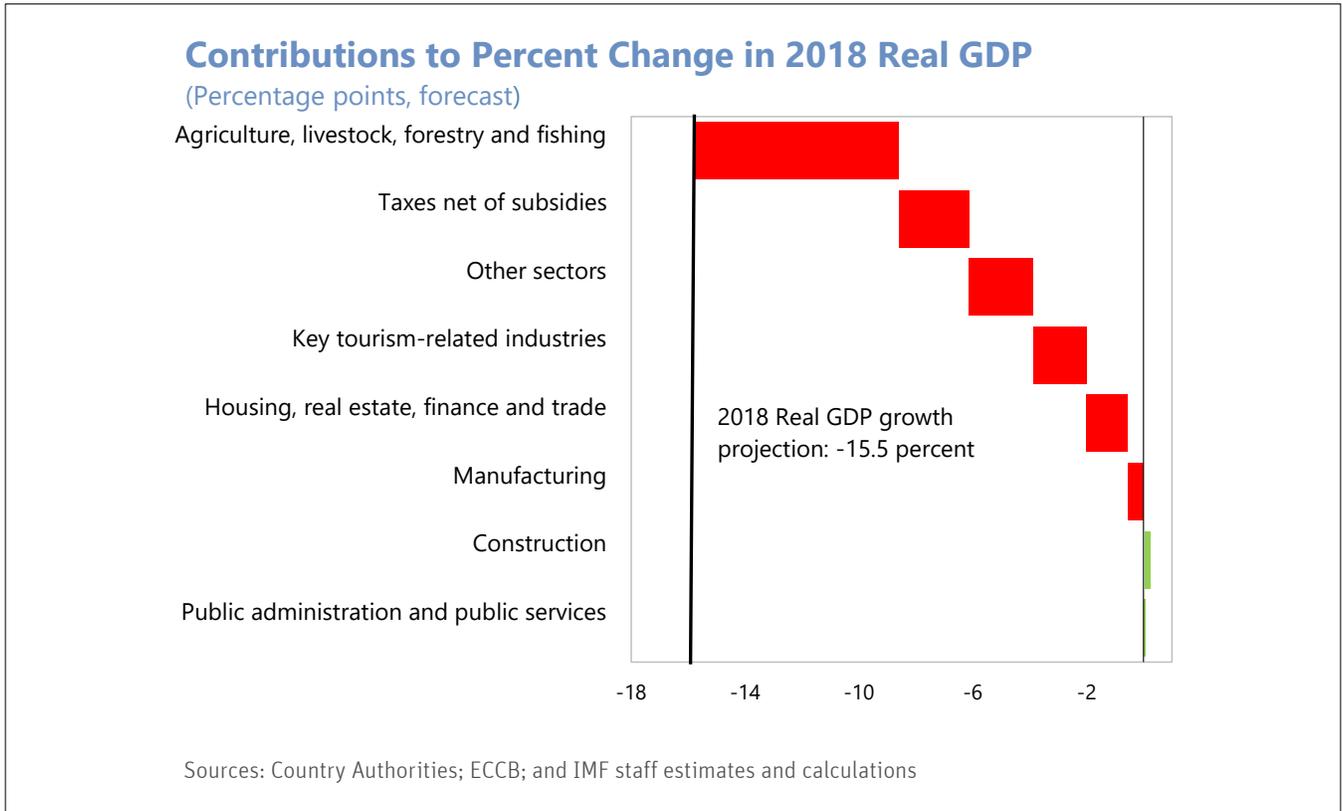
Key services linked to tourism, mainly hotels and restaurants, would also exhibit sharp declines, especially given the 50 percent drop in room capacity, and some hotels requiring several months to re-open. The decline in tourism would affect transport and wholesale and retail trade services, albeit with a relatively smaller decline as domestic demand is expected to show some resilience underpinned by government spending (see fiscal impact below), insurance claims, and a drawdown in bank savings. Manufacturing is projected to take a significant hit, as the need to rehabilitate and/or rebuild existing facilities might take months before productive capacity is at least partially restored. Some services, on the other hand, are expected to show relatively smaller declines or to hold their level of activity, including public administration, and financial activities. Construction, on the other hand, may have a positive contribution to growth reflecting rehabilitation and reconstruction.

Figure 6: Dominica Real GDP 1977-2018



11 Including tropical storm Erika and 2015, and Hurricane David in 1979.

**Figure 7: Contributions to Percent Change in 2018 Real GDP**



**Figure 8: Real GDP Growth by Sector**

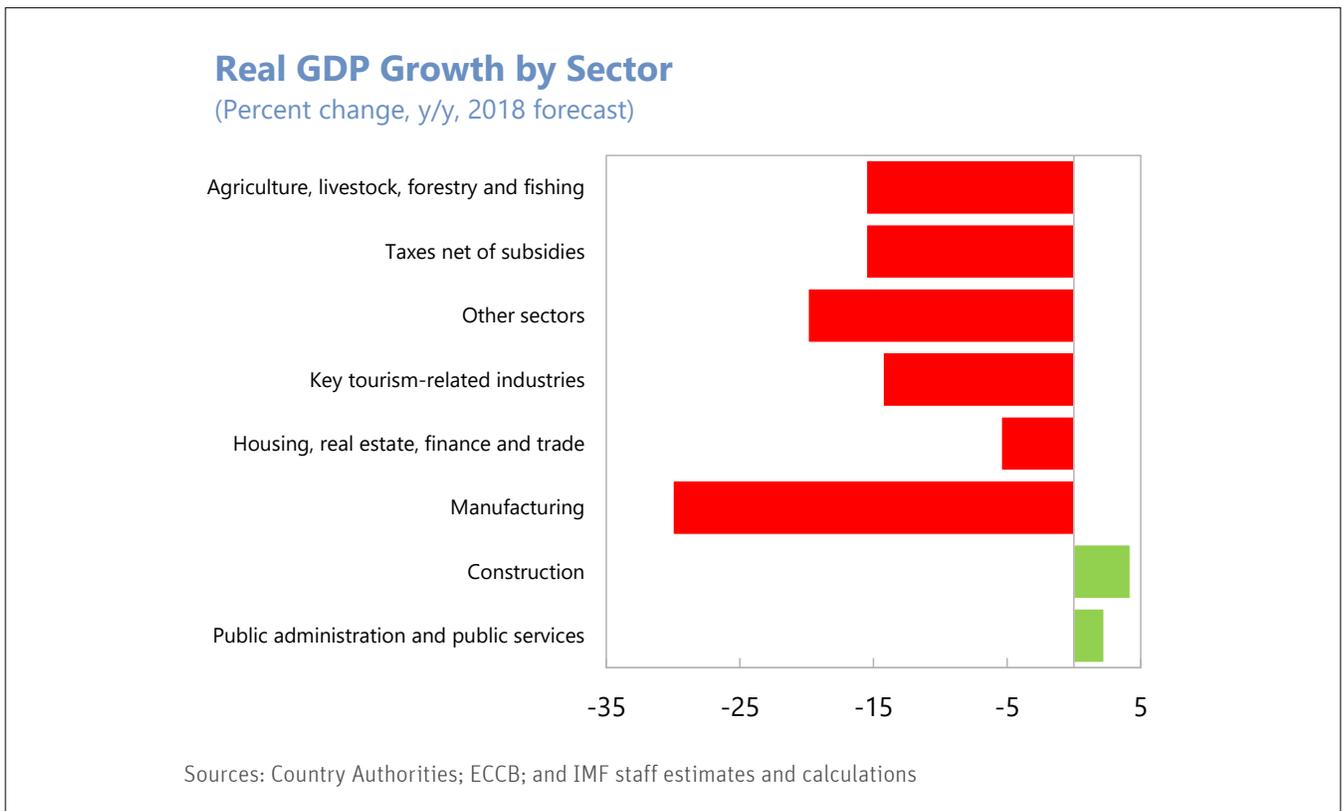


Figure 9: Dominica Fiscal Performance

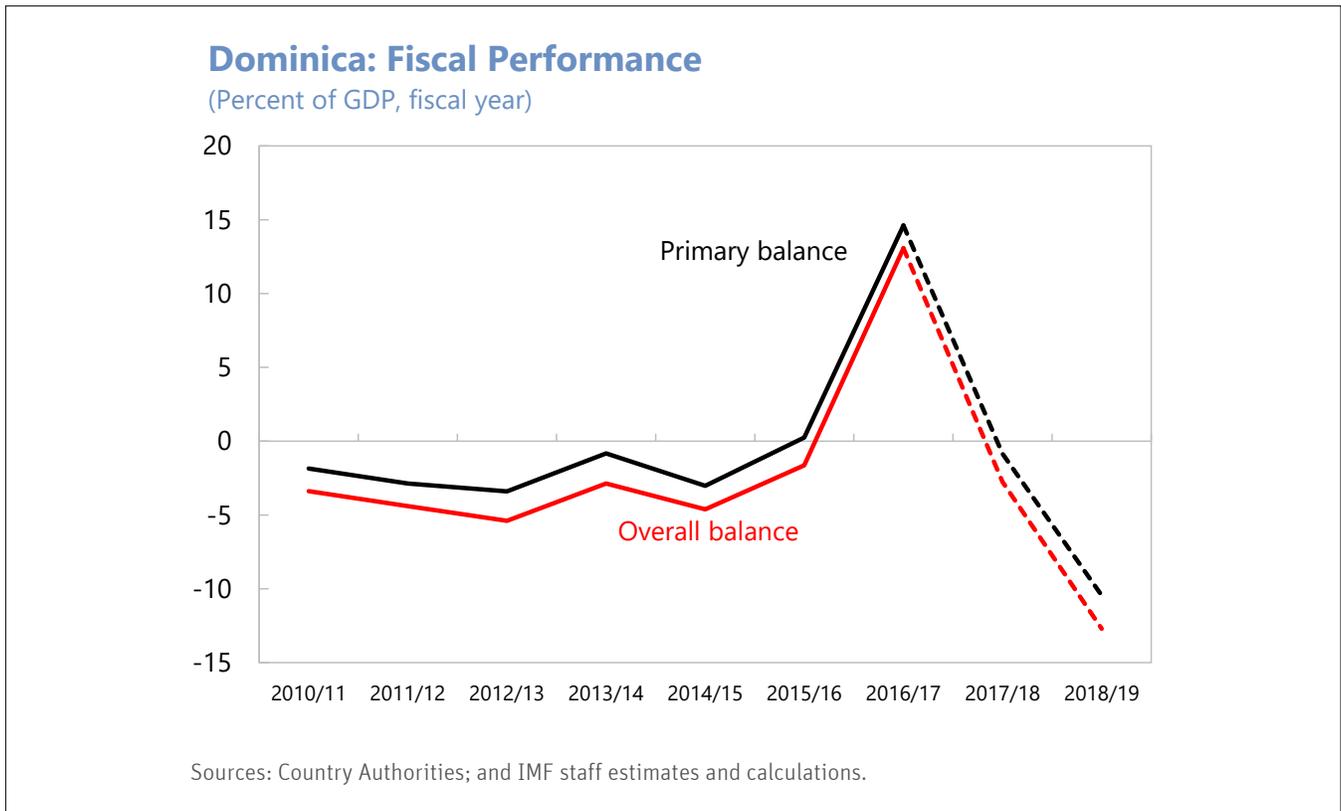


Figure 10: Central Government Revenues

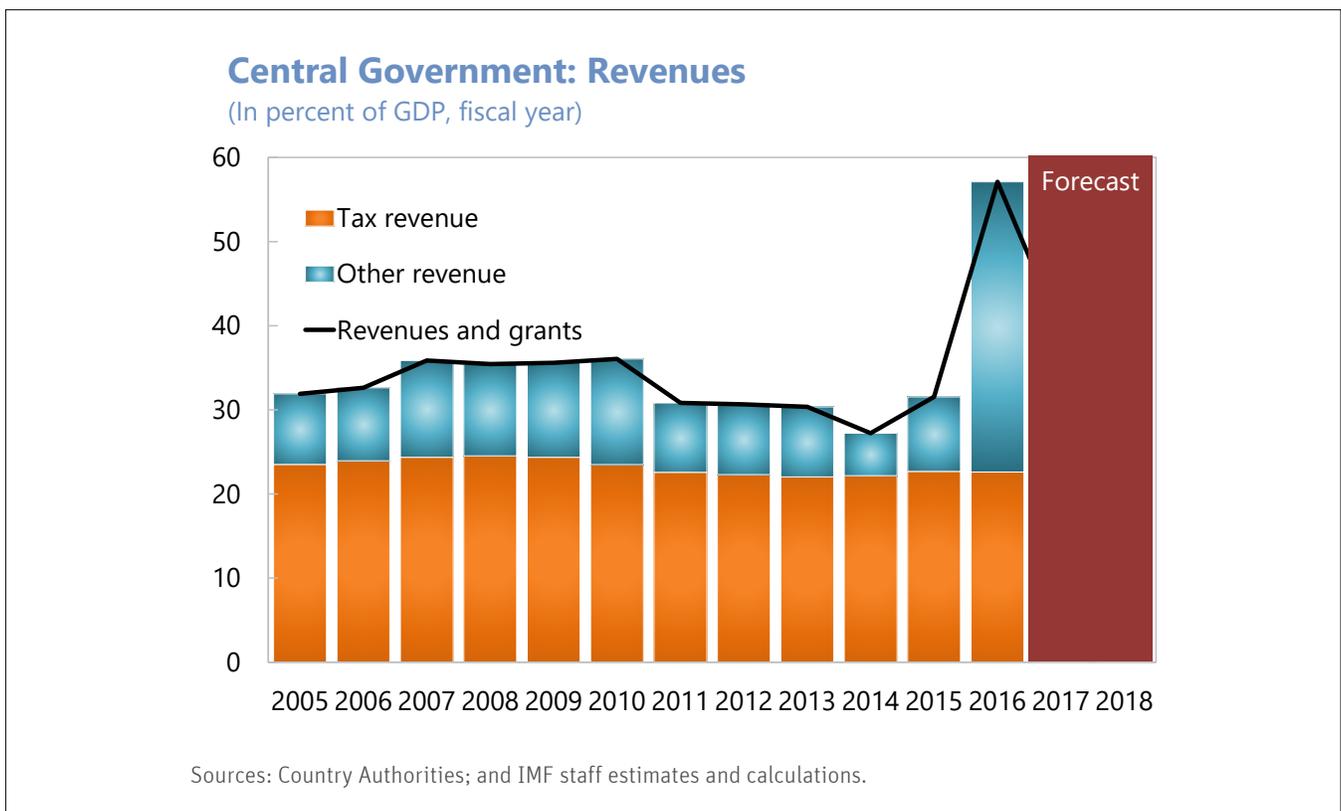
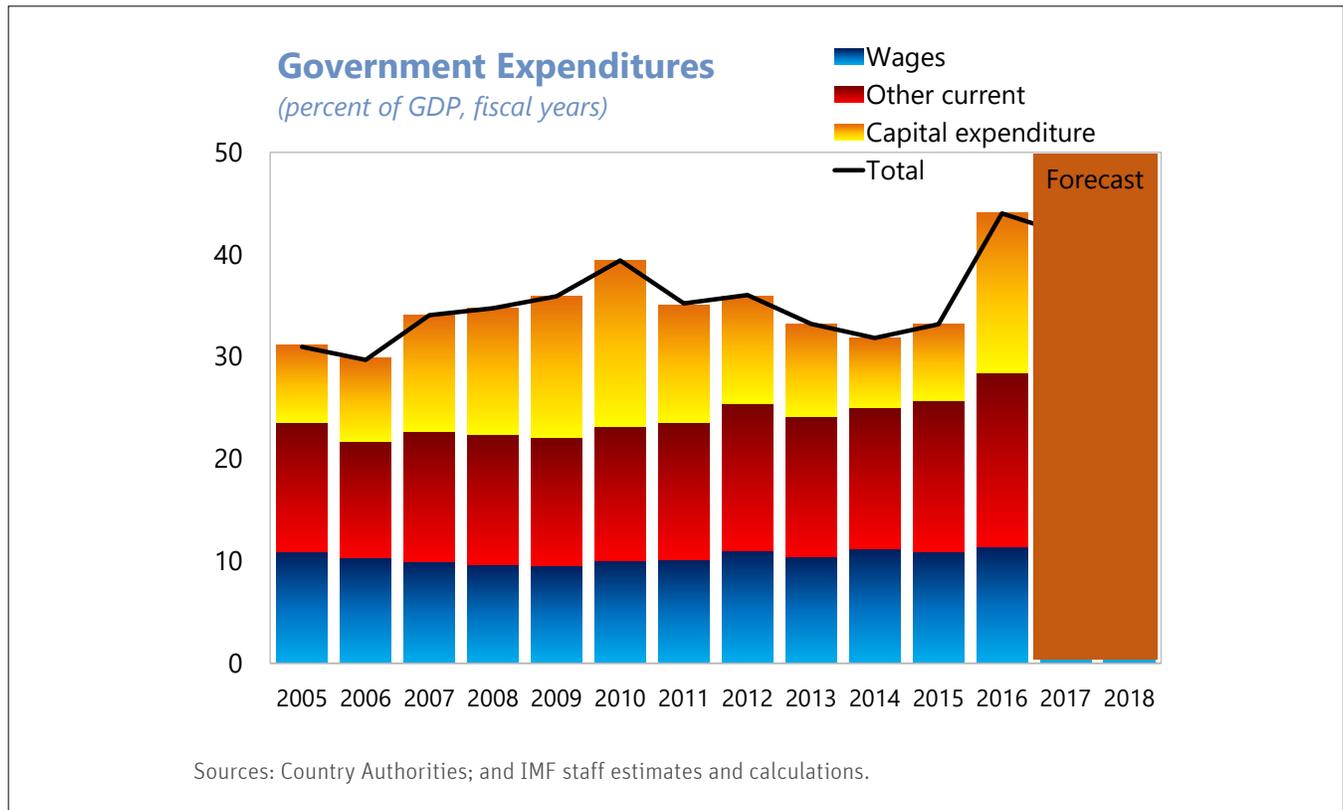


Figure 11: Government Expenditures



**A steep decline in output would reduce the tax base, which could worsen the fiscal balance to deficits of near 3 and 13 percent of GDP in FY2017/18 and FY2018/19, respectively.** This implies a significant deterioration of the fiscal balance relative to FY 2015/16, which showed an estimated surplus of 13 percent of GDP underpinned by Citizenship-by-Investment (CBI) program revenues.<sup>12</sup> In FY2017/18, tax revenues are projected to decline by over 30 percent (5 percent of GDP), with the decline in economic activity and the announced exemptions. Income taxes could be most affected, with possible declines to about one-third of pre-storm revenues. Expenditures, on the other hand, are expected to increase, on the back of goods and services' and transfers for social relief, and the reconstruction effort. Other expenditures are expected to remain broadly in line with budget allocations – mainly wages and pension expenditures and debt service obligations.

Public investment is expected to increase relative to the pre-storm plans given rehabilitation and reconstruction needs, and would pick up further in FY2018/19. The likely

need to re-assess, prioritize, and plan the reconstruction projects would create some initial delays in public investment execution. Assuming an increase in grants and a conservative outlook for CBI revenues, public debt would increase by 8 percent in nominal terms by end FY2018/19, to near 95 percent of GDP (up from estimated 74 percent in FY2016/17). Financing would be expected from disbursements from official creditors, and use of government deposits.

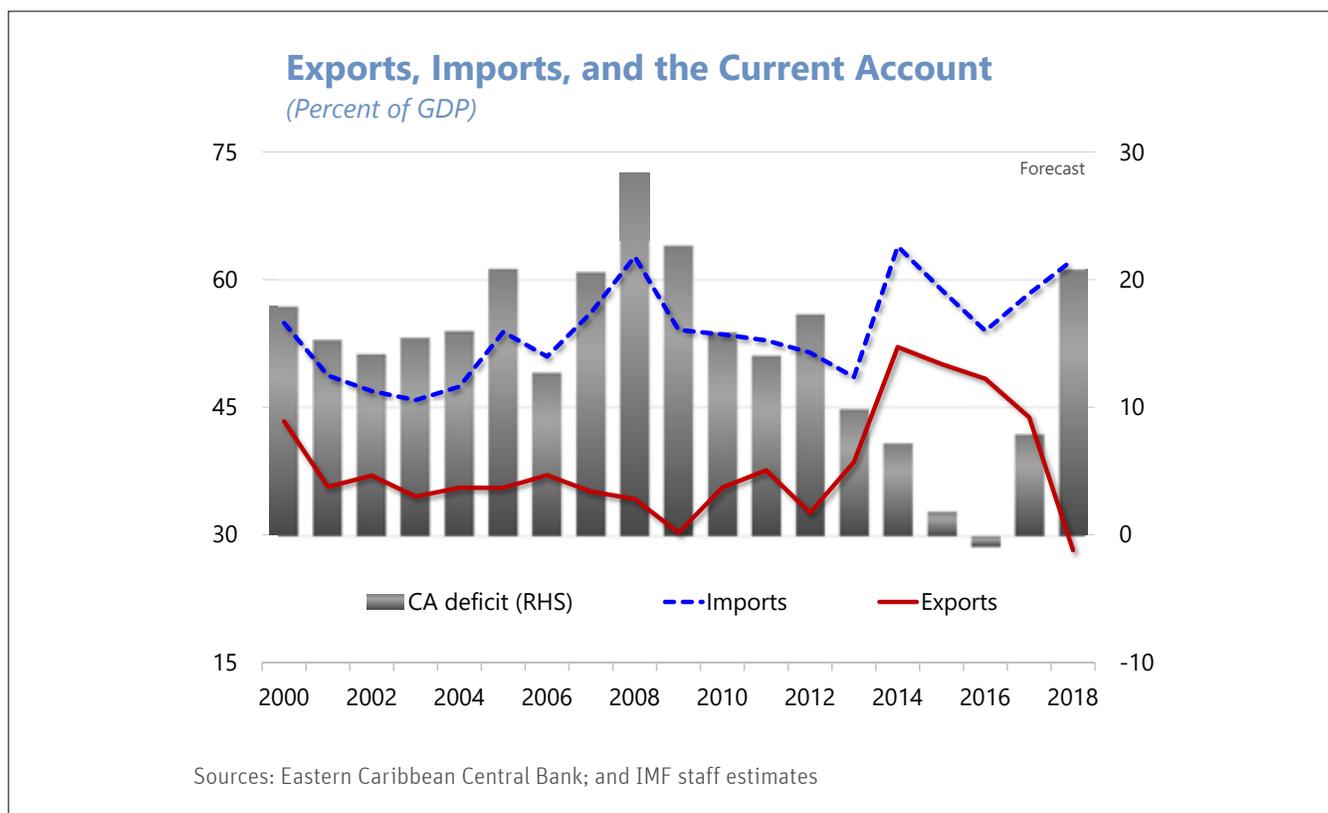
**The external current account balance would deteriorate sharply, to a deficit of 21 percent of GDP in 2018.** This mostly reflects the negative saving-investment balance of the public sector explained above. Exports of goods and services would decline to around ½ of pre-storm levels, to 28 percent of GDP, mostly reflecting the collapse in agriculture and tourism. Imports of goods and services are expected to show a smaller decline of 9 percent on the back of reduced households' incomes, and despite the resilience of government spending. External financing needs would be covered with official loans; insurance payouts, an increase in FDI for hotel reconstruction.

<sup>12</sup> The fiscal year begins in July.

**The financial sector is expected to remain resilient, albeit with an erosion of liquidity and capital buffers and some increase in NPLs.** Banks' mortgage portfolios are expected to be somewhat protected given that mortgaged properties are largely insured. Indeed, the damage to businesses and the likely rise in unemployment will likely push up NPLs. Private banks are not assumed to offer meaningful additional lending – clients are in general already highly leveraged. The large credit unions sector is expected to have a similar response, with some accommodation in lending and debt service relief. This reaction from the financial sector could help cushion the impact on the storm.

**A full economic recovery from the severe storm will require a large effort from Dominica and support from the international community.** Dominica had a commitment to reduce debt to less than 60 percent of GDP by 2030. Dominica's recovery will depend on its ability to mobilize the necessary financing, meticulous prioritization, planning, and sequencing of investments, and how successful it is in overcoming execution capacity constraints. Given the elevated debt and the significant shock now experienced by the country, support from the international community in the form of grants will be crucial to enable a recovery of Dominica's productive capacity without an excessive debt burden.

**Figure 12: Exports, Imports, and the Current Account**



## Human and Social Impact

### SUMMARY

**Loss of income is estimated at EC\$94.9 million.** Among the non-salaried economically active population 3.1 million work days were lost. The respective loss in work days and income resulting from the Hurricane, is likely to result in a 25 percent decline in consumption, which could translate into an increased poverty rate of 36.2 percent (from 28.9% as reported in 2009). This may, in turn, have the undesirable effect of increasing income inequality, which researchers argue could lead to an increase in violence and crime<sup>13</sup>.

**Change in the Quality of Life Index (QLI)<sup>14</sup> suggests there will be much variability in the quality of life at the parish level post Maria.** The findings suggest as much as a 36 percent decline in the quality of life in some parishes, with the lowest decline of 20 per cent in others. Unless every effort is made to reduce the geographic inequalities during the recovery period, the rural to urban drift may hasten, and the strong tendency towards out migration may increase.

**Government provides regular safety net to poor and vulnerable populations and has announced plans for programs to restore livelihoods, including a cash grant to subsistence farmers. Additionally, temporary relief may be provided through transfers from humanitarian agencies. However, given the immense scale of the event, current coverage of the safety net will need to be**

**further expanded to help restore reduced consumption and lost income to pre-disaster levels.** Short-term and one-off transfers may only partially bridge the gap needed to restore persons to their previous consumption levels and will need to be expanded to additional groups given the vulnerabilities of certain populations in this post-disaster context, including children, youth, women and elderly. Significant factors affecting consumption include a projected seven-month timeframe for full resumption of agricultural activities and the expected eight-months' time-frame for persons to remain in shelters; plus a three-to-six month period for full recovery of small business; and a minimum of 18 months expected for the reconstruction of the housing sector.

**The situation of poor elderly and single female heads of households is reason for concern.** A significant proportion were unable to move out of the shelters due to lack of access to housing material, knowledge of sourcing the material and inability to pay for the labour needed to rebuild. Many of these women, were without insurance and are caregivers for grandchildren.

**The disaster resulted in the loss of income, assets and agricultural production, and created a situation of vulnerability and food insecurity for wide segments of the population previously engaged in the agriculture, fisheries, tourism and commerce sectors. It is estimated that approximately 24,000 people will face severe or borderline food insecurity as a result of the Hurricane.**

**Table 3: Total affected population**

Total Population	Dead	Missing	Injured	Displaced	Number of persons requiring material support	Total number of persons affected
72025	30	34	n/a	1,862	65,000	66,926

Source: Estimates based on Government data

<sup>13</sup> UNDP (2012). In the HDR Report of 2012 for the Caribbean, it is noted that "Economic growth increases opportunities. It may, however, also intensify inequalities and exclusionary trends, and, in the rapidly changing societies of the Caribbean region, it may also trigger unrealistic expectations and have strong mobilizing effects even among the excluded. Exclusionary and jobless growth and, especially, high rates of youth unemployment, coupled with unrealistic expectations and high levels of inequality, tend to result in high rates of crime, including violent crime."

<sup>14</sup> A composite index of changes to housing, education, access to electricity, water, and per capita income.

## Change in Quality of life

Hurricane Maria, which came on the heels of Tropical Storm Erika two years earlier, dramatically impacted the quality of life of the average citizen of the Commonwealth of Dominica. As of November 8, 2017 30 persons had lost their lives as a result of Hurricane Maria (26 identified and 4 unidentified), and 34 were declared missing. Many families and individuals who were displaced as a result of Maria have returned home, travelled out of the island, or gone to live with family and friends. However some 1,862 individuals or 581 households are still in some 63 shelters (as detailed in Table 3). The United Nations reported that 32 per cent of the people still in shelters are among the most vulnerable. The most common vulnerabilities reported are: elderly persons (25 percent), single female-headed households (13 percent) and persons with chronic illnesses (12 per cent). Those who are still in shelters<sup>15</sup> indicated the main reason was the destruction or severe damage of their home.<sup>16</sup>

Hurricane Maria has affected some 21,240 households and an overall population of 66,920 throughout the 10 Parishes of Dominica. A significant proportion of the labor force is unemployment as an immediate consequence of Hurricane Maria. In addition, it is estimated that the decline in the production of goods and services may continue for one to two years, and will likely result in a loss of approximately 3,338,620 work days and EC\$963 million in personal income<sup>17</sup>, as detailed in Table 4. Personal income losses from the productive sector accounts for 57 percent of total income lost. The main contributors to this sector are tourism, agriculture and commerce.

**Table 4: Work days lost and personal income lost by sector**

Sectors	Work days lost	Personal income lost (EC\$ M)
Productive	1844019	548
Social	670,654	112
Infrastructure	823,947	302
<b>Total</b>	<b>3,338,620</b>	<b>963</b>

Source: Estimates based on Government data

Income inequality may become an issue of concern following Hurricane Maria. The data suggests that a significant proportion of the population will not only be without an income but also without access to usual agricultural production for a lengthy period of time (from seven months to a year). The 2009 Country Poverty Assessment (CPA) noted that income inequality, as measured by the Gini Coefficient, stood at 0.444 which suggested a medium to high degree of inequality. However, the other measure of inequality used was a comparative analysis of the consumption of the richest and poorest 10 percent of the population. That comparison suggested that the richest 10 percent accounted for 37.2 percent of consumption while the poorest 10 percent accounted for two percent. The respective losses in work days and income from Hurricane Maria will result in a decline in consumption, and may exacerbate the already existing inequality. An expected proportional drop in income could be as high as -41 percent, as detailed in Table 5.

<sup>15</sup> IOM DTM Survey Round 1, 19 October 2017

<sup>16</sup> United Nations Sit Report #8 Dominica, 26 October 2017

<sup>17</sup> Estimates of losses in work days and personal income is part of the cross cutting analysis and is dependent on the outcomes of the sector reports, particularly the sector reports on the duration of expected disruption of production of goods and services. This is triangulated by key informant interviews with national sector specialists and field visits to see those whose livelihoods have been affected. It is important to note that income of persons working in the civil service (such as administrators, teachers and nurses) is not expected to be affected, as these salaries will continued to be paid. For this reason, they are excluded from this analysis.

**Table 5 : Proportional drop in income as a result of Hurricane Maria**

Work days lost	3,163,275
Personal income	94.9
Income before Maria (EC\$ in millions)	128
Income post Maria (EC\$ in millions)	75.9
Proportional drop in income	-41%

Source: Estimates based on Government data<sup>18</sup>

Another measure of the impact of Hurricane Maria on the population is the change in the Quality of Life Index

(QLI)<sup>19</sup>, calculated using pre disaster data sets and post disaster information drawn from the sector assessments.<sup>20</sup> Analysis of the QLI (as illustrated in figure 1, based on Table 7), indicates that the highest decline in QLI occurred in St. Peter and St. John parishes, with more than a 36 percent decline. The lowest decline in QLI was in St. Paul, with less than a 20 percent decline<sup>21</sup>. Should development in the parishes remain uneven, two migratory trends may be exacerbated: rural to urban migration, and emigration, which has already begun to take effect.

Table 6 presents the sectoral indicators selected for use in the estimation of disaster impact on quality of life for the affected population<sup>22</sup>: The only indicator that could not be calculated was the health indicator, as much of the pre disaster data sets of the sector were destroyed by

18 Income before Maria is calculated based on the number of workers, daily wage, and number of days worked per year. Post-Maria income is calculated by subtracting the number of months in which each sector is expected to be inactive from the annual income multiplied by the monthly income.

19 Notes to the QLI:

The QLI is a simple unweighted composite index.

1. On housing, Dominica had a housing surplus (instead of a housing deficit) prior to the disaster. Thus the housing index before the disaster is above 1.0. The disaster caused widespread damage and destruction of housing units, and the post-disaster housing index declines significantly.

2. Since no data on number of injured was made available from the Health Sector, the QLI can only include 5 variables, instead of the usual six.

3. The pre-disaster information on personal income (which represents per capita GDP) has been adjusted. It now shows numbers for the entire parish of St. George, instead of data for the City of Roseau and the Rest of St. George. This was achieved by simply taking the cumulative figure for the City of Roseau and the Rest of St. George as presented in the 2011 Population Census data.

4. When estimating personal income index, a value of 1,000 was assigned to the Parish of St. Mark, which has the highest personal income (1,963 per person). And the corresponding indices for the rest of the parishes are estimated in reference to the value of St. Mark.

5. The values of post-disaster personal income are still preliminary as full estimation of production losses continues. Should these change, the post-disaster personal income numbers should be adjusted, resulting a change to the QLI.

20 UNDP initially sought to use changes in the Human Development Index, as a measure of change in quality of life following a disaster. This was soon recognised to be a very difficult task as the HDI was a static measure, and many of its sub-indices were not sensitive to disasters nor were they based on current data sets. Jovel and Kambon working on developing a methodology for the Government of India as part of an ADPC project, proposed that at the macro level “the team should consider the utilization of a selected number of indicators available at the national or sub-national level that would be sensitive to disasters for use in measuring the impact of the disaster on the quality of life of the members of the community”. They went on to suggest that “Indicators that may be sensitive to define the macro-social impact, would be those whose data sets have been used in sectorial assessments and where a marked change is measurable”.

21 More analysis is required of the pre-existing conditions in the Parishes that would have led to such outcomes. What can be noted however is the fact that St. Paul had the highest per capita GDP among all the Parishes and the newly thriving University City of Portsmouth, is in the parish of St. John.

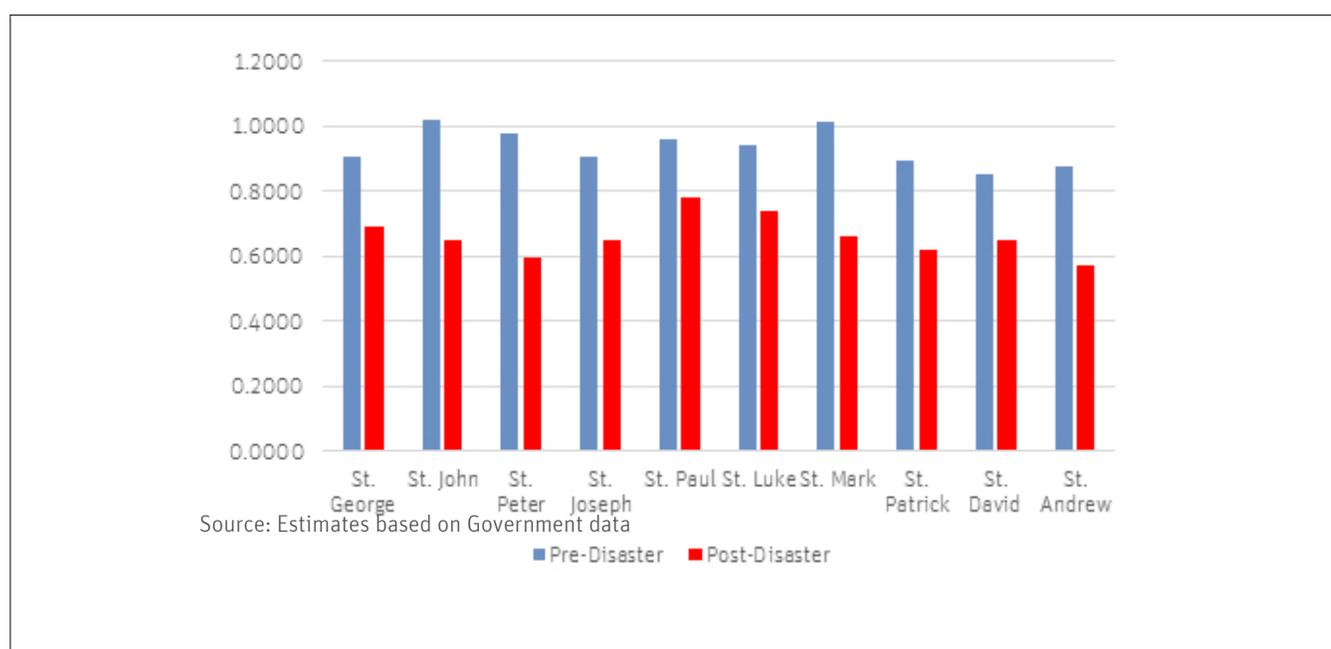
22 The quality of life indicators were selected following substantive discussions with sector specialists, the Chief Government Planner and the Dominica Statistics Division. The selected indicators were chosen on their sensitivity to disasters and their ability to capture the key components of the quality of life as experienced in Dominica.

Hurricane Maria, making it challenging for health sector experts to provide the necessary information.

**Table 6: Sectoral indicators used to estimate change in quality of life**

Change in:	
Quality of Housing	Using the data from the Population and Housing survey on the number of persons living in dwelling units, the index will measure the change in the status of housing condition as a result of the hurricane by the household
Number of patients treated in hospitals	Physical or psychological injuries, or due to the occurrence of disease outbreaks or requiring emergency treatment from chronic diseases that could not be treated as a result of the disaster
Number of school-days accessed (or number of school days lost ) by students due to interruption of classes	The baseline will come from the Ministry of education that will indicate the normal number of days of schooling a student is expected to have in a school year and the period which children have not been able to access education as a result of Hurricane Maria
Household connections to the electricity grid	The baseline is drawn from the Census data that indicates the number of persons on the grid by parish; the post disaster data will be provided by the electricity sector from data collected on the number of persons able to access electricity following Maria
Household access to potable water	Baseline will come from census data on the number of Households that receive pipe borne water into households, receive water provided by pipe in yard , or via public standpipe; and information will come from DOWASCO about household access following hurricane.
Annual or household income	Per capita income by parish will be utilized for the year prior to Hurricane Maria and per capita as a result of sector reports on change in flows ( or losses ) for each sector following the disaster.

**Figure 13: Composite index for change in the Quality of Life following Hurricane Maria<sup>23</sup>**



<sup>23</sup> From the data collected, five indices were prepared. The results composite index was calculated as a simple composite index without weighted averages.

St. Andrew	0.8738	0.5684
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Source: Estimates on Government data

**Table 7 : Quality of Life Index**

Parish	QLI	
	Pre-Disaster	Post-Disaster
St. George	0.9081	0.6885
St. John	1.0184	0.6469
St. Peter	0.9779	0.5941
St. Joseph	0.9075	0.6504
St. Paul	0.9567	0.7774
St. Luke	0.9430	0.7387
St. Mark	1.0103	0.6616
St. Patrick	0.8941	0.6195
St. David	0.8499	0.6514

**SOURCES:**

IOM. Displacement Tracking Matrix (DTM) – Dominica Hurricane Maria Response Round 1 – 20 October 2017. [https://www.humanitarianresponse.info/system/files/documents/files/dtm\\_dominica\\_report\\_round\\_1\\_20171019\\_0.pdf](https://www.humanitarianresponse.info/system/files/documents/files/dtm_dominica_report_round_1_20171019_0.pdf)

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## Social Protection

### 1. SUMMARY

Data simulations reveal that poverty in Dominica is likely to increase by 14 percentage points due a 25 percent reduction in consumption caused by lost income directly resulting from Hurricane Maria. With this scenario, the poverty head count is expected to rise from 28.8 percent to 42.8 percent; while the number of indigent individuals will double from 2,253 to 4,731; and, the number of poor will rise by 40 percent. Almost 2,800 individuals considered vulnerable prior to Maria will fall below the poverty line. In the Parishes of St. Joseph, St. Patrick, St. David and St. Andrew, more than half of the population are expected to fall into poverty. For other scenarios, an optimistic scenario estimating a 15 percent decline in consumption will translate into a poverty rate of 36.5 percent, while a pessimistic scenario estimating a 50 percent decline in consumption will result in an increased poverty headcount of 67.3 percent.

The Government of Dominica provides regular safety nets to poor and vulnerable populations and announced plans for programs to restore livelihoods, including a cash grant to subsistence farmers. Given the immense scale of the

event however, current coverage of the regular safety net will need to be further expanded to help restore reduced consumption and lost income to pre-disaster levels.

Approximately EC\$22.11 million (US\$8.19 million) is needed to finance the recovery strategy for social protection.

### 2. PRE-HURRICANE CONTEXT

At the time of the last CPA in 2009, Dominica was on a path to reducing poverty, recording a poverty headcount rate of 28.8 percent (ten percentage points lower than the 39 percent recorded in 2003).<sup>24</sup> Poverty may have likely declined during the period between the last CPA and the passage of Hurricane Maria, given a range of social protection initiatives introduced by the Government in recent years. However, in the absence of recent poverty data, the impacts of the expanded safety net on poverty cannot be assessed. Furthermore, repeated exogenous shocks since the last poverty assessment in 2009, including the global financial crisis, Tropical Storm Erika, and now Hurricane Maria have threatened to derail poverty reduction efforts. Based on the CPA, children,

<sup>24</sup> Caribbean Development Bank and Kairi Consultants. 2009.

youth and the indigenous population demonstrated higher probability of being poor, while most poor were employed, or ‘working poor.’

Social Protection (SP) is critical to helping the poor and vulnerable manage the risks they face and includes safety nets (social assistance), social insurance, labor market policies, social funds, and social services (Grosh et al, 2008). For Dominica, the SP system’s baseline includes a wide range of Government-led SP programs aimed at

addressing different vulnerabilities across the life cycle. However, this is hampered by a lack of updated poverty data to inform decision making; limited coverage given indicative poverty rates from the last survey of living conditions (SLC); limited spending efficiency resulting from duplication and fragmented service delivery; and rudimentary service delivery for identification, payments and monitoring, that limit the ability of the system to respond rapidly to the impacts of shocks. (For additional details, see Annex 1).

**Table 8 : Key Baseline Data for the Social Protection Sector**

Variable	Population	Poverty Line (monthly)	Poverty Rate	Unemployed Total	Female UE	Male UE	Labor Force	Average Value of Monthly Cash Transfer	Monthly Cash Safety Net Recipients <sup>25</sup>	Social Security Contributors
Value	73,543	\$519	28.8 (20,758) <sup>26</sup>	13.9	17.6%	11.1%	31,222	215	3609	22,737
Year	2016	2009	2009	2009	2009	2009	2011	2015	2015	2016
Source	World Bank	CPA	CPA	CPA	CPA	CPA	Census	Administrative	Administrative	DSS

### 3. EFFECTS<sup>27</sup>

As a consequence of Hurricane Maria, there is an estimated 3.1 million lost days of work, leading to a total income loss of EC\$94.9 million (US\$35.15 million). Inflationary effects resulting from supply side shortages should reduce purchasing power capacity and also affect final consumption, however, due to the lack of information, the latter effect is not considered. Income losses estimated during the post-disaster assessment is used as a proxy for consumption reduction. A first scenario is modelled, considering a 25 percent decline in consumption. Two additional alternatives are modelled (an optimistic scenario estimating a 15 percent decline in consumption and a pessimistic scenario estimating a 50 decline in consumption) to provide a range of the possible effects of Hurricane Maria on poverty.

With a 25 percent reduction in consumption, the poverty head count is expected to rise by 14 percentage points from 28.8 percent to 42.8 percent; while the number of indigent individuals will double from 2,253 to 4,731; and the number of poor will rise by 40 percent. Almost 2,800 individuals considered vulnerable prior to Maria will fall below the poverty line. In the Parishes of St. Joseph, St. Patrick, St. David and St. Andrew, more than half of the population are expected to fall into poverty. For the other scenarios, an optimistic scenario estimating a 15 percent decline in consumption will translate into a poverty rate of 36.5 percent, while a pessimistic scenario estimating a 50 percent decline in consumption will result in an increased poverty headcount of 67.3 percent.

<sup>25</sup> Includes 2,049 Public Assistance beneficiaries and 1,560 Over 70 Allowance beneficiaries (2015)

<sup>26</sup> The population in 2008 was 72,018.

<sup>27</sup> These simulations estimate the poverty impacts and needs based solely on Hurricane Maria’s impacts.

**Table 9: Poverty headcount: pre- and post-Maria scenarios**

	Indigent	%	Poor	%	Vulnerable	%	Non-poor	%
Pre-Maria	2,253	3.1	18,505	25.7	8,253	11.5	43,014	59.7
15% reduced consumption scenario	3,839	5.3%	22,481	31.2%	9,323	12.9%	36,386	51%
25% reduced consumption scenario	4,731	6.6%	26,092	36.2%	11,007	15.3%	30,199	41.9%
50% reduced consumption scenario	12,595	17.5%	35,867	49.8%	6,983	9.7%	16,580	23.0%

In the aftermath of the event, Dominica's safety net system has been moderately affected by damages to buildings used for service delivery and slight delays in delivering payments. Despite this, several regular safety nets have continued providing benefits, including Public Assistance and Over 70 Allowance. However, the system needs to be further equipped to fully address increased demands on the system, given the immense scale of the event. There has been physical damage to 20 of 42 village council buildings, critical to serving Public Assistance to Over 70 Allowance and National Employment Program (NEP) beneficiaries. Three of those village councils will need temporary relocation (Bagatelle, Soufriere, and Boetica). Nevertheless, from qualitative interviews with beneficiaries and program staff, most reported receiving payment by October 16, with some payments delivered directly in shelters.

An issue noted during the assessment exercise is the limited ability of the main safety net programs to scale up to address the poverty impacts of reduced income and consumption. Interviews with program staff have indicated that since the passage of Hurricane Maria, new applications to Public Assistance and the Public Support Program are currently on hold. Furthermore, post Tropical Storm Erika transfers (Rental Assistance, Displacement Allowance, and Loss of Content Grant) to address displacement are not yet being scaled up, despite over 17,000 homes significantly or completely destroyed. The future of these transfer programs will be reviewed in December, 2017. Tightened fiscal space in a post-disaster context such as this, understandably limits the resources available to expand coverage beyond those already enrolled in safety net programs, while there is an increased demand on the safety net. Additionally, although some relief may be provided by temporary transfers by humanitarian agencies, these short and one-off transfers may only partially bridge the gap needed to restore previous consumption levels of affected people, given

the projected seven-month timeframe for full resumption of agricultural activities and for persons to remain in shelters; plus three to six months for full recovery of small businesses; and the 18 months expected for the housing sector.

For Social Security, impacts are difficult to estimate, given the recent nature of the event. However, with projections for increased unemployment in several sectors and significant recovery times before sectors return to full capacity, some effects on social security reserves may be experienced. Increased out-migration by productive workers and permanent closure of businesses could also exacerbate these effects. This could potentially impact the long-term sustainability of the scheme, and consequently limit the impact of recent reforms introduced by Dominica Social Security (DSS) to address sustainability. Although too early to attribute, initial data reveals contribution income and active insured post-Maria show a slight decline relative to pre-Maria rates. Contribution income fell from EC\$4.52 million in August 2017 to EC\$4.11 million in September 2017, while active insured 21,806, lower than recorded in the past five years. Given that it is too early to see the effects of potential labor impacts on the social security system, it is suggested that DSS closely monitor contributions over the coming 12-month period to assess any negative trends in the sector.

Despite damages to some buildings required for social care services, there are varied changes in delivery of social care services. The Chances Home for abused and neglected children is currently home to 19 children, ranging in age from two months to 18 years. The center's roof was partially damaged and there was water damage to two floors of the building. As a result, all 19 children were sleeping in one room at the time of the assessment visit, as the other bedrooms were damaged. The center has a working generator and therefore has electricity. The Home had been reconnected to the Dominica Water

and Sewage Company Limited (DOWASCO) system. In addition, partners had affixed five Sawyer water filters to be used for cooking and drinking water. Food services for the children appeared not to have been significantly affected, although the babies appeared under-weight. Whether this was a pre-Maria condition was difficult to assess. However, the general unsanitary conditions of the facility, both internally and externally, suggest significant pre-Maria cleaning and maintenance issues. If left unchecked, there may be potential psychosocial effects on the children from the accumulated impacts of the living situation at the home.<sup>28</sup> Also, the trauma of the event itself on the well-being of the children in the residence should be addressed.

The Operation Youth Quake Facility, which ordinarily accommodates both children in conflict with the law as well as those in need of care and protection, was not operational. It lost part of its roof over the section which caters to girls. Tarpaulins, which have been provided, need to be affixed and the service restarted as soon as possible.

For the infirmary, residential care is provided for 96 elderly. The building experienced flooding and damage to electrical and telecommunication systems. The roof for a storage facility was also damaged. Although residential services have not been affected, the infirmary's daycare center services will likely be suspended until December 2017.

Rudimentary service delivery systems and limited capacity in Ministries, resulting from the immense scale of damage across the country, had a direct effect on the ability to rapidly assess households to support identification, benefit delivery, and longer-term support for affected households. In the weeks following the hurricane, Government staff were using paper-based forms to collect information on household damage, with limited standardization in the recording process and significant problems with quality control. These issues were so problematic that the instrument was recalled. As a result, six weeks after the storm, a comprehensive assessment of all affected households was not yet completed. Electronic data capture and the availability of data through a social information system would provide the government with the data and tools needed for supporting these processes.

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

As a consequence of higher unemployment and the work days lost, individuals will see their possibilities of contributing to social security affected, especially in the case of private sector employees. A decrease in the number of active contributors could affect Dominica Social Security net income as benefit expenses will remain the same, while total income could decline. In recent years, the difference between income and expenditures has been positive and growing and the net assets and reserves position exceed benefit expenditure (more than 7 times in 2013). This favorable position can change depending on Hurricane Maria's effects over the long run.

The decrease of social security contributors and beneficiaries will also have another macro-economic effect as the number of persons in need of social assistance is expected to rise. Besides, the increase in the number of poor households not only will have a negative impact on individual livelihoods but it will also affect economic performance at an aggregated level. Individuals falling into poverty can implement bad coping strategies, such as diminishing food intake or reducing human capital investments that in the long run will affect their productive capabilities and reduce economic growth. As a consequence, there will be a growing need of spending on social safety nets that will represent a higher share of total public spending in the long run. The country's fiscal situation, already under stress due to high debt levels and reconstruction needs, could hence worsen.

#### 5. RECOVERY STRATEGY

##### Recovery Needs and Prioritization

Using the 25 percent reduction in consumption, a total investment of EC\$1 million (US\$370,370) (0.07 percent of GDP or 17 percent of Public Assistance expenditure) is needed to bring indigent households to consumption levels prior to Maria. If a strategy is taken to restore pre-Maria consumption levels for all poor, EC\$11.9 million (0.83 percent of GDP or 200% of Public Assistance expenditure) would be needed. The pessimistic scenario of 50 percent decline in consumption will cost 0.47 percent of GDP to restore indigent households to previous consumption (2.6 percent of GDP if poor households are also considered).

<sup>28</sup> Based on UNICEF assessment

**Table 10: Estimated Cost to Return to Pre-Maria Poverty Levels**

	Indigent – Restoring previous consumption			Indigent and Poor - Restoring previous consumption		
	Dollar Amount Needed (EC\$)	% of GDP	% of Public Assistance Expenditure Needed	Dollar Amount Needed (EC\$)	% of GDP	% of Public Assistance Expenditure Needed
Post-Maria (15% drop)	604,154	0.0%	10.2%	7,145,239	0.50%	120%
Post-Maria (25% drop)	1,006,924	0.07%	16.9%	11,908,732	0.83%	200%
Post-Maria (50% drop)	6,751,244	0.47%	114%	36,818,871	2.6%	620%

The recovery strategy for social protection is centered on three pillars, (i) expanding the safety net to assist with consumption smoothing in the short and medium terms; (ii) restoring and improving service delivery systems to facilitate quick and efficient response to affected and poor households in the short and medium terms; and (iii) establish measures in the medium to long terms to build household resilience and ensure adequate financing for rapid scale up of the safety net system in times of shock. The strategy is a direct response to the recovery needs triggered by the impacts of the event on employment, incomes, livelihoods, and quality of life.

Approximately EC\$22.11 million (US\$8.19 million) is needed to finance this recovery strategy. As detailed in Section 3, 2,500 previously poor persons are likely to become extreme poor, while 7,500 previously vulnerable and non-poor persons are predicted to fall into poverty. Although the public safety net broadly covers the life cycle, transfer amounts and program coverage are not adequate to cover the new indigent and poor resulting from loss of assets and livelihoods. This recovery strategy proposes a prioritization of existing Public Assistance beneficiaries (given the program's targeting efficiency to extreme poor), the newly indigent, and the unemployed.

Approximately EC\$11.03 million is proposed to respond to the immediate consumption needs resulting from lost assets, livelihoods and reduced income and consumption. . A number of safety net responses to help restore consumption and substitute lost income are proposed to cover the newly extreme poor, while also providing immediate support for children, the elderly, and unemployed. These are detailed in Table 11, and include both vertical expansion (increased transfers) and horizontal expansion (increased beneficiaries) of Public

Assistance; expanded cash-for-work (ideally linked to certification and skills upgrading); and expanded school feeding to provide nutrition for school-aged children, who are disproportionately represented among the poor. Additionally, given the bottlenecks with post-disaster identification of affected households to provide various packages of Social Protection support, it is urgent that an efficient mechanism for collecting data on affected households be developed. As such, an electronic post-disaster household assessment system is proposed with offline and mobile capacity for quick data capture and rapid identification and assessment of household needs in post-disaster settings. In the medium term, expanded school feeding for secondary school-aged children is proposed and the development of improved delivery systems for more efficient delivery of safety net benefits, namely a social information registry and management information system (MIS) and modernized payment delivery mechanisms.

### **Recommendations for DRR and Building Resilience in Sector**

Ensuring that households are more resilient to the impacts of disasters is essential in post-Maria Dominica. With an expanded safety net, it would be important to introduce mechanisms to lift households further above the poverty line than pre-Maria levels and ensure their improved resilience through participation in more productive activities; higher income earning opportunities; climate resilience livelihoods and to mitigate against negative coping when disasters strike. A productive inclusion program to the non-indigent poor is suggested as a medium term start to achieving these objectives.

Finally, post-disaster contexts always necessitate expansion of the safety net, as Dominica's post Tropical

Storm Erika and post Hurricane Maria experiences illustrate. Contingency financing exists through the Caribbean Catastrophic Risk Insurance Facility (CCRIF), but those are not sufficiently linked to financing for safety net scale-up. As such, a contingency financing mechanism for the safety net is proposed to provide immediate resources for rapid scale-up of the safety net. Similar mechanisms such as Mexico's FONDEN's facilitation of rapid scale up of the Temporary Employment Program is one model that can be referenced as a best practice. This could also be operated through a revolving fund model.

**Table 11: Short, Medium & Long-term Recovery Initiatives and Costs**

	Item	Description	Cost	
			EC\$ M	US\$ M
Short term	Emergency top-up to Public Assistance. (Vertical expansion)	Medium-term top-up to Public Assistance beneficiaries for six months, timed to follow any short-term transfer provided by humanitarian agencies. (EC\$100/month to 800 households)	1.00	0.37
	Expand Public Assistance coverage to the new extreme poor (Horizontal expansion)	Short term expansion to approximately 2,500 new beneficiaries for 9 months	4.50	1.66
	Expand cash-for-work	Short term expansion of cash-for-work to 1,200 individuals for six months (estimated unemployment) (EC\$600/month)	4.50	1.67
	Expand School Feeding	Expand coverage of the school feeding program to cover to all public primary schools. This will cover 5,077 indigent and poor primary school aged children (there were 1,697 children receiving school feeding in 2015/6). (unit cost of \$45 per student per academic year) This will be a recurrent cost following roll-out	0.23	0.08
	Electronic post-disaster household assessment system	Develop an electronic post-disaster household assessment system with tablet support for electronic field updates.	0.54	0.20
	Review of social care institutions	Review of post-hurricane conditions at social care institutions and implementation of strategies to address the needs of vulnerable in these institutions.	0.27	0.10
Medium Term	Expand School Feeding	Medium term expansion of the school feeding program to cover all public secondary schools. This will cover an 4,394 indigent and poor secondary school-aged children, most of whom are currently without access to school feeding (as it is offered only in 3 secondary schools). (unit cost of \$45 per student per academic year) This will be a recurrent cost following roll-out	0.20	0.07
	Social information registry and MIS	Develop a social information registry to store data on poor households – for better service delivery, improved monitoring, and better data capture for disaster preparedness actions and fast identification of households in post-disaster contexts.	2.70	1.00
	Modernize payment delivery	Expand and modernize social protection payment delivery, for faster delivery of benefits to affected households in post-disaster settings	0.81	0.30
Long Term	Develop productive inclusion program for poor households (resilience)	Develop and roll-out a program to link safety net beneficiaries to productive activities, higher payment income generating activities, and climate resilient livelihoods – to increase their resilience and reduce the likelihood of them falling into poverty in future shocks. It will primarily focus on providing productive inclusion support to 25 percent of the non-indigent poor ages 20-45 in intervention rounds ranging from six to nine months. (approximately 2,055 persons) <sup>29</sup> This is proposed to be a recurrent cost following roll-out.	2.39	0.87
	Quick Response Fund	Develop a contingency financing mechanism for the social safety net to enable rapid scale up in times of crises and roll-back in periods of stability.	5.00	1.85
<b>TOTAL</b>			<b>22.1</b>	<b>8.19</b>

29 For an estimated 25 percent decline in consumption, it is estimated that there will approximately be 8,225 non-indigent poor.



## Implementation Arrangements

The different measures should rely as much as possible on existing management tools and key stakeholders in order to build a resilient Social Protection and labor market system, able to respond in an efficient manner to disasters. A central registry compiling into a single common database households' information will contribute to a better assessment of needs before and after a disaster and for delivering relief and assistance. This implies changing data collection from paper-based

mechanisms to a computerized system. Operations manuals and referral protocols are also important means for coordinated interventions. Changing the payment mechanisms from cash to increased electronic delivery of transfers is also a way of reaching people as fast as possible following a disaster. Institutions such as the Help Desk, introduced after Tropical Storm Erika, could also be expanded for the delivery of benefits, based on their accumulated experience and know-how.

## Food insecurity

### 1. SUMMARY

The hurricane occurred in a critical moment in the agricultural calendar. Given the damage and the recovery time needed, a deficit in the availability of certain crops for the coming months could be foreseen. In addition, households whose livelihoods were affected by the hurricane are having difficulty coping with the loss of income needed to cover food and other basic needs. The disaster led to loss of income, assets and agricultural production, and created a situation of vulnerability and food insecurity for the population.

The WFP estimates that approximately 24,000 people are severe or borderline food insecure as a result of the Hurricane. Taking into account the resilience capacity of people and their own desire to help their communities, the design and implementation of recovery strategies should be people-oriented, and undertake a multi-sectorial approach, involving government, multi-lateral institutions and civil society.

### 2. PRE-HURRICANE CONTEXT

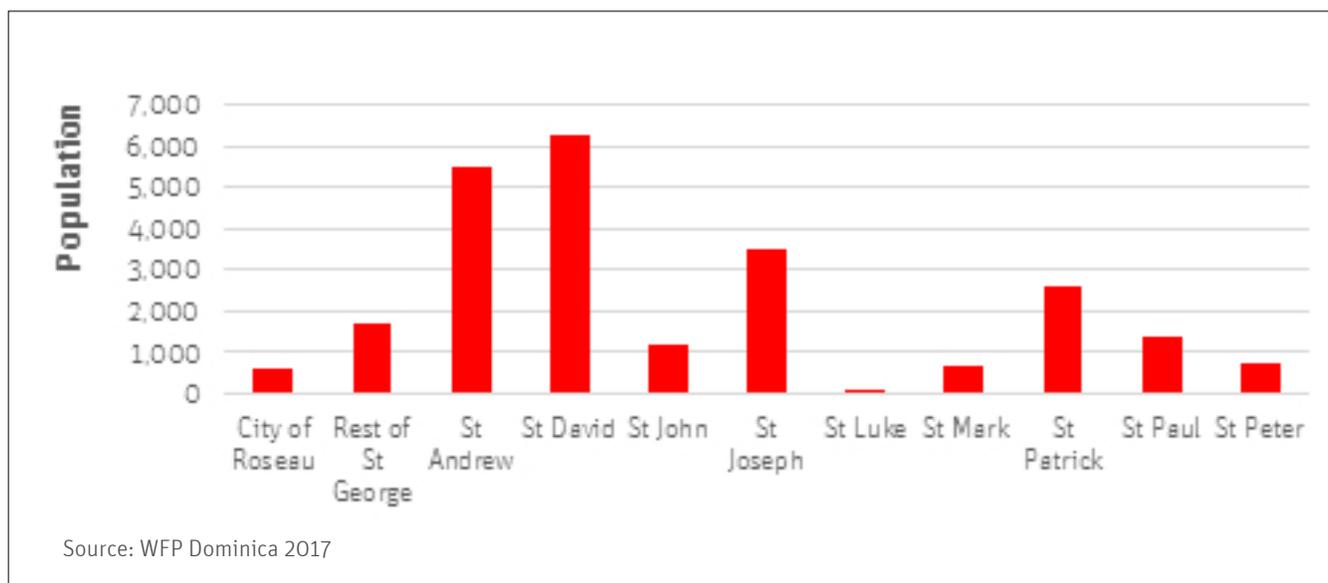
Dominica has sufficient available food to satisfy population needs. Even though agricultural production has declined over the past years, the food dependency ratio is still favorable, as 45 percent of the population has agricultural production as their main source of food (Food and Agriculture Organization (FAO) STAT 2014). Farming is typically done at a small-scale. Information provided by Ministry of Agriculture and Fishery (MOAF) indicates that about 8,300 Dominicans are small-scale farmers for both commercial and subsistence purposes. More than 22 percent of the Dominican adult population is engaged, either formally or informally, in the agricultural sector.

While Dominica has sufficient food supply overall, it is not self-sufficient in the production of high-protein foods like animal products (FAO Country Profile 2003). Commercial livestock ranching is also present on the island, including

cattle, goats, pigs and chickens, however at low levels (FAO STAT 2014). Animal products are largely imported to cover the food needs of the population. Dominica has a robust artisanal fishing industry. There are around 32 fishing landing areas along the 148km coastline. However, the Dominican fish industry is only able to satisfy domestic demand.

Backyard gardening is a stable source of tubers and roots consumed by Dominican households. From field observations, the World Food Program (WFP) estimates that around 80 percent of households, besides those living in Roseau and Portsmouth, have backyard gardens where families cultivate roots, tubers and vegetables. To complement household production, families purchase meat, milk, cheese, fish products, and oils. WFP's market assessment revealed that much of the imported food available in local markets are calorie-dense and high in fat and sugars. Poor households are more likely to choose these types of foods, as they are more affordable. Unhealthy consumption patterns contribute to the high rate of obesity in Dominicans, with a 52.6 percent obesity prevalence (World Health Organization (WHO) 2010).

While agricultural and animal products are typically available, food access remains an economic challenge for many Dominicans. The 2009 CPA revealed that about 29 percent of the population in Dominica live below poverty line and 11 percent were found to be indigent. Poor Dominicans spend large portion of their income on food. Poor households with high food expenditure are more vulnerable to market price rises as they have a narrower gap in their income to absorb an increase in food prices. Many are forced to resort to negative coping strategies to meet household needs. The 2009 CPA revealed that members of poor households borrow money and engage in high-risk activities in response to poverty and food insecurity. Other negative coping mechanisms include reducing the number of meals and food portions. Perhaps the most extreme food insecurity scenario is experienced by the population of the Kalinago Territory.

**Figure 14: Food Insecurity Estimates by Parish**

### 3. EFFECTS

Hurricane Maria irrevocably impacted livelihoods through Dominica, including in the agriculture, fishing and tourism sectors. The disaster led to loss of income, assets and agricultural production, and created a situation of vulnerability and food insecurity for the population. The WFP estimates that approximately 24,000 people are severe or borderline food insecure as a result of the Hurricane. The following graph shows an estimation by parish<sup>30</sup>.

#### Food Availability

The results of the overall damage, total and partial, in the agriculture sector leads to a decline in the national crop production, impacting: domestic markets by reducing volumes of supply to traders; loss of income and foreign exchange; and, limited or no food for households. There remain some farmers in the north that salvaged a portion of their crops, however, salvaged production is not enough to compensate for losses from high productivity regions. Most national agricultural production occurs in the southern interior zones, where agricultural damage was extensive.

WFP's Market Assessment conducted in October 2017 shows that retailers have limited to no stocks of tubers,

vegetables, fruits, flour, rice, and chicken. Wholesalers have experienced an average reduction of 50 percent in their trade volumes. Damage to the national electrical grid has disrupted the cold food supply chain in areas outside of Roseau and Portsmouth. The disruption of the cold food chain can be felt in the consumption of high-protein food such as meat, chicken, and fish. Fishermen have experienced a 60-70 percent reduction in catch volume, as fishing is limited to the bay. Furthermore, without electricity, fishermen are not able to store their catch for longer than one day. Therefore, they are starting to catch only what they can sell in a day. Due to the lack of electricity, households with the economic resources are now forced to buy only the meat or fish they can eat in one meal.

Farming livelihoods require a significant recovery time post-disaster, depending on the type of crop. Considering the agricultural calendar<sup>31</sup> at the time of the hurricane, most of the perennial crops were in the harvest season, while the annual crops, such as vegetables, were entering the planting season. This means that the hurricane occurred in a critical moment in the agricultural calendar in which losses in perennial crops such as banana and plantain trees will take from nine months to a year to recover, provided that no replanting is necessary. According to MOAF, where replanting is necessary, it will

30 WFP Map in Annexes show the distribution of food insecure settlements by parish and damage zone.

31 Agricultural Calendar elaborated by WFP, FAO, World Bank and the Ministry of Agriculture and Fishery.

take five to seven years to recover perennial crops. For short-cycle and annual crops, such as dasheen, cassava, and yam, the recovery time ranges from six to nine months. Given the losses and the recovery time needed, a deficit in the availability of certain crops for the coming months could be foreseen. However, additional information is needed to determine the extent or intensity of the deficit per basic crop. On the other hand, the fishing industry is quite resilient to disasters. The recovery of fisheries is dependent on access to gear, boats to fish, and cold storage to keep fish.

### Food Access

Households whose livelihoods were affected by the hurricane are having difficulty coping with the loss of income needed to cover food and other basic needs. Several interviewed households whose main source of income is agriculture, tourism or fishing, indicated that their only source of food is the humanitarian assistance provided by the Government with assistance of the international development partners.

Households that engaged in non-permanent seasonal labor, like in the tourism and agricultural sectors, have been severely impacted by the hurricane. Considering damages to hotels, the outlook for recovery for those employed non-permanently in hospitality is between 12 months and 24 months. On the other hand, it has been noted by the tourism sector specialists that the cruise season may be closed for the rest of the year, as ships are being diverted to other islands. Many people are already looking for opportunities to diversify their sources of income.

Field observations revealed that many of those with non-permanent seasonal jobs linked to agriculture, are now helping their old employers rebuild their farms in exchange for food. Two interviewed subsistence farmers said that they are now looking for jobs in the construction sector. One of them added that he is moving to the city of Roseau because he has nothing left on his farm and he lacks financial resources to rebuild and replant.

Blocked roads in the aftermath of Hurricane Maria not only disrupted trade flows, but also the ability of households to reach outlets and stores to sell or buy food. With regard to trade, information provided by MOAF shows that transportation capacity was reduced by up to 50 percent. For wholesalers, this meant they did not have the

capacity to pick up supplies from agriculture producers. For retailers, this meant they did not have the means to pick up supplies from wholesalers. For households, the physical disruption of roads, along with the lack of public transportation, made it difficult for them to reach stores with food, even if those locations had food in stock.

With the loss of production and disruption of trade and delivery capacities, prices of vegetables have doubled (WFP Market Analysis Dominica, 2017). The rise in prices of commodities such as vegetables and meat will only exacerbate the economic vulnerability of households that lost their income and livelihoods to Hurricane Maria. Production losses and the disrupted supply chain are the major drivers behind a potential increase in food prices and as such food availability, leading to food insecurity.

## 4. RECOVERY STRATEGY

- ▶ The most striking characteristic of Dominicans is their resilience and social solidarity. This social solidarity enables community members to help each other. In the spirit of solidarity, after the hurricane, fishermen donated their catch to neighbours and farmers distribute the crops they saved among their community members. Taking into account the resilience capacity of people and their own desire to help their communities, the design and implementation of recovery strategies should be people-oriented, and undertake a multi-sectorial approach, involving government, multi-lateral institutions and civil society.
- ▶ Strengthen the targeting processes for food assistance to the 24,000 people identified in this report as vulnerable to food insecurity, in areas with highest damage, especially in the southern and interior zones of the country.
- ▶ Given the damage to the subsistence agriculture, fishery, and non-permanent agriculture and tourism livelihoods, fine-tuning the identification of areas with vulnerable population groups (where and how many) is required in order to streamline recovery strategies. In addition to unconditional assistance, food for asset activities and agriculture based livelihood support programmes should be considered. These activities should aim to provide opportunities to rehabilitate livelihoods and strengthen coping mechanisms

- ▶ Special attention should be paid to the Kalinago territory, given that the population there are primarily subsistence farmers that live off their own production and the sale of crafts to tourists. Both livelihoods have been severely impacted.
- ▶ Considering the recovery time for producers with perennial crops, additional support may be required for a longer-term period of time (beyond immediate disaster relief).
- ▶ Through a multi-sectoral approach, stakeholders should encourage the design and implementation of market-based transfers in areas where markets are properly functioning, food is available and subsistence farmers can potentially sell their surplus. Not only to address food insecurity but also support local economies.
- ▶ Cash-based interventions should be accompanied with nutrition awareness campaigns.
- ▶ Cash-based transfers may need to be combined with in-kind food distributions in areas where markets are not yet stable and food commodities are not available.
- ▶ Provide context-appropriate emergency livelihood support to fishermen and farmers, through the distribution of fishing kits and agricultural inputs, in collaboration with the Ministry of Agriculture.
- ▶ Strengthen government capacity for continuous food security and nutrition monitoring, to fine-tune government recovery strategies.
- ▶ Strengthen early warning systems by improving the monitoring of rainfall and cropping conditions throughout the season. This should involve an updated agricultural calendar and rainfall monitoring through remote sensing and geographic information system (GIS) techniques.





# **DAMAGES, LOSSES AND NEEDS BY SECTOR**

## PRODUCTIVE SECTORS

### Agriculture

#### 1. SUMMARY

The Commonwealth of Dominica is fundamentally an agrarian-based economy. The agriculture sector, despite significant decline in economic performance, continues to play a dominant role in the socio-economic development of Dominica. Agricultural trade has been and continues to be a major factor determining food security outcomes in the Commonwealth of Dominica and a key driver of economic activity. In recent times, there have been increasing efforts towards a gradual conversion from a purely synthetic input base agriculture to one which relies more on natural processes, diversification, and one which incorporates more use of natural resources.

Based on current assessments by the Ministry of Agriculture, total damages amount to EC\$149.2 million (US\$55.27 million) and losses amount to EC\$335.8 million (US\$124.37 million). Total cost for the recovery need is estimated at EC\$239 million (US\$88.5 million).

#### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

The agriculture, livestock & forestry sector grew by 9.9 percent. The banana subsector is estimated to have grown by approximately 14.0 percent in 2016 while the other crops subgroup also is estimated to have grown by 10.5 percent. The agricultural diversification is beginning to take root on a scale never seen before. A mix of crops comprising mainly banana, plantain, dasheen, yam, tannia, sweet potato and ginger as well as vegetables now profile the agricultural export sector. Crop production is severely constrained due to limited arable land for agricultural development.

Livestock is a minor but important contributor to the sector. Poultry, cattle, goats, sheep, and pork are grown primarily for local consumption. In terms of agricultural importance, laying hens for egg production are considered number one, followed by pork production and finally ruminants (Government of the Commonwealth of

Dominica, 2015). In addition, the value of the livestock production can also be highlighted in the forward and backward linkage along the agriculture value change. For example, the value of livestock waste in supplementing plant nutritional requirements is significant within the context of imported mineral fertilizers, even within in the environment of 40 percent subsidies.

The priority development crops identified by the Government of Dominica are presented below in Table 12. However, cassava, touloma, ginger, avocado and other crops complement the list of crops grown in the country. For the purpose of this assessment we refer to 2015/2016 data.

**Table 12: Distribution of the Crop area and production**

Crop	Baseline (Ha)	Production (Ton)
Yams	324.0	6,240.0
Dasheen	324.0	4,800.0
Vegetables	121.4	1,500.0
Citrus	151.8	2,812.5
Tannia	97.1	1,620.0
Sweet Potato	80.9	1,000.0
Coconut-Fresh Water	566.6	3,850.0
Coconut-Dry Nuts	242.8	1,650.0
Cocoa	121.4	675.0
Coffee	56.7	227.5
Banana	567.8	8,418.0
Plantain	795.6	18,578.7

Source: Ministry of Agriculture and Fisheries, 2016.

Livestock sub-sector constitutes primarily small to medium size enterprises of various types.

**Table 13: Distribution of the Number of Live Animals**

Livestock Type	N. of animals
Cattle	1,500
Pigs	3,000
Small ruminants	3,000
Broiler chicken	55,000
Laying chicken	28,000
Rabbits	12,000
Bee hives	900

Source: Ministry of Agriculture and Fisheries, 2016.

### 3. SECTOR EFFECTS

The direct effect of Hurricane Maria to the local agricultural economy can be categorized as the following, but not limited to: a) physical/environmental impact (loss of bio-diversity, loss of a critical ecosystem services, dislocation of lands, transport and sedimentation of soil material, loss of crop canopy, feeder and farm access roads, damage to government infrastructures, etc.); b) economic impact (loss of foreign exchange, loss of

market share, loss of income, increase in food import, increase production cost, impact on revenue, etc.); c) socio-economic impact (loss of farm employment and related agricultural activities, exit from sector, migration, urbanization and changing agrarian structure, etc.). It is estimated that 65 percent of coconut, 80 percent of cocoa and 80 percent of citrus trees have been damaged. 100 percent of banana trees and vegetable crops have been affected. In general, farming crop production has been severely affected.

Figure 15: Proportion of losses by crop

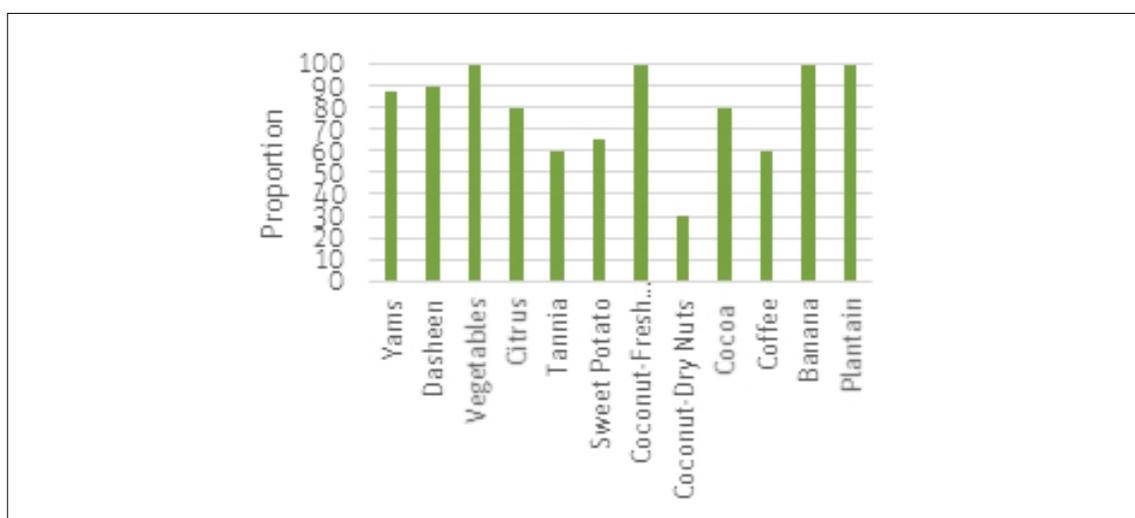


Table 14: Summary Table of Damage and Losses for Agricultural Sector

	PUBLIC		PRIVATE		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M	US\$ M	EC\$ M
DAMAGES	37.75	101.92	16.62	44.88.31	55.27	149.23
Crops						
Destroyed trees	-		15.06	40.85	15.06	40.85
Buildings	1.34	3.62	-		1.34	3.62
Equipment and Tools	1.97	5.32	-		1.97	5.12
Agricultural inputs	1.25	3.38	-		1.25	3.38
Infrastructures and Irrigation	30.72	82.93	0.15	0.40	30.87	83.34
Livestock						
Dead animals	-		2.31	6.25	2.31	6.25
Buildings	0.32	0.85	-		0.32	0.85
Equipment and Tools	0.05	0.14	-		0.05	0.14
Infrastructures	2.10	5.68	-		2.10	5.68
LOSSES			124.37	335.80	124.37	335.80
Destroyed crops			109.40	295.38	109.40	295.38
Meat, Eggs, Honey			7.73	20.86	7.73	20.86

There was a total of 675 (45 percent) dead cattle, 1,950 (65 percent) pigs, 1500 (50 percent) small ruminants, and 49,500 (90 percent) broiler chicken, 25,200 (90 percent) laying hens, 6000 (50 percent) rabbits, and 225 (25 percent) bee hives destroyed. In the case of the pork sector, drowning, heatstroke, lack of potable water and feed, as well as building collapse, all contributed to significant number of dead. For the poultry sector, and to a lesser extent rabbits, loss of animals was primarily due to building collapse and flooding. While for cattle and small ruminants, flash flooding, drowning and exposure to the natural elements, as well as flying debris, all contributed to the death of animals.

The most affected sub-sector within the livestock industry will be that of poultry, particularly egg production. Dominica has been self-sufficient in eggs for over 40 years. The entire sector, valued at EC\$5 million (US\$1.9 million), was lost. Implications would be the loss of income for farmers, and threat from external market importations. The total damages and losses for the poultry sector is estimated at EC\$16.5 million (US\$6.1 million).

The pork sub-sector is the second main contributor of the livestock sector, valued approximately at EC\$3 million (US\$1.1 million). Fifty-six pork farmers providing fresh pork on a weekly basis to the market, and live animals to the abattoir have been severely impacted. The total damages and losses for this sub-sector is estimated to EC\$3.6 million (US\$1.3 million).

Small ruminants play an important role in import substitution, the protein base and income for rural farm families and households. About 83 full time small ruminant farmers and associated families are active in this sector. The damages and losses in this sub-sector amount to EC\$1.8 million (US\$0.7 million).

#### 4. CONTRIBUTION TO THE MACROECONOMIC AND HUMAN IMPACT

The Agricultural Sector is a significant contributor to the economy of Dominica. Agriculture contributes approximately 17 percent, to the country's GDP and the sector is a major source of jobs in Dominica. Of the estimated 32,000 persons actively seeking employment, an estimated 7,000 are employed in agriculture, which represents 21 percent of the country's active work force.

The impact of Hurricane Maria on poor rural families relates to access to food, the decrease in job opportunities and lower wages and an increasing food and nutrition insecurity. The impact on Dominica's ability to contribute to Sustainable Development Goal 1 has been severely compromised by several years, due to changes in social and family cohesiveness, increased cost of health, migration, increased production costs, reduced investments in the sector, and reduction in the purchasing power of farm families.

At the macro level, the livestock sector contributes to one percent to GDP, primarily for the consumption of fresh and value-added livestock product. It contributes significantly to livelihood for rural farmers.

#### 5. RECOVERY NEEDS AND STRATEGY

##### Recovery Needs and Prioritization

The identified post-disaster needs are the best possible way to bring back normalcy in the agriculture sector. Due to the nature of the sector, the cost for the recovery needs could be less than the damage.

##### Crop farming

- ▶ Provision of seeds, planting materials and equipment, which will combine nutrient-efficient crops and cultivars as well as efficient fertilization practices.
- ▶ Invest in heavy equipment (chippers, chainsaws, etc.) for the efficient clearing and utilization of debris materials (conversion of spent wood into wood chips, etc.).
- ▶ Construct modern agricultural facilities (agricultural station and propagation\nursery).
- ▶ Continual development of the local human resources and provision of short-term consultancies in specialized areas.
- ▶ Improve institutional capacities (legislative framework, laboratories, human resources).
- ▶ Implement mitigation measures for building resilience of farming systems (windbreaks, contours, terracing).
- ▶ Restore and explore the use of alternative of water management systems.

- ▶ Develop climate smart agricultural production systems.
- ▶ Implement ecological/organic agriculture principles.
- ▶ Implement risk mitigation strategies (crop insurance, etc.,).

### **Livestock**

- ▶ Short term, the strategy is to address the protein needs of the population, targeting 3,000 broiler birds weekly for a total of 156,000 birds annually. This will produce approximately 12,000 pounds of meat weekly. The construction of 21 units of 1,000 birds is needed.
- ▶ Import laying hens to address the egg scarcity. Considering all quarantine protocols, the total number of birds imported will be 10,000 producing 8,500 daily at peak. The birds will be divided amongst 20 farmers each housing 500 birds.
- ▶ Within the pork sector, structures remained, but roofs collapsed, so investment will be made in roof repairs as well as water systems to these establishments. The animal population will be rapidly multiplied using artificial insemination methods. This technology is presently available at the Central Livestock Farm.
- ▶ Housing and rapid multiplication, using artificial insemination as well embryo transfer, will also be used for the small ruminant sector.
- ▶ Fencing material is also needed for reestablishment of lost pasture.
- ▶ Immediate action would consist to import animal feed. However, in the medium term, it will necessary to develop traditional feed materials.
- ▶ Improve institutional capacities (legislative framework, laboratories, human resources).

### 5.2 Recommendations for DRR and Building Resilience

#### **Crop farming**

- ▶ Develop production instruments which encourage use of crop rotations and diverse cropping systems,

combined with zero to minimal tillage practices and proper fertilization and irrigation, to enhance soil carbon sequestration and improved soil structure.

- ▶ Encourage land management practices through “green incentives” and appropriate policy that decreases agro-ecosystem disturbance, improves soil fertility, increases organic inputs and plant cover, and decreases soil organic matter decomposition rate.
- ▶ Explore the use of high nature value farming indicators as an overall management strategy and monitoring tool for agricultural production through participatory approaches. These will include management programmes which limit deforestation, increase organic matter OM storage in cultivated soils and reduce current erosion.
- ▶ Develop production programmes which will combine nutrient-efficient crops and cultivars as well as efficient fertilization practices. Moreover, fertiliser management strategies needs to take into account both production and environmental imperatives.
- ▶ Initiate the integration of biodiversity friendly land use systems into developmental strategies at the landscape scale which focuses on trade-offs between ecosystem conservation and agricultural production, e.g. REDD+ and PES national initiatives.

#### **Livestock**

- ▶ Increase utilization of local species to increase hardiness of productive animals.
- ▶ Improve structural integrity of housing.
- ▶ Better site selection of farms and orientation of the structure (wind direction, maximization of sunlight, etc.,).
- ▶ Improve animal waste management system (biogas system and other compost element, etc.,).
- ▶ Improve feed conservation and storage (silage, hay, etc.,).
- ▶ Continual improvement of the disaster risk strategy for the livestock sector.

**Table 15: Table of Short, Medium & Long-term Recovery Initiatives and Costs**

	Item	Description	Cost	
			EC\$ M	US\$ M
Short term	Restore damaged infrastructure for crops/ buildings	Irrigation system, greenhouses	18.8	6.94
	Seeds, planting materials		8.00	2.96
	Debris removal and utilization (for agricultural land and forestry)		77.00	28.52
	Human resources & training program		7.50	2.78
	Mitigation measures for building resilience of farming system (windbreak, contours, terracing)		5.00	1.85
	Monitoring agricultural production system (forest & farm)		3.00	1.11
	Rehabilitation/reconstruction of animal housing/ perimetral fencing		11.00	4.07
	Animal re-stocking (poultry, small ruminants, rabbits, pig)		8.60	3.19
Medium Term	Feed		6.30	2.33
	Agricultural station and infrastructures	Including irrigation system and Feeder road	42.00	15.56
	Improve institutional capacities (legislative framework, laboratories, human resources)		3.00	1.11
	Improve water management and use of renewable		2.00	0.74
	Improve risk mitigation strategy to include bio-security		2.00	0.74
	Introduction of the embryo transfer and artificial insemination		0.41	0.15
Long Term	Developing local feed resources		0.50	0.19
	Risk management strategy		2.00	0.74
	Reconstruction of infrastructures	Feeder Roads	41.72	15.45
		Total	238.8	88.45

### Implementation Arrangements

The Division of Ministry of Agriculture and Fisheries will provide leadership and guidance to implement the recovery strategy. Support and technical assistance will also be provided by the FAO, Inter-American Institute for Cooperation on Agriculture (IICA), Caribbean Agricultural Research and Development Institute (CARDI), OECS, CARICOM and the WBG.

### 6. SOURCES

**Government of the Commonwealth of Dominica. 2015.** Rapid Damage and Impact Assessment Tropical Storm Erika. Roseau, Commonwealth of Dominica.

# Forestry

## 1. SUMMARY

The strong winds and the salty sea blast resulted in an almost complete defoliation of all trees. In addition to the leaves, most trees lost all their fine twigs and/or part of the tree crown. Only in protected valleys or on the leeward side of slopes did a small number of trees retained their foliage. Most of the trees are expected to sprout back. Only the trees which have lost their entire crown will not re-sprout. If a small percentage of the middle size branches survive the storm, the tree has a good chance to survive. Already four weeks after the impact, trees are beginning to shoot out new leaves.

After a first rapid assessment it is estimated that more than 50 percent of the trees are still standing and are likely to recover. In the first two to three years after the impact the trees will look affected but within five years only a trained eye will recognise the effects of the storm. It is estimated that 10 to 20 percent of the trees in the forest were completely flattened. For the remaining 80 percent of the forest area, it is expected that the trees that survived the hurricane will be able to re-establish a closed canopy.

The rainy season will continue for two to three months, which is important for recovery. Within three months the forest floor will be covered with vines and herbal vegetation. In the larger clearings, the vines and herbal vegetation will persist for approximately five to ten years, and then gradually, natural tree regeneration will establish itself among the herbal vegetation and new forest will emerge. In the areas where the trees are still standing and re-sprouting, the herbal vegetation on the forest floor will gradually disappear as the canopy closes.

Based on current assessments, total damages amount to EC\$80.24 million (US\$29.72 million). Total cost for the recovery need is estimated at EC\$40.15 million (US\$14.87 million).

## 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

Dominica does not have any large-scale forest operations. Over the past five years the Forestry Department sold approximately 150 standing trees to private chainsaw operators who cut the logs into boards on site and hand carried them to the nearest forest road. Other forest uses are the production of charcoal and the harvesting of non-timber forest products, mainly for the artisanal production of baskets. The production of charcoal is mainly done on private land and the collation of the raw material for basketry in the Carib Territories. There is no quantitative data on the production of charcoal or the value of non-timber forest products harvested from the forest.

The main use of the forest is for ecotourism. The Forestry Department maintains 10 Ecotourism sites with a total of 55 km of nature trails. In addition to the trails in the parks there is the Waitukubuli National Trail, it is 185 km long and is managed by a separate unit within the Forestry Department.

## 3. SECTOR EFFECTS

The total forest area of Dominica is 47,580 ha. The entire forest was severely affected. Only in small and very protected pockets a few trees retained their leaves. Of the total forest area, 31,640 ha are classified as un-disturbed and disturbed sub-montane forest (Source National FRA Report 2015). Due to steepness of the terrain and accessibility, only 30 percent of this forest is accessible for forest management interventions. The other forest classes are montane cloud forest, evergreen montane shrubland, montane rain forest, lowland/submontane seasonal evergreen forest, lowland drought deciduous shrub, and seasonally flooded forest. They are not relevant for the production of timber.

Based on the above classification the usable forest estate is estimated to cover 9,552 ha. Based on a field visit on October 19 with staff of the Forestry Department, it is

estimated that approximately 20 commercial trees species and dimensions per acre were blown over or destroyed by the Hurricane. The average royalty value of a tree is estimated to be EC\$140.

Additional to the losses in timber are the damages to the environmental services the forest provides. The scenic value of the dense forest cover is one of the main attractions for the tourist industry. Another important aspect of the forest cover is erosion control and the provision of clean potable water. All the above environmental services were compromised through the hurricane but the monetary quantification of these damages is unknown.

In addition to the damages to the timber stock, the infrastructure of the Forestry Department was damaged. The infrastructure includes the Forestry Department and National Parks buildings, the parrot aviary, the amphibian house, the nurseries and the trail infrastructure.

Approximately 80 percent of the forest is owned by the government. Information of private forest activity is not available.

**Table 16: Summary Table of Damage and Losses for Sector (in local currency and US\$)**

	PUBLIC		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M
DAMAGES	29.72	80.24	29.72	80.24
Estimated damage to timber stock	24.47	66.10	24.47	66.10
Forestry buildings and nurseries	1.49	4.03	1.49	4.03
Habitat wildlife	0.37	1.00	0.37	1.00
Botanical gardens	0.49	1.34	0.49	1.34
Eco-Trail National Park	0.41	1.10	0.41	1.10
Waitukubuli National Trail Project	2.48	6.70	2.48	6.70

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

The main value of the forest in Dominica is in the environmental services for the provision of water, erosion control and scenic values, and these are difficult to quantify. All of the above are external values to the forest products and for which no payments are made. However, the water company, the roads department and the tourism industry rely on these services for their business.

#### 5. RECOVERY NEEDS AND STRATEGY

##### Recovery Needs and Prioritization

The forest is likely to regenerate naturally, the standing trees will re-sprout and areas completely flattened by the high winds will eventually regenerate. Hurricanes are a common feature in the Caribbean and the forest we saw prior to hurricane Maria emerged naturally after a similar hurricane.

While, at large, the forest will recover naturally there may be a need to replant in areas where a quicker forest regeneration is required, for example to protect human settlements or infrastructure from erosion.

**Table 17: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

	Item	Description	Cost	
			EC\$ M	US\$ M
Short term	Salvaging of economical timber species	Species with merchantable/commercial value, and charcoal production	2.50	0.93
	Rehabilitation of forest nurseries and forest stations	Four forest nurseries and three forest stations	5.00	1.85
	Harvesting of compostable material from forest (chipping/mulching)	Source industrial wood chippers and organize composting systems	5.00	1.85
	Tools and equipment	Source chainsaws and Alaskan mills, crane truck and pickup trucks required for transportation and other forestry tools	10.00	3.70
	Rehabilitation of eco-tourism sites and trails	Clearing of debris, restoration of infrastructure visitor facilities, bridges, and erection of viewpoints and platforms, restoration of Botanical gardens	10.00	3.70
Medium Term	Replant area to protect erosion-prone areas	Reforestation and enrichment planting of water sheds and water catchments. Land stabilization.	1.30	0.48
	Updating forestry inventory and survey	Develop baseline data on existing forest species and resources and to seek external support.	1.00	0.370
	Amendment of the forest law (wildlife, land use)	Update forest, wildlife and national parks related legislation.	0.40	0.15
	Public awareness and sensitization	Forestry education programme to provide information to the general public. To enhance capacity of the Division of forestry	2.70	1.00
Long Term	Capacity building	Build capacity in various aspects of forest resources conservation and management	0.25	0.09
	Establishment of the REDD+ strategy	Finalize the strategy for Dominica in collaboration with lessons learnt in other countries.	0.50	0.19
	Assessment of land use and capability (soil erosion)	Review of the national land use plan	1.50	0.56
Total			40.15	14.87

## **Priorities for follow up action:**

### **Charcoal**

Large amounts of woody debris lies on the forest floor and/or were displaced by landslides and floods. In the forest, the debris can remain and will eventually decompose but the debris along the roads and backed up under bridges should be removed. The shredding of this material is very expensive and not feasible. The best would be to convert as much as possible to charcoal. The knowledge on how to produce charcoal is widely spread in Dominica. The key problem is to find a market for this charcoal. The market in Dominica is too small to absorb it. The solution is in export. The best would be to identify a private entity who is interested in buying the charcoal from local producers, repackage the charcoal in smaller paper bags and export it to other countries in the region. There is a market for charcoal in the Caribbean. Currently most of the charcoal sold in the supermarkets in the Caribbean is imported from North America and Europe.

### **Production of lumber with chainsaws mills**

Chainsaw lumbering is an appropriate method to salvage fallen trees and to convert round logs in building material.

It is a practice commonly used in Dominica. The Forestry Department maintains a list of 120 chainsaw operators, who in the past bought trees from the Forestry Department. These chainsaw operators could be encouraged to salvage as much wood as possible. Operators who do not have a saw could be provided with one, through a lease agreement. To a lease a chainsaw mill from the Forestry Department the operator should pay an in kind rent to the Forestry Division. Upon completion of any such task the saw and sawmill will be returned to the Forestry Division in order to establish management control of the milling activity beyond the project.

### **Wildlife Monitoring and Observation programme**

To establish and seek support for monitoring of wildlife habitat and population status ( particularly the status of the endemic parrots and game wildlife)

## **6. SOURCES**

Global Forest Resources Assessment (FRA) 2015, Country Report – Dominica, Rome 2014

# Fisheries

## 1. SUMMARY

Hurricane Maria caused significant damages and losses to the fisheries sector in Dominica. The first assessment indicated approximately 128 vessels and 126 engines have suffered damages or are lost. Fisheries cooperatives have lost their ice-making machines, fuel pumps and supplies for market vendors. Fishers have lost a large percentage of their fishing gear. The Fisheries Division in Roseau has lost its roof and all furniture and office equipment. Most of the destruction took place on the east coast, whereas the west coast was less affected.

The destruction has affected the food security and livelihoods of fisher folk and those in associated sectors (e.g., market vendors, gutters, mechanics, boat builders). Vessel and engine repair and replacement is urgently needed, as well as repair of ice-making machines and replacement of coolers to store fish. In addition, the infrastructure of Fisheries Division and eight fishing cooperatives needs to be urgently addressed.

Based on current assessments, total damages amount to EC\$6.52 million (US\$2.41 million) and losses amount to EC\$1.35 million (US\$0.5 million). Total cost for the recovery need is estimated at EC\$6.87 million (US\$2.54 million).

## 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

Dominica's fishing industry can be described as artisanal and small scale, and consists of capture fishery and aquaculture. Most of the fish caught are used for subsistence or sold domestically. The 2011 census indicated that there were on average a total of 650 fishing vessels, 68 percent or 440 of these vessels are registered with the Fisheries Division.

The fishing fleet consists of three major types of vessels - traditional dug-out canoes (20 percent), open wooden boats (keel boats, 52 percent) and fiberglass reinforced

plastic vessels (28 percent). The majority of fishermen use outboard engines for propulsion. In terms of fishing gear, the majority of fishers use hook and line (70 percent), mostly surface drop line and trolling lines anchored around fish aggregating devices. Major fish species caught are tuna, dolphin fish, wahoo, ballyhoo (*hemiramphis brasiliensis*), and mackerels (*scombridae*).

There are 21 landing sites in Dominica. In 2010, the most important landing sites on the island were identified as Marigot, followed by Portsmouth, Dublanc and Scott's Head, based on the amount of fish that was landed at the site (203 tons, 133 tons, 54 tons and 34 tons respectively). There are approximately 30 market vendors in Dominica. Overall the fisheries sector employs approximately 2,200 people.

## 3. SECTOR EFFECTS

The fisheries sector has been severely damaged. In total 128 vessels have been damaged or destroyed. The total costs for repair and replacement is US\$745,889. Engines have been lost or destroyed with a total value of US\$934,011. Fishing gear has been lost including a 681 traps with a value US\$105,933. Lines and nets have also been lost with a total value of US\$107,333. Market vendors (mostly women) have lost the contents of their locker rooms (cutting boards, coolers, knives, aprons and boots), with total damages equal to US\$111,000.

Infrastructural damages to the sector (both the government fisheries buildings as well as the fisheries cooperatives) are averaged at US\$423,607. This includes damages to roofs, fuel pumps, ice-machine rooms, freezer storages etc.,.

The total losses in terms of lost fishing days for the various fisheries (reef fisheries, coastal pelagics and offshore pelagics) stands at approximately 60 days. Averaging the estimated catches per day, the total losses are US\$500,222. In addition, it is calculated that 10,000 pounds of fish stock is damaged by the hurricane resulting in a loss of US\$29,629 in value.

**Table 18: Summary Table of Damage and Losses for Sector**

	PUBLIC		PRIVATE		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M	US\$ M	EC\$ M
<b>DAMAGES</b>	0.57	1.53	1.85	4.99	2.41	6.52
Equipment			1.85	4.99	1.85	4.99
Infrastructure Fisheries Division	0.50	1.35	0.22	0.60	0.50	1.35
Office equipment	0.04	0.10			0.04	0.10
Damages to fish stocks	0.03	0.08			0.03	0.08
<b>LOSSES</b>			0.50	1.35	0.50	1.35
Fish production			0.50	1.35	0.50	1.35

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

The sector contributes four percent to GDP. It provides food security to a large number of the population and provides livelihood not only to fishers, but also to those associated with the industry (e.g., boat builders, mechanics, net builders, as well as market vendors whom are mostly women). Fishing, thus, provides food security and livelihood to many coastal communities around Dominica and the coastal ecosystem provides ecosystem services to the tourism sector.

While a few hundred vessels and engines are affected (each vessels has approximately three to four crew) in effect this means that 40 percent of the vessels cannot go out fishing and nearly half the fishers cannot engage in fishing activities. Repairing or replacing engines, vessels and gear will reinstate the livelihood of a thousand fishers and their three to four dependents.

Reinstating livelihoods to the fishers will have spill-over effects to the entire coastal communities by means of supporting mechanics, boat builders, small and medium sized business as well as all household dependents. This will support the livelihoods and food security of thousands of people in Dominica.

Fishing is also an economic alternative to many part-time agriculturists. As agriculture has also been heavily affected reviving the fisheries sector will therefore also support the livelihoods of agricultural households and communities and thus stabilize the economic situation of these communities. In addition, many elder community members receive free fish from fishers and provide necessary food security to those in need.

Support for fisherfolk will thus result in a stabilization of villages and communities and reduces the potential for disruptive activities and social cohesion.

#### 5. RECOVERY NEEDS AND STRATEGY

##### Recovery Needs and Prioritization

Reinstating government fisheries centers

- ▶ Infrastructural work on Fisheries Division, structural assessment, hiring building contractors.
- ▶ Office equipment to ensure sustainable fisheries management, procure list of identified needs.
- ▶ Refrigeration repairs to reinstate ice production (short term) and cold storage facility (mid-term). Procure list of identified needs, contract refrigeration contractor.

##### Rehabilitation of fisheries cooperatives

- ▶ Infrastructural work on fishing cooperatives. Procurement of (mostly roofing) materials and hiring building contractors.
- ▶ Administrative equipment for some cooperatives. Procure list of identified needs.
- ▶ Procurement of ice-machines to reinstate ice production (short term).
- ▶ Reinstatement operation functions of fuel stations.
- ▶ Replacement of coolers and operational equipment.

### Reinstating fisherfolk livelihoods

- ▶ Replacement of lost or damaged fishing gear. Procurement of fishing tackle, traps, and nets.
- ▶ Repair and replacement of vessels. Procurement of vessel repair materials, contracting boat builders.
- ▶ Repair and replacement of engines. Procurement of engines and engine parts, contracting engine service dealers.
- ▶ Replacement of lost or damaged equipment of fish vendors (note, 90 percent women).
- ▶ Replacement of lost or damaged equipment of boat builders.

### Recommendations for DRR and Building Resilience in Sector

- ▶ Develop fish harvesting safeguards which encourage the use of biodegradable panels in pots to diminish ghost fishing in case of future storms or hurricanes, to minimize fish loss and reduce impacts to the ecosystem.
- ▶ Promote fuel efficient engines (4-stroke engines) which also have less negative impacts on the marine environment.

- ▶ Improve the safety-at-sea of fisherfolk by providing increased training and equipment.
- ▶ Build safe harbours, boat hauling equipment and boat shelters.
- ▶ Encourage research and development of the aquaculture sector to potentially contribute to food security, while reducing exploitation pressures on marine species
- ▶ Incorporate and improve early warning systems of the fisheries sector as a critical component of disaster risk management (DRM) and climate change adaptation (CCA).
- ▶ Mainstreaming of climate change into fisheries plans, policies and legislation.
- ▶ Carry out an ecosystem damage assessment in terms of ecosystem services provision (e.g. habitats – coral reefs, seagrass beds, mangroves and damages to fish stocks; loss of livelihoods – fisheries and coastal tourism).
- ▶ Undertake a fisheries insurance needs assessment.
- ▶ Prepare a strategic action plan for climate proofing of the fisheries sector.
- ▶ Build institutional capacity to address DRM, CCA and resource management needs.

**Table 19: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

Term	Item	Description	Cost	
			EC\$ M	US\$ M
Short term	Reinstating fisherfolk livelihoods	Repair and replace fishing vessels	1.93	0.71
		Repair and replace fishing engines	2.52	0.93
		Reacquire fishing gear	0.58	0.21
		Boat building equipment	0.09	0.03
Medium/Long Term	Reinstating fisheries cooperatives	Market vendors	0.30	0.11
		Reinstating fisheries government facilities	1.35	0.50
		Office equipment and supplies	0.10	0.04
Totals			6.87	2.54

## Implementation Arrangements

The Ministry of Agriculture and Fisheries will collaborate with a number of different stakeholders for the execution of these activities including, inter alia, FAO, Fisheries Division, fisherfolk organizations, service providers (construction companies, office supply companies, refrigeration contractors), Ministry of Works, Ministry of Planning, Department of Environmental Health, Cooperatives Division, and small-medium sized businesses (e.g. market vendors, boat builders, engine service dealers).

FAO will be recruiting an International Emergency Coordinator and a National Agricultural Specialist which will be based in Dominica to support the implementation of the emergency projects and provide technical support to the MOAF. In addition, there will be a full-time staff member of FAO working under the CC4FISH project who will focus entirely on rebuilding the fisheries sector in Dominica.

## Commerce/Microbusiness

### 1. SUMMARY

The full cost of recovery is EC\$198 million (US\$73.3 million), of which the vast majority, or some 97 percent can be applied to reconstruction with resilience for the sector. The remainder, some EC\$11 million, is applied to the human recovery needs of the sector.

This cost is as a result of the extensive damage suffered by the sector amounting to EC\$190 million (US\$70.4 million) and another EC\$18.4 million (US\$6.81 million) in change in flows or loss.

### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

Dominica is a small open and dependent economy comprising mainly of micro, small and medium enterprises (MSMEs). It was estimated that MSMEs generated over 60% percent of private sector employment and income, and contributed significantly to GDP. Although a full inventory of micro business does not exist, it is estimated that some 10,000 of such businesses flourish throughout

Dominica. They can be found clustered in and around the urban centers of Roseau and Portsmouth and throughout rural parishes.

There is insufficient empirical evidence for Dominica and the region, however, it has been estimated that, region-wide, MSMEs account for over 50 percent of all jobs created. In agriculture they are responsible for over 70 percent of the production of the main export crops and an even higher proportion of domestic food crops. MSMEs play a leading role in the production and marketing of agricultural produce. Public transportation and other tour guide services are provided by MSMEs. They can also be found in some manufacturing sub-sectors, such as wood products, garments and sewn goods, and handicraft items. MSMEs play a lead role in construction, equipment repairs and maintenance, technical services, food and retail trade.

However, information from the Ministry of Commerce, Enterprise and Small Business Development, through its financial assistance program and other Government sponsored small business assistance programs (at the DYBT; AID Bank; and NDFD), suggest that the sector has not been able to realize its full potential. The failure rate in some sub-sectors is estimated to be as high as 80 percent of new entrants – suggesting that many micro businesses do not last longer than 12 months.

The sector had received a big hit following Tropical Storm Erika and was only beginning to regain its strength. This is on top of the long-standing weaknesses which had been identified in the sector and which limited the ability of micro businesses to take full advantage of economic opportunities in the local, regional and extra regional markets. Constraints identified include a poor policy and regulatory environment, limited access to finance, onerous conditionality in accessing finance and the unavailability of top quality business support services. Government had sought to address some of these constraints through a new MSME policy and strategy paper that was under consideration when Hurricane Maria struck.

With regard to entrepreneurship, women predominate in the micro business ‘informal economy’, as street and market vendors, ‘hucksters’ in the inter-island trade in agricultural produce and other commodities, and vendors at tourism sites.

**Table 20: Characteristics of micro enterprises in Dominica**

Size	Nature of Business	Nature of employment	Asset Base (EC\$)	Area of economic activity
1-2 persons	Self-owned	Own account worker	25,000 50,000	Agro-processing (coconut oil products; cocoa sticks), tourism and hospitality (tour guides, hair braiding and hair dressing), telecommunications sector, services sector (mechanics), retail, hucksters and vendors, food vendors, handicraft production and sales, tailors and seamstresses, the production of farine and farine products
2-5	Family owned	Family employee	75,000	Mini marts, food shops, bakeries barbers

Source: Estimates based on Government data

Table 20 presents a schematic outline of the characteristics of the micro enterprise sub sector of the commercial sector. It has been estimated that about 50 percent of the micro business are home based and the vast majority were uninsured.

### 3. SECTOR EFFECTS

Between October 4 and 16, 2017 the staff of the Ministry of Commerce, based on their experience from Tropical Storm Erika, conducted a preliminary assessment of approximately 135 businesses within Roseau and its environs, and 76 enterprises in the town of Portsmouth. A standardized questionnaire was used to determine the experiences of enterprises since Hurricane Maria. The Ministry sought to ascertain, among other things, how many enterprises had begun operations (when and if not); how many planned to reopen within the coming weeks; if damage was suffered; the impact of the hurricane on staff (dead, injured, migrated, non-accounted for, and ready to work); if the business was insured; damage to stock, and other assets: and, the number of hours open to the public.

In addition to the survey conducted by the Ministry, the PDNA team used the data gathered by the housing sector to ascertain the extent of the damage to the micro business sub-sector. The assumption was made that 50 percent of the micro business were to be found operating out of households, and the remainder in independent facilities.<sup>32</sup>

Using the proportions of damage suffered by the housing sector, it could be estimated that the micro businesses of the commercial sector would have suffered some EC\$495 million or US\$183 million in damages. This would include, as detailed in Table 1, effects to tools and furnishings, and stocks of goods held in shops. The Ministry's survey acted as both a validation exercise and provided a deeper appreciation of the change in flows which enterprises experienced.

**Table 21: Summary Table of Total Effects**

	TOTAL	
	US\$ M	EC\$ M
<b>DAMAGES</b>	70.40	190.08
Premises	31.74	85.70
Tools and Furnishings	22.92	61.88
Stock of Goods	15.74	42.50
<b>LOSSES</b>	6.85	18.50
Total changes in flow due to rehabilitation/reconstruction, (3 months); closure of business (25 days); unavailability of inputs (90 days)	6.75	18.23
Removal of Rubble	0.10	0.27

Source: Estimates based on Government data

<sup>32</sup> According to the housing sector assessment, some 15% of dwelling units were totally destroyed; 40% highly damaged, 20% moderately damaged, 15% slightly damaged and 10% suffered no damage.

With regard to change in flows (or loss) suffered by the micro business sub sector, this was estimated at EC\$18.5 million. This does not include the cost of rubble removal for those micro businesses which were housed in dwelling places, as this is captured in the housing sector, but only speaks to those micro businesses who were independently housed. The losses are underestimated as they do not include the possible increase in public utilities (such as use of generator for electricity or for the securing of water) or increased cost of procuring inputs from alternative sources at possibly increased prices due to inflationary processes or due to need for off island acquisition.

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

The CPA of 2009, identified a high proportion of the working poor in Dominica. It has been also been noted that strengthening micro business, moving them from informal to formal processes is one strategy that can keep people out of poverty. Researchers agree that micro businesses ought to be viewed as more than just a survival strategy. Data suggest that engagement in micro and small businesses have helped to improve the standard of living of those persons so engaged. (Akinwale, 2014)

It is generally acknowledged at local, regional and national level, that small-medium sized enterprises are becoming increasingly important in terms of employment, wealth creation and the development of innovation. (Commonwealth of Dominica, 2015)

The Government in its Draft Policy Paper on MSMEs notes that, MSMEs typically contribute about 50 percent of GDP in the developed economies and some 60 percent of total employment. Specific data for micro business is not available for Dominica, but it is suggested that the importance of micro business in the rural areas should not be underestimated in slowing the rural to urban drift.

The Ministry of Commerce acknowledges the importance of the MSME sector as a vibrant contributor to the economic and social transformation of Dominica, and

notes that the sector provides meaningful employment, skills transfer and diverse opportunities for the people of Dominica to participate in national development.

#### 5. RECOVERY NEEDS AND STRATEGY

##### Recovery Needs and Prioritization

Table 22 presents the details of recovery needs for the micro business sub-sector the commerce Sector. It should be noted that the full cost of recovery is EC\$209 million dollars, of which the vast majority, or some 95 percent, can be applied to the reconstruction with resilience building for the sector. The remainder, some EC\$10.5 million, is applied to the human recovery of the sector.

Specifically, it is envisioned that while the reconstruction process is taking place, micro business can be housed in retrofitted community centers to allow them to continue their trade. But support will be required to address any psychosocial challenges in the wake of Hurricane Maria, as many have been doubly hit, just repairing from the effects of Tropical Storm Erika.

It is also noted that some micro businesses will have to relocate as they had been previously located in precarious locations, such as near rivers or areas damaged by flooding and landslides, or have been too close to sea coastal areas and devastated from storm surge.

More specifically, the introduction of group insurance for micro business clustered in terms of their economic activity, should make them more resilient to future events. In addition, the re-seeding of the loan guarantee mechanism has been identified as a key measure.

It was highlighted that the needs of the Kalinago community should be addressed specifically as their unique land holding pattern increases their difficulty in securing loans. A special grant facility in the amount of EC\$3 million should be considered for those seeking to re-establish and strengthen their micro business in the wake of Maria.

**Table 22: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

Recovery with resilience for MSME's			
Term	Item	Description	Value (EC\$ M)
Short	Reconstruction	Reconstruction of partially and totally destroyed infrastructure and assets	180.57
	Retrofitting	Retrofitting of locations for business incubators (community centres)	3.50
	Relocation	Relocate businesses situated in river beds and sea coast	3.00
		Debriefing/psychosocial for micro entrepreneurs	0.50
	Loans/Grants	Concessionary loans/grants to micro businesses who have been affected by Hurricane Maria for the purpose of re-establishment of business	4.00
	Scaling up activities	Scaling up in terms clients and financial disbursements	
	Technical Assistance to client base	Clustering and formalization micro businesses in the informal sector	0.02
	Management	Monitoring and evaluation of implementation ( to run throughout the period of recovery)	
Medium	Loan Re- seeding	Re-seed loan guarantee funds	3.00
	Grant	Grant facility for Kalinago Territory	3.00
	Sourcing of inputs	Sourcing of inputs to support MSMEs	
	Technical Assistance	Scaling up of technical assistance from EC\$15,000 -25,000	
	Certification	Certification of skills of micro entrepreneurs (e.g. ,mechanics, music industry)	
Long Term	Innovation	Innovation and research to introduce recycling projects	
	Insurance	Group insurance for SMEs (clustered according to production output)	0.50
Total			197.14

Source: Estimates based on Government data

### Implementation Arrangements

The Ministry of Commerce, Enterprise and Small Business Development is the implementing agency and works closely with its many stakeholders.

### 6. SOURCES

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## Tourism

### 1. SUMMARY

In tourism damages amount to EC\$54 million (US\$20.1 million), and losses to EC\$191 million (US\$70.9 million). The heaviest damages linked directly to the tourism sector lies in hotel room stock. Out of a total of 909 rooms, 243 rooms are currently serving the market, 39 percent (358) are considered severely damaged and will not be back in service at least for a year, while 34 percent (308) may come back little by little within the year. The cruise season is currently considered lost, an EC\$25 million source of spend in 2016, and tour operators, vendors, and other support services, such as taxis, have suffered EC\$4.3 million (US\$1.59 million) in damages. Total sector recovery costs are assessed at EC\$70.72 million (US\$26.19 million).

### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

The tourism sector is one of Dominica's most important, with over 366,000 visitors in 2016, bringing in EC\$383 million. Although the highest number of tourists comes from cruise ship passengers, the highest number of income in the sector comes from stay-overs. This can be easily explained: cruise ship visitors, of which there are roughly 276,000, spend EC\$89 per day on the island, with the stay lasting one day. Holiday stay-over tourists, on the other hand, spend US\$406 per day, with the stay usually lasting nine days.

Both the stay-over and the cruise ship segments are mostly served by the private sector. Hotels are in private hands, and there is a cottage industry of guides and drivers that

**Table 23: Visitor arrivals and spend baseline for Dominica, 2016**

Segment		Avg. Days	Avg. Spend Per Day	Arrivals	Total Spend
Daily	Excursionist	1.00	496.74	1,003	498,318.38
	Cruise ship	1.00	88.81	276,289	24,536,171.53
Stay-over	Hotel - Holiday	9.20	405.88	19,533	73,143,266.69
	Hotel - Business	3.70	540.33	8,238	16,641,188.09
	Students	244.6	134.47	1,446	47,563,224.23
	Private Homes	14.3	180.17	44,103	113,825,571.90
			Subtotal Stay-over	73,321	251,173,250.91
			Total	350,613	276,207,740.81

Source: Discover Dominica

service the cruise ship arrivals. There are 73 properties, 17 tour operators, 9 dive operators, a cottage industry of 260 craft and souvenir vendors, and 273 tour guides. The

taxi industry is wide and diverse, consisting of 300 buses, 270 16-seaters, and 30 coasters (larger buses with 26 to 30 seat capacities).

**Table 24: Summary Table of Damage and Losses for Sector (in local currency and US\$)**

	PRIVATE		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M
<b>DAMAGES</b>	20.15	54.40	20.15	54.40
Moderately damaged hotel stock	3.96	10.68	3.96	10.68
Related common spaces	1.91	5.15	1.91	5.15
Related landscaping	0.40	1.07	0.39	1.07
Severely damage hotel stock	9.18	24.79	9.18	24.79
Related common spaces	2.21	5.98	2.21	5.98
Related landscaping	0.92	2.48	0.92	2.48
Infrastructure for operators and attractions	1.57	4.25	1.57	4.25
<b>LOSSES</b>	70.97	191.08	70.77	191.08
Visitor spend non-cruise related	61.68	166.54	61.68	166.54
Cruise visitor spend	9.29	24.54	9.29	24.54

### 3. SECTOR EFFECTS

Of the 73 properties, 34 suffered severe damage, 32 received light to moderate damage, with 7 properties not yet evaluated, mainly due to accessibility difficulties. The room stock of 909 rooms has seen an estimated 358 damaged to the point that they will not come on line for at least a year (39 percent of the stock, and some may never recover), 308 may be coming back within the year (34 percent), and 243 are serving the market now.

In addition, the cruise segment may be lost for the entire season. Other areas affected by both the hotel stock and the lack of cruise arrivals include tour operators (seven of the largest ones report a significant income loss of over EC\$9 million), diver operators (the two largest report losses of EC\$1.5 million, and damages of EC\$1.9 million), and most heavily hit are the smaller tour guides, vendors, and other micro-enterprises with an estimated loss of EC\$16 million<sup>33</sup>.

Cruise ships themselves suffer minimal losses, since they simply add another island, such as St. Lucia, St. Vincent,

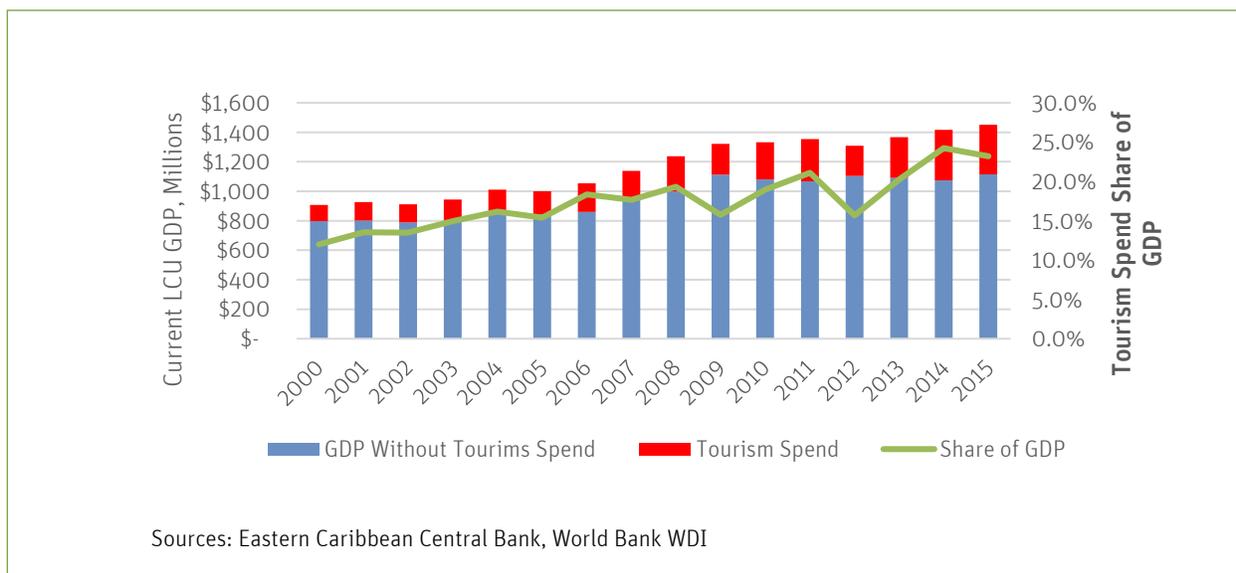
or Grenada to their agenda. Thought this might mean an increase in fuel consumption (the islands are further south), this loss would be difficult to quantify.

### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

After the OECS countries lost their favorable trading partner status with the EU in 1997, Dominica's banana exports collapsed, and another source of revenue was sought. Dominica, along with the rest of the OECS countries, shifted their focus on tourism. Since the economic slowdown of 2009, other sectors of the economy have remained stagnant, but tourism's growth jumped the sector from 15 percent of total GDP to 23.9 percent in 2016. In fact, the annual growth of the economy would have been 0.02 percent, but because of the 5.5 percent growth in tourism, the overall economy still managed a 1.1 percent growth rate.

<sup>33</sup> These losses are not itemized in the following table, since they are already captured in the tourism spend, and should not be double counted. However, the damages are itemized.

**Figure 16: The relevance of tourism to Dominica’s GDP, 2000-2015**



## 5. RECOVERY NEEDS AND STRATEGY

### Recovery Needs and Prioritization

The tourism sector, having two separate components (stay-over and cruises), faces two infrastructure challenges: rebuilding the hotel room stock, and rebuilding the piers that allow for cruise ships to dock. The tradeoff in rebuilding each component is shown in Table 25, added as a separate but important and intertwined component is the restoration of attractions and services that cater to both components.

**Table 25: Matrix of impacts of interventions in the tourism sector**

Tourism Sector	Ease of rapid implementation	Relative impact on the economy
Cruise Sector	High	Low
Stay-over tourism	Low	High
Attractions and Services for both	High	High

Source: Author

Though the cruise sector is not the highest earning, it is considered “easy pickings”, because all that is needed infrastructure wise is the facility to dock ships, and in terms of services, is the ability to attract and entertain cruise visitors. This is easier in the short term than

rebuilding the hotel stock. Since the main facility lies in Roseau, a first priority for the sector would be to rebuild the Roseau cruise berth. This is particularly important in light of suggestions that the Government may adopt a policy of marketing for hurricane victim support cruises, i.e., developing a sector of the cruise industry where passengers arrive on Dominica with the specific intent of helping the Dominican economy in its rebuilding. This should go hand in hand with the overall cleanup effort:

Cruises cater to people who vacation, and vacationers wish to vacation in a relaxing environment. As such the rebuilding of attractions and forms of entertainment, such as bars and restaurants, also on the high priority list. The cruise terminal is public infrastructure, however, the sources of entertainment and attractions are in many cases private. For the restaurant and bar businesses, the Government should facilitate lending to have these enterprises up and running as soon as possible. Similar stimulus might be advisable for some of the other services serving the cruise industry, such as tour operators.

The stay-over sector of the tourism industry will require the rebuilding of both the moderately and severely damaged room stock. The slight to moderately damaged room stock will progressively come on line over the period of one year, however, it is important that this process not be rushed, since significant disaster risk reductions must be included.

### Recommendations for DRR and Building Resilience in Sector

For the hotel sector, there are two elements make up the build back better component: quality of construction and the location of the property. This also applies to some tourist attractions with fixed properties, such as dive centers.

Two elements in Dominica's risk profile have come to significant play during Maria: wind and flash flooding. Though Maria was an extreme event, there are many examples of properties on the island that have survived the storm with their non-concrete roofs intact, evidence that better construction techniques can go far in mitigating disaster risks. Specific engineering suggestions commonly mentioned for roofs are thicker purlins and screwed down, rather than nailed, galvanized steel.

The flooding risk is best mitigated with an understanding of the hydrological features of a given site. Dominica advertises itself as the island with one river for each day of the year. There are many streams, and these streams under normal circumstances do not appear threatening in any manner. However, because of the steepness of the terrain that feeds them, they can rapidly develop into violent streams with extraordinary forces within them. This, along with bridge construction that does not allow for adequate clearance for washed down debris, generates an environment where flooding can be sudden and dangerous, as has occurred twice in recent memory (Erika and Maria). The best mitigation against this risk, if a location close to a riverbank is chosen, is to build at an elevation above the riverbank where severe flooding will not rise to.

**Table 26: Hazards and their mitigation facing Dominica's tourism infrastructure**

Type of hazard	Level of Impact during Maria	Examples of properties affected in the tourism sector during Maria	Methods of adding resiliency
Wind	High	Secret Bay	Better construction standards, especially on roofing
Flash flood (river overflowing)	High	Champagne Reef	Better location (out of potential riverbeds)
Storm Surge and swell	Low	Sea World	Better location
Earthquake	None	None	No concrete roofing

Source: Author

**Table 27: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

Timeframe	Item	Description	Cost	
			EC\$ M	US\$ M
Short Term	Roseau cruise berth	Rebuild <sup>7</sup>		
	Infrastructure for tour operators, taxis, other services, with BBB component	Rehabilitate	5.58	2.07
Medium Term	Slight to moderately damaged hotel rooms, with common areas and landscaping components, to BBB standards	Rebuild	21.97	8.14
Long Term	Severely damaged or destroyed hotel rooms, to BBB standards	Rebuild	43.22	16.01
Total			70.77	26.21

### Implementation Arrangements

The hotel sector is privately owned, as are the tour operators, service providers and vendors. In general, attractions fall under the MOFA.

For the private sector, the Government should create an enabling environment by assisting with access to financing, providing fiscal incentives to the sector, and providing resources. One way the Government could speed up implementing the rebuilding could be by giving loan guarantees to the most established private sector participants, allowing the private sector to lend with less risk exposure, and therefore with lower interest rates.

## 6. SOURCES

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## SOCIAL SECTORS

### Education

#### 1. SUMMARY

The assessment covers the entire education sector, which includes day care centers; early childhood development centers (ECD); primary, and secondary schools; and, the state college. The private offshore universities of medicine are not under the Ministry of Education policy, they report directly to the board of directors in United States of America. An initial assessment shows that 137 educational facilities out of the 163 (84 percent) have some level of damage, including severe damage to equipment and pedagogical materials, causing ongoing delays in the return of normal teaching and learning. Total damages to the sector were assessed to be EC\$199.8 million (US\$73.98 million) with losses totalling EC\$8.66 million (US\$3.21 million).

The Ministry of Education has developed an education emergency response strategy that entails reopening the schools by phases based on the level of damage. In addition to addressing the immediate needs to re-open schools, to ensure that the right to education of children and adolescents is realized, it is necessary to continue working on the repair and rebuilding of schools, fixing the water and sanitation systems, as well as the replacement of textbooks, furniture and equipment. Not having

functional classrooms and school facilities will impact in the quality of teaching and learning. These will also have adverse impact on the students' emotional and physical security. This situation needs to be addressed, including through a comprehensive reconstruction plan.

The learning time for students will be decreased by at least 40 percent, from 930 hours per year to 584 hours per year (two months already lost and factoring a one-hour reduction in contact time). Total recovery needs for the sector were estimated to be EC\$254.36 million (US\$94.19 million).

#### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

The Government of Commonwealth of Dominica places high priority on the education sector, with the major thrust during the last decade on investment towards achieving universal access to secondary level education. The figure for total recurrent expenditure on education for 2015/2016 was EC\$66.8 million (US\$24.74 million) being 16.5 percent of overall national recurrent expenditure for that year.

The Education Act 11 of 1997 governs the education system and mandates compulsory education for all children between the ages of 5-16. According to the Education Digest, prepared by the Ministry of Education and Human Resource Development, the education system is composed by:

**Table 28: The education system**

Cycle	No.	Duration	Age	boys	Girls	total
Day care centers	17	3 yrs.	0-3	122	120	242
ECD centres	73	2 yrs.	3-4+	728	714	1442
Primary	58	7 yrs.	5-11	3,685	3,375	7,060
Secondary	15	5 yrs.	12-16	2,568	2,505	5,073
Tertiary	1	2 yrs.	17+			1,747
<b>TOTAL</b>						<b>15,564</b>

Source: Education digest, 2015/16

According to the Education digest (2015/16), the primary gross enrollment rate was 94.1 percent, and the net enrollment 84.6 percent. For secondary schools, the gross enrollment was 91.2 percent and the net enrollment 80.2 percent. The transition rate to secondary education is at 77.9 percent. In the Eastern Caribbean Region, this same indicator is at 92.3 percent.

At tertiary level, enrollment saw a 10 point reduction compared with the previous academic year, meaning that just 1,803 students (44 percent male and 56 percent female) were enrolled in the state collage.

According with the OECS Education Digest, 2016, the repetition rate in 2012/13 was 4 percent in primary education and 8.9 percent in secondary education. However, the drop-out rate in primary was at 0.26 percent and 2.21 percent in secondary. Around 65 percent of the teachers in primary schools are trained, but for secondary schools only 42 percent are trained.

The education sector has put a strong focus on the implementation of the OECS Education Sector Strategy (OESS). The main strategic pillars of the OESS are: to improve (i) quality and accountability of leadership and management; (ii) teachers' professional development; (iii) the quality of teaching and learning; (iv) curriculum and assessment; also (v) to increase and expand access to quality ECD; (vi) provide opportunities for all learners in technical and vocational education and training; and, (vii) increase provision of tertiary and continuing education.

The government has focused support towards students from lower socio-economic groups through provision of safety net programmes, such as school bus service, a school feeding programme, school book rental, and an educational loan programme, among other initiatives.

The Government of Dominica, through the Ministry of Education, implemented different programmes to guarantee access and permanence in the education system to the most vulnerable population. Among the initiatives, it is important to highlight the school feeding programme (covering 1,925 students in the 2016/17 academic year, with an investment of EC\$158,478); the school bus scheme transported 2,449 students in the last academic year (with an investment of EC\$1,941,652); also 6,500 students benefited of the text book scheme with an investment of EC\$548,972.

### 3. SECTOR EFFECTS

The effect of Hurricane Maria has had a big impact on educational infrastructure.

Table 29 below provides a summary of the storm impact to infrastructure and physical assets in the education sector<sup>34</sup>. More specifically, out of a total 136 schools and education centers, 62 need minor repairs, 52 can be described as partially damage and 67 can be describe as high damage.

Access to schooling was interrupted for 100 percent of the student population. The initial date of schools to re-open, September 6, 2017, was pushed back to October 16, 2017. This is only for schools that were not damaged. School leaders, teachers, and students are coping with the disruption in a variety of ways, including resuming classes in temporary structures, and some students are traveling to neighbouring islands to continue with their education. As of October 29, 2017, 95 percent of the total student population has no access to schooling.

<sup>34</sup> Based on the rapid assessments conducted by the Ministry of Education and partners.

**Table 29: School damaged based on the rapid assessments**

Type of school	Mostly damage	Partially damage	Minor repairs	No damage	Total
Secondary	5	9	1	0	15
Primary	22	27	5	4	58
ECD	34	14	8	17	73
Day cares	6	2	3	6	17
<b>TOTAL</b>	<b>67</b>	<b>52</b>	<b>17</b>	<b>27</b>	<b>163</b>

Source: Rapid assessments conducted by the Ministry of Education and partners.

**Table 30: Summary Table of Damage and Losses**

	PUBLIC		PRIVATE		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M	US\$ M	EC\$ M
<b>DAMAGES</b>	48.80	131.75	25.18	67.96	73.98	199.8
Schools	40.63	109.7	20.96	56.58	61.59	166.3
Furniture	3.57	9.63	1.84	4.96	5.41	14.6
Equipment	0.38	1.02	0.20	0.53	0.58	1.6
Education Materials	4.22	11.4	2.18	5.89	6.40	17.3
<b>LOSSES</b>	2.12	5.71	1.1	2.95	3.21	8.66
Demolition and Rubble Removal	1.10	2.97	0.57	1.53	1.67	5.07
Repair of schools used as shelters	0.77	2.07	0.40	1.07	1.17	3.54
Temporary Schooling Solution	0.25	0.67	0.13	0.35	0.38	1.15

While the effects of the storm on infrastructure and physical assets are relatively easy to estimate in monetary terms, it is more difficult to estimate the financial implications of the storm on teaching and learning processes. The storm and its aftershocks led to the complete closure of schools and colleges for more than a month (September 18 to October 23) in the severely-affected districts, forcing more than 13,000 children and youth to stay out of educational institutions for a significant period of time as the academic year was just starting. The average/standard total days of schools in session in a year is 186 days. The majority of students have already lost 20 days (10 percent), and it unclear when all schools will be fully operational. Total school hours are also affected. Where regular school hours in a day is about six hours, currently schools are operating for a total of four hours, with plans to keep this schedule for at least the next two months. It is, therefore, likely that affected schools might experience a decline in learning outcomes in the short to medium term.

Due to the physical and internal effects from schools not being fully operational, implications could arise where there may be an increase of the total number of children out of school. There could also be an increase in the number of children with disabilities or significant injuries, for whom the temporary or transitional learning centres could be less than accessible. With the demand for additional labor, both at home and in the market, children and adolescents may prioritize working to support families, due to major loss of family income from hurricane Maria. In addition, the occurrence and increased number of children and adolescent who leave the island and to look for education opportunities in neighboring countries is highly likely. Specific details of risks and vulnerabilities are described below.

It is also important to consider that the destruction of houses and the displacement of families has had a severely negative impact on the learning environment at home. Several signs of post-trauma were observed in kids, families and among teachers in the school communities.

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

Education is not only a human right priority but also a major component of human capital development, and affects Dominica's ability to achieve its socio-economic development targets. Economics literature strongly correlates the relationship of years invested in education to both individual earnings and macroeconomic performance. In the case of Dominica, education is a key sector to guarantee the full inclusion of children and adolescents, and to address the challenges faced by the country before the hurricane, including the economic crisis and the need for greater economic diversification.

ECD is particularly important for girls and boys from zero to five years, especially in the most vulnerable communities, to get the best start in life, as inequalities in early education tend to be sustained and compounded in later years. Education is critical to ensure that children and adolescents obtain the skills and knowledge necessary for a successful life, and empowering children to make the best decisions in their childhood and adult life.

#### 5. RECOVERY NEEDS AND STRATEGY

##### Recovery Needs and Prioritization

The main objective for the recovery and reconstruction strategy in the education is to align all planned activities to ensure it is well implemented and education services are uninterrupted. This calls for a focus on both the structural and non-structural aspects of the education system to be resilient to shocks. It also entails an education system that constantly enabling a learning environment that is participatory and has strong engagement with the education community, including students, teachers, parents to name a few.

The overall recovery strategy will prioritize the education system to begin re-opening schools which are less affected, and in the next phase, to rebuild and/or demolish other schools to have them re-open as soon as possible.

The Ministry of Education and partners need to finalize a comprehensive structural assessment, including the design of suitable and BBB plans for each school, including the installation and operation of temporary learning spaces until the education system is fully operational.

The schools with "minor damage" and those used as shelters, need to be cleaned and minor repairs done, to guarantee students safety and security. Those schools with more than one building, need to identify a strategy to start in minor affected buildings, and design "shift" strategies to guarantee that students return to school as soon as possible.

The Ministry of Education and partners are already providing psychosocial support to students and teachers to facilitate a smooth transition into the education system.

##### Short-term needs (0-12 months)

These include the immediate and transitional needs required to resume the delivery of education services until reconstruction and rehabilitation of permanent structures is completed. It is necessary to guarantee the availability of educational and recreational materials in temporary spaces, including WASH solutions and psychosocial support activities, that will allow for the return to learning activities in the affected areas.

To resume the education system, the following is necessary:

- ▶ Detailed and comprehensive structural assessment of damaged school buildings, on a building-by-building basis. Identify the available physical infrastructure, furniture and pedagogical materials. After a more detailed needs assessment, this includes installation and operation of temporary spaces to maintain as much continuity in education as possible. Educational spaces occupied as shelters and logistical centers for humanitarian aid will need to be rehabilitated. Development of appropriate designs, prototypes and institutional arrangements, taking will need to take into consideration geography, climate, availability of land, cost effectiveness and other factors. Even when there are time constraints, it is necessary to review construction standards and building codes.
- ▶ Schools with minor damages will need repairs, including debris removal. New classrooms and permanent buildings will need to be constructed and furnished for the more severely damaged schools, adhering to BBB principles.
- ▶ Students and teachers traumatized by the storm and its aftermath will need psychosocial support to recover and fully resume their lives. Structured



group-based activities built on problem-solving therapy or cognitive-behavioral therapy have been proven effective in a variety of settings, generally with weekly or biweekly sessions over five to eight, and can be administered by non-specialists with some training, and even e-helpers.

- ▶ Curricular and pedagogical interventions to minimize loss of learning. These interventions ideally will include short-term programs to minimize learning disruption and, in the medium term, a temporary modification of the curriculum to compensate for the shortened school year. In the lower grades, recruitment of lightly trained tutors or teachers' helpers could target students already struggling with the normal curriculum, who are likely in greatest danger of dropout or a permanent negative impact to their learning trajectory. Such a program could also provide employment to young people in need of income support after the hurricane. Particular attention is required to the needs of students scheduled to sit regional examinations during the current school year.
- ▶ Support will be required to: continue teachers' professional development, as already planned in conjunction with the OECS; train teachers in providing psychosocial support to students; train teachers in the revised curriculum; and, incorporate risk reduction into teacher training.
- ▶ Vulnerable students will need additional support to maintain access to schooling, and conditions of security and good treatment. This includes: attendance monitoring; continuity of special education services for pupils with special needs; and, eliminating educational barriers in affected areas (e.g., distributing school informs, texts, school feeding, and school transportation). Implementing flexible modalities and tutoring to reduce dropout, as discussed above, will also support inclusion.
- ▶ Distribution of minimum educational and recreational materials, including textbook and teaching-learning materials, to ensure meaningful resumption of teaching-learning process given the massive damage to textbooks and teaching-learning materials.
- ▶ Revisiting and adapting the existing DRM strategy at school level, to mainstream the strategy during the reconstruction and recovery plan.
- ▶ Conduct a needs assessment of teachers and education personnel of the affected areas.
- ▶ Support to ensure adequate housing conditions for teachers and staff.

### Medium-term needs (12 to 48 months)

Medium-term needs will focus on reconstruction and retrofitting activities in education structures. This will require reviewing the existing legal and oversight mechanisms for strengthening and ensuring safety in all types of education facilities. The medium-term needs include:

- ▶ Reconstruction of fully-destroyed schools, using principles of BBB, with disaster resilience technology, creating a better learning environment and service delivery, and selective additional features.
- ▶ Review and rationalization of school locations, teachers deployment, unit costs and community needs.
- ▶ Carrying out curriculum and textbook reforms with a DRM and resilience perspective, and teacher training on the new curriculum and textbooks through existing teacher training institutes.
- ▶ Strengthening the education management information system to incorporate a module on school safety and DRM.
- ▶ Strengthening disaster preparedness and response at the school and community level, through school-based DRM training and planning, by enhancing the capacity and preparedness of parents, teachers and students associations, and communities.

### Recommendations for DRM and building resilience

The education system in Dominica needs to take advantage of the opportunity to reflect and to rebuild a more resilient and strong inclusive system for all the children and adolescents in Dominica. To do so, it is necessary to:

- ▶ Review the MoE system and structure, and review the existing institutional arrangements at the central and local level to respond more effectively to multi-hazards. This would require reviewing and revisiting existing policies and guidelines.
- ▶ Strengthening systemic capacity to deal effectively with post-disaster response, recovery and reconstruction. These would include mechanism to address the immediate needs, as well as to ensure that education building and systems meet higher standards and levels of safety. There should be adequate provisioning of human resources and technical capacity at the national and district levels to ensure safety and quality at all phases.
- ▶ Building back better. All new education, and partially new, institutions should be resilient to future disasters: building with safe and adequately sized staircases; proper exits, furnishing and equipment, to minimize potential harm to school occupants; and, ensure the provision of minimum enabling conditions for enhanced learning, including basic WASH facilities, among others.
- ▶ Enhancing disaster resilience is not only about building back better from a structural perspective. It requires intervention in non-structural aspects of the education system, such as the curriculum and textbooks, to ensure that teachers and students internalize safety issues and can act in times of need. This also requires strengthened disaster preparedness and response at the school and community level through school-based DRM and community-based DRM training and planning.

**Table 31: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

	Item	Description	Cost	
			EC\$ M	US\$ M
Short term	Provisional schools	Temporary learning spaces	1.02	0.38
	Rehabilitation (includes the repair of schools used as shelters and wash facilities)	Of schools with minor damage	1.17	0.43
	Adjusted curriculum with teacher training	Consultant led review	0.33	0.12
	Psychosocial support	Group activities for students and teacher training	0.41	0.15
	Supports to at-risk students	Tutoring, special education, attendance-related expenses (e.g uniforms)	1.674	0.61
	Teaching and learning materials		0.81	0.30
Medium-term	Reconstruction -build back better (includes demolition and rubble remove and the rehabilitation of wash facilities)	Of schools with partial damage	24.76	9.17
	Education emergency planning at national level	Develop strategies and capacities to include DRR in the education sector, including an emergency response plan, and curricular modifications	0.44	0.16
Long Term	Reconstruction- build back better (includes wash facilities)	Of schools with major damages	181.9	65.38
	Assets	Furniture, schools books and equipment	41.82	15.49
TOTAL			254.36	94.19

The recovery process for education is led by the Ministry of Education in coordination with Finance and Planning, with strong coordination support UNICEF and is expected to involve bilateral agreements with supporting countries and support from multiple international and donor organizations.

## 6. SOURCES

Education budget 2015-2016

Education budget reports 2017

Education assessment reports

First assessment tools (Secondary, Primary, ECD and Daycare centers)

Education digest 2016

## Health

### 1. SUMMARY

The Dominica health system, still recovering from Tropical Storm Erika in 2015, was hit hard by Hurricane Maria. Moderate or severe damage to more than half of all health centers, and significant damage to the main Princess Margaret Hospital, is exacerbated by the disruption of access to electricity, water and waste management. All health workers were personally impacted. Initial support came from outside and critical patients were evacuated. The health sector, with the support of a large humanitarian response, continues to work arduously to bring health and environmental services to full operation, while dealing with the increased injuries, illness and health risks due to the event and its consequences.

Immediate priorities are relief and continued support for health workers, reduction and management of environmental health risks, treating increases in illness and injury, and the restoration of health services. The strategy for recovery includes building more resilient facilities and systems, addressing human resource gaps and reorganization of primary care services. Regional approaches are needed to increase access to, and decrease cost of, care outside of Dominica.

The recovery needs for the sector amount to EC\$59.76 million (US\$22.13 million). The damages suffered by the sector amount to EC\$29.5 million (US\$10.9 million) with another EC\$18.8 million (US\$6.95 million) in losses.

### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

#### Health Indicators

The average life expectancy in Dominica in 2013 was 75 years. At the end of 2015, there were 22 centenarians (3 males and 19 females), for which the island is known. Crude birth rate decreased to 12.4 per 1000 population in 2015, with a decreasing proportion of births amongst adolescents. This is a result of universal access to sexual and reproductive health-care services. Maternal mortality remains low with numbers fluctuating from zero to two cases annually, most years being zero. Under-five mortality is low with zero to three deaths occurring annually

beyond the first year. Most deaths in the first year occur in the newborn period. Crude death rate in Dominica was 9.5 per 1000 population in 2015, with more deaths in the terminal ages, as expected. The leading causes of death for men in 2015 were prostate cancer, hypertensive disease and stroke, and for women, diabetes mellitus, stroke and hypertensive disease.

#### Health Conditions

The major diseases are chronic diseases such as hypertension and diabetes along with their main complications (stroke, heart disease, kidney failure (requiring dialysis), blindness and amputation) and cancer. Overweight and obesity have replaced underweight and stunting as the main types of malnutrition for the population, with increasing rates in children and adolescents. Alcohol and other substance abuse is of concern.

There have been outbreaks of endemic vector borne diseases including dengue, zika and chikungunya and leptospirosis. There were 23 new cases of HIV in 2016. Most are male of working age. AIDS deaths are uncommon due to a comprehensive program and free treatment. Drug resistant tuberculosis (TB) is a threat as there have been three cases in the last five years. Dominica is part of an OECs HIV/TB elimination project supported by the Global Fund.

#### Health Facilities and Services offered

The main hospital is Princess Margaret Hospital in Goodwill, Roseau. The hospital has 222 beds, inclusive of 50 psychiatric inpatient beds and 11 neonatal beds, and provides services typical of hospitals in this region. Construction had begun on the New National Hospital (NNH) in the same compound. There is also the smaller Reginald Fitzgerald Armour Hospital in Portsmouth, which falls under the primary care system. Most tertiary care is provided outside of the country.

The current primary care system was born out of Hurricane David in 1979. The services are arranged into seven health districts which are grouped into two administrative regions. Roseau, St. Joseph and Grand Bay make up Region I while Portsmouth, Marigot, La Plaine and Castle Bruce make up Region II. Each district has a major, Type 3, primary care facility, and several satellite Type 1 facilities for a total of seven Type 3 facilities and 42 smaller Type 1 facilities. Primary care services include typical health

services, including dental, pharmacy, environmental health services and home visits. Environmental health manages solid waste and provides monitoring services for water, food, port health and vectors. The Ministry of Health has a 14-vehicle fleet but ambulances are run by the fire service.

Private health services mainly consist of diagnostic services (laboratory and imaging), pharmaceutical services and outpatient care provided by private practitioners. These services compliment the public systems and provide backup when public systems fail.

Primary care services are delivered at no cost to the clients. Nominal fees are collected at hospital. A health insurance scheme for children and pregnant mothers had been launched as a pilot earlier in 2017. North American recruitment contributed to the resignation of 32 nurses in 2015-2016 leaving 80 vacancies.

The health system is currently in recovery from Tropical Storm Erika in August 2015. A Rapid Needs Assessment estimated damage and loss to the health sector at EC\$5.2 million. As a result, a “Smart Health Facilities” project supported by DFID through PAHO, was underway.

**Table 32: Services provided**

Primary Care Services		2015	2016						
Medical Visits No. seen by nurse		30543	40442						
Number seen by doctor or FNP		14437	18933						
Diabetic & HTN Visits		13379	13335						
Household & Home visits		5663	5513						
Hospital Speciality Outpatient Clinics- Patient Visits									
	Sep-16	Oct-16	4th Qtr 2016	Annual					
Total Spec Clinic visits	1361	1507	3917	17898					
Hospital Inpatient Admissions					Hospital Patient Days				
	#beds	Sep-16	Oct-16	4th Qtr 2016	2016 Annual	Sep-16	Oct-16	4th Qtr 2016	2016 Annual
Total	222	640	665	1828	7274	4768	4723	14093	56618
Without Psych	172	599	631	1724	6837	3428	3619	10590	42148

### 3. SECTOR EFFECTS

All health facilities were damaged. The main Princess Margaret Hospital in Roseau sustained severe damage with 15 percent of its buildings totally destroyed and 53 percent able to function. During the event it was necessary to relocate several wards. The generator failed and the oxygen generator malfunctioned. Central medical stores lost the majority of medical supplies<sup>35</sup> due to water damage but most medications were spared. Bed capacity has decreased by 95 beds. Electricity was restored within three days. Fluoroscopy, portable x-ray and all blood bank equipment were lost. Five weeks post-Maria no elective surgery is being done and services have been contracted.

La Plaine Type 3 centre and a third of all Type 1 facilities (17/48) were severely damaged. Marigot Type 3 centre (a rented facility) and a further 25 percent (12/49) of Type 1 facilities were moderately damaged. Debris removal, exposure to weather and access to water, telecommunication and electricity are current issues. Some rainwater tanks recently installed are functional, but some need to be replaced. There is also an increase in persons seeking care and an increased need for visits to homes and shelters. Five weeks after the hurricane, primary health services continue to be offered in buildings with only emergency repairs or in alternate premises.

The Environmental Health Office sustained damage and some equipment was compromised. The airport Port

<sup>35</sup> Medical supplies refer “consumable medical supplies” that is gloves, needles, tubes, etc. supplies and medications refer to pharmaceuticals and drugs.

Health building was destroyed. Water quality laboratory equipment was lost. The HIV program office has sustained damage, however most supplies and drugs are available and patients continue to access the nutrition program. Solid waste damage and loss costs are captured under the infrastructure section of this report.

The cost to continue operations is significant. Initial air evacuation of critical patients and neonates, and their ongoing care in hospitals in other countries, are major expenses. Lost diagnostic services must be met in private facilities or abroad. Health services have been continuous and the general human resources needed to clean up

and restore the premises, while still delivering services and addressing risks, is enormous. There has been an estimated 40 percent increase in persons seeking health services and a five-fold increase in environmental health monitoring and vector control activities. Health has increased surveillance and health promotion activities in the context of decreased communication and access. The Ministry of Health fleet sustained minimal damage but fuel costs have doubled in the response. Fuel is needed to maintain generators at prioritized major and hard to access primary care facilities, and donations of generators will increase.

**Table 33: Summary Table of Damage and Losses for Health (in local currency and US\$)**

	PUBLIC		PRIVATE		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M	US\$ M	EC\$ M
DAMAGES	10.79	29.1	0.15	0.391	10.9	29.5
Primary Healthcare Facilities	5.30	14.3			5.30	14.3
T1 Health Facilities	0.142	0.386			0.142	0.386
Princess Margaret Hospital	1.796	4.85			1.796	4.85
Furniture	0.236	0.636			0.236	0.636
Medical Equipment	2.99	8.07			2.99	8.07
Medications and Supplies	0.38	1.03			0.38	1.03
Other Assets	0.008	0.02			0.008	0.02
Private Labs and Facilities			0.15	0.39	0.14	0.39
LOSSES	6.95	18.8			6.95	18.8
Increased cost of operation	3.55	9.6			3.55	9.6
Increase in services & reducing risk	3.13	8.4			2.35	6.3
Loss of Revenue	0.273	0.738			0.273	0.738

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

Hurricane Maria has greatly increased health related risks including: acute respiratory conditions; gastroenteritis due to poor sanitation and food safety; and, vector borne disease outbreaks, including mosquito borne diseases such as dengue, zika and chikungunya, as well as leptospirosis. Poor nutrition is a concern and will

exacerbate chronic diseases. Increases in substance abuse, including alcohol, and increases in mental health problems are also anticipated. Men are at greater risk for leptospirosis and psychiatric conditions, and are less likely to seek care in the health system. The elderly population are also at increased risk. Out of pocket health care costs will increase both within and outside of Dominica. Poorer health will contribute to a general decrease in productivity.

## 5. RECOVERY NEEDS AND STRATEGY

Short-term recovery needs include restoration of services to health facilities, repair of damage, replacement of equipment and identifying temporary facilities for use during reconstruction. The focus is on the hospital, Type 3 centers and hard to access areas. There will be need for some mitigation for existing and repaired facilities, as the next hurricane season is less than a year away and not all permanent structures will be completed by that time. Health workers need time off as well as support for recovery. There is need for increased screening and more diligent management for chronic diseases and increased home visits. Increased surveillance, environmental monitoring, vector control, psychosocial support and health campaigns are needed to address increased risks. A large increase in the supply of health workers is needed.

The medium to long-term strategy is to build resilience in physical structures and in health systems, making use of affordable technology. Health policies, strategies and legislation will be reviewed with the lens of climate resilience. Communication and Health Information Systems (HIS) must be made resilient using affordable technology and equipment. Primary care services need to be reassessed. Consolidation of health centers and a mobile facility should be considered. The NNH plans should to be revised for resilience.

Permanent reconstruction to the facilities should incorporate PAHO Smart Hospitals Standards for resilience, and low energy and water consumption. Roofs for health centers should be designed to withstand 700-

year return period wind speed (159 mph, 3-second gusts) in accordance with OECS Building Code 2015 and roofs for the Princess Margaret Hospital should be designed to withstand 1700-year return period winds (172 mph, 3-second gusts<sup>36</sup>).

Remote facilities that may become inaccessible should be self-sustainable with back-up power supply, water storage, telecommunication, and adequate stocks to continue services. It is recommended that a structural analysis is done before construction of flat reinforced concrete roofs, to ensure that the building will not be compromised in the event of an earthquake.

The human resource strategy for nurses must be reviewed and consideration given to the expansion of environmental health services to make use of persons trained and unemployed. An OECS regional approach to health worker training and exchange should be developed, along with regional risk sharing strategies to reduce evacuation and overseas healthcare costs. Use of telemedicine and mechanisms for sharing key specialists between islands should be explored.

### Implementation Arrangements

The recovery process for health is led by the Ministry of Health of Dominica in coordination with Finance and Planning, with strong coordination support from the Pan American Health Organization and is expected to involve bilateral agreements with supporting countries and support from multiple international and donor organizations

**Table 34: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

Term	Item	Description	Cost	
			EC\$ M	US\$ M
Short term	Repairs to health facilities & equipment replacement	Equivalent to damages	29.53	10.94
	Fund/ relief for overseas care	For overseas evacuation & care	4.00	1.48
	Recruitment of 50 nurses for 2yrs	Proposal from Philippines	6.60	2.44
	Health promotion	6 campaigns for six months	1.73	0.64
	Environmental monitoring & vector control	Post Maria planning & increased monitoring	0.74	0.27
	Psychosocial support	Costed CDB proposal	0.17	0.06
	3 temp facilities	Clinic in a can or equivalent	0.70	0.26
	2 mobile clinics	27 ft gas with equipment	0.71	0.26
Medium to Long Term	Building for resilience	Improving on original structures	11.40	4.22
	Expansion of nursing program	Registered nurses, primary care nurses, Community Health Aids and mental health	1.25	0.46
	Review of primary care services & NNH	Consultant led reviews	0.81	0.30
	Review policies and legislation for climate resilience	Consultant led reviews	0.81	0.30
	Maintain gains of HIV/TB Elimination Project	Support for PLHIV and the program	0.67	0.25
	Post disaster recovery coordinator	To support Ministry of Health for 24 months	0.12	0.04
	HIS resilience	Backup servers, virtual space	0.54	0.20
Totals			59.76	22.13

## Housing

### 1. SUMMARY

Total damage to the housing sector is estimated at EC\$955 million (US\$353 million), fully affects the private sector, and is considered as the combined replacement cost of destroyed houses, the repair cost of partially damaged houses, as well as the replacement value of household goods destroyed. Losses are estimated at EC\$77 million (US\$28.5 million), and predominantly affect the private sector. These include expected loss of rental income, as well as the cost of demolition, rubble removal and shelter expenses. The recovery strategy focuses on roof repair for partially damaged houses to an improved standard of resilience, as well as the replacement of destroyed houses. Moreover, it recommends providing homeowners with training to ensure proper understanding of basic

techniques for strengthening houses to withstand the effects of high winds. The total cost for recovery is EC\$1403 million (US\$519.7 million).

### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

According to the 2011 census (Table 35), there are 31,352 dwelling units in the country, of which 80 percent are occupied, while the remaining are vacant. The demand for new and replacement housing, for all income groups, is estimated to average 400 units a year, of which less than 35 percent is met. Issues including land availability, tenure, adequate infrastructure and servicing, integrated planning, institutional capacities, access to appropriate finance, and construction costs all impact the sector and contribute to this gap.

**Table 35: Households and Dwellings Census 2001 to 2011**

CENSUS YEAR	NON- INSTITUTIONAL POPULATION	HOUSEHOLDS	OCCUPIED DWELLING UNITS	VACANT DWELLING UNITS	CLOSED DWELLING UNITS	TOTAL DWELLING UNITS
2001	71242	23803	22513	2442	1290	26745
2011	70739	26085	25001	5267	1084	31352

Main structural housing typologies include combinations of walls in different materials, among them wooden, concrete blocks and a combination of both. In terms of roofing, wood is used in most of the cases with galvanized sheeting. There is no evidence of confined masonry and

poor connection walls-to-roof seems to be a practice that needs to be revised. Concrete block is the single most popular material for the construction of the outer walls of dwelling units.

**Table 36: Structural Typologies in Dominica**

Typology	Description
I	Wooden walls with wood rafters and galvanized sheeting
II	Concrete block walls (CMU) walls with wood rafters and galvanized sheeting
III	Concrete block walls (CMU) walls with concrete slab roofing
IV	Unconfined masonry with wood rafters and galvanized sheeting

Dominicans were more likely to be living in owner-occupied housing units with 71 percent<sup>37</sup> indicating that they owned the units that they occupied. 29 percent of households and 39 percent of the population (reflects larger households among the poor, and by implication, more dense housing

conditions) are considered poor by the poverty definition of household income under \$1,500 per month. Of these 11 percent of households (15 percent of the population) are considered “very poor” (GSPS, 2006). The quantity, quality, and adequacy of housing to meet demand remains

<sup>37</sup> According to the 2001 census

a challenge, including the provision of basic services, further compounded by a complex topography with scattered small settlements difficult to interconnect, benefitting from an economy of scale.

Land ownership with deed is highly valued by farmers and the Carib Reserve was expanded to 3,700 acres, but by law it is communally owned by all its residents. The predominant inheritance practice is “family land”, in which a parcel of land is owned jointly by descendants of the original owner, either male or female. Use of land is determined by consensus or family tradition. Oral agreements frequently lead to dispute, but no part may be sold unless all co-owners agree.

Over the past years, several initiatives have targeted provision of housing, among them the “Housing Revolution” Program that looks at a comprehensive package. The program assists through various interventions such as the Squatter Regularisation Programme, a Special Mortgage Facility at the Government Housing Loans Board and the AID Bank (4 percent and 5 percent interest respectively), the Housing Renovation and Sanitation Programme, and the construction of low-income houses. The Government’s approach encourages people to build their own homes, with Government involvement focusing on the utilization of Government-owned lands and delivering serviced lots (GSPS, 2008).

### 3. SECTOR EFFECTS

The Ministry of Lands, Housing, Settlement and Water Resources Management (MLHSWRM), together with the Ministry of Social Services, initiated a country-wide assessment of damage to the housing stock, however data was not yet available for this report. Estimates of damages<sup>38</sup> to the island-wide housing units are consequently based on preliminary satellite imagery available for the southern region of the country and on discussions with government officials involved in the on-going assessment. Moreover, sample aerial photographs, taken shortly after the event, were reviewed and complemented by field visits in several parishes across the country, to understand the extent of damage to houses. The pre-event baseline for

residential building stock is based on the 2011 population and housing census data.

Predominantly observed effects of the hurricane on the built environment exposed major wind vulnerability of wood structures and unreinforced masonry buildings. In addition, houses along the coast line incurred severe damages due to storm surges, while those located in the riverbed were damaged or destroyed by river debris and flooding. Moreover, the mountainous terrain of the island led to major landslides across the country, affecting yet another share of houses located in the hilly regions.

Despite lessons disseminated in the aftermath of previous disasters, the awareness of disaster exposure risks (wind, seismic, flood, and landslide) in communities remains relatively low, coupled with low uptake of improved construction practices, particularly in rural areas. Based on field visits, it is estimated that most of the buildings that suffered severe damage were non-engineered buildings, predominantly wood constructions or masonry buildings. Damages were amplified by the prevalence of deficient construction practices, poor quality materials and inadequate wind-resilient connections. Enforcement of building codes has not generally been very strong and this has contributed to the extensive damage.

Total damage to the sector amounts to EC\$955 million (US\$353 million), fully affects the private sector, and is considered as the combined replacement cost of destroyed houses, the repair cost of partially damaged houses, as well as the replacement cost of household goods destroyed. Losses are estimated at EC\$77 million (US\$28.5 million), and are predominantly affecting the private sector. These include expected loss of rental income, as well as the cost of demolition and rubble removal, and shelter expenses incurred to date. Across all parishes, a total of 4,703 houses were considered as fully collapsed or damaged beyond repair, 23,514 houses were estimated to have incurred different levels of partial damage, and 3,135 were considered as not affected by the event. Estimated damage and losses to the residential building stock is summarized in the Table below.

<sup>38</sup> The damage levels were disaggregated into five categories: (i) no damage; (ii) slightly damaged houses with minor damage to roof sheeting (~10% damage to the roof); (iii) moderately damaged houses with roof structure partially destroyed (~50% damage to the roof); (iv) highly damaged houses with destroyed roof structure (~100% damage to the roof and minor damage to structure); and (v) destroyed house (entire structure is destroyed or compromised).

**Table 37: Summary of damage and losses for the housing sector**

	PUBLIC		PRIVATE		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M	US\$ M	EC\$ M
<b>DAMAGE</b>	-	-	353.98	955.71	353.98	955.71
Slightly damaged houses	-	-	3.29	8.88	3.29	8.88
Moderately damaged houses	-	-	21.92	59.17	21.92	59.17
Highly damaged houses	-	-	131.50	355.04	131.50	355.04
Completely destroyed houses	-	-	164.37	443.80	164.37	443.80
Contents - all affected units	-	-	32.90	88.82	32.90	88.82
<b>LOSSES</b>	3.43	9.33	25.04	67.62	28.50	76.94
Rental income losses (for monthly income leased houses)	-	-	7.27	19.62	7.27	19.62
Additional rental costs for those displaced by housing damage	-	-	17.78	48.00	17.78	48.00
Cost of shelter <sup>8</sup>	2.14	5.77	-	-	2.14	5.77
Demolition and rubble removal to lot boundary	1.32	3.56	-	-	1.32	3.56

Source: Estimation based on close consultation with Government

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

Nearly every construction material in Dominica is imported, except for sand and aggregates which are locally available. Taking into consideration the large number of houses that will need to be either rebuilt or repaired, construction material imports will increase in the next two to three years, thus impacting the national balance of payments. Moreover, excise revenue will also be affected as Government plans to waive taxes on construction materials.

On the positive side, the contribution of the construction sector to the national GDP will increase because large investments are expected in the construction sector through government programs, increased private sector activity and international loans or grants to the country. Both aspects need to be assessed in the overall macroeconomic analysis of the impact.

Analysis of the human impact needs to include an understanding of current living conditions and the coping mechanisms used by families through aspects such as: access to sanitation (toilets), electricity, clean water, status/condition of housing and ownership of assets, migration and remittances support.

#### 5. RECOVERY NEEDS AND STRATEGY

##### Recovery Needs and Prioritization

Based on preliminary estimates, the recovery and reconstruction needs amount to EC\$1.4 billion (US\$519 million). These include, among others, the costs of demolition and debris clearance; the reconstruction, repairs and retrofitting of houses for structural resilience; training for construction professionals and the informal sector; and, updating and authorizing housing reconstruction policy and the building code for resilient construction practices.

The Government plan for the recovery and rebuilding of the housing sector, outlined by the Prime Minister on October 16, 2017 comprises: (i) waiver of duties on construction materials for six months; (ii) convening power to ensure faster insurance payouts and lower bank charges; and, (iii) repair and rebuilding of schools, clinics, hospitals and homes in a climate-resilient way. The plan includes construction of 3,000 disaster-resistant homes: 1,000 immediately; another 1,000 from the Rainforest Fund; and, another 1,000 with support from foundations.

The options for post-disaster housing programs that have been adopted elsewhere include a cash approach, owner-driven reconstruction, community-driven reconstruction, and agency-driven reconstruction (in situ or relocated site). These imply a mix of targeted financial support and technical assistance. The self-supported recovery could be facilitated through specialized engineering technical assistance and grants based on compliance with disaster-resistant construction guidelines. Depending on the option considered, the homeowner, community and agency would have different levels of control on funds and management of the project.

To assist in the consideration of financing options, the following Table summarizes the range of recovery needs faced by various homeowners. . The financing framework for a simple two-level support option is shown below the Table 38. A basic support of about EC\$11,000 (US\$4,100) to all home unit owners, totalling US\$116 million, would cover basic damages and fund initial recovery. If this were a fixed amount it would be highly progressive and benefit the poorer groups. Support for additional needs, averaging EC\$65,369 for owners of substantially-affected units and totalling US\$417 million, would be controlled through eligibility criteria based on the detailed house damage survey now underway, and could be calibrated by home unit size<sup>39</sup> and by apportioning the responsibility of the owner for self-financing.

The short-term recovery needs focus first on the roof repairs of partially damaged houses to resilient standards. Second, the housing reconstruction policy, implementation plan and financing plan need to be finalized and initiated, covering both the repair and replacement of damaged houses.

### Recommendations for DRR and Building Resilience in Sector

The process for rebuilding the majority of the housing stock to higher standards of resilience requires an integrated multifaceted approach. Policy and planning measures, physical preventive and adaptive measures, and capacity building at the community level are entry points for building resilience in the sector. The revision and enforcement of the building code, to tie provisions in the planning and design stage to the construction phase, is important.

Training in the improved building practices for disaster-resilience house construction needs to be provided for firms, suppliers and homeowners involved in the reconstruction effort. Compliance with design codes is continually low, and increased supervision and inspection is crucial. For roof structures, the use of graded and treated timbers, use of bracing and hurricane ties, the spacing of fixings and use of screws, connections to the wall frame, and adequate overall roof structure and slope are critical factors.

**Table 38: Recovery needs faced by homeowners**

Affected Group	Home Units	Recovery Needs		Needs per Unit	
		EC\$ M	US\$ M	EC\$	US\$
Home units with contents losses	25,001	88.821	32.897	3,553	1,316
Home units - Light-moderate damage	10,973	87.576	32.435	7,981	2,956
Home units - Substantial damage	17,244	1,264.820	468.452	73,350	27,167
Subtotal - Contents losses	25,001	88.821	32.897		
Subtotal - House recovery needs	28,217	1,352.396	500.887		
<b>Total - Affected house unit needs</b>	<b>28,217</b>	<b>1,441.217</b>	<b>533.784</b>		
<b>Recovery Plan Option - Two-level Support</b>					
Basic support - all affected units	28,217	314.016	116.302	11,129	4,122
Additional - substantially-affected units	17,244	1,127.201	417.482	65,369	24,211

39 For example in three groups of: less than 40 sq m, 40 to 80 sq m and over 80 sq m.

This needs to be supported by a countrywide campaign to raise awareness of the special techniques for making houses disaster-resilient and the benefits of implementing these in all areas.

Developing a risk-based approach and integrating planning for natural disasters into the development of the housing sector is a medium-term priority. In view of the wind

and flooding effects caused by this event, modification of the national land use policy to add community-level zoning plans for high-risk areas should be considered. Mechanisms to encourage community participation are important. For the most vulnerable and seriously damaged areas, community consultation on disaster-risk mitigation plans and relocation options should be initiated before reconstruction progresses.

**Table 39: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

Term	Item	Description	Cost	
			EC\$ M	US\$ M
Short term	Inventory of damage for the housing sector	Formal detailed damage survey of all homes across country	0.32	0.12
	Shelter expenditure	Cost for 800 people expected to remain for next 7 months	8.68	3.21
	Transitional shelter expenditure	Families who lost their home who move out of shelters (EC\$800 allowance per family for 12 months)	3.40	1.26
	Debris removal and demolition	Demolition and debris removal of destroyed homes.	35.55	13.17
Short/Medium term	Repairs and retrofitting	(i) Repair of partially damaged houses to resilient standard (ii) Replacement of highly & completely damaged houses to resilient standard	1,352.40	500.89
	Training program	Targets construction firms, builders and communities	0.16	0.06
	Communication strategy	Raising awareness of home owners on safe housing construction	0.27	0.10
	Quality assurance for reconstruction	Training and facilitation of building inspectors	1.20	0.44
Medium term	Housing reconstruction policy	Review, strengthen and implement a housing reconstruction policy	0.41	0.15
	Building code	Update and authorize the building code for resilient construction practices. Identify and implement strategy for raising compliance and define agency responsibilities	0.18	0.07
	Zoning plan of high risk areas	Prepare community level plans mapping risks of landslide, flooding etc.,	0.50	0.19
	Community based disaster risk reduction program for the housing sector	Aims to raise awareness related to hazards and disaster risk reduction among homeowners	0.27	0.10
Totals			1,403.34	519.75

### Implementation Arrangements

Coordination of the housing reconstruction program will be critical in reaching all vulnerable households. Critical elements to be considered include regional allocation of funding, clear eligibility and targeting criteria, and availability of insurance compensation. Key stakeholders include:

- ▶ Government organizations: Ministry of Housing, Lands, Telecommunications, Energy and Ports, Planning and Finance (including Poverty and Social Development), Local Government/Reform Management Unit, Carib Affairs, Environment.
- ▶ The utility providers: such as DOWASCO, DOMLEC, National Solid Waste Management Company, the private sector housing and building material entities as represented by the Dominica Builders' Association, the private sector property developers.
- ▶ Community organizations: such as the Dominica Women's Bureau, Dominica Council on Ageing, non-government organizations, and community based organizations (involved in shelters) and professional associations such as the Dominica Society of Registered Engineers and the Dominica Society of Architects.

- ▶ Regional and national financing organizations, among them: the CDB, Dominica Cooperative Credit Societies League Ltd., Government Housing Loans Board, and international partners such as the EU, the WBG and the UN System.

## 6. SOURCES

**Commonwealth of Dominica:** Fourth Medium-Term Growth and Social Protection Strategy (GSPS) 2014 – 2018

**IOM – The UN Migration Agency:** Displacement Tracking Matrix (DTM) – Dominica Hurricane Maria Response Round 1 – 20 October 2017

Safer Homes, Stronger Communities. A Handbook for Reconstruction after Natural Disasters. Washington DC: The World Bank and the GFDRR (2010)

**Commonwealth of Dominica:** 2001 population and housing census, and 2011 population and housing census

Address to the Nation by the Prime Minister on October 16, 2017 <http://www.opm.gov.dm/?p=2323>

# Culture

## 1. SUMMARY

Dominica's cultural sector emphasizes the deep connections that exist between its people and their natural and cultural heritage, their traditional knowledge and creativity. The PDNA of the cultural sector analyzes impacts to the administration of cultural heritage and its institutions, built heritage (including historic churches, military, colonial and vernacular architecture, other historical buildings, and monuments of national significance etc.), archaeological sites, elements of intangible cultural heritage which reflect traditions, museums, collections and repositories, and the creative industries. It is important to note that in undertaking this assessment, there is a lack of data for historical built heritage and intangible cultural heritage. The disaster effects, damages and losses to the culture sector can be described as moderate to severe.

Based on current assessments, total damages amount to EC\$13.68 million (US\$5.07 million) and losses amount to EC\$7.85 million (US\$2.91 million). Total cost for the recovery need is estimated at EC\$12.63 million (US\$4.67 million).

## 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

Components of Dominica's cultural sector are subsumed in the work of various ministries. Cultural administration and key cultural centers fall under the Ministry of Youth, Sports, Culture and Constituency Empowerment. Heritage sites and Dominica's only World Heritage property – *Morne Trois Pitons* (inscribed to the World Heritage List

in 1997) fall under the Division of Forestry in MOAF. The preservation of buildings of special architectural and historic interest falls under the Ministry of Planning, Economic Development and Investment. Cultural industries falls under the Ministry of Trade, Energy and Employment. Repositories, such as those at the National Archives, fall under the Ministry of Education and Human Resource Development. While the Ministry of Tourism and Urban Renewal manages several key tourism sites across the island and its cultural festivals. There are of course various non-governmental and private individuals and institutions involved in the management and administration of heritage - such as associations, councils, trusts and faith-based organizations. Governing the work of these organizations are legislation such as the Culture Act (1981); Dominica's National Cultural Policy (2007); its National Export Strategy (2010); the Physical Planning Act; Legislation related to forestry, wildlife, national parks and intellectual property; as well as international treaties relating to culture ratified by Dominica - such as those relating to the world cultural and natural heritage (1972) and safeguarding intangible cultural heritage (2003).

Dominica is heavily dependent on eco-cultural tourism and is known worldwide as an important destination for nature tourism. Eco-cultural tourism is largely fed by the culture sector of the island through its sites - both natural and cultural, and its cultural industries. This sector is further augmented by the contribution of its indigenous pre-Columbian *Kalinago* community, who are key contributors to the creative economy of Dominica, and provide a direct link to the country's prehistoric and historical context. The cultural sector is therefore a significant contributor to the livelihood of many Dominicans.

**Table 40: Table of Key Baseline Data for the Sector**

Cultural Dimensions	Features
Infrastructure and physical assets	Division of Culture, Old Mill Cultural Centre, Arawak House of Culture, <i>Kalinago Barana Aute</i> , Dominica Museum, National Free Library, Morne Trois Pitons World Heritage Property, heritage sites and national parks registered under the Department of Forestry, Churches and historic Vernacular Housing in private ownership, Associations such as Dominica Festivals Committee, <i>Kommite pou Etid Kweyol</i> (KEK), Institute for the Arts, Craft Association, Pan Association, Writers Guild
Service delivery, production of goods and access	<ul style="list-style-type: none"> <li>• General and easy access to heritage places, cultural goods and events (some with cost)</li> <li>• Kalinago community largest craft producer</li> <li>• General practice of intangible heritage. No existing inventory</li> <li>• Available external markets for intangible heritage and cultural industries</li> </ul>
Governance and decision making processes:	<ul style="list-style-type: none"> <li>• Culture Act (1981)</li> <li>• Dominica's National Cultural Policy (2007)</li> <li>• National Export Strategy (2010)</li> </ul>
Existing gaps and challenges in the decision making process for cultural heritage	<ul style="list-style-type: none"> <li>• Forestry and Wildlife Act (1976, 1982, 1990)</li> <li>• International treaties relating to culture ratified by Dominica - such as those relating to the world cultural and natural heritage (1972) and safeguarding intangible cultural heritage (2003)</li> <li>• Physical Planning Act No.5 (2002) Article 46</li> </ul>
Risks and vulnerabilities	<ul style="list-style-type: none"> <li>• Split of culture sector among several Government entities provides challenges with regulation. A National Heritage Trust should be considered</li> <li>• Disaster Risk Reduction Study done for Dominica in 2014 however no disaster risk management strategies being implemented in culture sector</li> <li>• Limited resources (materials, personnel and capacity) for emergency interventions at heritage places etc.</li> <li>• Heritage sites are primarily coastal and susceptible to flooding</li> </ul>

### 3. SECTOR EFFECTS

Hurricane Maria's impact on Dominica was widespread with impacts on the culture sector having far-reaching repercussions for organizations, associations and the livelihood of communities and individuals. The role of culture and heritage in helping a country to recover post-disaster cannot be over-stated. In fact, although Creole Week in Dominica was cancelled due to post-disaster recovery efforts, Dominicans (both male and female) were still widely seen wearing their creole outfits and attempting to celebrate Creole Day however possible.

#### Built Heritage and Archaeological Sites

A comprehensive assessment of impacts is presently in the preliminary phase as partners first seek to address

individual and national relief efforts, and also establish access to heritage spaces where necessary. Assessed impacts to date have largely been identified as wind and water damage to roofs, ceilings and windows of historic structures and heritage spaces, cultural objects, ethnographic pieces, masquerade items, exhibitions and equipment - resulting in limited access and use of these facilities, spaces, objects, and a reduction of revenue, largely from having no visitors. In some cases, damages are linked to proximity to a water source. In other cases, the insecure situation caused by damage to these places has resulted in the looting of traditional instruments located at the Old Mill Cultural Centre or the possibility of vandalism at other places. In some instances, part-time staff have been temporarily laid off and are without income. Within the Kalinago Territory, three churches

have been destroyed and the Kalinago Barana Aute, which represented a cultural space for the display of Kalinago tangible and intangible heritage, has received 50 percent damage - primarily to roofs, work spaces and some cultural objects. This damage and the loss of visitors will impact the Kalinago Territory, which would receive up to 200 visitors per day in peak periods.

The World Heritage property of Morne Trois Pitons National Park - a considerable source of revenue for Dominica - has been affected with estimates of 80 - 90 percent of trees defoliated and 15 -25 percent of trees fallen or inclined above 45 percent, with paths currently inaccessible. Natural sites such as Trafalgar Falls, Emerald Falls and Indian River will require a natural process of rejuvenation.

Generally, many historic structures - particularly those around Roseau - have survived the impacts of Hurricane Maria. Several historic churches have been severely impacted, however some of these places were undergoing various stages of restoration and rehabilitation work at the time Hurricane Maria hit Dominica. Throughout the Caribbean (and indeed worldwide), there is strong evidence of architecture reflecting local traditions better surviving the impacts of hurricanes than more modern structures. These historic structures are, however, in a poor state and were in need of a restoration or rehabilitation programme prior to the hurricane's arrival. In an assessment of the important heritage tourism site of Fort Shirley at the Cabrits National Park, it was noted that its excellent survival in the face of the hurricane was linked to the traditional building techniques utilized in its construction, restoration and maintenance.

Heritage spaces such as the Dominica Museum, the Old Mill Cultural Centre and its outer buildings, and the Arawak House of Culture have sustained water and other structural damage to their spaces (roof, ceiling, window etc.), equipment and collections. The National Free Library lost all of its roofing with 98 percent of books sustaining water damage. The Dominica Museum in particular, has no disaster risk preparedness and management plan and cultural objects are presently unsecured and at further risk of water damage and being looted. Monuments around Roseau such as the important Neg Mawon (damaged) and Cecil Rawle (partially destroyed) have also been counted among the critical impacts.

## Intangible Heritage

Although it is a challenge to currently assess the impacts on intangible heritage, damage would be concentrated on the loss of resources for traditional activities and rituals, such as water damage to resources used for folk medicine. Although prayers for the dead continue, nine night activities related to traditional burial practices would be altered or interrupted as persons have to be buried in a day or two due to funeral homes being impacted and insufficient ice to preserve bodies. 2017 independence celebrations have been partially cancelled leading to an interruption of traditional activities associated with its hosting, and the activity *Practice Mas* will also likely be interrupted due to instruments sustaining water damage. At the *L'Escalier Tete Chien* and the Karina Cultural Space in the Kalinago Territory, there is presently an interruption of traditional dances and cultural events due to the space being severely damaged by Hurricane Maria and some persons taking up temporary opportunities in other countries. It is expected that these activities will resume once rehabilitation work is completed.

## Repositories

Repositories such as the National Library sustained extreme damage to two of its four facilities (Roseau and Portsmouth) with both losing their roof and flooring and up to 80 percent of materials destroyed. The National Archives sustained minor damage (one window broken), which did not result in significant water damage. All staff (approximately 30) are presently engaged in clean-up work or reassigned to other ministries for recovery work.

## Cultural Industries

Cultural industries are a significant contributor to the economy of Dominica, with crafts, festivals and carnival being among the most important and celebrated, and have been impacted significantly. There is an estimated 38 percent decline for the artisanal and visual arts sub-sector based mainly on an expected dip in *Kalinago* craft, due primarily to damages caused to producer's homes and workshops, coupled with the limited availability of the *larouma* plant (used for weaving) for roughly 18 months. This industry served as a major source of income for this indigenous community as well as those who buy from them for re-sale. Of the approximately 500 artisans in the *Kalinago* Territory, around 98 percent have sustained damages or total destruction of their work spaces, and

in some instances, their craft stock. In most cases these families only depended on craft sales. Presently, the *Kalinago* Council and the Minister of *Kalinago* Affairs are exploring how to send craft to other markets in the Caribbean. The craft market in Roseau, which housed 41 craft vendors, has also been damaged, further interrupting the sale of these craft items and also a loss of those items that were being stored on the premises. This will also be additionally impacted by cruise ships being unable to call on Dominica, which further limits the visitor market. The cruise peak period runs from October to April and there are no ships expected for the remainder of 2017. Another critical impact was the cancellation of significant income generating events, such as the annual *Dominica World Creole Music Festival* (loss of approximately EC\$3 million,

with projected value added up to 15 million) and Creole in the Park as part of Creole Week. Masquerade/Sensay carnival band costumes and traditional instruments have been reported damaged, which will impact the staging of carnival, cultural events and performances which happen in the first part of 2018.

### Sporting Facilities and Public Buildings

This section captures the storm effects on sporting facilities on the island (playing fields, basketball courts, cricket fields). This also includes damages associated with four public buildings not captured in other sections for which information was available (High court/registry, Parliament building, Physical Planning building, Printery).

**Table 41: Total Effects on the Culture Sector in US\$ and EC\$**

	PUBLIC		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M
<b>DAMAGES</b>	<b>5.07</b>	<b>13.68</b>	<b>5.07</b>	<b>13.68</b>
Cultural and Research Institutions	0.34	0.93	0.34	0.93
Moveable Heritage, Collections, Depositories	0.95	2.56	0.95	2.56
Built Heritage & Archaeological Sites	0.66	1.78	0.66	1.78
Intangible Cultural Heritage and Creative Industries	1.33	3.59	1.33	3.59
Public Buildings	0.29	0.78	0.29	0.78
Sporting Facilities	1.50	4.04	1.50	4.04
<b>LOSSES</b>	<b>2.91</b>	<b>7.85</b>	<b>2.91</b>	<b>7.85</b>
Cultural and Research Institutions	0.204	0.55	0.204	0.55
Moveable Heritage, Collections, Depositories				
Built Heritage & Archaeological Sites	0.12	0.32	0.12	0.32
Intangible Cultural Heritage and Creative Industries	2.58	6.98	2.58	6.98

## 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

Worldwide, culture is recognized as an important enabler of economic development, particularly in traditional and developing societies. The Dominican national identity is one that is uniquely entwined with its cultural heritage and natural environment. This can be clearly identified in the role of the cultural industries and eco-cultural tourism in Dominica and for promoting its creole culture through its festivals, performances and food. The indigenous *Kalinago* community uniquely demonstrates the importance of

cultural heritage to the livelihood of Dominicans, in that this community depends on cruise ships and other visitors coming to their communities and viewing their traditional performances, for example. They also supply a significant portion of craft to that industry. These impacts could leave this community in a precarious situation. In most instances, women are the primary makers of craft and families depend heavily on craft sales, so there will be imbalances in the household income of these families for perhaps the next 12 months, as other options are often linked to agriculture, which is also impacted.

With the exception of the cultural industries which benefit from detailed recording of their contribution to the Dominican national economy, much of the economic activity related to culture is not captured in national statistics. As most eco-cultural tourism sites remain intact or recoverable, losses in that area are related to diminished revenue from heritage related places being closed or temporarily inaccessible, as well as the destruction of equipment and damage to cultural objects. In some instances, persons have temporarily lost income due in part to heritage spaces being closed. The inability to host certain festivals, accommodate cruise ships, or to have a current supply of craft has contributed to tourism market losses and the loss of a revenue stream for artisans. The human development impact in the culture sector is moderate in most instances and severe in the *Kalinago* community.

## 5. RECOVERY NEEDS AND STRATEGY

Given the importance of culture to Dominica's economic development, the objective should be to ensure that BBB restoration in the sector happens in a sustainable manner, particularly due to the sensitive balance between the environment and development, and the importance of eco-cultural tourism. Culture is uniquely intertwined in all aspects of society and so it can be deduced that the effective recovery of the culture sector will have far reaching implications for its post-Maria recovery and the Dominican people, who are also still recovering from the effects of Tropical Storm Erika from 2015. Central to this recovery effort is a strategy which promotes and facilitates the enhanced coordination of efforts to better streamline the management and maintenance of the diversified cultural sector. In the short to medium term, the priority should be placed on the rehabilitation and restoration of all heritage places, to ensure the security of all cultural objects, and that these spaces can become revenue earners once more. Access to all natural and cultural sites should be ensured if it does not pose a security risk. For the important cultural industries, and specifically the craft sub-sector, natural resources that supplied these areas will need to be replanted.

Recovery efforts should also focus on ensuring local capacity-building to better manage the assessment of

impacts on cultural heritage, manage disaster risks, and develop and implement mitigation plans.

### Short-term Priorities (up to 1 year):

- ▶ Complete the full assessment of impacts to cultural heritage.
- ▶ Secure collections, repositories and cultural objects to mitigate against new risks (i.e., to vandalism or rainy weather etc.).
- ▶ Rehabilitate roofs and structures of key cultural institutions to secure objects and ensure revenue earning.
- ▶ Replace and upgrade damaged equipment to ensure full functionality of heritage places and their staff.
- ▶ Replace damaged equipment to ensure full functionality of artisans and artisanal workspaces.
- ▶ Replant crops important to the craft industry and used in intangible heritage herbal practices.
- ▶ Re-establish masquerade and carnival costumes etc., critical to the hosting of carnival, festivals and other traditional performances in time for Carnival and Dominica's 40th Independence Celebrations in 2018.
- ▶ Re-establish access to all cultural and natural heritage places.
- ▶ Restore basic revenues for affected people employed in the culture sector, restore essential cultural services and resume production of cultural goods (trainings).
- ▶ Strengthen public awareness programme regarding heritage resources.

### Medium-Term Priorities (up to 3 years):

- ▶ Enhance collaboration between agencies responsible for the cultural sector and fill gaps regarding the protection and management of cultural heritage.
- ▶ Undertake a complete inventory of all cultural assets and resources.
- ▶ Repair of churches with the communities (expert costs for structural assessment, project and monitoring of standards).

- ▶ Undertake a study of heritage places to determine, on a case by case basis, how to mitigate against flood damage.
- ▶ Develop concept and conduct re-exposition of the Dominica Museum.
- ▶ Build safer storage areas for craft and cultural objects to minimise water damage in the event of flooding.
- ▶ Rehabilitate libraries, including to function as information centres;
- ▶ Identification and inventory of elements of the intangible cultural heritage of Dominica, with a focus on the *Kalinago* community (trainings, inventory & safeguarding plan).
- ▶ Re-design and improve *Kalinago Barana Aute*.
- ▶ Establish the community radio for *Kalinago* people.

#### Long-term Priorities (5 years and beyond):

- ▶ Develop a DRM and reduction strategy for heritage places and collections, particularly taking into account future coastal flooding as a result of climate change.
- ▶ Update the Cultural Policy of Dominica to better reflect relationships that are required between cultural organizations and improve the governance of culture heritage (national body or Heritage Trust, update of legislation and regulations for historical buildings).

- ▶ Implement training programmes to ensure capacity-building of local staff on recent technological advances in heritage interventions, and establish a core of workers who are trained in restoring vernacular architecture.
- ▶ Reconstruct roofs of the historical buildings utilising traditional knowledge and techniques, under the monitoring of a historical conservation specialist (expert costs, plus redesign, plus improved materials).

#### Recommendations for DRR and Building Resilience in Sector

- ▶ Policy needs to be strengthened to include disaster mitigation strategies and effective implementation plans.
- ▶ Training for heritage workers on mitigation planning and implementation strategies.
- ▶ Ensure up to date inventories of heritage resources to better inform strategies;
- ▶ Update the alert system and implementation strategy (presently there is a warning system for Category 4 and higher cyclones but no effective implementation strategy for the weakened).
- ▶ Undertake a study of heritage places to determine, on a case by case basis, how to mitigate against flood damage.
- ▶ Build safer storage areas for craft and cultural objects to minimise water damage in the event of flooding.

**Table 42: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

	Item	Description	Cost	
			EC\$ M	US\$ M
Short term	Rehabilitate damaged infrastructure, access to heritage spaces and cultural assets	Cultural & research institutions, moveable heritage, collections, depositories, intangible Cultural heritage & creative industries	9.56	3.54
Medium Term	Undertake restoration, inventories and reduce risks	Built heritage and archaeological sites, complete inventory of all cultural assets and resources	1.90	0.70
Long Term	Update Cultural Policy and establish heritage expertise	Governance, capacity building in traditional knowledge and conservation techniques	1.17	0.43
			<b>12.63</b>	<b>4.67</b>

## Implementation Arrangements

Implementation arrangements should build long-term capacities. A project-based approach will be used in most instances ensuring that all partners and actors are fully engaged in the process.

## 6. SOURCES

Post-Disaster Cultural Sector Report prepared by the Division of Culture of Dominica (October 2017)

Post-Disaster Needs Assessment Mission of Andrea Richards and Yuri Peshkov, UNESCO. 24 - 29 October 2017

Post-Disaster Needs Assessment Mission, Guy Broucke, UNESCO. 17-20 October 2017

## Interviews with local counterparts

Report on the Heritage Sites of Dominica. Prepared by Lennox Honeychurch for the Dominica National Commission for UNESCO

Site visits to the Dominica Museum, Old Mill Cultural Centre, National Library, Kalinago Reserve, Cabrits National Park and various Churches and depositories throughout Dominica

Meetings with: National Cultural Council, Minister of Kalinago Affairs and community members, Dominica Museum, National Library, Festivals Commission, Forestry Department, Physical Planning, DEXIA, Architects and Dr. Lennox Honeychurch

Post-Maria Report on Heritage Sites prepared by Dr. Lennox Honeychurch

# INFRASTRUCTURE SECTORS

## Transport

### 1. SUMMARY

Damages in the sector totaled EC\$492 million (US\$182 million), of which EC\$387 million (US\$144 million) were public. Losses totaled EC\$142 million (US\$52.6 million), of which EC\$120 million (US\$44 million) were public. Damages were dominated by severe washouts at critical river crossings and losses are comprised of the costs of restoring road access, clearing debris and restoring river capacity, as well as traffic delays and income losses to transport service providers. The recovery strategy focuses on restoring safe operation to damaged assets and on replacing major bridges and critical crossings with high resilience. Total recovery costs are assessed to be EC\$815 million (US\$302 million).

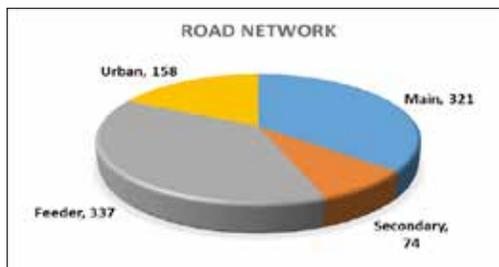
### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

Primary roads provide the main transport connectivity around the coastline and across the high hinterland in the central region. The roads intersect many of the 365 rivers on the island along the narrow coastal littoral. They are subject to storm surge in many areas, to flash flooding with heavy boulder debris in steep gullies and to landslides in the steep terrain. Primary and secondary roads are 99 percent paved, with 22 percent recently improved to resilient standard.. Feeder roads and urban/ community roads are 64 percent paved with only 13 percent built to relatively resilient standards. Bridge, culvert and retaining wall structures are crucially important assets but many are old or have inadequate hydraulic capacity. At least three long bridges destroyed in previous events have yet to be replaced and have temporary Bailey bridges in place.

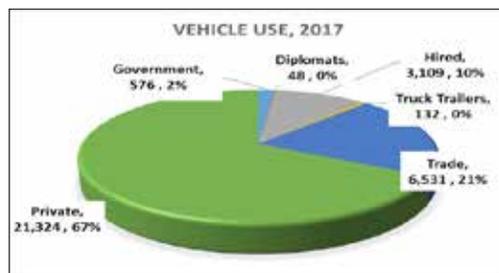
**Table 43: Key Baseline Data for the Road and Transport Sector**

Assets	Quantity	Replacement Value, EC\$ M	% qty
<b>Road infrastructure</b>		<b>1,994</b>	
Roads (km)	890	750	
Primary	320	492	36
Secondary	74	57	8
Feeder	337	101	38
Urban	158	100	18
Bridges (nr)	171	694	
Long (> 40 m)	12	144	
Medium (20-40 m)	30	180	
Small (< 20 m)	129	387	
Other assets (est.)		500	
<b>Motor vehicles (nr)</b>	<b>31,270</b>	<b>2,525</b>	
Cars, motorcycles	20,144	1,178	
Minibus & vans	3,778	865	
Trucks	7,419	360	
Equipment	379	121	

**Figure 17: Road Network**



**Figure 18: Vehicle Use 2017**



Motorization on the island is relatively high at 422 vehicles (veh)/1000 persons. Traffic volumes range widely from 300 to 4,300 veh/day on the primary and urban networks, and lower on the feeder network. The vehicle fleet usage is 67 percent private and, of the 10 percent for hire (3,108), about one-tenth are certified for tourism and the remainder provide small operator bus-taxi services. Insurance coverage is low, with only 20 to 25 percent having comprehensive insurance and less than 10 percent having cover for natural hazard events. Imported reconditioned vehicles predominate in the fleet with 10 to 30 percent purchased new across different vehicle classes. The assessed replacement value is high at EC\$2.5 billion, slightly larger than the value of the road infrastructure at EC\$2.0 billion.

### 3. SECTOR EFFECTS

Roads across the island were covered by substantial amounts of tree and flooding debris, and a relatively moderate number of landslides or embankment failures were visible. The major damages were incurred at river crossings, where strong flash flooding carried substantial boulder debris and high water flows filled existing floodplains and destroyed settlements. In valleys and steep gullies, especially in the south and west, some

structures were blocked and overtopped by 1-2 meters (m) of floodwater. Debris deposits of 1-4 m depth filled the riverbeds causing rivers to change course and erode abutments or approaches. The pavements, especially on improved roads with lined surface drainage, were generally undamaged, but more extensive damages were incurred on the less improved secondary and feeder road networks.

Six major bridges were seriously damaged and closed – three on the west coast and three in the south – and major erosion or washouts occurred over an estimated 19 km combined length. Selected road inspections were combined with drive-over video and satellite imagery taken days after the event to estimate the extent of damages. Damages were assessed in terms of road washouts, edge erosion and embankment failures, all requiring rehabilitation or replacement. Specific site surveys by the Ministry of Public Works and Ports (MPWP) to define repair treatments and costs are ongoing. Vehicles were damaged by flooding and flying tree and building debris, with an estimated one to four percent destroyed and seven to ten percent damaged. Assessment was made by extrapolation of samples from transport operators and observations, because insurance data had low coverage and claims were not yet processed.

**Table 44: Summary Table of Damage and Losses for Sector (in local currency and US\$)**

	PUBLIC		PRIVATE		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M	US\$ M	EC\$ M
<b>DAMAGES</b>	<b>143.50</b>	<b>387.44</b>	<b>38.66</b>	<b>104.37</b>	<b>182.15</b>	<b>491.82</b>
Primary-Secondary roads	15.59	42.10			15.59	42.10
Urban-Feeder roads	5.58	15.07			5.58	15.07
Bridges & Structures	121.60	328.32			121.60	328.32
Transport Services & Facilities	0.00	0.00	0.08	0.22	0.08	0.23
Vehicle fleet	0.72	1.95	38.58	104.15	39.30	106.11
<b>LOSSES</b>	<b>44.36</b>	<b>119.78</b>	<b>8.26</b>	<b>22.31</b>	<b>52.62</b>	<b>142.09</b>
Access & debris removal	5.73	15.48			5.73	15.48
Debris clean-up	1.58	4.27			1.58	4.27
Restoration of river capacity	37.04	100.00			37.04	100.00
Traffic delays - debris, veh-hr	0.004	0.01	0.18	0.49	0.19	0.50
Road closure, veh-hr	0.004	0.01	0.22	0.60	0.23	0.61
Recovery period (3 mth), veh-hr	0.004	0.01	0.20	0.54	0.20	0.55
Transport services			7.66	20.67	7.66	20.67

Roads were reopened within 2 weeks of the event, as a result of efficient government programs of hired contractors with heavy equipment to remove heavy debris and reinstate access, and hired community labor for clearance of light debris. A planned short-term program for excavation to restore riverbed capacity is also included. Road losses were assessed from the initial invoicing for these services and extrapolated to government estimates based on post-Erika costs. Traffic losses were assessed in terms of delays due to roadworks, suppressed trips due to road closures and suppressed trips over an estimated three-month recovery period, by when any reduction in tourism-related demand would be outweighed by added construction-related traffic. Transport services losses were computed for general bus operations, excluding tourism-related services which are accounted under tourism.

Government assessment of damages and recovery needs were hampered by a loss of IT system support, and other services were impacted by the delays in restoration of power and water and by building damages. Transport service providers were impacted by uninsured damages and losses far exceeding their income, and the financing costs needed to re-establish operations.

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

The security of major routes in the west coast, trans-island, northern link and east coast are critical to ensuring transport connectivity and the recovery of economic activity. The use of infrastructure to reduce flooding risks is limited, and partial or substantial relocation may be indicated in certain high risk areas.

#### 5. RECOVERY NEEDS AND STRATEGY

##### Recovery Needs and Prioritization

The short-term recovery needs focus, first, on restoring key road routes and assets to safe operation and sufficient capacity to withstand normal weather events and ,second, on preparing the medium- and long-term recovery programs. Damaged bridges and culverts will be surveyed to assess and prioritize reinstatement and upgrading needs, and crossings, which are not included in a major improvement program, will be repaired. Detailed engineering design of major needs will be undertaken as a pre-requisite to procuring civil works for the medium- and

long-term programs. The IT system platform and security at MPWP will be upgraded and the asset management system which is currently under development will be made operational.

In the one-to-three year medium-term, identified high-risk and inadequate small-medium bridges and culverts will be improved to new resilient standards. Six seriously damaged major bridges will be reinstated to a safe operational level, of which two would be interim measures prior to full replacement in the long-term. Four top-priority major bridges would be replaced to resilient standards.

In the three-to-ten year long-term, six more priority major bridges would be replaced, and the south road from Roseau to Scott's Head would be improved to resilient standards, addressing in particular high vulnerabilities at Champagne Reef, Pointe Michel and Soufriere. The south-east road, from Loubiere to Grand Bay/Bagatelle, where three major washouts occurred, is currently under UK-supported improvements scheduled over the next five years.

##### 5.2 Recommendations for DRR and Building Resilience in Sector

Noting the severity of the event and the dominant modes of failure, the resilience of hydraulic structures needs to be improved to accommodate debris flows to the extent possible, and to design for overtopping especially in narrow gullies. For bridges, concrete girder construction is preferred as it is more resilient to debris impact than steel; minimum 12 m span and 2+ m clearance will reduce the risk of blockage by trees and moderate boulders; and parapets should minimize obstruction to overtopping flows. For culverts, wide box design or small bridges should be a minimum for small rivers and be designed to accommodate overtopping at the structure, with extensive protection from erosion down and up stream. Increased use of lined side drains and, in areas subjected to high surface runoff or overtopping, use of concrete pavement will improve the resilience of the road structure in hilly terrain.

Road infrastructure programs should progressively improve the resilience of major routes and highly vulnerable assets to ensure that transport connectivity can be restored quickly after future events. Current programs may need to be reviewed to ensure that design standards are sufficiently resilient.

Disaster risk mapping and community consultation will be needed in settlements located in high-risk floodplains to identify any needs for partial or substantial relocation.

A communication strategy should aim to improve the adoption of vehicle insurance cover for natural hazards.

**Table 45: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

Term	Item	Description	Cost	
			EC\$ M	US\$ M
Short term	Restoration of river capacity	Excavation and reshaping of riverbeds to take storm floods	100	37
	Bridge & culvert repair	Rehabilitation of damaged bridges & culverts	80	30
	Engineering services	Survey & design of bridge replacements, and South road upgrading project	106	39
	Strengthen IT systems	Install asset management system; Upgrade IT platform, data and system security	0.5	0.2
Medium Term	Upgrading of critical bridges, culverts	Resilient standards: e.g., concrete, min span 12 m, clearance 2 m, overtoppable	250	93
	Reinstatement of major bridges	6 total: Melville Hall, Layou, Roseau (4)	24	9
	Replace 4 major bridges	Macoucherie, Rosalie, Coulibistrie, other tbd	60	22
Long Term	Improvement of south road & bridges	14 km length: Roseau-Scotts Head to resilient standard	105	39
	Replace 6 major bridges	Bath Road, Melville Hall, Blenheim, Boetica, other tbd	90	33
Totals			815	302

### Implementation Arrangements

The restoration of river capacity, bridge and culvert repair and reinstatement of major bridges will be undertaken by MPWP with government resources. Other short, medium and long-term needs may be appropriate for international funding or financing.

### 6. SOURCES

Consultations with MPWP; data from MPWP road database and preliminary asset management database; Satellite imagery from Digital Globe, September 2017; Videolog from Red Cross humanitarian response team; Field reconnaissance; Vehicle Licensing Division, Inland Revenue Department, Dominica; Combined Taxis Inc.; First Domestic Insurance; New India Insurance; Engineers without Borders.

## Ports and Airports

### 1. SUMMARY

The Dominican Air and Seaports Authority (DASPA), has suffered damages to all of its assets, both in the Roseau area, at Douglas Charles International Airport, and in Portsmouth. Damages add up to EC\$51 million (US\$18.9 million), with losses yet undetermined, since the length of the Government moratorium on port charges has not finally been established (at a six-month moratorium, DASPA would lose approximately EC\$8.8 million, at three months EC\$4.4 million). Private sector losses have not been collected as of the date of this report. The main cause of damages has been the loss of roofing at all sheds in both ports, Canefield airport, and at portions of the Ferry terminal. Recovery needs are assessed to cost EC\$61.2 million (US\$22.7 million).

### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

In Dominica, there are two airports (Douglas Charles and Canefield), and two main cargo ports (Woodridge Bay and Portsmouth). The two cargo ports have cruise piers associated with them, both outside the ports. In addition, Roseau also features a ferry terminal. The main airport is Douglas Charles Airport, located on the eastern shore of the island, with Canefield, a small airport just north to Roseau, is a general aviation airport that has on occasion acted as a port of entry during emergency relief efforts.

Both ports and airports fall under DASPA, a parastatal entity.

Vessel call history and DASPA revenues can be found in Table 46 below, with calls split by port.

**Table 46: Vessel call history**

	2015-2016		2016-2017	
<b>Roseau</b>				
Cargo/Freight ship calls	1,149	48%	1,256	49%
Cruise Ship Calls	126	5%	138	5%
Ferry Calls	549	23%	603	23%
Subtotal Roseau	1,824		1,997	
<b>Portsmouth</b>				
Cargo/Freight ship calls	507	21%	539	21%
Cruise Ship Calls	52	2%	39	2%
Ferry Calls	12	1%	0	0%
Subtotal Portsmouth	571		578	
Total	2,395	100%	2,575	100%
<b>DASPA Port Revenues</b>				
Revenues EC\$	21,724,916		23,441,338	
Revenues US\$	8,046,265		8,681,977	

Flights to the two airports, with passenger counts, from January to October 2017, can be found below:

**Table 47: Flight history**

Airport	Indicator	Month								Total
		1	2	3	4	5	6	7	8	
Douglass Charles	Flights	389	372	393	379	380	353	383	388	3,037
	Pax	12,248	10,976	2,054	12,406	10,802	11,276	14,239	14,969	88,970
	Avg Pax	31	30	5	33	28	32	37	39	29
Canefield	Flights	67	83	77	87	76	83	79	91	643
	Pax	655	636	712	897	367	439	1,060	1,115	5,881
	Avg Pax	10	8	9	10	5	5	13	12	9
Totals	Flights	456	455	470	466	456	436	462	479	3,680
	Pax	12,903	11,612	2,766	13,303	11,169	11,715	15,299	16,084	94,851

### 3. SECTOR EFFECTS

At the port of Woodridge Bay, all sheds lost their roofs and suffered other damages. The security fencing was compromised, windows in the main office building were blown out, the maintenance shed was destroyed, and electrical equipment and electronics were damaged. In Roseau, besides Woodridge Bay, the ferry terminal was severely damaged, both by heavy seas and river flooding. The damage incurred includes all electronic equipment, furniture, and vendor shops. There was a 3 to 4 ft layer of debris as a result of the flooding. The Roseau Cruise Ship Berth was also rendered inoperable, with railings, lighting, and the walkway being destroyed.

In Portsmouth, the cargo shed had similar damages, with the roof destroyed, though the main pier remained intact. Security fencing has been compromised. The Cabrits cruise ship berth, which features a full-fledged terminal building, was badly damaged, with the walkway of the pier destroyed, and the terminal building lost most of its roof.

Due to the application of BBB principles after Tropical Storm Erika, the main pavements of Douglas Charles Airport were undamaged, and there was no flooding or debris on the runway. The adjacent river did rise beyond its banks, however, and flooded the terminal building causing the loss of all electronics, such as x-ray machines. In addition, the airport suffered some damage to its tower, and some related communications and navigation

equipment will need to be repaired.

The shipping sector losses are comprised of two elements: (1) loss of traffic, some of it due to infrastructure damages; and, (2) a government moratorium on charges for non-commercial activity. Since most of the port's shipments are now related to the relief and rebuild efforts after Maria, revenues are 25 percent of the baseline, indicating a 75 percent revenue loss. There is no income from cruise ships since there is no infrastructure to receive them.

At Canefield Airport, there was more significant damage in that more of the basic infrastructure was involved. Debris had to be cleared from the runway. The terminal lost a substantial part of its roof (as well as the building housing fire and ambulance services). The tower was more severely damaged than at Douglas Charles, and the fencing has come down in several places.

The losses at the airports are not so much a function of damages, since both reopened quickly, but the main challenge lies in terms of the main driver in demand: stay-over tourism. With a large part of the hotel stock not available, and many tourist attractions in need of repair, demand for Douglas Charles will remain depressed, and the management at DASPA is asking for Government support to cover operating costs and keeping the airport open. Canefield Airport now has another spike in traffic: it is used to help relief workers arrive in Roseau.

**Table 48: Summary Table of Damage and Losses for Sector (in local currency and US\$)**

	PUBLIC		PRIVATE		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M	US\$ M	EC\$ M
<b>DAMAGES</b>	<b>18.89</b>	<b>51.00</b>			<b>18.89</b>	<b>51.00</b>
Cargo Port Woodbridge Bay	3.70	10.00			3.70	10.00
Longhouse Portsmouth	2.96	8.00			2.96	8.00
Roseau Ferry Terminal	3.89	10.50			3.89	10.50
Roseau Cruise Ship Berth	1.85	5.00			1.85	5.00
Cabrits Cruise Ship Terminal	3.33	9.00			3.33	9.00
Douglas Charles Airport	1.85	5.00			1.85	5.00
Canefield Airport	1.30	3.50			1.30	3.50
<b>LOSSES</b>	<b>3.26</b>	<b>8.79</b>			<b>3.26</b>	<b>8.79</b>
Loss of Revenue (6 months) (Depending on GoCD policy)	3.26	8.79			3.26	8.79

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

The ports of Dominica serve as the main cargo entry point for all trade, and the island's economy survives by importing nearly all goods. The port of Woodridge Bay is the only container port on Dominica, and is the only entryway for large machinery, large shipments of merchandise and refrigerated food items. The northern port of Portsmouth serves the local inter-island trade based on smaller freight carries, locally called "schooners". Since Dominica is not really served by any passenger aircraft belly cargo capacity, except for dedicated cargo flights, the ports of Dominica are the only way critical imports can enter the country.

The cruise ship berths of Roseau and Fort Shirley in Portsmouth have received a combined 160 calls in 2016, totaling over 275,000 passengers. The Discover Dominica tourism authority places the passenger spend from cruise ships at nearly EC\$25 million for 2016.

In the period between June 2015 and July 2016, the ferry terminal in Roseau handled over 80,000 passengers, a number in excess of the entire population of Dominica.

Douglas Charles Airport handles nearly all stay-over arrivals, a part of the tourism sector that contributed over EC\$251 million in visitor spend in 2016.

Canefield Airport, though not economically viable, has been key in the relief efforts after both Erika and Maria,

and has proven again that an alternative point of entry for aid and assistance after a natural catastrophe is vital for Dominica.

#### 5. RECOVERY NEEDS AND STRATEGY

##### Recovery Needs and Prioritization

There are four short-term priorities:

The cruise berth in Roseau, a vital source of tourism revenue that could potentially help re-vitalize the tourism industry, should be repaired as quickly as possible. The island also needs its attractions and services restored to attract cruise ships, however, the infrastructure to take on the vessels is vital.

The ferry terminal in Roseau is a priority because operations temporarily had to be shifted to the cargo port after the terminal was flooded and buried in debris. This interfered with vital cargo operations, which are now focused on relief efforts and the rebuilding process of the island.

The deep-water cargo port at Woodbridge Bay is making due under challenging and difficult conditions. Temporary cargo sheds have been set up using empty 40 ft containers stacked as both walls and ceilings, with tarps covering the gaps between the containers that serve as roofs. On a small island such as Dominica, where containers are often inspected, unpacked, and processed on the premises of the port, warehouses are still important. In addition, the offices for the port authority need to be

made functional as quickly as possible. One of the reasons for the lack of data for vessel calls after Maria is because the compilation of the data could not be completed in the normal computerized format, due to the destruction of offices and the related IT technology.

### Recommendations for DRR and Building Resilience in Sector

The recovery needs carry a 20 percent premium over damages in order to allow for some disaster risk reduction construction practices to be applied. For the sheds of both ports, as well as the roof of the Canefield Airport terminal, the cruise terminal in Portsmouth, and the ferry terminal

in Roseau, this would imply using better, more resilient roofing techniques.

At Douglas Charles Airport, much of the x-ray screening equipment was damaged or lost because sensitive electronics are installed at the bottom of the instruments. Raising the instruments slightly off the floor might be a method for mitigating future damages due to flooding.

On both cruise berths it may be worthwhile finding better fastening techniques for the walkway planking, or some method of alleviating pressure from below the planking due to rough seas.

**Table 49: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

Term	Item	Description	Cost	
			EC\$ M	US\$ M
Short Term	Woodridge Bay	Complete rehabilitation	12.00	4.44
	Ferry terminal Roseau	Complete rehabilitation	12.60	4.67
	Cruise Berth Roseau	Complete rehabilitation	6.00	2.22
	Douglas Charles Airport	Complete rehabilitation	6.00	2.22
	<b>Subtotal Short Term</b>		<b>36.60</b>	<b>13.56</b>
Medium Term	Port in Portsmouth	Complete rehabilitation	9.60	3.56
	Canefield Airport	Complete rehabilitation	4.20	1.56
	<b>Subtotal Medium Term</b>		<b>13.80</b>	<b>5.11</b>
Long Term	Portsmouth Cruise terminal and berth	Complete rehabilitation	10.80	4.00
Total			61.20	22.67

### Implementation Arrangements

DASPA is currently planning to commence rehabilitation in November 2017, in part financed through internal funding. The authority is seeking to address the rehabilitation of its assets as quickly as possible.

### 6. SOURCES

DASPA, *Report on the Aftermath of Hurricane Maria on the Ports of Entry*, Roseau, October 2017

## Water and Sanitation

### 1. SUMMARY

Damages in the sector totaled EC\$65 million (US\$24 million), and were almost totally public. Losses totaled EC\$ 107 million (USD 40 million), of which EC\$ 39 million (USD 15 million) were public and EC\$ 68 million (US\$25 million) were private. Damages disabled water intakes, distribution pipelines and treatment plants in 43 water areas, the three wastewater treatment facilities and landfill facilities. Losses included reduced revenues and higher operating costs, and private costs of obtaining water. The recovery strategy will focus on restoring water supply and wastewater treatment over three years, extending landfill capacity, and include initiatives to make systems, institutions and communities more resilient. Recovery costs are assessed to be EC\$151.9 million (US\$56.3 million).

### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

Before hurricane Maria, 97 percent of the population had access to basic water supply and 87 percent had access to basic sanitation, according to WHO/UN Children's Fund (UNICEF) Joint Monitoring Programme 2017 report, although data are not disaggregated by urban and rural areas. A government enterprise, DOWASCO, working with a private contractor, is responsible for the operation and management of water and sanitation in the country, under the oversight of the Ministry of Lands, Housing, Settlement and Water Resources Management. Surface water and springs are the main sources of water, and water supply is provided in 41 water areas to approximately 70,739 people (two areas were decommissioned after Tropical Storm Erika). The intake basins, production and distribution pipelines and systems in most of the water areas were in need of upgrading. Annual water supply income was EC\$19.5 million and expenditure EC\$11.5 million in 2016.

The government, through DOWASCO, owns and operates wastewater collection and treatment systems in Roseau, Canefield and Jimmit, which receive 500,000 gallons/day of influent from about 3,000 connections. Other towns and villages use onsite septic tank systems or simple pit latrines. The government is acting to eradicate pit latrines. Poor hygiene behavior and discharge of septic

sewage into rivers, sea and land are common practices. Annual income from sewerage was EC\$1.3 million against expenditure of EC\$1.8 million.

The Dominica Solid Waste Management Cooperation (DSWMC) provides waste collection services throughout the island and operates the Fonde Cole landfill. Due to the distances and the lack of transfer and storage facilities, the service is costly by international standards. DSWMC was operating under a budget deficit for several years due to insufficient and untimely budget allocations. The consequent lack of liquidity resulted in limited re-investment and maintenance and poor payment performance of contractors. Before the hurricane, the service was in a critical situation with severely depleted equipment, unreliable private contractors, and lack of storage containers or transfer facilities.

### 3. SECTOR EFFECTS

The 41 water supply areas were damaged by strong winds, flooding, landslides, falling trees and power outage, 16 were heavily damaged and 21 moderately damaged. Production and distribution pipelines were damaged or washed away, intake systems were blocked with sand and debris, and storage tanks, pumps, physical structures and access roads were damaged, with an estimated cost of EC\$53.6 million.

Sanitation damages amounted to EC\$9.8 million. Damage to the Roseau wastewater treatment plant affected 5,190 households and included lift stations, fore mains, manholes, interceptor pipes, sewer lines, three major bridge crossings, gravity mains and about 3,000 service connections. The Canefield and Jimmit sewerage systems were blocked by flood debris. On-site septic tank systems and latrines have been damaged and assessment is ongoing.

In solid waste management, the depleted infrastructure suffered further damage and the service has been interrupted. Two collection trucks were damaged and many private contractors stopped collecting waste. The DSWMC administrative facilities and roof of the office building were heavily damaged and the disposal site was severely damaged. Currently, irregular service has been established in Roseau but damages in road infrastructure, reduced capacity in DSWMC and a lack of available private contractors is restricting the recovery service countrywide.

**Table 50: Table of Damage and Losses for Water and Sanitation Sector**

	Public		Private		Total	
	US\$ M	EC\$ M	US\$ M	EC\$ M	US\$ M	EC\$ M
<b>DAMAGES</b>	<b>24.00</b>	<b>64.79</b>	<b>0.00</b>	<b>0.00</b>	<b>24.00</b>	<b>64.79</b>
Water supply	19.84	53.57	0.00	0.00	19.84	53.57
Sanitation - wastewater	3.58	9.65	0.00	0.00	3.58	9.65
Solid waste management	0.58	1.57	0.00	0.00	0.58	1.57
<b>LOSSES</b>	<b>14.71</b>	<b>39.71</b>	<b>25.02</b>	<b>67.56</b>	<b>39.73</b>	<b>107.27</b>
Water supply	10.54	28.45	24.93	67.31	35.47	95.76
Sanitation - wastewater	0.49	1.33	0.09	0.24	0.58	1.58
Solid waste management	3.68	9.93	0.00	0.00	3.68	9.93

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

The disruption of water and sanitation services has impacted livelihoods and disrupted production, manufacturing and tourism activities. The limited access to water supply has changed habits and consumption patterns among the affected population. The worst impacts have been offset by substantial international response in providing potable water, portable treatment systems and desalination plants, but residents have also incurred costs purchasing and transporting fresh water. The health impact could be high given increased vulnerability of affected communities and the risk of water, sanitation and vector borne related diseases, such as cholera, diarrhea and malaria. The burning of uncollected solid waste presents a health threat and the large volume of solid waste in public and private areas and the very poor drainage systems can contribute to vector born illnesses (e.g., mosquito born illness and leptospirosis). In addition, the aesthetic impacts could have a medium or long-term impact on tourism.

#### 5. RECOVERY NEEDS AND STRATEGY

##### Recovery Needs and Prioritization

The total recovery needs are estimated at EC\$146 million (US\$53 million), as presented in Table 51. Given the extent of damage and challenges with capacity and contractors, the timeline for full recovery is estimated to be 36 months. The recovery needs and strategy are aligned with the government's commitment for Dominica

to become a climate resilient island, by rebuilding water and sanitation and solid waste infrastructure to withstand disasters.

This includes for water and wastewater, the harnessing of aquifer resources to mitigate the vulnerability with current surface water systems, and reducing pipelines. Strengthening of the enabling environment for water and sanitation services at national and parish level needs support through DOWASCO and DSWMC.

For solid waste management services, recovery and improvement are needed in both facilities and processes to BBB and smarter. This includes reestablishing services throughout the island, re-building and strengthening what was an already depleted service to an adequate level, and introducing cost saving and resilient systems that allow for decentralized public and private sector waste storage, transfer, and operation, especially in hard to reach areas. Finally strengthening the financial and technical capacity of DSWMC to manage the rebuilt services is needed.

##### Recommendations for DRR and Building Resilience

The following recommendations are aligned with the national agenda for climate resilience:

- ▶ Consolidate quick actions taken to restore water and sanitation services, and solid waste collection and disposal, as the basis for complete rehabilitation and reconstruction activities.
- ▶ Design and reconstruct water, sanitation and solid waste facilities based on whole project life cycle cost and risk-informed programming approaches.

- ▶ Adopt a community water safety approach to planning and implementation of reconstruction activities, with special focus on the reinforcement of intake basins, use of flood resistant pipelines and storage tanks, and protection of water sources.
- ▶ Develop a water and sanitation planning, design and reconstruction unit, and empower communities to better prepare and respond to disasters.
- ▶ Build on local knowledge in the community to improve integrated water and sanitation management, monitoring and reporting systems.
- ▶ Adopt new and environmentally friendly technologies to develop high yield aquifers in adverse topography and geology, to dispersed and remote populations.
- ▶ Establish a more cost-effective and resilient system of waste collection and disposal, including transfer and storage facilities.
- ▶ Strengthen the enabling environment<sup>40</sup> for sustainable water, sanitation and solid waste services provision, especially at Parish level and water areas.

**Table 51: Recovery Recommendations, Timeline and Costs**

Water	Item	Description	Cost	
			EC\$ M	US\$ M
Short-term	Priority water supply systems	Repair intakes, pipes, storage tanks in 15 priority water areas	15.18	5.62
	Prepare water system program	Procure pipes & equipment for water supply system rehabilitation	8.80	3.26
	Operational support	Operational support for WSW enterprises during 3-yr recovery period	35.00	12.96
	Wastewater system backup	Install backup renewable-energy pumps control panel; lift stations	2.87	1.06
	Priority solid waste actions	Procure urban collection containers & trucks; repair structures	6.21	2.30
Medium term	Water supply safety & quality	Community Water Safety planning and water quality monitoring	1.0	0.37
	Water supply rehabilitation	Rehabilitate 22 water schemes with resilience and renewable energy pumps	51.02	18.90
	Wastewater reconstruction	Reconstruct 1 treatment plant, sewage lines, crossings and manholes	1.72	0.63
	Sanitary landfill reconstruction	Reconstruct and upgrade sanitary landfill to include medical waste	9.32	3.43
	Solid waste capacity building	National and subnational institutional strengthening and capacity building	1.4	0.52
Long-term	Water resources & monitoring	Strengthen national and parish level water resources monitoring and management capacity and systems	2.1	0.78
	Wastewater treatment	Reconstruction/expansion of 2 wastewater treatment systems	1.15	0.42
	Wastewater governance	Strengthen wastewater treatment capacity, systems and processes	0.6	0.22
	Solid waste landfill	Build new sanitary landfill; Install stationary compactors in rural areas	15.53	5.75
Total			151.9	56.26

40 Policy and strategy, institutional arrangements, financing and budgeting, planning, monitoring and review, and capacity development

## Implementation Arrangements

The Ministry of Lands, Housing, Settlement and Water Resources Management will be responsible for the overall management and quality assurance oversight of the water and sanitation recovery initiatives. DOWASCO will undertake implementation directly and through private contractors. For solid waste management recovery initiatives, DSWMC will be the execution agency, through private contractors, under the oversight of the Ministry of Health. For Parish-level government departments, civil society organizations will be engaged, based on comparative advantage. Community engagement in the design, implementation and monitoring will be key for all initiatives.

## Implementation of Water Supply Rehabilitation Program

### Prioritization of the water supply system rehabilitation

In order to prioritize the water supply recovery program for maximum impact, the system rehabilitation needs have been grouped first by project size and second by per capita cost (cost per person impacted) in the table below. On the basis of least size, 21 small systems could be rehabilitated for EC\$ 6.1 million but this would impact only 15,486 people. On the basis of least cost per person impacted, shown in the lower part of the table, 44,566 people (62 percent of the population) would be impacted by prioritizing the least per capita cost systems first, i.e.15 projects for a cost of EC\$ 15.2 million. It is thus preferable to prioritize on the basis of cost per capita.

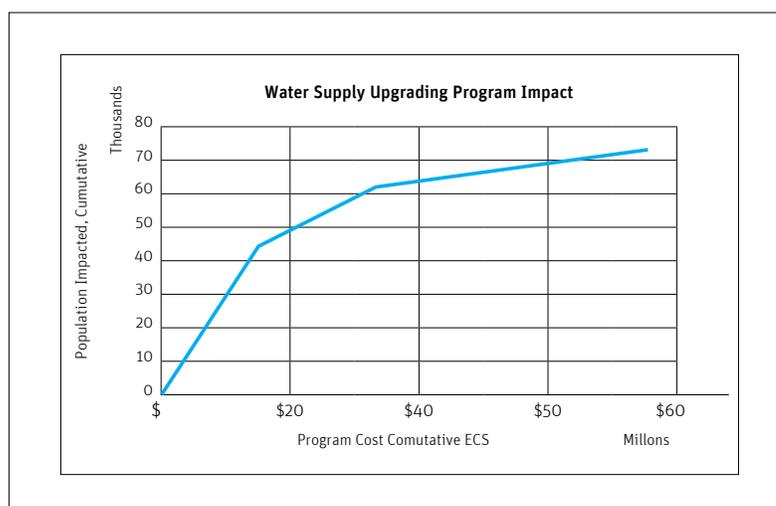
System rehabilitation group	Cost ceiling, XCD	No. of systems	Recovery Need, XCD	People impacted
Major system rehabilitation	>\$4,000,000	4	\$38,971,573	35,658
Medium system rehabilitation	\$4,000,000	12	\$29,924,125	20,949
Minor system rehabilitation	\$1,000,000	21	\$6,109,075	15,486
<b>Total</b>			<b>\$75,004,773</b>	<b>72,093</b>
Cost ceiling per person				
Low cost system rehabilitation	\$500	15	\$15,178,713	44,566
Medium cost system rehabilitation	\$2,000	13	\$17,976,000	16,794
High cost system rehabilitation	>\$2,000	9	\$41,850,060	10,733
<b>Total</b>			<b>\$75,004,773</b>	<b>72,093</b>

Note: Recovery needs factor = 1.40 \* Damage assessment

**Figure 19: Impact of Water Supply Rehabilitation Program ranked by per-capita cost group.**

### Water Supply Rehabilitation Program ranked by Impact or Per-cap cost

The figure shows the population impacted as a result of program cost invested when the projects are prioritized by cost per capita.



## 6. SOURCES

Initial Post Hurricane Maria Needs Assessment: Solid Waste Services<sup>41</sup>

Dominica Post Tropical Storm Erika W

Water and Sanitation assessment report

WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene. Dominica Update July 2017

Roseau City Wastewater Assessment Review

ACAPS Country Profile. Dominica October 2017

Commonwealth of Dominica 2011 Population and Census Report

DOWASCO Hurricane Maria Water Systems Updates

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<sup>41</sup> This assessment does not include management of debris. The topic will be fully analyzed separately.

# Electricity

## 1. SUMMARY

Electricity service completely ceased in Dominica due to widespread damages to the transmission and distribution network. Damages total EC\$89.59 million (US\$33.18 million) and losses total EC\$88.94 million (US\$32.94 million). Damages and losses combined total EC\$178.5 million (US\$66.1 million). The recovery should involve the undergrounding of a significant part of the network, which is critical to enhance the power system's resilience. In the medium to long-term, Dominica should continue development of its endogenous energy resources (such as geothermal) that can provide more resilient, cost-efficient and greener power supply. Recovery costs were assessed to be EC\$99.9 million (US\$37 million).

## 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

Dominica's power system is operated by a single private concessionaire, Dominica Electricity Service Limited (DOMLEC)<sup>42</sup>. The utility serves 36,467 customers, mostly residential, accounting for 98 percent of the island's population. The installed generation capacity of the country totals 26.7 Megawatts (MW), of which more than 20 MW are provided by two diesel-fueled power stations (Fond Cole close to Roseau, and Sugar Loaf in the Portsmouth area). The residual 6.7 MW is derived from three small cascading run-of-the-river hydro plants (Laudat, Trafalgar and Padu) installed by the Roseau River. Peak load is approximately 17 MW and is accommodated using hydropower generation for the base load to the extent possible, and diesel-based generation for the remaining part. It is estimated that up to 15 MW self-

generating capacity (fuel-based) complement DOMLEC's installed capacity. DOMLEC's existing power transmission and distribution (T&D) system comprises 1,672 km of overhead lines<sup>43</sup>, 18,000 poles, and more than 1,500 pole mounted transformers. The transmission system includes an 11 kiloVolt (kV) transmission ring interconnecting the Fond Cole, Padu, Trafalgar and Laudat power stations, with some of the interconnectors capable of being upgraded to 33 kV. The Sugar Loaf power station is normally linked to the grid via the Portsmouth feeder, but has alternate links through the East Coast, the Sugar East and the Belfast feeder. The distribution network consists of nine feeders and has two main load centers: Roseau (in the south) and Portsmouth (in the north)<sup>44</sup>.

Because of the heavy reliance on imported diesel, the average retail price of electricity in Dominica, at around US 33 cents per kilowatt hour (kWh) (as of end of December 2016), is among the highest in the world. The ramifications of high and rising oil prices run through the economy. Lowering and stabilizing electricity costs was the single most impending priority for Dominica's power sector ahead of the hurricane. In response, the Government had advanced the development of its rich geothermal resources at the Wotten Waven field in the Roseau valley. An exploration and production drilling program confirmed sufficient steam availability to develop a 7 MW geothermal plant for domestic purpose. Geothermal electricity will be sold to DOMLEC via a power purchase agreement, leading to the displacement of a significant part of the existing diesel capacity. The Government recently established the Dominica Geothermal Development Company Limited (DGDC), which prepared a first-rated geothermal project now investment-ready, gathering unprecedented technical and financing and risk mitigation support from multiple partners coordinated by the World Bank<sup>45</sup>.

<sup>42</sup> Dominica Power Holding Limited, a subsidiary of Emera (Caribbean) Incorporated, owns 52 percent of the ordinary share capital of the company. The ultimate parent is Emera Inc., an energy and services company registered in Canada. Dominica Social Security (state-owned enterprise) owns 21 percent, while 27 percent is held by the general public.

<sup>43</sup> Due to the use of the same voltage both for transmission and distribution (11-kV), DOMLEC distinguishes between high-voltage (11kV) and low-voltage (230/400V) when accounting for the length of the network. Based on this classification, there are 500 km of high-voltage lines and 1172 km of low-voltage lines.

<sup>44</sup> Four of the heavily loaded feeders are supplied from the Fond Cole station, the main distribution generation station; two are supplied from the Padu hydropower station; two from the Sugar Loaf station; and one from the Laudat station.

<sup>45</sup> Support is being provided, in addition to the World Bank Group, by DFID, the Government of New Zealand, the SIDS DOCK Program and the Clean Technology Fund.

**Table 52: Table of Key Baseline Data for the Sector (DOMLEC; as of December 31, 2016.)**

<b>ELECTRICITY ACCESS</b>							
Category	N. of customers		Electricity sold (kWhx1000)		Yearly cons/ conn. (KWh)		
Domestic	31,913		45,847		1,437		
Commercial	4,198		40,820		9,724		
Industrial	40		9,492		237,300		
Hotel	33		1,245		37,727		
Street lighting	283		1,980		6,996		
<b>Total</b>	<b>36,467</b>		<b>99,384</b>		<b>2,725</b>		
<b>ELECTRICITY INFRASTRUCTURE</b>							
Power plants	Technology	Installed capacity (MW)		Available capacity (MW)		Power plants	
Laudat	Hydropower	1.30		1.29		HV lines 500km	
Trafalgar	Hydropower	3.52		3.18		LV lines 1,172 km	
Padu	Hydropower	1.88		1.34		Poles 18,000	
Fond Cole	9 diesel units, medium & high speed	13.27		12.30		Transformers 1,504	
Sugar Loaf	5 diesel units, medium & high speed	6.75		6.00			
<b>Total generation capacity</b>		<b>26.72</b>		<b>24.10</b>			
<b>INFRASTRUCTURE ASSET VALUE</b>				<b>DOMLEC REVENUES</b>			
	EC\$ M	US\$ M.	EC\$ M	US\$ M		EC\$ M	US\$ M
Generation	31.24	48.61	45.54	16.87	Electricity sales	67.67	25.06
T&D	123.16	45.61	68.69	25.44	Fuel surcharges	20.61	7.63
Other	35.41	13.11	19.95	7.39	Other	0.63	0.23
Work in progress	3.95	1.46	3.95	1.46	Total	88.91	32.93
<b>Total</b>	<b>293.75</b>	<b>108.80</b>	<b>138.13</b>	<b>51.16</b>			

### 3. SECTOR EFFECTS

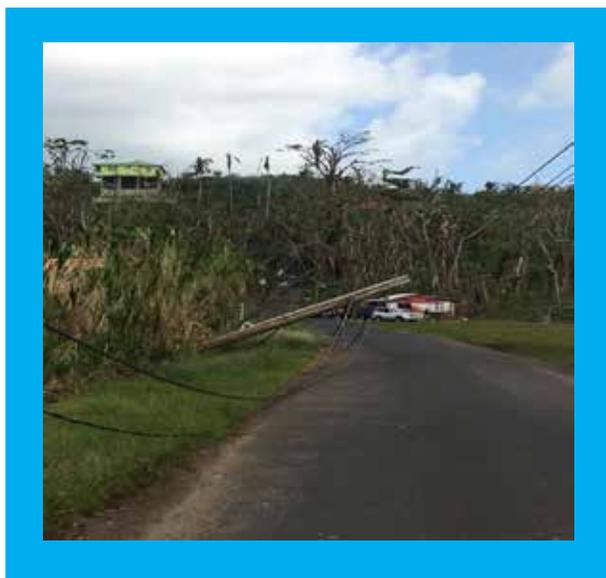
Electricity service completely ceased following Hurricane Maria because of the widespread and severe damages to the T&D system. Entirely overhead, the network is highly vulnerable to severe weather events. It also happened to be in poor state, with poles overloaded with multiple services, installed in disaster-prone locations, and with inadequate depth of burial. DOMLEC is in the process of completing a full damage assessment and information provided at this stage is only preliminary. At least 75 percent of the network is down, although part may be recoverable, 80 to 90 percent of the transformers inspected are badly damaged and cannot be repaired. Damages to generation sites vary from moderate to severe. Specifically, at Fond Cole there are damages to the

building structures and three generation units must be inspected and repaired (enclosures were lost). Sugar Loaf also suffered some damages to the building structures and to the electrical equipment (in the latter case caused by flooding). DOMLEC reported that the diesel-storage and diesel-importing facilities did not suffer any damage, therefore, fuel supply is expected to proceed smoothly. Among the hydropower plants, Padu was the most affected. The top part of a man-made rock barrier was damaged, which allowed for mud and debris to cover approximately 3-4 ft. of the power house. There is visible damage to control equipment, and there may be damage to hydromechanical equipment of the power house and to the electro-mechanical equipment, which will be confirmed once a comprehensive cleanup is completed. Difficulties in servicing spare parts from abroad may delay

the repairs. Trafalgar experienced only minor damages to the building structure and Laudat is intact. The water pipeline feeding the three hydropower stations from Freshwater Lake suffered damage at different sections along its length. There is severe damage at the beginning of the pipeline due to landslide and rock impacts, and valves were also damaged. Severe damage is suspected due to landslide along the road from Padu to Trafalgar,

affecting a 10-15m section of the pipeline. Minor damage was observed near Padu (fractured support structures and misplaced pipeline sections).

The total value of damages is estimated at EC\$89.6 million (US\$33.2 million), equal to 30 percent of the capital value and 65 percent of the depreciated value of DOMLEC's asset base before the hurricane. EC\$81 million (US\$30 million) relates to the T&D network alone.



**Damages to network infrastructure in Marigot area**



**Padu hydropower plant**

DOMLEC has prioritized restoring electricity to essential public and commercial facilities before repairing the grid in residential areas. As of October 19, 2017, service had been restored in Roseau for hospitals, the finance centre, the police station, the stadium (International Aid Centre), key parts of the Roseau Commercial Centre; and in Portsmouth, for police and fire stations and the Ross University. As a result, nearly one percent of customers, prevalently public and commercial, currently have electricity service<sup>46</sup>. DOMLEC estimates to be able to rebuild infrastructure and restore service provision to pre-hurricane conditions within a one-year period. In the meantime, as much as 70 percent of domestic consumption may be lost, a share that

may increase to 90 percent in the commercial (mainly hotels) and industrial customer segments<sup>47</sup>. DOMLEC also predicts that electricity consumption will take up to 18 months to return to historical levels, due to emigration in the aftermath of the hurricane, lower use of domestic appliances while houses are being rebuilt, and reduced productive and commercial activities. Overall losses due to foregone revenues while consumption returns are estimated in the amount of EC\$88.9 million (US\$32.9 million). Therefore, total damages and losses to the electricity sector are estimated to be EC\$178.5 million (US\$66.1 million).

<sup>46</sup> It should be noted that the use of backup diesel generators is not uncommon in Dominica. Currently, DOMLEC efforts are being somehow complemented by civil support whereby owners or diesel-fueled generators share their equipment (and associated costs) with neighbors for partial supply.

<sup>47</sup> While such predictions, especially in relation to the residential segment, may be overly pessimistic, it is fair to assume that at least 60% of electricity household consumption, and up to 80% of commercial and industrial consumption, will be lost in the first year

**Table 53: Summary Table of Damage and Losses for Sector (in local currency and US\$)**

	PUBLIC		PRIVATE		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M	US\$ M	EC\$ M
<b>DAMAGES</b>	<b>33.18</b>	<b>89.59</b>			<b>33.18</b>	<b>89.59</b>
Damages to Generation Assets						
Laudat	0.00	0.00			0.00	0.00
Trafalgar	0.01	0.03			0.01	0.03
Padu	0.52	1.40			0.52	1.40
Hydropower pipeline	0.56	1.50			0.56	1.50
Fond Cole	2.00	5.40			2.00	5.40
Sugar Loaf	0.10	0.27			0.10	0.27
T&D network	30.00	81.00			30.00	81.00
<b>LOSSES</b>	<b>32.94</b>	<b>88.94</b>			<b>32.94</b>	<b>88.94</b>
Domestic	10.67	28.82			10.67	28.82
Commercial	9.69	26.17			9.69	26.17
Industrial	2.49	6.72			2.49	6.72
Hotel	0.31	0.83			0.31	0.83
Street Light	0.31	0.83			0.31	0.83
Fuel Surcharge	9.26	25.00			9.26	25.00
Other Sales	0.21	0.58			0.21	0.58

## 5. RECOVERY NEEDS AND STRATEGY

### Recovery Needs and Prioritization

The most impeding priority facing the electricity sector is to rebuild the T&D network, which is the basic condition to reactivate power supply and restore service to customers. So far, DOMLEC has been working with the Government and the Dominica EOC to safely reenergize priority load centers. Such collaboration will have to continue to ensure adequate prioritization, safety and reliability. Outside these areas and throughout the island, there are still massive amounts of electricity debris, with loose cables and poles down on the roads creating a hazard to people and transportation. The cleaning process should be accelerated. A full damage assessment related to the T&D network has not been completed yet and should be prioritized. In parallel, DOMLEC will have to complete inspection and repairs of the generation equipment.

A significant part of the network (to the extent possible due to geographic and terrain conditions) should be undergrounded during the restoration efforts, as opposed to simply repairing/rebuilding overhead lines. This is the most critical measure to enhance resilience of Dominica's power system. Although investment costs are set to be

significantly higher, they would be offset by the long-term benefits. A feasibility study will be needed for identifying locations/segments that are better suited for undergrounding and for selecting the most appropriate design options. It can be anticipated that the urban centres of Roseau and Portsmouth should be prioritized. The undergrounding of the distribution lines in both cities was already planned by DOMLEC with an estimated cost of EC\$10.4 million (US\$4 million). Both cities have flat terrains suitable for undergrounding and the costs could be shared with telecommunication utilities that are also burying the cables. DOMLEC may want to consider rebuilding the distribution network using 11kV lines with ground mounted (but elevated to protect from flooding) transformers and switchgear. The undergrounding of interconnections among power stations and of key transmission lines (to main load centers such as Roseau and Portsmouth) are likely to be priorities as well. In addition, the option to rebuild key transmission links (such as the "backbone" between Roseau and Portsmouth) as underground 33kV rated cables – but operated initially as 11kV – should be explored. This would enable more effective load management in the island and provide future proofing in the face of increasing loads.

Investment needs for recovering the power system with more resilient features cannot be accurately estimated until a feasibility study is completed. Using cost figures for underground T&D lines from countries that operate in similar circumstances (highly distributed customers, relatively low density of load, a fair amount of exposure to tropical cyclones), it can be predicted that investments for rebuilding the power system as fully resilient are set to exceed EC\$108 million (US\$40 million). In the absence of better estimates, costs are assumed to be in the range of EC\$108-162 million (US\$40-60 million).

While the immediate priority is to restore service, the Government should maintain focus on geothermal development and begin implementing the planned project in the medium-term. In the context of an island country exposed to extreme weather events, geothermal energy provides a cost-efficient, clean and resilient alternative to diesel for baseload capacity. The significant displacement of diesel generation with geothermal can raise the share of renewables in the energy mix to nearly 60 percent<sup>48</sup> and enable a significant reduction of retail prices. This would relieve hardship for households (especially the poor), increase the competitiveness of Dominica's firms and reduce the weight of diesel imports on the country's balance of trade. As an endogenous, underground resource, geothermal steam cannot be lost due to weather events and the above-ground infrastructure can be built with enhanced resilient features. The volume of geothermal resources, largely exceeding domestic needs, also provides a transformational growth opportunity for

the country, if larger capacity is built for electricity export purposes. Electricity could become Dominica's new, most profitable export commodity. The financing plan for the geothermal project was nearly finalized ahead of the hurricane. All development partners had committed funding, which will remain available to the project. The Government had committed to provide EC\$40.5 million (US\$15 million) equity to capitalize the company and invest in the project. Should the Government not be able to honor such commitment, due to reduced budget capacity in the aftermath of the hurricane, additional financing from other donors and development partners may be needed.

### Recommendations for DRR and Building Resilience in Sector

- ▶ Complete feasibility study for identifying locations/segments suited for undergrounding.
- ▶ Immediate underground rebuilding of the distribution network in Roseau and Portsmouth (possibly as 11kv-rated network).
- ▶ Evaluate undergrounding of interconnections, key transmission lines (evaluating the option to rebuild these as 33kV-rated cables) and distribution lines in other significant urban areas.
- ▶ Cease the construction of any further overhead lines on the island.
- ▶ Continue development of geothermal resources.

**Table 54: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

	Item	Description	Cost	
			EC\$ M	US\$ M
Short term	Feasibility study for undergrounding	Identify locations/segments better suited for undergrounding and select design options	1.35+	0.5+
	Repairs to generation assets	Complete inspection of equipment and repairs	8.59	3.18
	Recovery of T&D network	Rebuild network with undergrounding	108-162*	40-60*
Medium/ Long Term	Fully resilient T&D network	Rebuild or maintenance works of overhead lines progressively turned into underground	T.b.d.*	T.b.d.*
	Geothermal development	Commission 7MW geothermal capacity	99.9	37

*\*To be confirmed/determined based on feasibility study*

<sup>48</sup> If the power system is endowed with adequate transmission capacity and as demand picks up, there would be no constraints to the full utilization of geothermal capacity. Ideally Dominica could have an energy mix predominantly made of renewables (hydro and geothermal) with diesel generation used for reserve.

### **Implementation Arrangements**

Repairs and reconstruction of any electricity infrastructure fall under DOMLEC's responsibility. The company is insured for damages to its generation assets but not to T&D assets. It is apparent that the magnitude of losses has put DOMLEC under severe strains; the company has just filed for force majeure, and the request is currently being reviewed by the regulator (Independent Regulatory Commission). Immediate tasks such as the cleaning of debris and damage assessment, let alone repairs/reconstruction, evidently exceed DOMLEC's local capacity in terms of human resources, equipment and logistics. The parent company (Emera) is arranging for additional manpower and equipment coming from overseas. Support

is also being provided by the Caribbean Electric Utility Services Corporation and the Government of Cuba. A plan to restore service in a timely manner, including ensuring adequate capacity and financing, should be defined at the soonest by Emera/DOMLEC, in coordination with the Government and the IRC. Responsibility for implementing geothermal development falls under the responsibility of DGDC, which has resumed its activities. The definition and enforcing of a construction code for ensuring resilience of the T&D system should be considered by the IRC and agreed with DOMLEC.

## **6. SOURCES**

DOMLEC Annual Report 2016

## Telecommunications

### 1. SUMMARY

In the immediate aftermath of Maria, almost all communication between Dominica and the outside world was cut for nearly three days. The full extent of damage and needs did not become apparent until partial telecommunications were re-established by the two private service providers in Dominica. The total damages to the sector were EC\$128.8 million (US\$47.74 million) with losses amounting to EC\$22.4 million (US\$8.3 million). The Government is supposed to maintain and operate an Emergency Communications Network (ECN) but this has suffered from lack of qualified operators, maintenance and investment; which was apparent in the aftermath of the disaster. For improved resilience, the improvement of the ECN and redundancy of government information and communications technology (ICT) services and infrastructure needs to be given greater priority. Assessed recovery and BBB needs were assessed to total EC\$129.17 million (US\$47.84 million).

### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

Telecommunications in Dominica are operated by two major service providers; Digicel and Flow. Both providers operate independent mobile, broadband internet, television and voice services for government, business and private users. The Government relies on Flow for

connectivity between its offices and Flow also operates the national emergency response (911) system. Both providers have separate fiber backbones, consisting of separate northern and southern loops running along the coast and originating from Woodbridge Bay, Roseau. The fiber backbone owned by Digicel consists of overhead fiber plant sharing poles with DOMLEC, and the Flow backbone is buried underground on the northern loop and is overhead in the south. Flow operates 49 mobile sites, and Digicel 55, making for a total of 104 sites in Dominica. The backhaul of this network varies, all of the Flow towers utilize a fiber backhaul, and Digicel uses a combination of fiber and microwave backhaul. Flow owns an overhead copper network for telephone and television services, while Digicel offers television services through mobile broadband.

The Government oversees the telecommunications sector through the Director of Telecommunications as well as the National Telecommunications Regulatory Commission (NTRC), both reside within the Ministry of Information, Science, Telecommunications and Technology (MOI). In addition to the private telecommunications networks, an emergency communications network, consisting of amateur radio operators is supposed to exist within the purview of the EOC.

The Eastern Caribbean Telecommunications Authority (ECTEL) provided the following Table detailing some baseline indicators for the telecommunications sector in Dominica.

**Table 55: Key Baseline Data for the Sector**

	2011	2012	2013	2014	2015	2016
Provider Revenues (EC\$M)	101	108	106	105	108	122
Investment (EC\$M)	17	12	13	14	46	13
Employment	233	237	213	153	160	178
Fixed line Penetration	21%	21%	20%	23%	21%	21%
Mobile Penetration	140%	141%	143%	103%	107%	105%
Fixed Broadband Penetration	12.20%	13.30%	14.70%	15.00%	20.90%	22.50%
Mobile Broadband Penetration	-	-	0.00%	0.00%	42.40%	40.50%
Local fixed traffic (million minutes)	26	23	23	21	16	14
Local mobile traffic (million minutes)	199	196	182	178	151	103
International incoming traffic (million minutes)	27	23	33	25	22	18
International outgoing traffic (million minutes)	24	12	14	17	13	9

### 3. SECTOR EFFECTS

Hurricane Maria resulted in extensive and widespread damages to the private telecommunications network and public ICT resources. All telecommunication services, except for amateur radio, were disabled from September 19 to 21. A total of 33 cellular sites were destroyed or severely damaged and the fiber-optic backbone was severed in several locations, leading to a nationwide loss of connectivity. Damages to the network were caused by high winds and flooding. In Roseau, Flow headquarters was flooded with water, mud and debris, causing service outages and loss of equipment. Flooding and wind also destroyed support buildings, notably the main technical engineering building as well as exchange buildings owned by Flow. The satellite farm and the main television building for Flow were also heavily damaged by wind. Digicel did not report major damage to any building assets. However, Digicel operates a network based on overhead lines running on poles owned by DOMLEC, which were damaged extensively island-wide. Underground cable was damaged by flooding and scouring of trenches, but this damage is far more localized. Flow has restored much of the northern fiber backbone a month after Maria. For both providers, the southern backbone will pose a greater challenge to restore since the level of damage is much greater.

Recovery efforts by the main telecommunications providers have focused on restoring the fiber backbone and mobile communications infrastructure. To aid in restoring services, while permanent infrastructure is rebuilt, temporary 'Cell on Wheels' (COWs) mobile cellular towers have been deployed by both providers, as well as Ku-Band very small aperture terminals (VSATs) provided by the International Telecommunication Union. These temporary measures have allowed the restoration of services to 50 percent of Flow as well as 68 percent of Digicel customers by October 26, 2017. Digicel has been able to achieve a greater restoration of coverage due their cell towers possessing microwave backhaul links which have allowed them to quickly re-connect their network and bypass destroyed towers. Flow is currently in the

process of shipping the hardware required to set up their own microwave backhaul. Both providers have set a target of early next year for a complete restoration of mobile services.

Landline services will take longer to restore and providers stated that they may reconsider the technologies currently being used to provide landline linkages. The restoration of these services is very much dependent on the progress of DOMLEC in restoring the poles in their distribution network, which they are aiming to complete within a year. Therefore, full restoration of landline services will likely not happen for at least a year.

Providers complained that recovery efforts were hampered by the damage to the port, which has slowed the receipt of needed equipment. Extensive pilfering of equipment and fuel from cellular sites have also slowed recovery efforts. Clean-up efforts have also caused some damage to underground cables through scouring resulting in service outages. Flow have been working with the Ministry of Public Works to notify them of any cables in areas marked for clearing.

ICT services and capacity in the Government were adversely affected by Hurricane Maria. Three public ICT centers were structurally compromised and the equipment therein damaged. The main server room of the Government in the Treasury Building in Roseau was flooded and equipment was damaged by water and sediment. Unfortunately data on these servers was not backed up offsite. ICT officers are currently attempting to clean the equipment and rescue data.

The following Table (56) lists the private and public damages and losses resulting from Hurricane Maria. Revenue losses from the private sector were calculated from the baseline data provided by ECTEL, revenue losses given by the providers, as well as household figures from the 2011 Dominica Census. Pilferage is an estimated cost of equipment and fuel lost by both providers and disruption is an estimate of the losses incurred due to pilferage and other disruptions in the recovery process. Public damages were provided by the Director of Telecommunications.

**Table 56: Summary Table of Damage and Losses for Sector (in local currency and US\$)**

	PUBLIC		PRIVATE		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M	US\$ M	EC\$ M
<b>DAMAGES</b>	<b>0.37</b>	<b>0.99</b>	<b>47.37</b>	<b>127.89</b>	<b>47.74</b>	<b>128.88</b>
Total Damage to Private Infrastructure			47.37	127.89	47.37	127.89
State College Center of ICT Excellence	0.20	0.54			0.20	0.54
Grand Fond SmartCentre	0.08	0.22			0.08	0.22
La Plaine SmartCentre	0.04	0.11			0.04	0.11
Government Server Room	0.05	0.12			0.05	0.12
<b>LOSSES</b>			<b>8.31</b>	<b>22.43</b>	<b>8.31</b>	<b>22.43</b>
Revenue Losses and Concessions (12 month period)			7.64	20.63	7.64	20.63
Pilferage			0.37	1.00	0.37	1.00
Disruption			0.30	0.80	0.30	0.80

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

The interruption of telecommunication services had a significant negative human impact as Dominica was almost cut off from the outside world for three days. Communities within Dominica were isolated from one another. Information required for critical relief and rescue activities was delivered using a few satellite phones and a sparse amateur radio network, and suffered from a lack of trained operators as well as a lack of backup power. On the September 21, basic mobile services were restored in the vicinity of Roseau, but only basic text and data services which were quickly overwhelmed by the volume of traffic from persons wanting information regarding the well-being of their friends and family.

Reliable telecommunications are an essential service for many sectors of the Dominican economy. One of the largest industries in Dominica is the Clear Harbor telephone call center which had 850 employees, as of April 2017. Clear Harbor was closed from September 19 to October 2. The number of telecom service providers in Dominica has gone from four (SAT, LIME, Marpin2k4, and Digicel) in 2014 to two (Flow, Digicel) in 2017. ECTEL employment numbers indicate that the sector has undergone reductions in employment as consolidation has occurred. Revenues and investment have remained steady, except in 2015 when investment increased by EC\$33 million and revenues increased EC\$16.4 million. This may have been due to extra investments required to repair damages caused by Tropical Storm Erika in 2015.

#### 5. RECOVERY NEEDS AND STRATEGY

##### Recovery Needs and Prioritization

The private telecommunication companies are in the process of implementing recovery plans. Neither company was willing to share these plans. However, both companies were clear that the rebuilding efforts will involve the redesigning of their respective networks and replacement of old technologies, where possible.

For the public sector, the Government ICT infrastructure has been compromised with the loss of the central server room. Rebuilding of the server and network infrastructure will be essential in restoring basic government ICT services, such as email. Unfortunately, the Government did not have an offsite backup for many of its ICT services and is now working to recover data from damaged hardware.

The loss of community ICT centers has restricted community access to computers and the internet. These facilities suffered water damage and their structural soundness will need to be evaluated prior to the beginning of rehabilitation and the replacement of computer and networking equipment.

##### Recommendations for DRR and Building Resilience in Sector

The Government should rehabilitate the ECN by offering training to persons interested in becoming amateur radio operators nationwide, with the goal of having a licensed amateur radio operator in every community with an emergency shelter. Emergency shelters and the

EOC should be equipped with amateur radio and/or a satellite phone so that contact may be quickly established during or after a storm. In addition to the equipment, the Government needs to develop a plan for the operation and maintenance of the network long term, including replacement of equipment, training of operators and activation procedures for the network in case of an emergency.

Free-standing cell towers utilized by both providers were destroyed by wind and flooding. Having COWs ready to deploy in the event of a disaster would speed up recovery and improve resilience by providing temporary mobile coverage. When providers were asked whether they had COWs ready for deployment, they stated that they only had one or two in storage and had to ship in the remainder, which was difficult due to damage to the port.

Undergrounding the remainder of the fiber infrastructure is a key need but a microwave backhaul based network has proven to be easier to recover than fiber. The Government could mandate the telecommunications providers to install microwave links on select towers from both providers to ensure greater redundancy. Additionally, providers do not share backhaul, even on co-located sites. Mandating sharing in emergencies would speed up recovery and allow connectivity to be restored more rapidly.

Flooding was a serious problem for both the public and private sectors. Critical infrastructure placed in areas vulnerable to flooding, and measures to prevent such flooding, were inadequate. In discussions with Flow, they acknowledged that they need to have a greater consideration of natural hazards in the placement of their infrastructure and support structures.

In addition to replacing hardware, the Government needs to strengthen its ICT institutions. Currently, MoI is responsible for telecommunications and a separate government ICT unit operates under the Ministry of Planning, Economic Development and Investment. Bringing the ICT Unit under the MoI would simplify responsibilities and create a stronger ICT body within the Government. Additionally, the Government did not have ICT disaster recovery or continuity of operations plans. These plans would have dictated how services should be quickly restored and data recovered.

### **Implementation Arrangements**

The private sector telecommunications companies have plans in place for recovery which include some of the initiatives mentioned in Table 57 above. MOI will take a lead role in the recovery through the Director of Telecoms and the NTRC.

**Table 57: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

	Item	Description	Cost (M)	
			EC\$	US\$
Short Term	Emergency Communications Network	Rehabilitation of the National Emergency Communications Network.  -Redesign for expansion of the existing network and creation of deployment/maintenance plans.  -Purchase of amateur radio equipment (HT/HF/VHF) and repeaters.  -Purchase of satellite phones and other technology required for the network.	1.41	0.52
	ICT Data Recovery, Server Room Re-instatement	Evaluate damages and recover data from damaged storage devices.  Purchase new hyper-converged server infrastructure and off-site backup.  Install flood proofing measures.	2.16	0.80
	Repair Cellular Sites	71 cellular sites suffered varying degrees of damage and 33 are completely destroyed. The sites which are not completely destroyed are in the process of being repaired and restored.	27.00	10.00
	Restore Northern Fiber Loop	Replace damaged fiber plant and associated equipment	2.70	1.00
Medium Term	Install microwave links on Flow towers (49 towers)	All Digicel towers already have these links, 49 Flow towers do not but they awaiting on the shipment of the technology required to install on certain towers.	3.51	1.30
	Replace overhead fiber plant	Northern Loop	8.10	3.00
	Replace destroyed towers	Replace the 33 destroyed towers and associated transmission/reception infrastructure	54.00	20.00
Long Term	Create disaster recovery and continuity of operations plans for ICT.	Consultancy to create plans and provide implementation assistance for a period of 2 years.	0.32	0.12
	Rebuild Destroyed Support Buildings	Satellite farm, engineering support buildings	17.55	6.50
	Public ICT Center Reinstatement	Perform structural assessment of centers, repair structural issues and restore electrical wiring. Purchase replacement networking and computer equipment.	1.62	0.60
	Underground fiber plant	Undergrounding of the southern fiber loop.	10.80	4.00
<b>Totals</b>			<b>129.17</b>	<b>47.84</b>

## CROSS-CUTTING ISSUES

### Disaster Risk Reduction

#### 1. SUMMARY

While significant investments have been made in addressing disasters in Dominica over the years, there is need to strengthen the legislative framework and regulatory mechanisms to effectively maximize the results from these investments. More research and data gathering is needed for adequate planning, monitoring and decision-making. The assessment of the recovery needs, after the impact of Hurricane Maria, for DRR indicate a total of EC\$27.6 million (US\$10.2 million), which accounts for replacing and repairing infrastructure and equipment that was damaged as well as capacity building and BBB interventions. This total includes EC\$5.4 million to support the startup of a Reconstruction authority that will facilitate the recovery process. Total damages amount to EC\$8.11 million (US\$3 million) and losses add to EC\$2.17 million (US\$0.8 million).

#### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

The National Emergency Planning Organization (NEPO) is the governmental body with responsibility for the planning and organization of counter-disaster measures at central level. The NEPO is comprised of an Advisory Committee whose primary responsibility is to ensure that the country is in a state of preparedness at all times. The Senior Meteorological Officer, Chief Fire Officer as well as the Commissioner of Police are members on this committee. The Office of Disaster Management (ODM) is commissioned to taking proactive and timely measures to prevent or reduce the socio-economic impact through its collaborative efforts with national, regional, and international agencies. NEPO's key function is to develop, operate, and maintain a NEOC in accordance with requirements specified in the National Disaster Plan of 2001. Together, the ODM and NEPO coordinate the overall disaster management programme based upon the principles of prevention, mitigation, preparedness, response and recovery.

Originating from a tropical wave, Maria became the tenth-most intense Atlantic hurricane on record and the second Category 5 hurricane of the unusually active 2017 Atlantic hurricane season. At its peak, the hurricane caused catastrophic damage upon making landfall on Dominica on September 18, with maximum sustained winds of 175 mph (280 km/h). The Government of the Commonwealth of Dominica led the humanitarian response assisted by several regional and international organizations, including CDEMA, the UN System, the Red Cross, and the Private Sector. To this date, 63 collective centers house nearly 2000 people that have been internally displaced and 53% of them are currently residing in schools, which further disrupts the regular functioning of that sector. A Flash Appeal on the amount of US\$31.1 million has been requested to support those communities most distressed due to widespread affectation to housing and livelihoods.

Dominica faces many challenges caused by repetitive disasters, making recovery a complex and difficult process. The lack of a solid institutional and coordination mechanism for recovery has further compounded this issue, leaving some past recovery processes still incomplete.

#### 3. SECTOR EFFECTS

To estimate the damage in the DRR area, physical assets and equipment belonging to those institutions that are part of the NEPO System, among them the Police, the Fire and Ambulance Service as well as the Meteorological Service, we assessed. Effects relating to the seismic system were also assessed.

Damage to the police stations and their content represented the largest share, with this being calculated at EC\$5.25 million over 11 of 17 police stations. Five of these 11 stations have received significant damage and in two instances, the officers had to be relocated. There was also moderate damage to vehicles used by the officers. These damages were calculated using the per unit cost gained from the housing sector.

Damage to the Fire and Ambulance Service as well as the meteorological and seismic stations was also moderate to significant. Five out of the eight Fire and Ambulance stations and their content suffered damaged, with four of them being classed as significant damage. All the seismic stations across the island have been reported as completely damaged with the hydro-meteorological stations across the island experiencing moderate damages. To estimate

the damage to the building structures, the per unit cost gained from the housing sector was used.

In terms of the change in economic flows, the most significant flow relates to the increase in operational

expenses for the NEPO/EOC relating to the rental of additional vehicles for the security forces. The losses for the other agencies are mainly comprised of the additional costs incurred by the government to purchase generators and the associated fuel cost for their operation.

**Table 58: Summary Table of Damage and Losses for Sector**

	PUBLIC		PRIVATE		TOTAL	
	US\$ M	EC\$ M	US\$ M	EC\$ M	US\$ M	EC\$ M
<b>DAMAGES</b>	3.00	8.11			3.00	8.11
Infrastructure for fire and ambulance, police, ODM, Red Cross	2.49	6.72			2.49	6.72
Content equipment and vehicles for fire and ambulance, police, ODM, Red Cross	0.35	0.95			0.35	0.95
Hydro-meteorological equipment	0.06	0.16			0.06	0.16
Seismic Stations	0.10	0.27			0.10	0.27
<b>LOSSES</b>	0.80	2.17			0.80	2.17
Generator fuel for fire and ambulance, police, ODM, NEPO/EOC	0.03	0.08			0.03	0.08
Food and catering services for fire and ambulance, police, NEPO/EOC	0.02	0.06			0.02	0.06
Vehicle rental for fire and NEPO/EOC	0.72	1.95			0.72	1.95
Rental expense for fire and ambulance, police, ODM, Red Cross, NEPO/EOC	0.02	0.06			0.02	0.06
Cost of demolition and rubble removal for ODM and NEPO/EOC	0.01	0.013			0.01	0.013

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

Improving institutional and community resilience capacity could significantly contribute to reduce the overall human impact of a disaster. The implementation of good risk management practices, including greater consideration of hazard-related issues in broader sustainable development and poverty reduction policies and programs as well as appropriate, cost-efficient post-disaster recovery efforts. Improvements to livelihoods to reduce vulnerability are also important, as well as a complete assessment of emergency shelters on the island.

Mainstreaming DRR into sector and national policies is necessary to ensure that there is political commitment and that the dialogue on DRR is included as part of national and sectoral policies. DRR ought to be a critical component of development planning, as well as sectoral strategies, programmes and work plans. Although some sectors are affected more obviously than others, the

recent increasing scale and frequency of disasters has proven that all sectors should develop an effective approach to reducing disaster risk and BBB in the post disaster recovery realm.

#### 5. RECOVERY NEEDS AND STRATEGY

##### Recovery Needs and Prioritization

The response to the severe damages caused by Hurricane Maria requires a dedicated and specialized agency that helps implement recovery interventions in an efficient and effective manner, while at the same time strengthening national development capacities through the existing ministerial structure. Other identified needs relate to the current DRM System which needs to be strengthened for improved preparedness, response, DRR and recovery.

The recovery process is furthermore a unique opportunity for mainstreaming DRR policies and practices into the wider process of development planning through an inter-agency and territory-based approach. Sound investments in risk zoning, integrated watershed management and urban risk

management are urgent tasks if climate change resilience and multi-dimensional risk-informed development are to be achieved by 2030. To this end, NEPO and ODM need to expand their vision from emergency response to a more comprehensive DRM perspective, where the issues of preparedness, risk assessment, risk sensitive land use and planning, urban risk reduction and other issues are linked to development interventions. Given the linkages of the damage to the housing sector and the lack of these elements, the budget for these related activities are presented in the housing sector report, with the caveat that both sectors need to work in a coordinated manner.

Restoration of lifeline facilities and basic services requires immediate decisions and investments to pursue rapid recovery. At the same time, the aftermath of the disaster offers the country a window of opportunity to utilize disaster and climate resilience as a pillar of Dominica's sustainable development strategy.

Revision of the legislation and updating of the disaster plan are immediate priorities as this will form the legal basis for the roles and responsibilities to be outlined in the plan. Simulation exercises should be seen as a priority so that individuals have a better understanding of how and where to respond. Pre-positioning of supplies in some cases is being undertaken but some consideration can be given to pre-positioning of personnel (security, SAR etc.) who can immediately help with the response post system impact.

The probability of occurrence (return period) of extreme events should be reevaluated as the intensity and frequency of some hazards, such as flooding, wind storm and storm surge, has evolved over time due to climate change and their impact has increased because of urbanization. To enhance the resilience of infrastructure new construction, design standards, technical guidelines and codes should be developed, adopted and enforced.

### **Recommendations for DRR and Building Resilience**

- ▶ Updating the legislative framework in response to a changing environment and context, approval of draft policies and bills will be a significant part of any DRR strategy, as DRR requires the redefinition of roles, responsibilities and mandates of several agencies. This update will also guide the required update of the national disaster plan which should also be considered a priority.
- ▶ Increase the capacity of the private sectors to respond to disasters. Private sector actors should take the necessary measures to reduce the likelihood and impact of hydro-meteorological events by strengthening the capacity of employees to respond in a timely manner.
- ▶ Strengthening community capacity to prepare for and respond to disasters is one of the most valuable ways of ensuring that communities and countries are well equipped for limiting the potentially adverse effects that disasters can bring. This will include strengthening the existing village council network, through ongoing training in DRR and enhancing response capacity through simulation exercising.
- ▶ Enhancement of the Early Warning (EW) System Network. While the EW network in Dominica has improved some gaps still exists. This system will require real time inputs from monitoring devices. Emphasis should also be placed on the response component so community members and the country know how to react and where to go once a warning message has been received.
- ▶ Development of a Climate Resilient Recovery Authority of Dominica. The severe damages caused by Hurricane Maria in Dominica require a dedicated and specialized agency that helps implement recovery interventions in an efficient and effective manner, while at the same time strengthening national development capacities through the existing ministerial structure.
- ▶ Further development of Relief Tracking System. The current system of tracking the distribution of relief supplies requires strengthening, as supplies in most cases can only be tracked to port.
- ▶ Enhance disaster preparedness and crisis response capacity by improving communication. Communication between affected communities and government authorities should be enhanced to ensure that government authorities are continuously informed about situation on the ground. This flow of information in both directions will help to better adopt and respond to a crisis.
- ▶ Reliable seismic hydrological, meteorological and climate data are of utmost importance for planning and designing investments that are resilient to the impacts of climate change. Seismic and hydro-meteorological data management systems need to be upgraded and maintained to provide a source of information on hazard events and patterns.
- ▶ A dedicated public awareness programme on DRR is needed, with an emphasis on the most vulnerable.

**Table 59: Table of Short, Medium & Long-term Recovery Initiatives and Costs**

Term	Item	Description	Cost (M)		
			EC\$	US\$	
Short term	Procurement of generators	To be provided at 4 fire and ambulance and police stations each	0.208	0.08	
	DRM legislative review	Review and update of legislation governing DRM across the island. No cost is allocated as funding has already been previously provided to completed. Noting the importance of this review it still is mentioned in this document			
	Updating National Disaster Plan	Revision and update of the 2001 plan	0.004	0.001	
	Procurement of equipment and assets	Purchase of necessary vehicles, equipment and assets so essential services can be provided for (Fire and ambulance, police, ODM, Dominica Red Cross)	3.102	1.15	
	Hydro-meteorological equipment	Updating hydro-meteorological network across island to improve monitoring and forecasting capacity (some of these equipment needs will be met through DVRP and 5C's)	0.316	0.12	
	Seismic network	Updating hydro-meteorological network across island to improve monitoring and forecasting capacity	1.579	0.58	
	Coordination/Support Authority	Recommended development of a specialised agency to help implement recovery interventions	5.400	2	
Medium Term	Increase private sector capacity	DRM training for this sector and technical guidance which will include (i) preparing business continuity and evacuation plans, (ii) preparing facility maps showing critical equipment (iii) backing up all computer data, and (vi) raising electrical outlets	0.075	0.03	
	Strengthening community mechanisms	This is one of the most valuable ways of ensuring that communities and countries are well equipped for limiting the potentially adverse effects that disasters can bring. This will include strengthening the existing village council network through ongoing training in DRM. This training should include an identification of evacuation routes and safe buildings in the community.	1.350	0.5	
	Enhancement of EW system network	This system will require real time inputs from rain gauges, rain radar and river gauging stations. Emphasis should also be placed on the response component within EW so community members and the country knows how to react, what path and where to react too once a warning message is received.	0.740	0.27	
	Relief Tracking System	Development of a relief tracking system so relief can be tracked before, during and after distribution	0.200	0.07	
	Strengthening communication capacity	Provision of VSATs, two way radios and satellite phones as well as national training in their use	0.392	0.15	
	Review and update of evacuation routes	Updating of evacuation routes and printing and placement of revised maps in respective districts	0.350	0.13	
	Hurricane Shelter Assessment	Review of shelter capacity on the island	0.600	0.22	
	Public Awareness programme	Dedicated public awareness programme on DRR is needed with an emphasis on the most vulnerable	0.54	0.20	
	Restoration of priority buildings	To re-build fire and ambulance, police, ODM, Dominica Red Cross to resilient standards	8.740	3.24	
	Long Term	Restructuring staff capacity at the ODM	Increasing and modifying roles of ODM staff to effective perform the mandate of the organisation	3.00	1.11
		Capacity enhancement at the Dominica Meteorological Office	Training additional staff and increasing staff complement at the Dominica Meteorological office with an ultimate goal of operating on a 24/7 basis	1.00	0.37
	Totals			27.596	10.22

### **Implementation Arrangements**

The implementation arrangements will be discussed and agreed with the government with a combination of national and agency direct implementation being utilized. The ODM will be the national focal point agency, in collaboration with the Red Cross for implementation of these proposed actions.

## **6. SOURCES**

Dominica Country Profile – ACAPS

National Physical Development Plan, NPDP, of Dominica draft

Disaster Risk Reduction Country Profile – Dominica 2014

Rapid Damage and Impact Assessment – Tropical Storm Erika 2015

The Commonwealth of Dominica National Disaster Plan – 2001

The Commonwealth of Dominica Social and Livelihoods Assessment following Tropical Storm Erika

## Environment

### 1. SUMMARY

The damage to the environment is very high, with 80-90 percent of environmental resources estimated to be significantly affected, particularly forests. Permanent losses are likely to be low, although wildlife data is lacking.

The environmental damage will have a high impact on other sectors such as tourism and agriculture for a period of one month to one year.

The recovery phase requires thorough planning with mitigation measures and monitoring to avoid the high risk of environmental damage from areas such as waste management, construction, and emergency initiatives in agriculture and tourism. Priority should be given to the Morne Trois Pitons World Heritage site, a flagship site for tourism. The recovery and mitigation measures used in MTP NP will be replicated in other areas.

### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

The environment of Dominica is active volcanic with high rainfall, leading to nearly 60 percent tropical forest coverage on high relief topography. There is 150km of coastline and associated tropical marine ecosystem, with more than 80 hectares in coral reefs, and few pockets of mangrove forest. 20 percent of the land surface is protected; as are 0.13 percent of the territorial waters, with around 2.5 percent of its coral reefs. Dominica is part of the Caribbean Biodiversity hotspot. The ecosystem is significantly impacted by natural disasters, weathering and absence of integrated land-use planning.

The forest coverage shows slow decline of about 10 percent in 25 years. Other challenges include human encroachment, wildlife capture and hunting, invasive species, agro-chemical pollution, extraction of coastal resources and soil, water and marine pollution from poor waste management.

**Table 60: Table of Key Baseline Data for the Sector**

Environmental factor	Indicator	Trend	Comments
Tropical rainforest	58%	Decline from 67% (1990)	
Protected areas	21.2%		
World Heritage	1 site since 1997 under cat 8 & 10	Limited reporting of state of conservation	Buffer zone recommended
Marine PA	2 MPAs 1100Ha		
Agro biodiversity	Diversity declines		
Wildlife	High biodiversity and Endemic species, several endangered species	Poaching concerns increase	
Coral reefs	80Ha	10-15% lost since 2005	Main risk are climate change bleaching events
Mangroves	80Ha		
Fish	320 sp	Commercial species strong decline	
Waste management	10,000t/y solid waste	Poor standards, no sorting at source, no recycling	

Environmental governance faces significant challenges, with weak legislative frameworks and the absence of an integrated development process, including lack of rigorous environmental impact assessment (EIA) practice. Solid and liquid waste management is poor and involves environmental risks in addition to human risks. Capacity in the sector mainly depends on externally funded projects.

### 3. SECTOR EFFECTS

No comprehensive assessment of effects has yet been undertaken. The majority of the forest area was affected, with estimates of 80-90 percent of trees defoliated and 15-25 percent of trees fallen, with corresponding losses in non-timber forest products such as medicinal plants and beehives.

The limited existing fragmentation of forests makes additional fragmentation effects likely to be low. Terrestrial wildlife losses have not yet been monitored but are likely to be significant. Fisheries and marine impact is estimated to be modest, with some damage but there are also likely positive effects of reduced pressure due to temporary decline in tourism and fisheries.

Rapid production and disposal of solid waste and sewage release has a significant impact due to existing poor waste management standards. Reduced tourism and business numbers will have a temporary positive effect on waste production.

### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

Comprehensive reversal of the ecological impact would take 20 years. However, within one year the ecosystems are expected to recover sufficiently to cater for regular

human and other species' usage. Nonetheless, sectors significantly affected for the next 9-12 months include tourism, agriculture, waste management, and fisheries.

Given the baseline vulnerability and impact, the recovery phase involves a considerable additional environmental risk, which could lead to cumulative economic and human impacts.

With weak environmental governance, the recovery phase is likely to see an increase in risks related to uncontrolled extraction of coastal building materials, poor waste management, wildlife hunting and possibly capture (alternative livelihoods), human encroachments in damaged forest areas (for agriculture), high opportunity of spreading of invasive species and possible additional fragmentation. This could have particularly damaging effects on the tourism sector.

### 5. RECOVERY NEEDS AND STRATEGY

#### Recovery Needs and Prioritization

The main risk for the sector is the impact of the recovery process. The baseline situation shows several poor practices in terms of environmental management; and in a situation of exacerbated needs, without mitigation, this is likely to have major negative impacts.

The priority need for the sector is, therefore, to integrate environmental monitoring and planning in each aspect of the recovery plan, with attention to waste management, construction and forest management.

Given that MTP NP is known globally as a World Heritage site and tourism flagship resources, the highest recovery priority should be given to it. A recovery programme focused on MTP can replicate these measures to cover the entire sector.

### Recommendations for DRR and Building Resilience in Sector

The sector requires guidelines for future events, particularly for waste management. This should be part of a comprehensive sustainable liquid and solid waste management plan based on a feasibility study.

Environmental Management (EM) policy and practice needs to be strengthened to include DRR in EIAs of developments, and apply strict enforcement and monitoring of management plans by developers.

**Table 61: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

	Item	Description	Cost	
			EC\$ M	US\$ M
Short term	MTP World Heritage Recovery Plan	Impact assessment, implementation of emergency measures including buffer	2.05	0.76
	Replication of WH Recovery plan	Expansion of MTP measures in other areas – sector recovery environmental guidelines (agriculture, tourism, works, waste management), stakeholder training	1.40	0.52
Medium Term	EIA/EM as tool for DRR	Integration of EIA and EM in sector planning and DRR		
Long Term	Sustainable natural heritage governance	Multi-sectoral capacity building for natural heritage development and emergency planning with integrated DRR	1.35	0.50
	Waste management	Separation at source of solid waste, treatment of wastewater – cf waste and water sector reports		
Total			4.8	1.78

## Implementation Arrangements

Implementation arrangements should incorporate the multi-sectoral aspects and build long-term capacity and avoid a project-based approach. The recovery should contribute to the establishment of the environmental management authority. The World Heritage Centre (United Nations Educational, Scientific and Cultural Organization (UNESCO WHC)) and International Union for Conservation of Nature (IUCN) will provide Technical Assistance with the Dominica National Commission.

## 6. SOURCES

PDNA mission, UNESCO. 17-20 October 2017

UNESCO/IUCN Reactive Monitoring Mission Report, Morne Trois Pitons, 2017

Wind and trees, Lessons learned from hurricanes, University of Florida, <http://edis.ifas.ufl.edu/pdffiles/FR/FR17300.pdf>

Dominica National Biodiversity Strategy and Action Plan, 2014

<https://sustainabledevelopment.un.org/content/documents/1446dominica.pdf>

Coral Reefs of Dominica, ITME 2015

[http://www.itme.org/reports/ITME\\_RReports33\\_2015\\_Steiner\\_Coral%20Reefs\\_Dominica\\_web.pdf](http://www.itme.org/reports/ITME_RReports33_2015_Steiner_Coral%20Reefs_Dominica_web.pdf)

Dominica Coral reef report card 2016, TNC

[www.agrra.org/wp-content/uploads/.../DMA-Report-Card\\_2016\\_WebLowRes.pdf](http://www.agrra.org/wp-content/uploads/.../DMA-Report-Card_2016_WebLowRes.pdf)

World Bank open Data, <https://data.worldbank.org/indicator/AG.LND.FRST.ZS?locations=DM>

## Gender

### 1. SUMMARY

Although Dominica has made significant strides towards gender equality the impact of Tropical Storm Erika and Hurricane Maria have exacerbated the challenges the country faces in this context. These challenges include, but are not limited to, access to resources for women farmers, access to health care for women and men, increasing levels of gender based violence (GBV) and economic empowerment for women, especially those in lower socio-economic sectors.

Sex disaggregated data specific to the immediate impact of Hurricane Maria remains a challenge. However there is robust baseline data from the Government of Dominica launched CARICOM gender equality indicators.

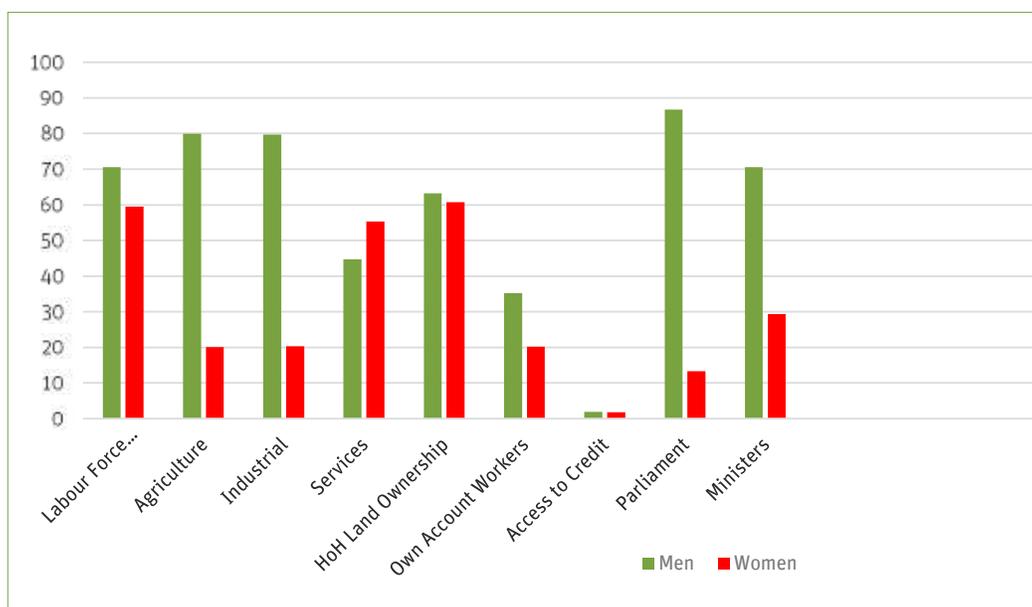
Initial support provided has been in the form of emergency supplies, including dignity kits, food and water. Needs remain, and a second phase of support is required. Other immediate needs include labor to rebuild houses and reinstate farms, access to financial resources through cash for work programmes, reinstated referral services for GBV cases and psychosocial support for men and women.

The recovery needs amount to EC\$2.12 million, to support a strategy which includes a multi-sectoral gender responsive approach to directly address the more urgent needs while establishing more resilient services, including strengthening the Bureau of Gender Affairs to support implementation of the recovery programme.

### 2. PRE-HURRICANE CONTEXT AND BASELINE FOR THE SECTOR

Prior to Hurricane Maria in 2017, Dominica made significant strides in social inclusion and gender equality, especially in education and leadership. However significant gaps related to GBV, labor force participation and health remain. Women represent 48.9 percent and men 51.1 percent of the population, respectively<sup>49</sup>. Female head 39 percent of households and male 61 percent. In addition to their role in household leadership, women continue to play a significant role in the care economy, logging an average of 16.14 hours per week in unpaid care work, which is more than half of the time spent by men (7.00 hours). There is a high incidence of both girls and boys dropping out of secondary school, however the data suggests that girls are outperforming boys in secondary school with a graduation rate of 0.41 girls to 0.34 boys<sup>50</sup>. It is therefore surprising to note that female unemployment remains slightly higher

**Figure 20: Key Baseline Data for the Sector, CARICOM Gender Equality Indicators: Dominica**



49 2011 Census

50 Dominica Gender Equality Indicators, Statistics Division, 2016.

than that of male unemployment with 2,950 unemployed females to 2774 males. This is in spite of the fact that there are more men than women in the formal labor force, 70.6 percent male to 59.5 percent female. This may be attributed to the fact that there are less women than men counted in the formal economy and therefore less women are included in unemployment statistics. As of 2010, the main sectors of the economy represented as a percentage of the GDP are as follows: Government services 19.2 percent, tourism 18 percent, agriculture 17.4 percent, commercial services 38.9 percent, and manufacturing 3.79 percent<sup>51</sup>. There is a gender division of labor in Dominica, with women overrepresented in the services sector (both government and commercial). These jobs are perceived to be more stable, however in times of financial and environmental crises are often most at risk. Women in the formal economy are primarily in government services 55.7 percent, commercial services sector 55.3 percent followed by the agricultural sector 20.1 percent. Men represent 79.9 percent of the formal agricultural sector, and manufacturing. There is a wage gap across all sectors for men and women, with the largest gaps being between skilled agricultural and fishery workers and, craft and related trade. There are many women engaged in subsistence agriculture for the food security of their families, these women predominate in the 'informal economy'. These women who participate in the informal economy are usually connected to agricultural sector as street and market vendors, 'hucksters' in the inter-island trade in agricultural produce and other commodities, as well as vendors at tourism sites. These are usually women over 40 years old. A WBG study, though dated, outlined that hucksters (higglers, traders) can be quite profitable. In the 1990s hucksters earned between EC\$200 and EC\$4,000 (US\$74 – US\$1,480) per week, equivalent to around 40% of the value of their produce (World Bank, 1996). These women are critical to the food security of Dominica and many of the other countries in the OECS. Despite this contribution, and women's increased education attainment, women experience unequal access to credit for agriculture and enterprise development through the mainstream banks (such as the Dominica Agricultural and Industrial and Development Bank (AID Bank)) but have greater access through micro- and small

enterprise 'windows' such as at the National Development Foundation of Dominica and credit unions.

There is a significant gender disparity with regards to the health sector. Men are overrepresented in the psychiatric cases, representing 72.7 percent of psychiatric patients in 2016.<sup>52</sup> Men are also the majority of those living with HIV/AIDS with a rate of 8.8 for those 15 to 49 compared to 3.4 for women in the same age range<sup>53</sup>. In July 2017, the Government of Dominica launched a pilot health insurance scheme for mothers and infants, which made accessing prenatal and postnatal care more affordable for all Dominican mothers.

Although women are benefiting from improvements in the health sector, GBV remains a significant health and social threat. There has not yet been a prevalence survey completed in Dominica, however the administrative data indicates that 86.9 percent of the victims of GBV are women, one in two of these women report sexual assault and two in five report physical assault<sup>54</sup>. Elderly and women living with disabilities are at increased risk, because the crimes often go unreported. However, there has been a notable increase in elderly persons reporting GBV related crimes to the Bureau of Gender Affairs. 80 percent of the reported perpetrators are men. The main forms of GBV in Dominica are reported to be intimate partner violence and child abuse. Although there are anecdotal reports of incest, it is rarely reported.

Access to justice has been reported to be easier for women in urban areas, and continues to be a challenge for those in rural areas. Interviews with key stakeholders within the court system revealed that the majority of the cases being heard in the courts, as of October 2017, were GBV related, however because of a lack of electricity the registrar was unable to source the statistics that would confirm this. Police sensitivity remains a challenge, especially for GBV cases and even more so for those in the Lesbian, Gay, Bisexual, Transgender, Intersex and Questioning (LGBTIQ) community.

Dominica has had an active Bureau of Gender Affairs for over two decades. The Bureau provides services and programmes to address the challenges the country faces with regards to gender inequality. However, over the past

51 Draft Dominica Gender Policy, 2014.

52 Health Statistics 2017 (Hospital Services).

53 Gender Equality Indicators, Statistics Division, 2016

54 Bureau of Gender Affairs, National registry on Gender Based Violence 2017.

few years the Bureau has experienced a cut in critical resources and has not had a confirmed Director over the past year.

### 3. SECTOR EFFECTS

Since Hurricane 1,862 persons are in 63 shelters, however, again while the data has not yet been disaggregated, observational evidence suggests that there is a predominance of women, elderly persons, and children in the shelters. Site visits by the Bureau of Gender Affairs, supported by UN Women<sup>55</sup> indicate that elderly women are doing the majority of the care work especially in the shelters. Respondents indicated that they were spending at least 18 hours<sup>56</sup> per week on unpaid care work, which represents a significant increase since the hurricane. Most of these elderly women (over 65) are also the head of household (HoHs), with households comprising on average five persons (an increase representing additional dependent family members)<sup>57</sup>. Most of the elderly men in the shelters were on their own. In Marigot, St Andrew, many of the infirm were elderly men. There were concerns raised in shelters and by those who were able to move back to their communities in St David and St Andrew, that special care was needed for the elderly, persons living with disabilities and the mentally unstable.

Most primary schools were closed until October 18, 2017 (one month post Hurricane Maria) which meant that young children required specific care in the shelters. There have been reports of primary caregivers, who are mainly women, leaving children in the shelters under communal care, usually that of an elderly woman. Most secondary schools in Roseau have been opened but only for 4th and 5th formers, leaving adolescents 11-14 outside of schools.

As previously mentioned women represented 39 percent of the HoHs in Dominica. Site visit interviews highlighted that many women, particularly the elderly women HoHs, did not have housing insurance because they were living in family homes which were built by their parents. These women indicated they were unable to move out of the shelters because they did not have access to housing material or knowledge of where to source the material. In spite of this, their main concern was being able to pay for the labor needed to assist them in rebuilding.

The Bureau of Gender Affairs and UN Women conducted interviews with five groups of women farmers in four different Parishes: St George, St Andrew, St Paul and St Joseph. 79.4 percent of the women farmers interviewed reported that they were significantly impacted by the severe damage and loss of tools and crops, with the most damage reported in Bellevue Chopin and Morne Prospere (100% of the women farmers in these locations reporting significant damage). However, in Marigot (St Andrew) and Warner (St. Paul) women reported having some root crops remaining, which they shared among the community and in shelters. Women reported that although they lost some livestock, the lack of feed, shelter and water is resulting in increased losses every day.

Based on 2015 Dominica Tourism Association figures there are 36 hotels and accommodation options and women own 22 percent of these. Women own many of the hotels with the most rooms, with the smallest hotel owned by a woman reportedly having 16 rooms.

Women and men interviewed indicate a reported increase in mental instability and psychosocial needs, especially for men and boys who reportedly have struggled to employ healthy coping techniques. There has been an increase in drug and alcohol usage, which reflects much of the experience during the aftermath of Tropical Storm Erika.

There have been no reports of GBV, however interviewees were concerned about the behavior exhibited by some of the emergency security forces serving in the country since the Hurricane. Reports indicate that some members of the security forces were openly soliciting young women. Although this is a concern, there have been no official cases reported.

Access to health care has been compromised since the hurricane because all health centers around the island have been impacted. Each district has a major, Type 3, primary care facility, which provides primary care services, which include contraceptive services and services for pregnant women. The Type 3 centres also have District Medical Officers who play an essential role in managing sexual assault cases. La Plaine Type 3 centre was severely damaged and Marigot Type 3 centre (a rented facility) was moderately damaged. Since the Hurricane primary health services continue to be offered in buildings with only

<sup>55</sup> Site visits were conducted in at least 10 communities.

<sup>56</sup> Ibid.

<sup>57</sup> Shelter Data, Community Development 2017.

emergency repairs or in alternate premises. Many women interviewed indicated that increased communication was needed to make sure everyone was aware of where and how to access critical health services.

The Bureau of Gender Affairs is located in Roseau and coordinates gender responsive services and programmes for the entire country from this location. In the aftermath of the Hurricane the Bureau office was completely looted losing seven computers, furniture, a fridge and a microwave. The estimated damage is EC\$17,250.

#### 4. CONTRIBUTIONS TO THE MACROECONOMIC AND HUMAN IMPACT

Hurricane Maria has significantly increased social vulnerability in Dominica. This vulnerability includes: increased reliance on negative coping methods, including drug and alcohol especially by men; increased GBV, including transactional sex for goods and supplies; lack of access to health services among women, the elderly and

persons living with disabilities; and lack of food security especially for households that depend on subsistence farming by women. This can lead to increased social instability on the island and lack of productivity.

### 5. RECOVERY NEEDS AND STRATEGY

#### Recovery Needs and Prioritization

- ▶ Prior to Hurricane Maria, women were highly engaged in subsistence farming or the informal sector through micro-enterprises. The loss of assets, crops, increased reproductive and community work has had a direct impact on income and food security which results in an immediate need for livelihood recovery interventions, including grants or cash for work programs.
- ▶ Elderly persons make up the majority of persons still in shelters signalling the need for grants that can assist this vulnerable group in returning home.

**Table 62: Table of Short, Medium & Long-term Recovery Initiatives and Costs (local currency & US\$)**

	Item	Description	Cost	
			EC\$ M	US\$ M
Short term	Labour grants for women farmers	Grants for women farmers to pay labourers to assist clear their land (\$350 per farmer x 250).	0.08	0.03
	Pool of equipment and materials for women farmers	Seeds, livestock feed, basic farming tools	0.12	0.05
	Labour grants and building material for elderly and disabled	Grants for elderly and disabled to get assistance and supplies to repair their homes (1,200x10,000)	1.20	0.45
	Counselling hotline	Hotline for women and men (set-up fee and training of volunteers)	0.02	0.007
Medium-term	Climate resilience training for farmers	Training for farmers, especially women farmers, to apply climate resilient techniques	0.12	0.04
	Counselling for psychosocial support for women and men	4 counsellors for men and women. Counsellors will be mobile. (3,500EC\$ per month x 4 counsellors)	0.34 (24 months)	0.13
	Reestablishment of referral networks	Training for front line service providers and awareness raising in rural communities	0.04	0.01
	Gender sensitivity training for shelter managers and community leaders	Psychosocial support, responding and preventing GBV	0.04	0.01
Long Term	Strengthen counselling capacity at the Gender Bureau (to deal with issues that may arise post Maria with household conflict, drug and alcohol use etc..)	2 counsellors on staff based in Roseau. Budget for counsellors to travel (3,500 per counsellor)	0.16 (24 months)	0.06
			2.12	0.79

- ▶ Psychosocial support and counselling is a major need. Data collected from focus groups discussions and interviews shows the need for on-going psychosocial support especially for men and boys who have already displayed unhealthy coping mechanisms. There also needs to be a system set up at community level to provide community persons with on-going psychosocial support.
- ▶ Although there were no official reported incidences of GBV, there is a need for capacity building and psychosocial support for victims given that the causes of violence are prevalent, including impacts of loss of employment on the household, shelters that are not designed with gender considerations, and an increase in drug and alcohol use.
- ▶ Women and men can also benefit from some of the other proposed initiatives from the other sectors targeting vulnerable groups e.g. Health and Agriculture; however, it is imperative that this is reiterated to ensure that they receive the assistance they need.

### **Implementation Arrangements**

The proposed activities will be implemented through a combination of national and agency direct initiatives. The Bureau of Gender Affairs will collaborate with UN Women on the implementation of the activities to restore women's livelihoods and psychosocial support, UNFPA on GBV and sexual and reproductive health initiatives. Other relevant UN agencies such as UNDP and FAO, and regional development partners such as the Caribbean Development Bank, will also be engaged for the execution of these activities. In addition, civil society partners will be engaged to ensure community level responses.

The Bureau of Gender Affairs will be the national focal point agency for the implementation of these proposed actions. The detailed implementation arrangements will be confirmed with the government.

## Summary of Identified Priority Actions for Recovery

### ESTIMATING RECOVERY NEEDS

Recovery needs are estimated based on the PDNA sectorial results for disaster effects and disaster impacts considering the following four components:

- ▶ Reconstruction of physical assets;
- ▶ Resumption of production, service delivery and access to goods and services;
- ▶ Restoration of governance and decision-making processes;
- ▶ Reduction of vulnerabilities and risks.

The short and medium-term recovery needs refer to measures required to address the current crisis while also providing access to basic services, temporary shelter and bringing communities' life and national and local institutions to normality. The longer-term recovery needs include measures to reduce the risk associated to weather related hazards and its possible impact in Dominica, including those of Climate Change, particularly in view of the likely increase in the frequency and severity of this type of phenomena.

The proposed needs also take into consideration the issues of governance, particularly those measures required to strengthen the capacity of national and local authorities across all sectors to implement and manage the recovery program, through additional expertise and human resources, equipment and information management systems to facilitate monitoring and inter-institutional coordination.

The identified needs include disaster risk reduction measures to build resilience and reduce the impact of future adverse hazards in the country. The proposed resilience interventions are integrated within each of the sectors as part of the proposed sectoral long-term measures, and are reflected as such in the matrix below outlining the recovery needs and budget.

Table below presents the proposed budget for recovery, totaling EC\$ 3,693 million or US\$ 1,368 million. The greatest needs are in the housing sector with 38% of all estimated needs, followed by transport with the 22% of the

total. Other sectors with significant needs are Education, Electricity, Agriculture and Commerce.

The recovery needs include measures required in the short-term (up to 1 year), medium-term (1 to 3 years) and long-term (3 to 5 years).

### RECOVERY CHALLENGES OF A SMALL ISLAND DEVELOPMENT STATE

Dominica, as any other Small Island Development State (SIDS), is particularly vulnerable to natural and manmade hazards, including those related to climate and its variability. The recovery strategy should consider realistic solutions to address specific capacity gaps with the view to reducing the frequency and magnitude of future disasters. Some of the key aspects relating to SIDS context that need to be considered include the following:

- ▶ Climate change could disproportionately magnify disaster risk in Dominica, due to rising temperatures and sea level and associated coastal erosion, flood and storm surge. Further, Dominica is also exposed to geological hazards (volcanoes, earthquakes, tsunamis and landslides).
- ▶ Economic growth driven by the tourism sector has led to an increase in hazard exposure, as private and public investments are concentrated in hazardous areas, such as cyclone prone coastlines. Small size, geographic dispersion and isolation from markets poses additional challenges to Dominica including the development of economies of scale, limiting its potential for diversification. A single disaster event can affect the entire territory or economy and cause a disproportionately high loss of GDP and capital as has been the case of Hurricane Maria that has affected all the economic and social sectors in Dominica.
- ▶ People's livelihoods are highly dependent on a healthy eco-system (coastal, marine, forests, wetlands), Hurricane Maria has caused a widespread destruction of these habitats, resulting in loss of livelihoods.
- ▶ Local governance mechanisms have a critical role to play to facilitate effective community risk management. However, the interface between local government and communities needs to be strengthened and national policies facilitate this

Sector	short term (<1 year) EC millions	medium term (1-3 years) EC millions	long term (3-5 years) EC millions	TOTAL EC Millions	TOTAL US Millions
Agriculture	145	50	44	239	88
Fisheries	5	1		7	3
Forestry	33	6	2	40	15
Commerce and Micro Business	192	6	1	198	73
Tourism	6	22	43	71	26
Housing	48	1354	1	1403	520
Education	5	25	224	254	94
Health	44	4	12	60	22
Culture	10	2	1	13	5
Transport	287	334	195	815	302
Electricity	118	100		218	81
Water and Sanitation	68	64	19	152	56
Telecommunication	33	66	30	129	48
Airports and Port	37	14	11	61	23
Disaster Risk Management	0	15	13	28	10
Environment	3		1	5	2
Gender	1	1	0	2	1
<b>TOTAL</b>	<b>1035</b>	<b>2063</b>	<b>597</b>	<b>3693</b>	<b>1368</b>

## A TAILORED STRATEGY FOR DOMINICA

The issues discussed in this section are preliminary and based on the findings and recommendations made in the sector reports based on the PDNA, they will need to be further discussed and developed into a disaster recovery framework that would consider detailed planning and implementation of a comprehensive recovery intervention in Dominica.

All the 17 sectors assessed after the disastrous event of Hurricane Maria in Dominica are important and contribute in different ways to support the socio-economic development of the country. They have been clustered in four main categories: social sectors, productive sectors, infrastructure sectors and the cross-cutting issues. As indicated earlier, some of them have been heavily impacted and may need to be looked at in a prioritized manner:

## Housing Reconstruction

Housing is the most affected sector and one of the most important and challenging areas for recovery as this provides shelter and security to the families, but also, quite often they also include small businesses that are part of the income generation mechanism. The Government plan for the recovery and rebuilding of the housing sector, outlined by the Prime Minister on October 16, 2017 comprises: (i) waiver of duties on construction materials for six months; (ii) convening power to ensure faster insurance payouts and lower bank charges; and, (iii) repair and rebuilding of schools, clinics, hospitals and homes in a climate-resilient way.

It is critical that a comprehensive National Housing Reconstruction Program is developed and implemented to replace what was damaged and lost. The options for

post-disaster housing programs that have been adopted elsewhere include a cash approach, owner-driven reconstruction, community-driven reconstruction, and agency-driven reconstruction. Depending on the selected alternative, the homeowner, community and agency would have different levels of control on funds and management of the project. This could be linked to different capacity building processes to incorporate not only the affected community but also small to medium locally based enterprises who could be integrated to the reconstruction program thus offering them an opportunity for income generation.

### **Infrastructure**

Reconstruction of damaged infrastructure such as roads, water and sanitation, electricity will focus in the short run in quickly providing access to the communities to markets, schools, health centres and repairing basic services such as provision of water, sanitation and electricity. The geographical setting and the widespread location of small towns and infrastructure pose an additional burden in the recovery planning and implementation as it would be difficult to benefit from economies of scale by clustering different communities in a single reconstruction scheme. In the intermediate and long run, focus should be in making the necessary studies and assessments to make sure that detailed engineering designs of major interventions will be undertaken as a pre-requisite to procuring civil works making all infrastructure disaster resilient.

For solid waste management services, recovery and improvement are needed in both facilities and processes. This includes reestablishing services throughout the island, re-building and strengthening what was already depleted service to an adequate level, and introducing cost saving and resilient systems that allow for decentralized public and private sector waste storage, transfer, and operation, especially in hard to reach areas.

### **Livelihoods**

Gender-responsive livelihoods programs will focus on empowering men and women through national and community-level training for climate resilient agriculture and by supporting the creation of value chains that reduce food insecurity among vulnerable groups. The recovery programme provides the opportunity to prepare agricultural workers to engage in value-added activities,

based on the restoration of the natural environment.

Some 10,000 persons were involved in micro businesses in the formal and informal sector, their economic activity ranged from such activities as barbering, baking of goods, seamstresses, cosmeticians, mechanics and the repair of household items. They would require support to refinance their businesses as part of the recovery programme.

### **Disaster Risk Reduction**

With climate change on the rise, Dominica will be faced with disasters of increasing magnitude and intensity thus ex-ante preparedness for recovery is a must. Focus should be in proactively building regional and national institutional arrangements, communication, coordination and planning capacities to ensure timely and resilient recovery, including contingency planning to assure business continuity not only from the private sector but most importantly from the public sector.

Resilient reconstruction requires strengthening the interface between national and local governments and the communities to enhance community risk management and design strategies that are more responsive to community needs. The growing urban centres in Dominica need also dedicated attention to make sure that risk sensitive land use and plans are used for and orderly and safe growth of the cities.

The long-term recovery strategy proposed includes disaster risk reduction measures to build resilience and reduce the impact of future hazards. The proposed disaster risk reduction interventions are integrated within each of the sectors as part of the proposed sectoral long-term measures.

### **GUIDING PRINCIPLES**

- ▶ Key aspect of the recovery strategy should be underpinned by approaches that will retain skilled people within the country.
- ▶ Use the opportunity which the disaster presents to prepare persons to engage in value-added activities, based on the restoration of the natural environment.
- ▶ Support entrepreneurial activity that kick-starts the agricultural production for niche markets and adds value in the production process, such as in the development of specialty bananas or other fruits.

- ▶ Engage the people in the development of the recovery strategies and measures, through consultative processes
- ▶ Seek the support of the diaspora community for the recovery process – they are a rich source of both human and financial resources
- ▶ Ensure that resilience to climate change is built into all new development initiatives and into the reconstruction of damaged infrastructure, public or private.
- ▶ The disaster should provide an opportunity for the regulation of land use adopting measures for conserving energy and strengthening the management of forest resources.
- ▶ Most vulnerable people (low income, women headed households, people living with disabilities) will be given priority in recovery assistance.
- ▶ Gender sensitive and participatory approaches promoted in all interventions.

### **IMPLEMENTATION ARRANGEMENTS**

Recovery is multi sectoral in nature. It includes reconstruction of physical assets, restoration of livelihoods, and re-establishment of social and community services. This work requires the collective efforts of all

governments' ministries, private sector actors, the civil society and national and international organizations.

While it is recognized that recovery should be implemented under the strong leadership of the national government, other partners can bring technical skills and experiences that will improve the quality of recovery. The recovery strategy should be inclusive and participatory, integrating national and local authorities, the affected communities, community organizations, women's groups, traditional authorities and other relevant local actors.

To this end, establishing a recovery agency that has a short-term mandate, strengthens the country's public service, and has credible leadership is a good alternative to be considered by national authorities. This agency could improve the following aspects:

- ▶ Overall coordination to maximize the impact of new resources avoiding overlap, duplication of efforts and conflicting projects.
- ▶ Sequencing of projects to bring benefits earlier than otherwise.
- ▶ Ensure a smooth roll out of projects as all supporting activities could be handled by one, focused body
- ▶ Ensure that all donor-funded rebuilding activities are carried out to a high standard of transparency and financial accountability.





# ANNEXES

## Annex 1: Dominica Poverty and Social Protection Profile

At the time of the last Country Poverty Assessment (CPA) in 2009, Dominica was on a path to reducing poverty, recording a poverty headcount rate of 28.8 percent, which was ten percentage points lower than the 39 percent recorded in 2003.<sup>58</sup> Indigence also declined from 10 percent to 3.1 percent over the same period. Poverty may have likely declined during the period between the last CPA and the passage of Hurricane Maria, given a range of social protection initiatives introduced in recent years. However, in the absence of recent poverty data, the impacts of the expanded safety net on poverty cannot be assessed. Furthermore, repeated exogenous shocks since the last poverty assessment in 2009, including the global financial crisis, Tropical Storm Erika, and Hurricane Maria have threatened to derail poverty reduction efforts.

The poverty profile of Dominica at the time of the last CPA illustrated several poverty trends and highlighted sections of the population more likely to be poor. Children and youth (ages 0-24) account for a larger share of the poor, at 52.1 percent. Most of the poor in Dominica were working poor, meaning that while they were employed, their income was not sufficient to consume the basic goods needed. Additionally, indigenous demonstrated higher poverty levels, with one (74.1 percent) in two Kalinago likely to be poor in 2009 (49.8 percent). In terms of geographic distribution, the following Parishes demonstrated poverty that was higher than the national average: St Joseph, St Patrick, St David, St Andrew and St Paul.

To respond to poverty challenges, Dominica provides a range of social protection programs. Key safety net programs include, Public Assistance (a main cash transfer to poor households); Education Trust Fund (support to poor children attending secondary schools); Over 70 allowance (a social pension to poor elderly); Public Support Program (operated by the Prime Minister's office for persons in need of emergency assistance); and the National Employment Program (direct employment for recent graduates and unemployed youth. The country's spending on social assistance (2.2 percent of GDP), exceeds the global average of 1.6 percent of GDP,<sup>59</sup> financed by mainly local public resources. However, as a share of social

spending, spending on the sector is comparatively lower. For instance, in the 2016/2017 financial year, Dominica spent 17.3 percent of recurrent expenditures on education and 13.9 percent on health. However, expenditure for the Ministry of Social Services was 5.7 percent. While Public Assistance transfers and Social Pensions are quite generous by international standards, the coverage of these programs, given the poverty rate, is low. Despite this, Public Assistance was assessed to be well-targeted to the indigent. Current targeting efficiency for most programs is also difficult to assess due to unavailability of more recent poverty data. Following Tropical Storm Erika, the Government also provided three emergency cash transfers to support affected households. These transfers included a Displacement Allowance, Loss of Content Grant, and Rental Assistance. These transfers accounted for 0.5 percent of GDP in 2015/16. As of October 25, 2017, there were 298 beneficiaries still receiving the Rental Assistance and Displacement Assistance for post Tropical Storm Erika effects. The country also has a well-established social insurance system, with 22,737 active contributors covered the Social Security system in 2016, and recent reforms introduced to improve sustainability of the system. Social care services are also provided, principally through residential services for vulnerable groups, including the Chances home for neglected children and an Infirmary for the elderly.

Despite high safety net spending and the number of social protection programs offered, there were several areas in the social protection system which could be improved to modernize service delivery, strengthen resilience building and link the sector more closely to disaster response.. These challenges included fragmented delivery; rudimentary systems for program delivery and monitoring; and limited linkages between the established safety net to prepare for and respond to disaster risks. For social security, improving coverage of the informal sector is critical, particularly given the importance of agriculture to labor.

### Child Protection:

The Social Welfare Division of the Ministry of Social Services, Family and Gender Affairs has the overall

<sup>58</sup> Caribbean Development Bank and Kairi Consultants. 2009.

<sup>59</sup> World Bank. 2017.

mandate for child protection issues. A specialized unit to focus on the more serious cases is comprised of one coordinator and one welfare officer. The unit is mandated to carry out all aspects of child protection work, from receiving reports through investigation, placement, seeking court orders and reintegration. The unit has also been given the task, as the name would suggest, of carrying the Division's child abuse prevention mandate. Even pre-Maria, there was not the human capacity to fully

discharge the responsibilities for children's protection, including the monitoring of children in care and facilities. To date, there had been no systematic follow-up of the 87 children in official foster care. In addition, despite anecdotal reports of suspected abuses in shelters, no reports had been made to either law enforcement or the Unit, even in the context of such widescale displacement and compromised systems for children's safety.

**Table 1: Project Poverty Headcount Rate by Parish<sup>60</sup>**

Parish	Time period	Indigent	Poor (not Indigent)	Vulnerable	Not Poor
City of Roseau	Pre	0.0%	12.8%	13.8%	73.4%
	Post	1.8%	29.0%	20.9%	48.3%
Rest of St George	Pre	0.0%	16.3%	14.7%	68.9%
	Post	4.2%	29.5%	10.0%	56.3%
St. John	Pre	0.0%	10.2%	7.9%	81.8%
	Post	0.0%	19.9%	16.5%	63.6%
St Peter	Pre	0.0%	23.7%	11.3%	65.0%
	Post	0.0%	42.2%	26.8%	30.9%
St. Joseph	Pre	5.7%	41.5%	3.3%	49.6%
	Post	8.5%	45.1%	16.7%	29.7%
St Paul	Pre	4.5%	28.0%	12.9%	54.5%
	Post	11.4%	34.5%	10.6%	43.6%
St. Luke	Pre	0.0%	17.5%	17.5%	65.0%
	Post	6.3%	31.9%	21.9%	40.0%
St. Mark	Pre	.7%	26.6%	10.1%	62.6%
	Post	2.9%	40.3%	7.2%	49.6%
St. Patrick	Pre	7.9%	34.8%	10.5%	46.8%
	Post	8.6%	47.2%	12.7%	31.5%
St. David	Pre	4.7%	35.7%	8.9%	50.7%
	Post	8.0%	41.3%	15.5%	35.2%
St. Andrew	Pre	4.7%	33.4%	13.5%	48.4%
	Post	11.9%	41.6%	13.3%	33.2%
Dominica	Pre	3.1%	25.7%	11.5%	59.7%
	Post	6.6%	36.2%	15.3%	41.9%

60 Based on an estimated 25% reduction in consumption

## Annex 2: Summary Table of Recovery and Reconstruction Initiatives by Sector

Sector	Short Term (< 1 year)	Medium Term (1-3 years)	Long Term (3-5 years)
<b>PRODUCTIVE SECTORS</b>			
Agriculture	<ul style="list-style-type: none"> <li>• Restore damaged infrastructure for crops/ buildings</li> <li>• Provision of seeds, planting materials</li> <li>• Debris removal and utilization (for agricultural land and forestry)</li> <li>• Human resources &amp; training program</li> <li>• Mitigation measures for building resilience of farming system (windbreak, contours, terracing)</li> <li>• Monitoring agricultural production system (forest &amp; farm)</li> <li>• Rehabilitation/reconstruction of animal housing/perimeter fencing</li> <li>• Animal re-stocking (poultry, small ruminants, rabbits, pig)</li> <li>• Feed</li> </ul>	<ul style="list-style-type: none"> <li>• Agricultural station and infrastructures</li> <li>• Improve institutional capacities (legislative framework, laboratories, human resources)</li> <li>• Improve water management and use of renewable</li> <li>• Improve risk mitigation strategy to include bio-security</li> <li>• Introduction of the embryo transfer and artificial insemination</li> <li>• Developing local feed resources</li> </ul>	<ul style="list-style-type: none"> <li>• Risk management strategy</li> <li>• Reconstruction of infrastructures e.g. Feeder Roads</li> </ul>
Forestry	<ul style="list-style-type: none"> <li>• Salvaging of economical timber species</li> <li>• Rehabilitation of forest nurseries and forest stations</li> <li>• Harvesting of compostable material from forest (chipping/mulching)</li> <li>• Tools and equipment (Source chainsaws and Alaskan mills, crane truck and pickup trucks required for transportation and other forestry tools)</li> <li>• Rehabilitation of eco-tourism sites and trails i.e. clearing of debris, restoration of infrastructure visitor facilities, bridges, and erection of viewpoints and platforms, restoration of Botanical gardens</li> </ul>	<ul style="list-style-type: none"> <li>• Replant area to protect erosion-prone areas</li> <li>• Updating forestry inventory and survey</li> <li>• Amendment of the forest law (wildlife, land use)</li> <li>• Public awareness and sensitization e.g. Forestry education programme to provide information to the general public. To enhance capacity of the Division of forestry</li> <li>• Build capacity in various aspects of forest resources conservation and management</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of the REDD+ strategy</li> <li>• Assessment of land use and capability (soil erosion) - Review of the national land use plan</li> </ul>
Fisheries	<ul style="list-style-type: none"> <li>• Reinstating fisherfolk livelihoods</li> <li>• Repair and replace fishing vessels, fishing engines</li> <li>• Reacquire fishing gear</li> <li>• Boat building equipment</li> <li>• Reinstating fisheries cooperatives</li> </ul>	<ul style="list-style-type: none"> <li>• Infrastructural work on fisheries division</li> <li>• Office equipment and supplies</li> </ul>	
Commerce/ Microbusiness	<ul style="list-style-type: none"> <li>• Reconstruction of partially and totally destroyed infrastructure and assets</li> <li>• Retrofitting of locations for business incubators (community centers)</li> <li>• Relocate businesses situated in river beds and sea coast</li> <li>• Debriefing/psychosocial for micro entrepreneurs</li> <li>• Concessional loans/grants to micro businesses who have been affected by Hurricane Maria for the purpose of re-establishment of business</li> <li>• Scaling up in terms clients and financial disbursements</li> <li>• Clustering and formalization micro businesses in the informal sector</li> <li>• Monitoring and evaluation of implementation</li> </ul>		<ul style="list-style-type: none"> <li>• Innovation and research to introduce recycling projects</li> <li>• Group insurance for SMEs (clustered according to production output)</li> </ul>

Sector	Short Term (< 1 year)	Medium Term (1-3 years)	Long Term (3-5 years)
Tourism	<ul style="list-style-type: none"> <li>• Rebuild Roseau cruise berth</li> <li>• Rehabilitate infrastructure for tour operators, taxis, other services, with BBB component</li> </ul>	<ul style="list-style-type: none"> <li>• Rebuild slight to moderately damaged hotel rooms, with common areas and landscaping components, to BBB standards</li> </ul>	<ul style="list-style-type: none"> <li>• Severely damaged or destroyed hotel rooms, to BBB standards</li> </ul>
<b>SOCIAL SECTORS</b>			
Education	<ul style="list-style-type: none"> <li>• Provisional schools</li> <li>• Rehabilitation (includes the repair of schools used as shelters and wash facilities)</li> <li>• Adjusted curriculum with teacher training</li> <li>• Psychosocial support</li> <li>• Supports to at-risk students</li> <li>• Teaching and learning materials</li> </ul>	<ul style="list-style-type: none"> <li>• Reconstruction according to build back better approaches (includes demolition and rubble remove and the rehabilitation of wash facilities)</li> <li>• Education on emergency planning at national level</li> <li>• Develop strategies and capacities to include DRR in the education sector, including an emergency response plan and curricular modifications</li> </ul>	<ul style="list-style-type: none"> <li>• Reconstruction according to build back better (includes wash facilities)</li> <li>• Furniture, schools books and equipment</li> </ul>
Health	<ul style="list-style-type: none"> <li>• Repairs to health facilities &amp; equipment replacement</li> <li>• Fund/relief for overseas care</li> <li>• Recruitment of 50 nurses for 2yrs</li> <li>• Health promotion campaign</li> <li>• Environmental monitoring &amp; vector control. Post-Maria planning &amp; increased monitoring</li> <li>• Psychosocial support</li> <li>• -3 temp facilities and mobile clinics</li> </ul>	<ul style="list-style-type: none"> <li>• Expansion of nursing program</li> <li>• Review of primary care services &amp; NNH</li> <li>• Review policies and legislation for climate resilience</li> <li>• Maintain gains of HIV/TB Elimination Project</li> <li>• Post disaster recovery coordinator to support for 2 years</li> </ul>	<ul style="list-style-type: none"> <li>• Building for resilience</li> <li>• HIS resilience (e.g. Backup servers, virtual space)</li> </ul>
Housing	<ul style="list-style-type: none"> <li>• Formal detailed damage survey of all homes across country</li> <li>• Shelter expenditure as well as transitional shelter expenditure.</li> <li>• Repair of partially damaged houses to resilient standard</li> <li>• Replacement of highly &amp; completely damaged houses to resilient standard</li> <li>• Training program that targets construction firms, builders and communities</li> <li>• Raising awareness of home owners on safe housing construction</li> <li>• Quality assurance for reconstruction. Training and facilitation of building inspectors</li> </ul>	<ul style="list-style-type: none"> <li>• Review, strengthen and implement a housing reconstruction policy</li> <li>• Update and authorize the building code for resilient construction practices and identify and implement strategy for raising compliance and define agency responsibilities</li> <li>• Prepare community level plans mapping risks of landslide, flooding etc.,</li> <li>• Aims to raise awareness related to hazards and disaster risk reduction among homeowners</li> </ul>	
Culture	<ul style="list-style-type: none"> <li>• Rehabilitate damaged infrastructure, access to heritage spaces and cultural assets</li> </ul>	<ul style="list-style-type: none"> <li>• Undertake restoration, inventories and reduce risks.</li> <li>• Built heritage and archaeological sites, complete inventory of all cultural assets and resources</li> </ul>	<ul style="list-style-type: none"> <li>• Update Cultural Policy and establish heritage expertise, including Governance, capacity building in traditional knowledge and conservation techniques</li> </ul>

Sector	Short Term (< 1 year)	Medium Term (1-3 years)	Long Term (3-5 years)
<b>INFRASTRUCTURE SECTORS</b>			
Roads and Transport	<ul style="list-style-type: none"> <li>Restoration of river capacity: Excavation and reshaping of riverbeds to take storm floods</li> <li>Rehabilitation of damaged bridges &amp; culverts</li> <li>Survey &amp; design of bridge replacements, and South road upgrading project</li> <li>Install asset management system; Upgrade IT platform, data and system security</li> </ul>	<ul style="list-style-type: none"> <li>Upgrading of critical bridges, culverts Resilient standards</li> <li>Reinstatement of major bridges</li> <li>Replace 4 major bridges</li> </ul>	<ul style="list-style-type: none"> <li>Improvement of south road &amp; bridges</li> <li>Replace 6 major bridges</li> </ul>
Ports and Airports	<ul style="list-style-type: none"> <li>Complete rehabilitation of Woodridge Bay, Ferry terminal Roseau, Cruise Berth Roseau, Douglas Charles Airport</li> </ul>	<ul style="list-style-type: none"> <li>Complete rehabilitation of Port in Portsmouth and Canefield Airport</li> </ul>	<ul style="list-style-type: none"> <li>Complete rehabilitation of Portsmouth Cruise terminal and berth</li> </ul>
Water and Sanitation	<ul style="list-style-type: none"> <li>Ensure supply systems for priority water areas</li> <li>Prepare water system program, i.e. procure pipes &amp; equipment</li> <li>Operational support for WSW enterprises during recovery period</li> <li>Install backup renewable-energy pumps control panel; lift stations</li> <li>Priority solid waste actions including procuring urban collection containers &amp; trucks and repairing structures</li> </ul>	<ul style="list-style-type: none"> <li>Community Water Safety planning and water quality monitoring</li> <li>Rehabilitate 22 water schemes with resilience and renewable energy pumps</li> <li>Reconstruct 1 treatment plant, sewage lines, crossings and manholes</li> <li>Reconstruct and upgrade sanitary landfill to include medical waste building</li> </ul>	<ul style="list-style-type: none"> <li>Strengthen national and parish level water resources monitoring and management capacity and systems</li> <li>Reconstruction/expansion of 2 wastewater treatment systems</li> <li>Strengthen wastewater treatment capacity, systems and processes</li> <li>Build new sanitary landfill and install stationary compactors in rural areas</li> </ul>
Electricity	<ul style="list-style-type: none"> <li>Feasibility study for undergrounding to identify locations/segments better suited for undergrounding and select design options</li> <li>Repairs to generation assets, Complete inspection of equipment and repairs</li> <li>Recovery of T&amp;D network</li> </ul>	<ul style="list-style-type: none"> <li>Establish fully resilient T&amp;D network through rebuilding or maintenance works of overhead lines progressively turned into underground</li> </ul>	<ul style="list-style-type: none"> <li>Pursue Geothermal development: Commission 7MW geothermal capacity</li> </ul>
Telecommunications	<ul style="list-style-type: none"> <li>Rehabilitation of Emergency Communications Network (Redesign for expansion of the existing network and creation of deployment/maintenance plan)</li> <li>ICT Data Recovery, Server Room Re-instatement</li> <li>Repair Cellular Sites</li> <li>Restore Northern Fiber Loop</li> </ul>	<ul style="list-style-type: none"> <li>Install microwave links on Flow towers (49 towers)</li> <li>Replace overhead fiber plant</li> <li>Replace destroyed towers</li> </ul>	<ul style="list-style-type: none"> <li>Create disaster recovery and continuity of operations plans for ICT</li> <li>Rebuild Destroyed Support Buildings</li> <li>Public ICT Center Reinstatement</li> <li>Underground fiber plant</li> </ul>

Sector	Short Term (< 1 year)	Medium Term (1-3 years)	Long Term (3-5 years)
<b>CROSS-CUTTING ISSUES</b>			
Disaster Risk Reduction	<ul style="list-style-type: none"> <li>• Procurement of generators</li> <li>• Review and update of legislation governing DRM across the island</li> <li>• Updating National Disaster Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Purchase of necessary vehicles, equipment and assets so essential services can be provided for</li> <li>• Updating hydro-meteorological network across island to improve monitoring and forecasting capacity</li> <li>• Development of a specialized agency to help implement recovery interventions</li> <li>• Increase private sector capacity</li> <li>• Strengthening community mechanisms</li> <li>• Enhancement of EW system network</li> <li>• Development of a relief tracking system so relief can be tracked before, during and after distribution</li> <li>• Strengthening communication capacity</li> <li>• Review and update of evacuation routes</li> <li>• Conduct Hurricane Shelter Assessment</li> <li>• Establish Public Awareness programme</li> </ul>	<ul style="list-style-type: none"> <li>• Restoration of priority buildings</li> <li>• Restructuring staff capacity at the ODM</li> <li>• Capacity enhancement at the Dominica Meteorological Office</li> </ul>
Environment	<ul style="list-style-type: none"> <li>• MTP World Heritage Recovery Plan</li> <li>• Replication of WH Recovery plan</li> </ul>	<ul style="list-style-type: none"> <li>• Integration of EIA and EM in sector planning and DRR</li> </ul>	<ul style="list-style-type: none"> <li>• Sustainable natural heritage governance. Multi-sectoral capacity building for natural heritage development and emergency planning with integrated DRR</li> <li>• Separation at source of solid waste, treatment of wastewater</li> </ul>
Gender	<ul style="list-style-type: none"> <li>• Labor grants for women farmers</li> <li>• Pool of equipment and materials for women farmers</li> <li>• Labor grants and building material for elderly and disabled</li> <li>• -Counseling hotline</li> </ul>	<ul style="list-style-type: none"> <li>• Climate resilience training for farmers</li> <li>• Counseling for psychosocial support for women and men</li> <li>• Reestablishment of referral networks</li> <li>• Gender sensitivity training for shelter managers and community leaders</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen counseling capacity at the Gender Bureau (to deal with issues that may arise post Maria with household conflict, drug and alcohol use etc..)</li> </ul>
Social Protection	<ul style="list-style-type: none"> <li>• Emergency top-up to Public Assistance. (</li> <li>• Expand Public Assistance coverage to the new extreme poor</li> <li>• Short term expansion of cash-for-work for six months</li> <li>• Expand coverage of the school feeding program to cover to all public primary schools</li> <li>• Develop an electronic post-disaster household assessment system with tablet support for electronic field updates</li> <li>• Review of post-hurricane conditions at social care institutions and implementation of strategies to address the needs of vulnerable in these institutions.</li> </ul>	<ul style="list-style-type: none"> <li>• Medium term expansion of the school feeding program to cover all public secondary schools</li> <li>• Develop a social information registry to store data on poor households for better service delivery, improved monitoring, and better data capture for disaster preparedness actions and fast identification of households in post-disaster contexts.</li> <li>• Expand and modernize social protection payment delivery, for faster delivery of benefits to affected households in post-disaster settings</li> <li>• Develop and roll-out a program to link safety net beneficiaries to productive activities, higher payment income generating activities, and climate resilient livelihoods</li> </ul>	<ul style="list-style-type: none"> <li>• Developing a contingency financing mechanism for the social safety net to enable rapid scale up in times of crises and roll-back in periods of stability.</li> </ul>

**(Footnotes)**

1 Losses for Forestry were quantified under Tourism.

2 Losses and Damages for Environment were not quantified.

3 Losses and Damages for Gender were not quantified.

4 Includes 2,049 Public Assistance beneficiaries and 1,560 Over 70 Allowance beneficiaries (2015)

5 The population in 2008 was 72,018.

6 For an estimated 25 percent decline in consumption, it is estimated that there will approximately be 8,225 non-indigent poor.

7 Since the rebuilding of the cruise berth falls under the needs of the port, in order to avoid double counting the amount will not be included here.

8 Number of people in shelters based on IOM – The UN Migration Agency estimates as of 19 October 2017.

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