ACKNOWLEDGEMENT

The Secretariat of the Organisation of Eastern Caribbean States wishes to acknowledge the significant assistance provided by Dr. Claudius Preville of the Caribbean Regional Negotiating Machinery (on secondment to the OECS Secretariat), Ms. Laurel Bain and Ms. Teresa Smith of the Eastern Caribbean Central Bank, Dr. David Smith of Smith Warner International, and Mr. Roosevelt Isaac, of Strata Engineering Consultants Ltd, all of whom participated as members of the ten person OECS Team.

The United Nations Development Programme for Barbados and the Eastern Caribbean provided financial assistance. The speed with which this assistance was provided to the OECS Secretariat is recognised and much valued.

The support provided by the staff in the various ministries in Dominica, is acknowledged with deep gratitude, as is the assistance provided by various other private sector agencies and individuals. Special mention is made of the tremendous assistance provided by the Executive Director and staff of the OECS Export Development Unit in Dominica and Mr. Michael Norris of the Ministry of Finance.
Dominica: Macro-Socio-Economic Assessment
Of the damages caused by the Earthquake and Landslides
November 21, 2004

Table of Contents

ACKNOWLEDGEMENT ........................................................................................................... i
TABLE OF CONTENT ............................................................................................................. ii
EXECUTIVE SUMMARY ....................................................................................................... iii
LIMITATIONS OF REPORT .................................................................................................... ix
PREFACE ................................................................................................................................. x

I. BACKGROUND ................................................................................................................. 1
  1. The Mission .................................................................................................................... 1
  2. Description of the Phenomenon and their Effects ...................................................... 1
  3. Affected Population ...................................................................................................... 6
  4. Emergency Actions ....................................................................................................... 10

II. ASSESSMENT OF THE DAMAGE ................................................................................. 12
  1. Social Sectors .............................................................................................................. 12
  2. Damage in Productive Sectors ................................................................................. 15
  3. Infrastructure .............................................................................................................. 21
  4. Effects on the Environment ....................................................................................... 25

III. MACROECONOMIC EFFECTS ..................................................................................... 33
  1. Summary of Damage .................................................................................................. 35
  2. The Pre-Disaster Situation ....................................................................................... 36
  3. The Short-Run and Medium Term Run Expected Performance of the Economy Without the Disaster (2004-2007) ................................................................. 40
  4. The Post-Disaster Macroeconomic Assessment ....................................................... 42

IV. GUIDELINES FOR REHABILITATION, RECOVERY AND A RECONSTRUCTION PROGRAMME .............................................................................................................. 53
  1. The Overall Context .................................................................................................. 53
  2. Project Proposals ...................................................................................................... 56

V. ANNEX 1. PROPOSED LANDSLIDE METHODOLOGY & ESTIMATED COST .......... 57

VI Project Profiles .................................................................................................................. 59
Executive Summary

The Process

This study to undertake a Macro-socio-economic Assessment of the effects of the flooding, earthquake and landslides on the performance of the Dominican economy, in the short, medium and long term, was initiated as a result of a request to the Director General of the Organization of Eastern Caribbean States, by the Prime Minister, Hon. Roosevelt Skerrit.

It was clear from the scope of the damages sustained, that while efforts needed to be deployed urgently to deal with the immediate effects of the events, critical thinking also needed to be applied rather quickly, to the process of rebuilding those aspects of the economy that had sustained damage. This is an especially vital consideration in order to ensure that Dominica’s attempt at restoring economic growth and its ability to meet IMF targets are not compromised.

Dominica presents a unique challenge and is a special case, in that the effects of an exogenous shock as a result of the combination of floods, earthquake, and landslides have been superimposed on those of an endogenous shock propelled by an unsustainable fiscal situation which led to the implementation of a macro-economic adjustment program.

Dominica has exhibited the lowest average rate of economic growth among OECS economies in the past twenty years (see Table 1 below) and the prospects of growth in the pre-disaster scenario were still within a low range of 2% to 2.6%.

<table>
<thead>
<tr>
<th>Year</th>
<th>Antigua</th>
<th>Dominica</th>
<th>Grenada</th>
<th>St. Kitts and Nevis</th>
<th>St. Lucia</th>
<th>St. Vincent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980-1993</td>
<td>5.7</td>
<td>4.0</td>
<td>4.8</td>
<td>5.8</td>
<td>6.6</td>
<td>5.6</td>
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<tr>
<td>1993-2003</td>
<td>3.5</td>
<td>0.7</td>
<td>3.9</td>
<td>3.7</td>
<td>1.1</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Source: ECCB

The country’s growth trajectory which had recovered in the second half of the 1990’s reaching on average 3% for the period 1996-1998 began to deteriorate thereafter. While in 1999 and 2000, the rate of growth stagnated (0.4% on average) in 2001 and 2002 it turned negative. In fact the country registered a cumulative contraction of -10% for both years. In 2003 the country adopted a two stage strategy to confront its impending macroeconomic disequilibria. The first stage consisted of a stabilization program under an IMF Standby Arrangement. The second stage which was a Poverty Reduction and Growth Facility aimed at reigniting growth and reducing poverty levels. The latter program involves structural and public sector reform. While in both stages the government has complied with the established benchmarks for the respective

1 The projected rate of growth for 2004 in the pre-disaster scenario adopted in this document is 2.6% and is that projected by the government. It should be important however to indicate that international organization had forecasted a lower rate of growth (2%) for 2004.
programmes growth is still incipient and unevenly distributed among the different sectors of economic activity.

In some cases, the effects of the earthquake (the external shock) may compound those of the adjustment programme (the internal shock) amplifying the latter’s intended consequences. In others, the effects of the external shock will partly offset or run counter to those of the endogenous shock. Different scenarios are possible and complex dynamics are likely to ensue.

In addition to the delicate macroeconomic situation the country faces, Dominica is vulnerable geologically given its position on a series of tectonic plates, and active volcanic activity and environmentally, given its location in the hurricane belt.

From the above it follows that a key objective of the report is the need to project the impact of these damages on overall macroeconomic performance in the short, medium and long terms, as the basis to guide discussion of recovery and rehabilitation requirements, establish guidelines for these efforts and identify a range of policy, programmatic and project interventions best suited to the process of economic, social and environmental recovery.

This type of comprehensive assessment of macro-economic impacts is based on a methodological approach formulated by UN-ECLAC and refined to suit the needs of Small Island Developing States by the Organization's staff at the regional Headquarters for the Caribbean. Reports of this type have formed the basis for targeted efforts at recovery and rehabilitation, on the part of development partners in response to similar types of crises in other Caribbean countries. Most recently, this methodology was employed by the OECS led mission with partners from ECCB, UNECLAC and USAID, to determine the Macro-Economic and Social effects of the damage caused by the passage of Hurricane Ivan in Grenada in September 2004. What sets this particular event apart however, is the multiplicity of events (floods, earthquake and landslides) and the continuity in the earthquake activity.

The Director General led the OECS Assessment Team; the Technical Coordinator of the Team was a member from the CRNM who is presently on secondment to the OECS Secretariat. The ten person Team that was fielded comprised of six persons from the OECS Secretariat, two from the Eastern Caribbean Central Bank, and two specialist consultants. The assessment took place in Dominica over the period 12 – 17 December. The report was presented to the Prime Minister and Cabinet colleagues on 17 December.

The OECS mission interviewed representatives of the government, the private sector, and residents in the affected communities, all of whom provided information and valuable suggestions for the preparation of this document.
The Report

The report undertakes an analysis of the relevant sectors impacted by the earthquake and landslides; an assessment of overall damages is then computed. Sectors are grouped into four categories: Social, Productive, Infrastructural and Environment. The first includes the housing, health and education sectors. The second comprises agriculture, and tourism. The third includes electricity, water and sewerage, telecommunications, roads and drainage. The environmental assessment includes, among other things, the impact of damages to ecosystem and habitat damages, ecotourism sites and attractions, and water quality.

In each of the sectors, a distinction is made between direct and indirect damage. Direct damage refers to the damage suffered by productive assets, infrastructure and inventories. By definition they are damages to stocks and immovable assets that occurred at the same time as the natural disasters. These stocks comprise: physical infrastructure, buildings, installations, machinery and equipment, means of transportation, damage to stocks of land. Indirect damage refers to the damage done to flows of goods and services and income. The damage results as a consequence of the interruption of production and distribution processes from the moment the disaster occur. It can be defined as the sum of the value of income foregone (due to the interruption of production and distribution as a consequence of the natural disaster) and the increase in costs and expenditure to confront the damages of the disaster. As a matter of convention, the time domain for the estimation of indirect damage may include up to five years.\(^2\)

Estimates of direct and indirect damage for the economy as a whole are then presented in summarized format. Their magnitude is evaluated in relation to macroeconomic aggregates. The overall computation of the damage also includes a detailed macroeconomic assessment of the situation prior to the disaster, the projected macroeconomic performance without the disaster, and estimated economic performance of the economy as a result of both the direct and indirect costs and effects associated with the earthquake and landslides.

The report concludes with a presentation of guidelines for a recovery strategy and program. Of critical importance is the need to reduce vulnerability over time and increase resilience of the communities impacted upon by the hazard events. At the same time, community level recovery must be married with strategic policy interventions aimed at managing risks. A portfolio of projects aimed at facilitating recovery is therefore also included in this report.

\(^2\) Examples of indirect costs: losses in agricultural and industrial production due to land or factory destruction and damage; increasing transport costs (longer or alternative routes), lower incomes in service firms due to the interruption in the provision of those services.
The Effects

Events such as the flooding, earthquake and landslides serve to give stark reality to the inherent vulnerability of Small Island Developing States. Prior to the hazard events, Dominica’s economy was projected to grow by 2.6 per cent in 2004, as the country completes a two-year stabilization and adjustment programme. Tourism, construction and agricultural sectors had recorded significant increases during the preceding months of July to September, compared to the same period in 2003. However, the recently concluded visit by an IMF Mission expressed concern that key sectors like the banana industry continue to decline with no immediate signs of improvement. The Mission also stated that it was difficult to make a comprehensive assessment because the growth was “incipient” and that while some areas of the economy had grown others had not grown or were contracting. The Director of the Economic Stabilization and Adjustment Program has recently disclosed that ten per cent of the public sector wage bill will be slashed to bring expenditure in line with revenue.

As of October 2004, the fiscal operations of Central Government were estimated to result in a current account surplus of $6.0m or 0.8 per cent of GDP, with an overall surplus (after grants) of $18.8m or 1.4 per cent of GDP. On the external account, the current account deficit was estimated to contract as a result of the projected slower growth in imports and the improved performance of the tourism industry.

Most of the effects of the earthquake and the landslides are likely to be felt in 2005 since the disaster occurred at the end of 2004. With the earthquake and the landslides, in the absence of any reconstruction and recovery efforts economic activity is projected to decline by approximately from 2.6% (pre-disaster scenario) to 2% (post-disaster scenario). In the following year (i.e. 2005) under the same assumption the economy is projected to grow at 1% percent.

The impact of the series of hazardous events therefore makes for a situation that is rather complex in its entirety, and has implications for the overall debt burden of the country. Consideration may therefore need to be given to a combination of debt write off and or rescheduling, in order to mitigate the overall macro effects of these latest events.

One of the key challenges facing Dominica is how the effects of the disaster and the interplay between the internal and external factors will affect the country’s ability to maintain a fiscal stance allowing it to meet its debt commitments. Dominica’s public debt increased from 61% to 122% of GDP between 1991-1997 and 1997-2003. In 2003, the public debt to GDP ratio stood at 127%. Of this amount 88% is external debt and 39% represents internal debt. At the end of 2002 the country had the seventh ranking among the top 30 most indebted emerging market countries. The effects of the disaster are bound to translate into lower revenue collection and higher expenditure (mostly capital expenditure) due to recovery and rehabilitation activities (in particular in the agricultural sector). At the same time the country will need foreign exchange to cover some of its expenditures.

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3 Caribbean Net News at www.caribbeannetnews.com, December 9 2004
4 The other six are Guyana, Lebanon, St. Kitts and Nevis, Jamaica, Argentina and Antigua and Barbuda.
It is vital that capital be injected into the economy to undertake reconstruction activity and stimulate the economy in an effort to offset losses in agriculture in 2005. This capital should not add to the debt burden of the country and should take the form largely of grant flows to the fullest extent possible. Failure to inject this needed capital into the economy would result in a dampening of the growth for 2005, and a worsening of the fiscal situation.

The Future

The assessment presented in this report should form the basis for the government to identify and set national priorities for rehabilitating those areas that had been impacted upon by the floods, earthquake and the landslides associated with the events before and after 21 November. Of concern is that the northern and some other parts of the country continue to experience earth tremors, albeit weaker ones, caused by tectonic earthquakes as a result of being located in a zone of subduction in which the Atlantic Plate pushes under the Caribbean Plate. The continued shaking is bound to affect the soil and have long term impacts on infrastructure and housing stock. As late as 16 December, major landslides continue to occur. In addition Dominica is very prone to landslides and mudslides.

This report should be utilized as a basis for introducing disaster preparedness, planning and mitigation into the development planning apparatus of the country and into the consciousness of the people of the country, especially given the array of natural features which combine to make Dominica especially vulnerable to landslides, mudslides, volcanic activity, flooding and hurricanes. This is therefore the opportune time to put systems in place to assist in reducing overall impacts of such an event when they do occur. The following are some of the recommendations resulting from the discussion of Macro-economic and social effects:

- Land use planning, the review of building codes and standards, and environmental impact assessments for infrastructure development, including road construction, should be given priority. Technical assistance with respect to introducing natural disaster safety provisions in the rebuilding process is an immediate need, as is assistance relative to retrofitting for this purpose.
- A major campaign of public awareness with respect to disaster preparedness is indicated, as is a systematic approach to providing counseling to the many persons who are suffering post-traumatic stress disorder.
- The need to engage in programs relating to river engineering and bank stabilization.
- Review of Cut and Fill procedures relating to the construction of roads particularly in mountainous areas.
- Evaluation of Agricultural practices, systems of crop zonation and land tenure as that relate to agricultural ownership, given their implications with respect to the ability of farmers to undertake improvements (e.g. contour planting and contour drains) to land holdings.
- Integrated Watershed Management

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• Hazards Mapping – including landslide susceptibility maps, and seismic hazard zone maps\textsuperscript{6} - as a central element of Land Use Policy

It is vitally important for Dominica, and the other Member States of the OECS, to undergo the transition towards a culture of risk reduction. Risk reduction plans should not be a mechanical process in which a natural disaster leads to emergency response and then to remedy, but part of integrated policies to achieve social and economic stability and low risk.

\textsuperscript{6} The Seismic Unit in UWI/St. Augustine has developed seismic maps for the southern part of the country where there is seismic activity caused by volcanic action; it is now recommended that seismic maps be prepared for the north of the country which continues to experience seismic activity caused by tectonic movement.
Limitations of the Report

This report was undertaken over a four-day period, three weeks after the earthquake and landslides associated with it. The level of effort represented here is in keeping with both the amount of time available to the OECS Assessment Team, and the extent of the spatial damages of the hazard events.

The primary objective of the Mission was to undertake a critical assessment of the impact of damages, both direct and indirect, as well as their secondary causes and effects, on the macro-economic performance of the country in the short, and medium term. The assessment does not provide, for example, a quantitative analysis of the impacts on those in the informal sector and their linkages to the formal sector. Benchmark numbers with respect to those operating in the informal sector are not available, and as a result, their linkages, while they do exist, have not been quantified. It is important however to understand that they exist, and that the overall quantum of impacts is therefore likely to be higher.

The report provides an overall estimate of the magnitude of the damage and states the reconstruction requirements. It quantifies the losses and projects macro performance soon after the combined events in an effort to ensure that the critical discussions required, relative to the continued recovery of the Dominican economy, can start. It sets the basis for critical next step actions at both the community and national, and hopefully, international levels.
Preface

On Sunday 21st November 2004, Dominica was struck by a moderate earthquake measuring 6.0 on the Richter Scale. The epicentre of the earthquake was about 10 kilometres north of Dominica; the preliminary location of the event was 15.77°N 61.44°W. A strong aftershock followed at 09.36am. The quake was also felt in Antigua and Barbuda, Montserrat, St. Kitts and Nevis and St. Vincent and the Grenadines. The movement of tectonic plates caused the earthquake. Prior to the earthquake, the country had been subjected to heavy rainfalls that had caused rivers to overflow their flood banks and for soils to be over saturated and to result in landslides.

Pursuant to a request from the Prime Minister of Dominica to the Director General of the OECS, on 23 November 2004, the OECS Secretariat fielded a multi-disciplinary team to undertake a macro-socio-economic assessment of the damages caused by the earthquake and landslides. This Inter-Agency Team consisted of six persons from the OECS Secretariat, two persons from ECCB assisted by two specialist consultants. The OECS Team worked with local counterparts who had been assembled for coverage of each of the main sectors. Funding for the assessment was provided by UNDP. This assessment, which was undertaken from the 13th to the 17th of December 2004, complements the compilation of damage and needs assessments prepared by numerous other agencies.

The assessment presented in this Report includes estimates of direct and indirect damage to the economy as a whole: their magnitude was evaluated in relation to macroeconomic aggregates. The overall assessment of the damage also includes a detailed macro-economic assessment of the situation prior to the disaster, the expected situation without the disaster, and the estimated performance of the economy with the passage of the hurricane. The information presented is based on data that was available and on evidence collected through field visits and interviews.

The assessment employed was in accordance with the methodology that has been developed by UNECLAC7 and the OECS8. The focus of this methodology is on the valuation of the damage on the society, economy and environment of the affected parts of the country so that appropriate mitigation strategies can be formulated during the recovery phase in an effort to reduce the country’s vulnerability and build resilience with respect to these types of events. The recommendations for the recovery phase take into account an assessment of the worst affected social, economic, infrastructure and environmental sectors.

It is estimated that the magnitude of the loss exceeds the country’s ability to address recovery needs on its own, particularly since it is presently undergoing strict macroeconomic adjustments. Furthermore, international cooperation is considered essential if the aim is to also reduce the impact of similar events in the future. Consequently, outputs of the assessment include a tentative list of project outlines.

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Issues related to improved land use planning, watershed management, agricultural zoning, river engineering, structural preparedness for hazard events, and environmental impact assessments are seen as important considerations for the recovery process. Special attention and priority should be given to the allocation of resources to the reinforcement and retrofitting of vulnerable infrastructure, basic lifelines and services. Most of all, special attention has to be paid to the cutting and construction of roads particularly in the mountainous parts of the country.

The impact of the series of hazardous events however, make for a situation which is rather complex in its entirety, and has implications for the overall debt burden of the country which stood at 127% of GDP in 2003. While a portfolio of interventions and responses will be required, issues relating to the debt burden of the country will need to be carefully evaluated, and addressed. This is perhaps one of the most important aspects of the impact of these events. Indeed, the macro-economic effects themselves may very well require that consideration be given to a combination of different debt strategies including debt write off and/or rescheduling and restructuring, in order to mitigate the overall macro effects of these latest events, and to cushion the shocks on an already burdened economy.

It is essential that the natural disaster does not impair Dominica’s initiative and capacity to reduce the burden of its debt stock to sustainable levels over time, which is an essential part of the country’s Poverty Reduction and Growth Facility arrangement, by imposing an adjustment burden that is beyond the country’s capacity to endure.9

It is also fundamental to take into account as it will be shown in Section III that the fiscal situation cannot be viewed in isolation from the external position of the country. Export performance is a variable that limits the scope and effectiveness of fiscal policy. Fiscal policy can ultimately work only if the external conditions allow it to work. Thus any attempt at fiscal adjustment, reform or consolidation must also go hand in hand with efforts to develop export promotion strategies and to raise the productivity of imports. Debt reduction strategies must incorporate options to soften the external constraint.

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I. Background

1. The Mission

The OECS Mission was deployed on December 13th 2004. Mr. Michael Norris in the Ministry of Finance was appointed as the focal point for the OECS Team. Mr. Collin Bully and Ms. Deborah Blackman of the OECS Export Development Unit in Dominica were responsible for coordinating all logistical support to the Mission Team. The Members of the Mission are identified below:

Dr. Len Ishmael  
OECS, Director General

Dr. Claudius Preville  
Caribbean Regional Negotiating Machinery, Macro-Economist (on secondment to the OECS Secretariat)

Dr. Vasantha Chase  
OECS, Environmental Specialist

Mc. Valerie Isaac St. Hill  
OECS, Environmental Specialist

Ms. Rosalyn Hazelle  
OECS, Social Scientist

Mr. George Alcee  
OECS, Agricultural Specialist

Ms. Laurel Bain  
ECCB, Macro-Economist

Ms. Theresa Smith  
ECCB, Macro-Economist

Dr. David Smith  
Smith Warner International, Coastal Engineer

Mr. Roosevelt Isaac  
Strata Engineering Consultants, Geo-technical Engineer

Local counterparts provided continuous support to this effort.

2. Description of the Phenomena and their Effects

On Sunday 21\textsuperscript{st} November 2004, at 7:45AM, Dominica was struck by a moderate earthquake measuring 6.0 on the Richter Scale. The epicenter of the earthquake was about 10 kilometers north of Dominica (Fig. 1); with the preliminary location of the event being at 15.77\textdegree N 61.44\textdegree w. The quake was also felt in Guadeloupe, Antigua, Montserrat, St. Kitts and Nevis and St. Vincent and the Grenadines. The earthquake was determined to be caused by tectonic plate movement (Fig.2) and not by volcanic activity.

Figure 1  Map of Dominica Showing Epicentre of Earthquake
Prior to this earthquake, there had been ongoing activity in the vicinity of Dominica since 24\textsuperscript{th} March 2004. This activity is summarized as small burst of about nine (9) earthquakes, with magnitudes of 2.1-2.5, and with epicenters in the northern part of Dominica.

On November 21\textsuperscript{st}, in the first hour after the event, there were over 30 earthquakes with magnitude 2.0 or greater. Six hours after the main shock, over 200 events had been generated, with the largest of these ranging in magnitude from 3.4-3.9. This aftershock activity has continued into December, and can be summarized as follows:

- 26\textsuperscript{th} November – Just north of Dominica, with magnitude 4.6
- 3\textsuperscript{rd} December – Just west of Dominica, with magnitude 4.3
- 4\textsuperscript{th} December – West of Dominica, with magnitude 3.7
- 7\textsuperscript{th} December – Just northeast of Dominica, two earthquakes occurring five minutes apart, with magnitudes 4.0 and 3.8 respectively
- 14\textsuperscript{th} December – North of Dominica, with magnitude 4.3
Figure 3 above (Seismic Research Centre, Trinidad, W.I.) shows the annual number and magnitude of earthquakes in the Dominica-Guadeloupe region and serves to illustrate the significant increase that has occurred since November 21st, 2004. The burst of low magnitude events in 2001 and 2003 occurred in northern Dominica. By contrast with the number of earthquakes experienced on an annual basis between 1990 and 2003, over 700 earthquakes have been recorded since Sunday 21st November 2004.

The earthquakes by themselves would have been expected to trigger landslides, given the geologic makeup of the island. This impact was, however, exacerbated by the excessive rainfall that occurred prior to, and in the same week as the earthquake, and which led to widespread flooding of several communities. Weather reports indicate that after three days of heavy rainfall, a number of rivers overflowed their banks, triggering numerous landslides. Approximately 1500 people were cut off from the rest of the island in the communities of: Grand Fond, Rosalie, Good Hope, Laplaine, Delices, Riviere Cyrique, Scottshead and Petit Souffriere. The earthquakes which followed this flooding triggered further landslides, thereby exacerbating the situation.

The northern section of Dominica, and in particular the Portsmouth District, was severely affected by the quake that caused serious structural damage. Assistance to the area was hampered due to blocked roads into Portsmouth. This was a result of mudslides from the heavy rains that had impacted the country a few days prior to the earthquake.
Initial reports indicated that a number of buildings and 2 historic churches had sustained serious damage. The Portsmouth Hospital was evacuated because of structural damage to the building. Twenty-five persons were reported to have sought refuge in shelters.

**Figure 4** Damage to the Roman Catholic Church in Portsmouth

![Damage to the Roman Catholic Church in Portsmouth](Photo Credit: OECS)

The airport in Melville Hall was closed for the day (of the earthquake) and 8 flights were re-routed. It took firemen a day and a half to wash away the mud and debris that had been washed on to the road in front of the airport building.

Scouring and erosion of river-banks continues to be very evident. This is problematic where these river-banks are adjacent to unstable cliffs. A number of landslides, particularly in the south-east of the country, were also reported. These slides were caused by the over saturation of the soil and have resulted in the destruction of many roads, especially feeder roads into rural communities. Agricultural production has been impacted and the water supply to one community still remains cut off because of the high incidence of minerals (manganese and iron oxide) in the water. One water distribution system has been shut down because of heavy levels of sediment loading.

While there were initial concerns of sediment loading of the rivers and of the coastal waters, at the time of writing this report, there was no longer such visual evidence. It is, however, possible that the fringe coral reefs along the coast may have been covered in sediment. The impact of sediment loading of the nearshore coastal resources will only be known in about 2 to 3 months time when fishermen revert to fishing in coastal waters; they are presently engaged in the fishing of pelagic species.

From an historical perspective, there are many factors that combine to make Dominica very vulnerable to landslides. These include the volcanic origin of the slopes on the island, which create stratigraphic and lithologic conditions that favour landslides. The geology of Dominica is almost entirely of volcanic origin, with the main rock types being andesite, dacite and basalts in various forms. Most of the volcanic rocks occur as pyroclastic, varying from coarse agglomerates and breccias, agglomerate ashes to fine ashes and tuffs although coarser fragmented rocks predominate. The basalts however, are often seen as flows, especially in the north and central parts of the island.
The surficial soil cover varies over most of the island, but saprolitic and lateritic residual soils form the dominant surficial deposits.

The main triggering factor for landslides is rainfall, during which an increase in pore-water pressure leads to decreased soil strength. In the past, a number of major landslides have affected Dominica. These include:

- One in the village of Bagatelle during heavy rainfall in 1977. This resulted in eight deaths.
- Delays to the construction of the Dominica Hydroelectric Expansion Project, due to massive landslides, and
- The largest and most significant landslide in recent history, in the Layou River Valley. This series of slides started in March 1997 and culminated in November 1977. Fortunately, no lives were lost in this event.

In all, a total of twenty-five deaths have been recorded in Dominica as being due to landslides.\(^\text{10}\)

In 2004, the island experienced unusually high periods of rainfall, especially during the month of November when 912 mm of rainfall was recorded. Figure 5 provides a summary of rainfall data for Dominica over the past five year period.

3. Affected Population

3.1 Description of Affected Population

The Commonwealth of Dominica has a population of 69,625 and comprises of ten parishes. The earthquake of November 21, 2004 mainly affected the parishes of St. John, St. David and St Andrew. The impact was most severely felt in the parish of St. John and the Northern end of St. Andrew.

Table 2
Population by Parish

<table>
<thead>
<tr>
<th>Parish</th>
<th>Male</th>
<th>% of total</th>
<th>Female</th>
<th>% of total</th>
<th>Total</th>
<th>% of total</th>
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<tr>
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<td>5765</td>
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<td>778</td>
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<tr>
<td>St. Mark</td>
<td>935</td>
<td>49.0</td>
<td>972</td>
<td>51.0</td>
<td>1907</td>
<td>2.7</td>
</tr>
<tr>
<td>St. Patrick</td>
<td>4273</td>
<td>51.0</td>
<td>4110</td>
<td>49.0</td>
<td>8383</td>
<td>12.0</td>
</tr>
<tr>
<td>St. David</td>
<td>3658</td>
<td>54.1</td>
<td>3100</td>
<td>45.9</td>
<td>6758</td>
<td>9.7</td>
</tr>
<tr>
<td>St. Andrew</td>
<td>5298</td>
<td>51.7</td>
<td>4942</td>
<td>48.3</td>
<td>10240</td>
<td>14.7</td>
</tr>
</tbody>
</table>


The island also experienced torrential rains and as a result mudslides were triggered in the areas of Castle Bruce, Grand Fond, Morne Jaune, Calbishie, Petite Soufriere, Marigot and Good Hope. The villages of Grand Fond and Morne Jaune were also isolated as a result of the hazardous road conditions caused by landslides.

Figure 6
Landslide Blocking the Community of Capuchine
The population affected by the Earthquake and Landslides was 19,527 or 28% of the total population. This represents a total of 7,944 households, 35.2% of the overall 22,359 households in Dominica. Many of those affected were part of the farming community. Fortunately, despite the severity of the earthquake and the number of landslides there was no loss of life.

The Poverty Assessment conducted in 2002 indicated that 39% of persons in Dominica were poor and 15% were indigent or extremely poor. The Poverty Assessment also indicated that 29% of the households in Dominica were poor with 11% being indigent households. In the affected areas of St. Andrew, St. John and St. David 25%, 28% and 52% of the households respectively are poor. This means that in fact the overall impact of these events hit hardest those who were already poor.

The annual expenditure of the poorest quintile is EC$2,670.00 which is considered to be the cost of meeting the minimal food and other basic non-food items. The assessment found that poverty in the Carib population was even higher with 70% of the population poor and almost half being indigent.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>HOUSEHOLDS %</th>
<th>POPULATION %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indigent/very poor</td>
<td>11%</td>
<td>15%</td>
</tr>
<tr>
<td>Poor</td>
<td>29%</td>
<td>39%</td>
</tr>
<tr>
<td>Non poor</td>
<td>71%</td>
<td>61%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Poverty Assessment 2002

Disasters are linked to natural events and are essentially an issue of development. Low-income populations and communities are usually affected disproportionately by natural hazards. In the case of Dominica the effects of the disaster on the parishes with the highest proportion of the poor exacerbated an already strenuous situation. This became evident in the aftermath of the earthquake and landslides particularly in St. David where 52% of the households are poor. In that parish, cultivated farmlands of bananas and coconuts were washed away and access roads to these farms were impassable. Farm to market access road in Grand Fond in the parish of St. David remains disrupted making it impossible to market produce on which the community depends for its livelihood.
The affected areas were without the supply of safe pipe-borne water. The water supply was restored to most of the other affected communities after three (3) days. However, the village of Clifton was without water for one week. The water supply system in Riviere Cyrique has had to be closed as a result of high levels of manganese and iron found in the water. A massive landslide in the intake area of the water source caused this.

### Table 4  Distribution of Household Poverty by Parish

*Figures in () relate to population. All other figures relate to households

Source: Official Statistics

<table>
<thead>
<tr>
<th>PARISH</th>
<th>Indigent</th>
<th>Poor</th>
<th>All Poor</th>
<th>Not Poor</th>
<th>Total</th>
<th>% of all poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. George (Roseau)</td>
<td>5%</td>
<td>13%</td>
<td>18%</td>
<td>(23%)*</td>
<td>82%</td>
<td>100%</td>
</tr>
<tr>
<td>Rest of St. George</td>
<td>11%</td>
<td>12%</td>
<td>24%</td>
<td>(39%)</td>
<td>76%</td>
<td>100%</td>
</tr>
<tr>
<td>St. John</td>
<td>7%</td>
<td>21%</td>
<td>28%</td>
<td>(37%)</td>
<td>72%</td>
<td>100%</td>
</tr>
<tr>
<td>St. Peter</td>
<td>6%</td>
<td>12%</td>
<td>17%</td>
<td>(31%)</td>
<td>83%</td>
<td>100%</td>
</tr>
<tr>
<td>St. Joseph</td>
<td>13%</td>
<td>20%</td>
<td>33%</td>
<td>(44%)</td>
<td>67%</td>
<td>100%</td>
</tr>
<tr>
<td>St. Paul</td>
<td>12%</td>
<td>11%</td>
<td>23%</td>
<td>(36%)</td>
<td>77%</td>
<td>100%</td>
</tr>
<tr>
<td>St. Luke</td>
<td>4%</td>
<td>28%</td>
<td>32%</td>
<td>(48%)</td>
<td>68%</td>
<td>100%</td>
</tr>
<tr>
<td>St. Mark</td>
<td>13%</td>
<td>31%</td>
<td>44%</td>
<td>(62%)</td>
<td>56%</td>
<td>100%</td>
</tr>
<tr>
<td>St. Patrick</td>
<td>9%</td>
<td>32%</td>
<td>41%</td>
<td>(48%)</td>
<td>59%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>St. David</strong></td>
<td><strong>28%</strong></td>
<td><strong>23%</strong></td>
<td><strong>52%</strong></td>
<td>(67%)</td>
<td><strong>48%</strong></td>
<td><strong>100%</strong></td>
</tr>
<tr>
<td><strong>St. Andrew</strong></td>
<td><strong>9%</strong></td>
<td><strong>16%</strong></td>
<td><strong>25%</strong></td>
<td>(32%)</td>
<td><strong>75%</strong></td>
<td><strong>100%</strong></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>10%</strong></td>
<td><strong>18%</strong></td>
<td><strong>29%</strong></td>
<td>(39%)</td>
<td><strong>71%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Under these conditions the water cannot be adequately chlorinated. The water in this village remains off line; it is anticipated that it will be returned to normalcy by the end of December. Alternatively, if this matter cannot be addressed it is being anticipated that water will have to be rerouted from a neighbouring community. The villages of Good Hope, Petite Soufriere, San Sauveur, Tranto, Depa and Castle Bruce in the parish of St. David were without electricity for one week. These services have now been restored.

The solid waste and on-site excreta and wastewater disposal services were not adversely affected.

#### 3.2. Vulnerability of Women and Children

In Dominica, households headed by males account for some 66% with 34% being headed by females. According to the Poverty Assessment, “there is no significant difference in the gender distribution of poverty where 50% of those poor were males and
50% were females.\textsuperscript{11} However, irrespective of the quantitative results of the assessment, the plight of women with large families, doubling responsibility of raising children and bread-winning coupled with oftentimes inadequate support from absent fathers, can be very severe. The report states, “around 20% of poor households have no adult male present.”\textsuperscript{12} The report also indicates that poor households in Dominica tend to be much larger than non-poor households. The average size of poor households is 4.5 persons as compared to non-poor household of 2.8 persons.

The living conditions and capabilities of the head of household is important as it affects issues of intergenerational poverty, the life chances of children and other dependents, such as youth and elderly who live in the household. Over 40% of poor households are multigenerational (three generations) or extended households\textsuperscript{13}. This is consistent with the greater average size of poor households. About 70% of poor households include children compared with 44% of non-poor households.

In the village of Grand Fond in the parish of St. David, 174 secondary school students and 4 teachers of Castle Bruce Secondary School have been unable to return to the classroom as a result of the hazardous nature of the roads.

\section*{3.3. Psycho-Social Trauma}

Although approximately, the earthquake and landslides directly affected 19,527 people, it is estimated that 40,000 are considered at high risk for psychosocial trauma. In addition, according to health officials several people were socially displaced and many more suffer from sleep deprivation.

Dominica’s populace had never before experienced an earthquake of this magnitude. Many elderly persons confirmed this to be the first in their lifetime. It is reported that people were very shaken and gathered in large numbers in the streets, while others were too afraid to return to their homes or to sleep in their beds. The event has resulted in stress and psycho-social trauma especially for residents in the north and northeast. Several residents of these areas have been traumatized by the experience of the earthquake, lost or damage of property and the aftershocks that followed. Many have expressed that they are experiencing:

- Sleepless nights
- Loss of appetite
- Fear of being in their homes and workplaces
- Fear of being or sleeping alone
- Elevated blood pressure due to anxiety caused by the situation
- Stress due to displacement
- Anxiety

Community meetings are being held in an attempt to allay some of the fears and concerns of the members of these communities. However, based on the psycho-social trauma experienced by the affected population, it is imperative that some psychosocial interventions be provided. Responding social agencies including health have indicated

\textsuperscript{11} Dominica Country Poverty Assessment; volume one.
\textsuperscript{12} Dominica Country Poverty Assessment, page 78; volume one
\textsuperscript{13} Dominica Country Poverty Assessment, page 57; volume one
the need to implement a Community based stress management programme utilizing the PAHO Stress Management in Disaster Approach.

4. Emergency Actions

4.1 Government Actions

The Coordinator of the National Emergency Planning Organization (NEPO) reported the passage of the earthquake to CDERA on November 21, 2004. An agreement was reached to airlift emergency relief supplies to the communities that were inaccessible as well as the provision of engineering personnel to carry out initial assessments of the impact of the earthquake on the island. NEPO also activated the Disaster Response Plan and several initiatives were undertaken to respond to the disaster in the immediate aftermath as follows:

- Request through CEDERA, PAHO and other agencies for immediate assessment
- Local preliminary assessments of affected areas were also conducted
- Aerial reconnaissance
- Airlift of relief and medical supplies to isolated areas
- Relocation of patients from the Portsmouth Hospital and relocation of the health centre services
- Schools in the affected areas were ordered closed
- Emergency protection of food and drinking water supplies activated
- Parish response teams, counsellors from the Ministries of Education and Health provided emotional support
- A coordinated response by the electronic media to disseminate information to the people

Almost immediately following the disasters the Cabinet, headed by the Prime Minister, undertook a first hand assessment of the areas affected. The Prime Minister and the Minister of Communication, Works and Housing also undertook an aerial reconnaissance of the eastern part of the island. Several press conferences were held to inform the people of the existing situation and to allay the fears of others.

The Disaster Preparedness Office with assistance from the regional seismology office conducted town hall meetings with residents in affected areas. Teams from various central and local governments carried out preliminary assessments of affected areas. A preliminary assessment report was submitted to Cabinet in the week immediately following the disaster.

4.2 International Cooperation

A team from CDERA arrived in Dominica on November 23, 2004. This team comprised of Julie Leonard, CDERA's Preparedness and Response Manager, along with the representatives from USAID/OFDA, Mr Kilas Narayan, CIMH Mr. Yamakawa, and Drs Derick Gay and Robert Clarke of the UWI. The team met with the Prime Minister. The
Government of Trinidad provided a team of three engineers, who joined the CDERA team.

PAHO/WHO has provided technical assistance to assess the impact on the health services in the northern town of Portsmouth, which was worst hit by the earthquake. PAHO/WHO also supported an initial structural assessment of the Portsmouth Hospital.

The World Bank has indicated its willingness to provide budgetary support of about US$225,000 by re-allocating the un-disbursed balance from the Emergency Recovery Project. The funds (which are savings under the project) will be used for post-disaster rehabilitation.
II. Assessment of the Damage

This chapter contains an assessment of the damage caused by the earthquake and landslides to the social sector (housing, education and health), infrastructure and telecommunications, and production sectors (agriculture, including fisheries; and tourism), and to the environment, including water and sanitation. The assessment was carried out on the basis of information available during the mission. Direct and indirect damages or costs were assessed. The former refer to the damage suffered by productive assets, infrastructure and inventories. By definition they are damages to stocks that occurred at the same time as the natural disasters. These stocks comprise: physical infrastructure, buildings, installations, machinery and equipment, means of transportation, damage to stocks of land.

Indirect damage refers to the damage done to flows of goods and services and income. The damage results as a consequence of the interruption of production and distribution processes from the moment the disaster occurs. It can simply be defined as the sum of the value of income foregone due to the interruption of production and distribution as a consequence of the natural disaster and the increase in costs and expenditure to confront the damages of the disaster.

The costs of rebuilding damaged assets have also been calculated where relevant. If the aim were to return to the situation prior to the flooding, earthquake, and associated landslides, the value would be the same as the direct cost according to this methodology. However, for the purpose of a reconstruction programme, the assessment also takes into account when possible, the value of improved replacement, including disaster prevention and mitigation criteria, such as the use of improved technology, higher quality and more resistant structures. Natural disasters provide a country with an opportunity to rebuild, at a higher and better standard, in an effort to reduce vulnerability and build resilience to similar future events.

The figures used in this chapter were calculated in local currency.

1. Social Sectors

1.1 Housing

Some 150 homes sustained damage due to the earthquake as well as landslides, 90 of the damaged homes are located in the town of Portsmouth. It is important to note that some persons reported that damage has worsened with some of the aftershocks while others say they are only now discovering some of the damage to homes. The reported levels of damage vary in severity ranging from minor damage to complete destruction, 3% of the homes will require reconstruction.
The costs to repair and replace the damaged housing stock to a similar condition is valued at EC$5,801,000. This is based on the estimated costs of replacement of a low-income home at a rate of EC$150 per square foot while the cost of a middle income home is EC$225 per square foot.

### Table 4  Summary Effects on the Housing Sector

<table>
<thead>
<tr>
<th></th>
<th>Thousands of EC Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>5,801,000.00</td>
</tr>
<tr>
<td><strong>Direct effects</strong></td>
<td></td>
</tr>
<tr>
<td>i. Reparation of damaged houses</td>
<td>4,751,000.00</td>
</tr>
<tr>
<td>ii. Replace of lost houses</td>
<td>1,050,000.00</td>
</tr>
</tbody>
</table>

Source: OECS estimates based on official sources and consultation with government officials

### 1.2 Education

The situation in the education sector is not unlike that of the housing sector, in that the damage to schools was due both to the earthquake and to landslides. All levels of schools were affected and the damage sustained was significant. Most of the affected schools are government owned including the Portsmouth Secondary School and the Roosevelt Douglas Primary School, both located in Portsmouth, and the Salybia Primary School located in the Carib Reserve. The estimated costs for damage to the education sector, that is direct costs, is EC$7,750,000.00.
Table 5 above shows the details of the costs of repair and reconstruction to the public schools by selected parishes.

1.3 Historic Sites

Damage to historical sites by the earthquake is extensive in the town of Portsmouth and in the village of Vieille Case. In Portsmouth, the over 100-year old Catholic Church sustained extensive damage; the Methodist church was also severely damaged. The Catholic Church in Vieille Case built in 1931, also experienced extensive damage including a collapsed tower. The Preliminary Structural Forensics Report by the CDERA/UWI Team indicated that these structures are not immediately reusable and recommended extensive repairs. The total cost of the repairs amounted to EC$1,540,000.
Table 6  Historical Sites Damaged by Earthquake and the Cost of Repair (Direct Costs in EC$)

<table>
<thead>
<tr>
<th>Structure</th>
<th>Damage</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portsmouth RC Church</td>
<td>Collapsed URM tower and gable end and portion of front side walls; severely damaged beams over side walls</td>
<td>1,200,000</td>
</tr>
<tr>
<td>Portsmouth Methodist Church</td>
<td>Collapsed URM tower and gable end; minor walls cracking</td>
<td>40,000</td>
</tr>
<tr>
<td>Vieille Case RC Church</td>
<td>Collapsed URM tower and gable end and tower; minor walls and arches cracking and spalling; partial roof collapse</td>
<td>300,000</td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
<td></td>
<td><strong>1,540,000</strong></td>
</tr>
</tbody>
</table>

Source: CDERA Report

1.4 Health

The health sector suffered infrastructural damage to some of its health facilities. The Reginald Fitzgerald Armour Hospital in Portsmouth, which suffered some damage, was evacuated as a precautionary measure following the earthquake. The health centre attached to the Marigot Hospital suffered wall cracks throughout, while the Clifton Health Centre was also damaged prompting the relocation of its basic medical services to the Cottage Village Community Centre. There was also some brief interruption of water supplies and electricity at other locations.

The Consulting Engineers Partnership LTD (CEP) indicated in their report to PAHO that the scope of the damaged did not warrant demolition of the main building, but that the covered area over the driveway may require demolition. They stated further that the damage observed in the main appeared to be non-structural in type and confined to blockwall partitions. However, the report also mentioned that further investigation should be carried out to ascertain a number of possible actions including whether the existing structure can withstand the code-required earthquake parameters. The estimated cost for repairing health facilities is EC$ 200,000.

2. Damage In Productive Sectors

2.1 Agriculture\textsuperscript{14}

2.1.1 Overview

The Dominican economy is very dependent on agriculture, livestock, and fisheries and remains highly vulnerable to physical climatic conditions and to developments in the international economic environment. The sector, though declining continues to play a

\textsuperscript{14} Agriculture as used in this text includes livestock and fisheries.
significant role in the overall social and economic development of the country. It remains the leading contributor to GDP at factor cost, constant prices. Although the sector recorded a declining trend in its contribution to GDP between 1996 and 2001 (21% and 17.5% of GDP for both years) it has since then stabilised around 17%-18% of GDP. (See Figure 10 below).

![Figure 10](image-url)

Source: ECCB National Accounts Data.

The decline in agriculture’s contribution to GDP is largely due to the changing fortunes of the banana industry. The industry’s export value declined from $45mil to $12.8mil in 2003. (See Figure 11 below)

![Figure 11](image-url)


The decline in banana output resulted from a reduction in acreage cultivated and the number of active growers that decreased from 6,218 in 1995 to 2,435 in 2000. Despite its steady decline, the agricultural sector continues to provide employment to 40 per cent of the labour force\(^\text{15}\). Apart from the export commodities - bananas, soap, bay oil,

\(^{15}\) This is followed by industry and commerce with 32 percent, and services with 28 percent (CIA, World Fact Book – Dominica, updated 30, November, 2004).
vegetables, root crops, plantain and citrus - the sector also produces a wide range of agricultural products for internal consumption. In 2002 the contribution from crop production was estimated at $152,647,808.  

The agricultural sector performs a multifunctional role in generating foreign exchange, providing employment, contributing to food security and as a stimulant to other economic activities. Agriculture must therefore be positioned to achieve sustained economic and social development, and address issues of rural development.

Figure 12  Damage Caused by Flooding and Land Slide

Photo Credit: OECS

2.1.2  Description, Analysis and Estimation of the Damage

Following the torrential rains, the earthquakes and landslides, the agriculture sector suffered damages to infrastructure, crops, livestock and fisheries. The damage was most severe in the South eastern region where 20 per cent of the dasheen crop was washed away. In addition, 1,175 cartoons of bananas were left in the field, in La Plaine, because the feeder road was not accessible. It should be noted that the damages in this part of the country were from flooding and landslides. In all, the hazard events impacted on 28-farm access feeder roads in the North, Northeast, East and South eastern agricultural regions. The damage to the feeder roads resulted from landslides, erosion of surface and sub-base material, and damaged culverts, drains and bridges.

Some farms and field crops also sustained damage in the North, Northeast, Southeast, and Eastern regions: 100 acres of dasheen (260 farmers); 31 acres of bananas (16 farmers); and 17 acres of plantain were completely demolished by land slippage. Tree crops and vegetables were also lost as a result of flooding and land slippage.

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16 Agriculture Information & Communication Technology Unit, AICTU, Ministry of Agriculture, Dominica. 
17 The exact acreages cannot be ascertained.
Table 7  Direct Damage EC$

<table>
<thead>
<tr>
<th></th>
<th>Crops</th>
<th>Livestock</th>
<th>Fisheries</th>
<th>Farm Infrastructure</th>
<th>Irrigation and drainage</th>
<th>Farm soil loss</th>
<th>Farm roads</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,610,501</td>
<td>27,000</td>
<td>61,480</td>
<td>13,600</td>
<td>2,620</td>
<td>11,905,720</td>
<td>22,420,000</td>
<td>36,040,921</td>
</tr>
</tbody>
</table>

Source: OECS and Official Statistics

Table 8 summarises the direct and indirect damage to the agricultural sector. The total direct and indirect damages were estimated at 36 million and 20 million EC$ respectively or 64% and 34% of the total respectively. That is by far the greatest part of the damage is direct damage.

Table 8  Summary of Direct and Indirect Damage to Agricultural Sector

<table>
<thead>
<tr>
<th>Damage</th>
<th>Direct</th>
<th>Indirect</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crops</td>
<td>1,610,501</td>
<td>1,823,943</td>
<td>3,434,444</td>
</tr>
<tr>
<td>Livestock</td>
<td>27,000</td>
<td>27,000</td>
<td>54,000</td>
</tr>
<tr>
<td>Fisheries</td>
<td>61,480</td>
<td>213,840</td>
<td>275,320</td>
</tr>
<tr>
<td>Farm infrastructure</td>
<td>13,600</td>
<td>13,600</td>
<td>27,200</td>
</tr>
<tr>
<td>Irrigation &amp; drainage</td>
<td>2,620</td>
<td>2,620</td>
<td>5,240</td>
</tr>
<tr>
<td>Farm roads</td>
<td>22,420,000</td>
<td>18,000,000</td>
<td>40,420,000</td>
</tr>
<tr>
<td>Farm soil loss</td>
<td>11,905,720</td>
<td>11,905,720</td>
<td>23,811,440</td>
</tr>
<tr>
<td>TOTAL</td>
<td>36,040,921</td>
<td>20,037,783</td>
<td>56,078,704</td>
</tr>
</tbody>
</table>

Source: OECS and Official Reports

Crops
Crop losses associated with the events were recorded in bananas, root crops (primarily dasheen), plantains, vegetables and tree crops. The damage recorded included the impacts of landslides, flooding and erosion of topsoil. The excessive moisture conditions also led to a leaching of soil nutrients. It should be remembered a corollary of leaching is a reduction in soil fertility and crop yields, resulting in further impacts later on.

In estimating the crop losses, consideration was given to the crops ready for harvest at the time of the disaster. The losses for annuals destroyed were recorded as a loss on investment in labour and inputs. The loss of applied soil nutrients through leaching was also estimated in accordance with the life cycle of the crop.

The crop sub-sector contributed EC$73.3m to GDP in 2003 and to date, has contributed EC$76.2m.

Forestry
The impact on forestry was minimal when compared to the crop sub-sector. Slight damages were sustained to the Cabrits National Park and Emerald Pool as a result of falling rocks and stones and water erosion on trails respectively. Some damage was also recorded in the forest reserve as a result of landslides.

The forestry sub-sector contributed EC$3.5m to GDP in 2003.
Livestock
The livestock sub-sector suffered mortality losses as a result of landslides and flooding. Total losses of 7250 rabbits, 8 pigs and 8 head of cattle have been provided in official records. There was also some loss of small ruminants.

The livestock sub-sector has been a steady contributor to GDP contributing EC$7.7m in 2003.

Fisheries
The fisheries sub-sector suffered minimal damage to infrastructure. However, losses of six outboard engines, which sank as a result of torrential rains and flooding, were recorded.

Siltation and debris as a result of erosion occurred in all regions but the greatest impact is observed on the East coast because of its sub-marine topography. The assessment of damage to the fisheries stock will be estimated by the volumes landed during the period January to March, when fishermen engage in inshore fishing.

The fisheries sub-sector contributed EC$8.8m in 2003.

Farm roads
A total of 28 farm roads serving the farming population were damaged. The damage sustained included erosion of surface and sub surface material, road slippage, broken bridges. The damages coupled with blockage due to landslides made farm holdings inaccessible.

Farm soil loss
In the regions of the North, Northeast, Southeast and East where soil and crop loss was extensive, a value was assigned to the damage based on the production potential of the land over the next 10 years. The average productivity levels of the dasheen, plantain and bananas lost was used to estimate the loss of farmland.

2.2 Tourism

2.2.1 General Overview

Tourism in Dominica generates about EC$114 million annually in direct visitor expenditures. About eighty-eight percent of these expenditures (or EC$100 million) originate with the stay over tourist – defined as those electing to stay in paid accommodation, those visiting friends and relatives and staying at private homes, and excursionists who stay for at least one day. The remaining 12% (or EC$13.5 million) of Dominica’s tourism business is generated by cruise ship arrivals\(^\text{18}\). The indirect damages incurred as a result of interruption of income due to cruise ship cancellations following the earthquake was estimated at EC$198,000. Dominica’s tourism sector includes about 675 rooms in accommodation ranging from hotels to apartments, cottages and guesthouses.

\(^{18}\) Draft National Tourism Policy
The dive product, nature tourism, and to a lesser extent the soft adventure product, are highlights of Dominica's tourism sector. The dive product in particular has succeeded in establishing itself as a competitive, international class experience offered by Dominica.

The ecosystems of Dominica are of major economic significance for subsistence and commercial agriculture, forestry, fisheries and tourism. Although activities in and around the coastal areas are an important element of the tourism product, Dominica's tourism experiences are focused on key nature attractions. This increasing reliance on ecotourism means that the vulnerabilities of the forestry and the terrestrial and coastal eco-systems are also the vulnerabilities of the tourism sector. Annually, about one-half to three-quarters of all tourist arrivals visit the ten eco-sites owned by the public sector (and managed either by Parks or Ministry of Tourism).

Estimated total net revenues generated annually from these eco-sites increased in 1998-1999 from EC$1,034,884.99 to EC$1,457,617.14 for the period 2003-2004. 90% of revenues generated by the Parks Division during the 2003-2004 period, were obtained from the most popular sites: Trafalgar Falls, Emerald Pool and Indian River. These figures represent the user fees charged to non-residents by the Parks Division for entrance into the sites. The amounts do not include fees paid by site visitors (resident and foreign) directly to tour guides and commissions paid to vendors. If these were included, then the estimated income obtained from these sites is significantly higher than that recorded by the Parks Division.

<table>
<thead>
<tr>
<th>Table 9 Sites &amp; Attractions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sector</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Tourism</td>
</tr>
<tr>
<td>(eco-tourism)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

The Indian River Bridge that spans the mouth of the Indian River from which tours up the river commence, sustained some structural damage as a result of the earthquake. For public safety, the bridge will have to be replaced in the short term. Reconstruction of the Indian River Bridge will result in the interruption of the river tours. The installation of a temporary structure further up the river would therefore be required to facilitate the continuation of guided tours. The indirect costs are therefore associated with the

19 These sites are Emerald Pool, Trafalgar Falls, Freshwater Lake, Boeri Lake, Soufriere Sulphur Springs, Middleham Falls, Cabrits, Indian River, Syndicate and Boiling Lake.

20 Walsh, National Parks Division, 2004.
construction of a temporary Bailey Bridge, which would cease tours for approximately 4 months.

Direct cost to repair water erosion damage to a section of the Emerald Pool and Trafalgar Falls trails was estimated at EC$29,000\textsuperscript{21}. The water system was also affected and the cost for two additional water tanks was estimated at EC$30,000. Although the Emerald Pool site exit trail has been closed, no indirect damages were considered since the site is still accessible and tours have not been affected.

In summary total costs amount to EC$382,000. Direct and indirect costs represent 18% and 82% of the total respectively.

3.0 Infrastructure

3.1 Public Utilities

Electricity
The Dominica Electricity Services Ltd. (DOMLEC), headquartered at 18 Castle Street, provides Roseau electricity services in Dominica. Resulting from the excessive rainfall, landslides and earthquake, a number of electric poles that were located at the edge of steep slopes, were carried away when the landslides occurred. For the most part, these losses occurred in remote communities on the eastern side of the island.

A damage assessment carried out by DOMLEC personnel revealed damage primarily to the high voltage lines. Damage was experienced in Formelle, Good Hope, Petite Savanne and Batali. In all, approximately 1600 ft of line will need to be replaced, and

\textsuperscript{21} Personal communication with the Director of Forestry
one 3-pole structure. All affected communities across the island, with the exception of Good Hope, had electricity within days after the earthquake event. This was due to difficulty in transporting the necessary materials to this location.

Some damage also occurred to DOMLEC buildings, although this was largely of a minor nature and characterized by cracking and spalling of concrete.

The cost of damages to these buildings was estimated to be EC$10,000 by DOMLEC management.

**Water Supply**
The Dominica Water and Sewerage Co. Ltd. (DOWASCO), located at 3 High Street, Roseau, provides water supply and sewerage in Dominica. During and following the periods of heavy rain and earthquakes, most of the problems that were experienced by this company pertained to:
- Siltation of intake structures;
- Land slides;
- Rivers in spate, resulting in the dismantling of sections of pipeline.

In general, however, infrastructural damage to this utility was not considered to be significant.

*Figure 14  Impact of Landslide on Pipeline Infrastructure*

A damage assessment carried out by DOWASCO revealed the following breakdown:

- General material requirements  EC$11,000
- General labour requirements  EC$19,000
- Clearing intake at Riviere Cyrique  EC$ 7,000
- Relocation of supply pipeline at Clifton  EC$ 7,000

This gives a total estimate of the direct replacement costs at EC$44,000.
Also as a result of the works, there were problems with water shortage to a number of communities. These included:

**West District:** Salisbury; Colihaut; Campbell; Coulibistrie

**North District:** Woodford Hill/Wesley and Marigot; Dublanc/Bioche; Portsmouth; Thibaud; Vielle Case; Calibishe; Clifton; Dos D’Ane

**East District:** Delices; Good Hope; San Sauver/Petit Soufriere; Riviere Cyrique; Grand Fond; Morne Jaune; Boetica

Water shortage periods varied from one to eleven days. Despite the number of communities that experienced these shortages, however, DOWASCO management estimates that the loss of revenue from these occurrences were of the order of EC$1,000. This low figure is no doubt as a result of the fact that the population in these communities is small.

**Telecommunications and Communications**

Cable and Wireless Dominica Ltd. is presently the sole company providing direct exchange line service to customers in Dominica. Since the passage of Hurricane David in 1979, the company has made a continued effort to install underground cables, primarily in the most populated centres. This has significantly improved the resilience of this provider to the ravages of naturally occurring hazards. On the east coast of the island, however, where population numbers are low, this utility relies on the use of poles for the transmission of service.

Because of this, most of the damage experienced by Cable and Wireless was on the east coast. This damage consisted mainly of damage to poles, which were carried away by landslides. This also led to many broken cables.

In some cases, villages were out for as long as four weeks. These included Grand Fond, Fond Melle and Riviere Cyrique. In all, it is estimated that approximately fifty (50) customers were affected. Since usage is generally low in the rural areas, the estimate of indirect losses resulting from lost revenues, as EC$2,500.

To some extent, there has been deregulation of the telecommunications industry in Dominica, and some cellular and internet providers are now in operation. These include AT&T and Orange. No losses were reported for this sub-section of the telecommunications sector.

### 3.1 Roads and Bridges

The landslides that occurred resulted in blocking of many roads across the island. This required a major effort on the part of the Ministry of Works in mobilizing crews to have these slides cleared. In addition to blocking roadways, the action of the landslides also resulted in erosion of roads, through the loss of significant quantities of earth material down ravines.
A damage assessment was carried out by the Ministry of Works, which listed all of the sites across the island at which damage was recorded. In all, twelve categories of reparation works were developed. It should be noted that the majority of the funding (either required or already spent) is to be spent on rehabilitation of feeder roads, sea defense and road reconstruction/rehabilitation (67% of total). The following table summarises the costs associated with each category.

**Table 10. Summary of Road Infrastructure Works**

<table>
<thead>
<tr>
<th>Rehabilitation Category</th>
<th>Repair Estimate (EC$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Training</td>
<td>3,675,000</td>
</tr>
<tr>
<td>Box Culvert Repair/Replacement</td>
<td>850,000</td>
</tr>
<tr>
<td>Feeder Road Rehabilitation</td>
<td>10,700,000</td>
</tr>
<tr>
<td>Bridge Replacement/Repair</td>
<td>4,270,000</td>
</tr>
<tr>
<td>Clearance of Landslides</td>
<td>2,387,000</td>
</tr>
<tr>
<td>General Rehabilitation</td>
<td>500,000</td>
</tr>
<tr>
<td>Retaining Walls</td>
<td>1,510,000</td>
</tr>
<tr>
<td>Sea Defense</td>
<td>9,000,000</td>
</tr>
<tr>
<td>Road Reconstruction/Rehabilitation</td>
<td>8,944,000</td>
</tr>
<tr>
<td>Cliff Stabilization</td>
<td>950,000</td>
</tr>
<tr>
<td>Road Backfill</td>
<td>120,000</td>
</tr>
<tr>
<td>Drain Construction</td>
<td>60,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>42,966,000</strong></td>
</tr>
</tbody>
</table>

Source: Official Statistics and OECS

The rehabilitation of feeder roads and the reconstruction/rehabilitation of main roads are required as a direct result of landslide damage. These two items consume almost one-half the entire budget. Coupled with the fact that the threat of landslide is an ongoing one, this makes the proper identification and treatment of this hazard of the utmost importance. It is therefore recommended that a proper method of slope stabilization be adopted for specific identified locations around the island. These methods will include:
• Cable net drapery;
• Wire mesh drapery;
• Rock pins;
• Rock fall barrier at toe of slope;
• Planting of suitable vegetation on the slope in question, with the aid of a fibre material.

See Annex 1 for details on slope stabilisation methodologies and cost of remedial methodologies.

4. Effects on the Environment

4.1 The Environmental Baseline

Sixty-five percent (65%) of Dominica’s land area is covered by natural vegetation ranging from dry scrub woodland on the west coast to dense, tropical rain forest in the interior. The diversity is a consequence of its elevation and the fact that more than 80% of the island receives at least 2500 mm of rain per year and much of the vegetation is either protected in law by an extensive national park and forest reserve system or too remote for human interference. Over 20 percent of land area is under protection, including Morne Trois Piton National Park, a UNESCO World Heritage Site.

The interior of the island contains a great diversity of wildlife species and is interspersed with rivers, waterfalls and lakes. Additionally, with eight active volcanoes and the Boiling Lake, which is the second largest, thermally active lake in the world, and marine and coastal habitats, which support a wide range of biodiversity, the Commonwealth of Dominica is known as "The Nature Island of the Caribbean".

The very narrow continental shelf, particularly on the west coast, provides the conditions for pelagic communities of fish, squid, birds, whales and dolphins that would normally be found much further out to sea. Areas of coral reef, mangrove and seagrass are not extensive due to the steep topography and rugged terrain of the coast, but they are critical habitats that fulfill important ecological functions and support high species diversity.

Many archeological and historic sites have been identified as places of cultural significance. Indigenous cultures, such as the Caribs (Kalingo) of Dominica, are a part of the ecological landscape. The Carib Territory covers 3,782 acres of land and is located in the north east of the island within the Parish of St David. According to the 2001 Population and Housing Census the Territory recorded a population of 2208 persons. The ecological knowledge of the Caribs is most evident in their agricultural systems, which contribute significantly to the conservation of local biological diversity.

Figure 16  Calibishie Sandy beach          Figure 17  Swamp Forests
Dominica’s biodiversity provides many natural goods and services that sustain local communities and the economy, including food, fuel, building materials, water purification, flood control, storm protection as well as cultural and aesthetic benefits. However, prior to the recent earthquake and subsequent landslides on 21 November 2004, the environmental resources of Dominica were already increasingly under pressure from agrochemical pollution, natural disasters, overexploitation, coastal development including quarrying and road construction, deforestation, urbanisation and marine pollution, which threaten the capacity of the environment to continue providing these vital goods and services.

4.1.1 Marine and Coastal Habitats

Coral Reefs
The most significant coral reefs sites in Dominica are Scotts Head, Dublanc, Soufriere, Point Guignard, Mero, Grand Savanne, Pointe Round, Portsmouth, The Cabrits, Petite Baie, Toucari, Calibishie and Pointe Baptiste. To date an assessment of the damage to the coral reefs following the hazard events has taken place only in the Cabrits. A sedimentation study has also been initiated for the Soufriere Scotts-Head Marine Reserve.

The most highly stressed areas of coral reef on Dominica occur along the west coast of the island, in an area stretching from Point Michel to Colihaut (NBSAP). The single largest cause contributing to the stress of these corals is sedimentation from quarrying operations primarily along the west coast that deposit tons of muddy sludge daily into the sea. As a result of the landslides and floods, sediment plumes have been observed along the east and northeast coast. In some instances the dumping of soils displaced by landslides has caused these sediment plumes. It is envisaged that this will result in sediment loading of the coral reefs, which in turn may impact on reef fisheries.

Figure 18   Sediment Plume at Woodford Hill
4.1.2 Forests and Natural Vegetation

Forests dominate the landscape of Dominica. It is estimated that approximately, two thirds of the island or 51,170 ha is covered in natural forest, woodland and scrub. The steep topography, high relief and considerable microclimatic variability have had a strong influence on the distribution of vegetation types.

Approximately 20% or 16,700 ha of the country’s forest base is incorporated into a legally defined forest reserve and national park system viz: the Central Forest Reserve (410 ha); the Northern Forest Reserve; the Eastern Forest Reserve including Morne Trois Piton National Park (6,879.8 ha); Cabrits National Park (531ha); and the Morne Diablotin National Park (3335.49 ha). Within the Eastern Forest Reserve and national park system, Forestry Officials have observed 16 slides caused primarily from soil saturation. The landslides resulted in average acreage of 1.34 ha of deforested lands.

According to the CDERA Report of 28th November 2004, seven parishes were impacted by the hazard events. The table below describes the natural resources found in each of the parishes.

<table>
<thead>
<tr>
<th>Parish</th>
<th>Population</th>
<th>Natural Resources (Key)</th>
</tr>
</thead>
<tbody>
<tr>
<td>St John</td>
<td>5,327</td>
<td>Cabrits National Park, coral reefs, sea grass beds, beaches, mangrove wetland, turtle nesting sites, Marine Protected area, rivers</td>
</tr>
<tr>
<td>St Andrew</td>
<td>10,240</td>
<td>Cold sulphur Springs, turtle nesting sites, sea grass, rocky and sandy beaches, coral reefs, Morne Diablotin National Park, rivers, forests</td>
</tr>
<tr>
<td>St Peter</td>
<td>1,452</td>
<td>Sea grass, corals, rocky beaches, forests</td>
</tr>
<tr>
<td>St Joseph</td>
<td>5,765</td>
<td>Beaches, corals, sea grass, forests</td>
</tr>
<tr>
<td>St David</td>
<td>6,758</td>
<td>Emerald Pool, Carib territory, forests, lakes, rivers, rocky beaches, waterfalls, Morne Trois Piton National Park,</td>
</tr>
<tr>
<td>St Patrick</td>
<td>8,383</td>
<td>Morne Trois Piton National Park, rivers, forests, waterfalls</td>
</tr>
<tr>
<td>St Mark</td>
<td>1907</td>
<td>Marine Protected area, turtle nesting, sandy beaches, seagrass, coral</td>
</tr>
</tbody>
</table>

Source: OECS

The main direct environmental impacts include:

22 Government of Dominica Population and Housing Census 2001
Impact to forestry resources; damage to ecotourism infrastructure and impact to water resources.

Indirect environmental impacts include:
Those associated with landslides and improper disposal of soils displaced by the landslides e.g. increased siltation of rivers and streams due to need for soil disposal sites, adverse effects on water quality in streams and damage to some primary forests; reduced tourist revenues (user fees from affected ecotourism sites). Moreover, there are some areas, for example, coral resources, where the environmental impacts are unclear and which will require ongoing environmental monitoring.
<table>
<thead>
<tr>
<th>Ecosystem</th>
<th>Goods</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest ecosystems</td>
<td>Food, Timber</td>
<td>Maintain array of watershed functions (infiltration, purification, stabilisation)</td>
</tr>
<tr>
<td></td>
<td>Fuel wood</td>
<td>Remove air pollutants, emit oxygen</td>
</tr>
<tr>
<td></td>
<td>Drinking water</td>
<td>Cycle nutrients</td>
</tr>
<tr>
<td></td>
<td>Non-timber products (fruit, plant medicines, wildlife)</td>
<td>Maintain biodiversity</td>
</tr>
<tr>
<td></td>
<td>Genetic resources</td>
<td>Sequester atmospheric carbon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate weather extremes and impacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Generate soil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide aesthetic enjoyment and recreation</td>
</tr>
<tr>
<td>Agro-ecosystems</td>
<td>Food crops</td>
<td>Maintain limited watershed functions (infiltration, partial soil protection)</td>
</tr>
<tr>
<td></td>
<td>Crop genetic resources</td>
<td>Provide habitats for birds, pollinators, soil organisms, etc. important to agriculture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Build soil organic matter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sequester atmospheric carbon</td>
</tr>
<tr>
<td>Freshwater ecosystems</td>
<td>Drinking and irrigation water</td>
<td>Dilute and carry away waste</td>
</tr>
<tr>
<td></td>
<td>Fresh water fisheries</td>
<td>Hydropower</td>
</tr>
<tr>
<td></td>
<td>Genetic resources</td>
<td>Cycle nutrients</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maintain biodiversity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide aquatic habitat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide transportation corridor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide for aesthetic enjoyment and recreation</td>
</tr>
<tr>
<td>Coastal ecosystems</td>
<td>Fisheries</td>
<td>Moderate storm impacts (mangroves, barrier reefs)</td>
</tr>
<tr>
<td></td>
<td>Seaweeds (sea moss)</td>
<td>Provide wildlife (marine and terrestrial habitat)</td>
</tr>
<tr>
<td></td>
<td>Wood for charcoal</td>
<td>Maintain biodiversity</td>
</tr>
<tr>
<td></td>
<td>Genetic resources</td>
<td>Dilute waters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide for aesthetic enjoyment and recreation</td>
</tr>
</tbody>
</table>

Source: OECS
Figure 19  Map Showing Impacted Eco sites

23 OECS Ground truthing
Water Quality Degradation
Erosion of riverbanks as a result of the flooding was clearly visible along rivers and streams particularly where the lands adjacent to riverbanks are being used for agricultural purposes. Siltation of watercourses including clogging due to branches and other debris was also evident (Figure 17). The loss of agricultural soil has been quantified for some areas and is addressed under the section of the report addressing Agriculture.

The reduced water quality as a result of the flooding from heavy rains and landslides was temporary. However the major direct cost for DOWASCO is due to the additional recurrent costs associated with restoration of water quality.

Soil and Debris Disposal
A significant concern was the evident disposal of cleared soil and mud from landslides in locations where it can be washed into watercourses. Emergency clearing efforts have led to haphazard disposal soil and debris along roads into drainage ditches, rivers and streams.

Figure 20  Sediment Loading of Water Courses
![Sediment Loading of Water Courses](Photo Credit OECS)

4.2 Valuing the Damage

The purpose of assessing the quantum of damages is to identify the magnitude of the impact on environmental resources and services and on the economy as a whole. Damage may be valued in different ways, based on the end use to which the information will be put. The two values are full economic loss and remediation cost. The full economic loss is used to gauge the impact of the event on the national economy.

The simplest method of crudely estimating full economic cost on any environmental asset is to multiply the value of the asset by a factor that represents the extent and intensity of the damage. In Dominica, as is true in the rest of the OECS sub-region,
national accounts do not include environmental assets. Consequently, as observed from the tables above, the damage assessment has not been able to quantify the economic loss of the environmental assets and services as a result of the earthquake and landslides.

In the absence of full economic loss, the most appropriate response to assessing damage to environmental assets is to cost the remediation. These values are particularly useful in determining the estimates for financial assistance. However, remediation costs are based on the nature of the remediation work to be undertaken and must be estimated on a case-by-case basis. Some of the remediation costs are also provided under the section dealing with agriculture, forestry and fisheries.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Direct Costs EC$</th>
<th>Indirect Costs EC$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forestry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reforestation</td>
<td>35,000</td>
<td></td>
</tr>
</tbody>
</table>

As all environmental impacts cannot yet be assessed due to the unavailability of data, the development of comprehensive environmental monitoring programs becomes an important priority particularly with respect to potential impact on riparian and coastal ecosystems.

\[24\] Some of the value of environmental services is, however, included in the statistics of such sectors as agriculture and tourism.
III MACROECONOMIC EFFECTS

This Section comprises five parts. The first part presents an estimate of the summary of damages, both direct and indirect, followed by an evaluation and initial interpretation of these results. In the second part, the macroeconomic trends in the year prior to the disaster are described and this is followed by an analysis of the short run (2004) and medium run (2005-2007) expected performance of the economy without the disaster, in the third part. The fourth part provides a macroeconomic assessment of the disaster and shows the extent to which the economy’s path has deviated from projected trends as a result of the disaster. Finally, part five discusses the evolution of debt, its structure and implications if reconstruction is to be undertaken by the Government of Dominica. The second, third and fourth parts survey the overall economic trends of the economy, fiscal policy, the external sector and the financial system to the extent that is permitted by the availability of data. The fourth part also gives a detailed analysis of the expected performance of the main economic sectors. In addition, the fifth part discusses the effect of the Earthquake and Landslides on Dominica’s economy in the context of its increasing debt burden.

Estimations were carried out on the basis of officially reported data since the disaster, as well as information provided by private sector organizations in Dominica. Secondary data sources from the Eastern Caribbean Central Bank, the Caribbean Development Bank, the World Bank and the International Monetary Fund have been relied upon in depicting the macroeconomic situation in Dominica prior to the Earthquake and Landslides. They are presented in Eastern Caribbean Dollars ($EC) or United States Dollars ($US) as appropriate.

The effects of the damages are significant. They amount to approximately $EC 119 million or 17 percent of the GDP at current prices in 2003. By far the most important component of overall damages, losses or costs is the direct damage. Additionally, the damage has important social implications since it has affected a number of places of religious worship, schools and agricultural output. With respect to the agricultural sector, which is labour intensive, decline in output is expected to adversely impact exports, especially of traditional crops in a year in which a bumper harvest had been predicted given unusually heavy rains.

In the year in which the disaster occurred (2004) overall GDP was projected to grow 2.6 percent. Most of this economic growth was expected to come from the Tourism Sector, in which Hotels and Restaurants were expected to grow by 10 percent and Transport was expected to grow by 7.7 percent. Construction was also expected to make a significant contribution to economic growth of 6 percent, while Agriculture was expected to grow by 4 percent. If no reconstruction or rehabilitation activities take place the economy would experience a 2% growth in 2004 in the post-disaster scenario taking into account the fact that only a few of the effects of the disaster would take place in 2004. Indeed, because the disaster occurred in the month of November most of the effects will be felt in 2005. In 2005 the rate of economic growth is projected to reach 1% under the assumption that no reconstruction or rehabilitation activities are undertaken.

The Earthquake and Landslides have destroyed significant existing infrastructure in Dominica and poses important challenges for the present administration. Having recently renewed its resolve to pursue a path of economic stabilization with the IMF, which
includes tight austerity measures for fiscal year 2004-05, government faces the dilemma of not having sufficient funds to finance existing recurrent and capital expenditures. As such, any additional expenditure incurred by the government is likely to seriously adversely impact its primary fiscal position. In addition, the lower tax intake that generally occurs following a natural disaster will further deteriorate the fiscal position of Dominica.

Therefore, one of the most important challenges that policy makers will face is to successfully reconstruct damaged buildings, without incurring additional debt. As things stand, Dominica is presently on a non-sustainable debt path, with the country’s total debt stock representing 127% of GDP. External debt accounts for approximately 88 percent of its GDP in 2003. A key issue that authorities must confront and resolve is how Dominica can engage into recovery and rehabilitation operations without further deteriorating its debt position.
1. Summary of Damages

The total damage caused by the Earthquakes and Landslides in Dominica is estimated to be EC$119 million, which is approximately 17 percent of Dominica’s current value of GDP in 2003. The bulk is concentrated in direct damages, which accounts for approximately 79 percent of the damage, while indirect damage accounts for the remaining 21 percent of the damage (See Table 14).

As discussed further in this report, the results highlight the fact that most of the damage resulting from the Earthquakes and Landslides has been concentrated in Construction sector, within which infrastructure, particularly housing, roads and bridges have been severely damaged. Additionally, the Agriculture sector has been just as hardly hit.

Table 14
Summary of Damage by Sector in EC$ dollars

<table>
<thead>
<tr>
<th>Sector</th>
<th>Direct damage</th>
<th>Indirect damage</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Forestry and Fisheries</td>
<td>36,075,921</td>
<td>20,037,783</td>
<td>56,113,704</td>
</tr>
<tr>
<td>Tourism</td>
<td>1,609,000</td>
<td>313,000</td>
<td>1,922,000</td>
</tr>
<tr>
<td>Electricity, Water and Communication</td>
<td>54,000</td>
<td>3,500</td>
<td>57,500</td>
</tr>
<tr>
<td>Transportation</td>
<td>42,966,000</td>
<td>4,285,000</td>
<td>47,251,000</td>
</tr>
<tr>
<td>Housing</td>
<td>5,801,000</td>
<td></td>
<td>5,801,000</td>
</tr>
<tr>
<td>Education</td>
<td>7,750,000</td>
<td></td>
<td>7,750,000</td>
</tr>
<tr>
<td>Health</td>
<td>200,000</td>
<td></td>
<td>200,000</td>
</tr>
<tr>
<td>Total</td>
<td>94,455,921</td>
<td>24,639,283</td>
<td>119,095,204</td>
</tr>
</tbody>
</table>

Source: On the basis of official data

The Agriculture sector recorded a level of damage equivalent to 7.9 percent of GDP of which 5.1 percent is direct damage. Indirect damage (2.8 percent of GDP) (see Table 14 above) reflects mainly extensive destruction of farm roads. In terms of the direct damage, the major component of this has been the loss of top soil and consequent destruction of several crops. As a result the source of income of traditional farmers was been destroyed and will not be easily substituted.

The damage to transportation is equivalent to 7 percent of GDP. Direct and indirect damage represent 6 percent and 0.6 percent of GDP respectively. Tourism reflected mostly direct damage amounting to 16 million EC$ and 0.2 percent of GDP. For their part the social sectors, housing, education and health recorded an overall damage equivalent to 2 percent of GDP. The damage in the social sector is concentrated in education and housing (approximately 1 percent of GDP) (See Tables 14 and 15).
Table 15
Summary of Damage by Sector as a Percentage of GDP

<table>
<thead>
<tr>
<th>Sector</th>
<th>Direct damage</th>
<th>Indirect damage</th>
<th>Total</th>
</tr>
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Source: On the basis of official data.

2. The Pre-Disaster Situation

2.1 General Trends

Since 1995, Dominica has undergone two phases of economic development (See Figure 21). Between 1995 and 1999 economic activity increased on average, by 2.4 per cent and by 2000, grew at a rate of 1.3 per cent. Economic activity contracted by 4.2 per cent in 2001 and 5.1 per cent in 2002. The decline in economic activity in 2001 and 2002 was precipitated by the downturn in the agricultural sector – particularly the banana sub-sector, manufacturing, construction and tourism. Following two years of negative growth, economic activity was estimated to have remained stagnant in 2003.
In 2003 economic activity increased in the construction and manufacturing sectors and the tourism industry, while decreases were recorded in the agricultural, communications and government services. In that year construction activity was vibrant following contractions in the previous two years. Growth of 11.3 per cent was recorded in that sector and its contribution to GDP rose by 0.7 percentage points to 7.2 per cent in 2003. This outcome was largely associated with higher investment in the public sector investment programme and private investment in commercial development.

Performance in the tourism industry improved during 2003, marked by growth in value added in the hotel and restaurant sector, which increased by 8.3 per cent following contractions of 3.3 per cent in 2002 and 7.4 per cent in 2001. The number of stay-over visitors grew by 5.4 per cent.

In the manufacturing sector, growth of 0.6 per cent was recorded, following contractions of 2.3 per cent and 13.6 per cent in 2002 and 2001 respectively. The growth in 2003 in this sector was largely attributed to increases in output of dental cream and beverages as demand in both the external and domestic markets rose.

Activity in the agricultural sector continued to decline in 2003, mainly influenced by developments in the banana industry. Value added in that sector contracted by 3.7 per cent and was associated mainly with a 38.9 per cent decline in banana production. This outcome was also influenced by a decline in acreage under cultivation and a contraction in the number of farmers.

Over the period 1995 to 1998, the current account operations of the central government resulted in a surplus of 0.8 per cent of GDP, on average. Between 1999 and 2002, the central government’s fiscal operations deteriorated resulting in a current account deficit averaging 3.0 per cent of GDP over that period. By 2003, consistent with developments in the rest of the economy the current account deficit narrowed to 0.8 per cent of GDP.
This outturn also reflected the impact of the IMF Stand By Arrangement introduced in the latter part of 2002.

On the external account, the merchandise trade deficit widened in 2003 to 24.6 percent of GDP from 23.3 per cent of GDP in 2002, mainly reflecting a fall in export earnings - in part associated with the decline in banana production and exports. In the services sector, the surplus rose to 14.1 per cent of GDP in 2003 from 10.2 per cent of GDP in 2002. Largely as a result of the aforementioned, the current account deficit widened to 24.6 per cent of GDP from 23.3 per cent of GDP in 2002.

2.2 Fiscal Policy

Between 1995 and 1998 the central government’s fiscal operations resulted in current account surpluses averaging 0.8 per cent of GDP, while the overall deficit averaged 4.3 per cent of GDP. In 1999, central government’s fiscal position deteriorated resulting in a current account deficit of 0.8 per cent of GDP and an overall deficit of 9.8 per cent of GDP. Between 2000 and 2002, the fiscal operations of the central government continued to deteriorate, evidenced by current account deficits averaging 3.7 per cent of GDP and overall deficits averaging 7.5 per cent of GDP. In addition to the weakening fiscal position, central government’s external debt position expanded rapidly – particularly between 1998 and 1999 – moving to 37.0 per cent of GDP in 1999 from 21.9 per cent of GDP in 1998. Servicing a high level of domestic debt at high interest rates also compounded the weaknesses found in the fiscal operations of the central government in the late 1990’s and early 2000’s. Consequently, central government interest payments rose on average by 5.6 per cent of GDP between 2000 and 2002 compared with an average growth of 2.5 per cent of GDP between 1995 and 1999.
By late 2002, Dominica established a Stand By Arrangement with the IMF and introduced various fiscal measures to stabilise the economy in the first instance and stimulate economic and fiscal growth subsequently.

By 2003, current revenue increased to 28.9 per cent of GDP from 28.0 per cent of GDP in 2002. Based on measures introduced as part of the stabilization programme, current expenditure contracted to 29.7 per cent of GDP from 33.2 per cent of GDP in 2002. As a result central government’s current account deficit narrowed to 0.8 per cent of GDP while the overall deficit contracted to 1.4 per cent of GDP from 8.7 per cent of GDP in 2002.

2.3 The Balance of Payments

During 2003 an overall balance of payments surplus of $7.3m (1.0 per cent of GDP) was recorded compared with a surplus of $33.9m (4.6 per cent of GDP) in 2002. This outturn reflected developments on the current account as the deficit narrowed to $72.5m (10.3 per cent of GDP) from $103.3m (15.0 per cent of GDP) in 2002. This outturn was due in part to an increase in net inflows on the services account, which were estimated to have grown to $99.6m (14.1 per cent of GDP) in 2003 from $70.2m (10.2 per cent of GDP) in 2002. These developments were largely attributable to an increase in inflow on the travel account and reduced outflows on the other business services account. On the income account the deficit narrowed to 4.6 per cent of GDP in 2003 from 7.3 per cent of GDP due primarily to interest payments. The merchandise trade deficit widened to $177.0m (24.6 per cent of GDP) from $163.0m (23.3 per cent of GDP) in 2002, mainly influenced by lower export earnings.

On the capital and financial account, the surplus fell from $87.2m (12.4 per cent of GDP) in 2002 to $84.4m (11.9 per cent of GDP) in 2003 due to lower inflows of official loan funds as well as developments on the portfolio investment sub account.

2.4 Developments in the Financial System

At the end of 1995 total monetary liabilities (M2) were roughly 60.6 per cent of GDP, rising to 64.8 per cent of GDP in 1999 and 78.4 per cent of GDP in 2003. Despite the contraction in economic activity during 2001 and 2002, total monetary liabilities of the banking system continued to increase, expanding by 1.0 per cent to $554.5m in 2003 compared with growth of 8.5 per cent in 2002. The growth in M2 was associated with expansions in both the narrow money supply (M1) (1.2 per cent) and quasi money (0.9 per cent). The increase in M1 was mainly attributable to an expansion of 3.6 per cent in private sector demand deposits. Of quasi money private sector savings deposits rose by 6.4 per cent, while private sector time and foreign currency deposits decreased by 0.5 per cent and 54.1 per cent respectively.

In 2003 domestic credit contracted by 19.7 per cent to $359.3m compared with a decline of 11.2 per cent in 2002. Net credit to the central government from the banking system decreased by 45.4 per cent ($23.2m) to $27.9m compared with a contraction of 43.4 per cent ($39.1m) in 2002. This development was consistent with targets set under the IMF Stand By Arrangement. Central government credit from commercial banks fell while deposits with the banking system increased mainly reflecting loan proceeds deposited at
the Central Bank. Lending to the private sector declined by 2.9 per cent to $420.6m, in part reflecting the sluggishness of the economy.

During 2003 the net foreign assets of the banking system rose by 48.9 per cent ($98.2m), largely attributable to inflows associated with Dominica’s stabilisation programme. The net foreign assets of the commercial banks moved to $170.4m in 2003 from $78.2m in 2003. Dominica’s imputed share of the reserves held by the Central Bank grew by 4.9 per cent to $128.8m. Liquidity within the commercial banking system increased during 2003.

3. The Short and Medium Run Expected Performance of the Economy Without the Disaster 2004-2007

3.1 Overall Trends

Based on projections prior to the earthquake and landslides, economic activity was projected to increase by 2.6 per cent in 2004. This outturn was expected to reflect developments in the Agricultural, Manufacturing and Construction sectors, as well as Tourism. Agriculture was estimated to grow by 4.0 per cent resulting from an increase in performance of the traditional crops – particularly bananas. The Hotel and Restaurant sector was projected to increase by 10.0 per cent. For the first ten months of 2004 value added in this sector would have benefited from a 7.7 per cent growth in stay over arrivals. This growth is expected to have spillover effects in the more service-oriented sectors, particularly in communications and transportation. Among the other sectors, Construction was expected to grow by 6.0 percent driven by the construction of a fisheries complex, sea defences and general infrastructure rehabilitation. Growth of 3.0 per cent was projected outside the Manufacturing sector, consistent with developments in the soap and beverage sub-sectors for the first ten months of 2004. In 2005, the economy was projected to grow by 2.9 per cent as a result of the sustained growth in Agriculture, Tourism and Construction.

Following years of negative current account balances, preliminary estimates indicated that the central government was expected to realize a current account surplus of approximately 1.2 per cent of GDP, and an overall surplus of 1.5 per cent of GDP in 2004. Current revenue was expected to grow by $20.9m over the 2003 level as a result of the expansion in economic activity. Recurrent expenditure was projected to decrease, resulting in a lower current account balance relative to the outturn in 2003. The growth in capital expenditure was projected based on ongoing implementation of the PSIP. Projections also suggested that fiscal performance was to further improve over the medium-term based on measures implemented as part of the Poverty Reduction and Growth Facility arrangement with the IMF, as well as the government’s debt restructuring/rescheduling efforts.

On the balance of payments, the current account deficit was projected to contract to 8.8 per cent of GDP from 10.3 per cent of GDP in 2003. This performance was based primarily on the increase in current transfers during 2004. Merchandise imports were projected to increase to 41.9 per cent of GDP in 2004 from 40.0 per cent of GDP in 2003 in part attributable to the increase in economic activity. Consequently, the merchandise
trade deficit was projected to widen to 27.3 per cent of GDP in 2004 from 24.6 per cent of GDP in 2003. On the capital and financial account, the surplus is estimated to contract to 10.6 per cent of GDP from 11.9 per cent of GDP in 2003, due to a reduction in direct investment. Given the higher level of economic activity projected in 2005, the current account deficit of the balance of payments was projected to widen to 12.5 per cent of GDP in 2005 largely associated with the increase in the merchandise trade deficit.

Based on growth in economic activity, total monetary liabilities of the banking system are estimated to increase by 4.2 per cent in 2004. Domestic credit was expected to grow by 13.0 per cent, reflecting growth in credit to the non-financial public sector and the private sector. The net foreign assets of the banking system were expected to increase by 9.4 per cent in 2004 influenced primarily by an increase in net assets of commercial banks. The liquidity in the banking system was expected to remain adequate.

3.2 The Real Sector

The projected growth of 2.6 percent in 2004 was based on recovery in Agriculture and the continued growth in Tourism and Construction. Following a contraction in banana output in 2003, the sector recovered in 2004 as a result of expansion in acreage under cultivation and more favourable market conditions. At the end of September, banana production increased by 22 percent thereby contributing to the positive growth to Agriculture in 2004. The rate of growth of Agriculture is projected at 4.8 percent in 2005, influenced mainly by developments in banana production.

The growth in Tourism experienced in 2003, is expected to be sustained in 2004. At the end of September, stay over visitors grew by 7.6 percent. Consequently, the Hotel and Restaurant sector is projected to grow by 10 percent in 2004. In 2005 growth in the Hotels and Restaurant sector is projected at 8.0 percent. Over the medium term, the sector will benefit from the expansion in hotel rooms, improvement in airport facilities, and the national road network.

The construction sector, which expanded by 11.3 percent in 2003, is projected to expand by 12 percent in 2004 and will be a main growth sector over the medium term. In 2004, the growth in construction activity will be influenced by the construction of the fisheries complex at Marigot. Over the medium term, growth in the sector will be influenced by the construction of the Windsor Park Stadium, the upgrade of the Melville Hall Airport and road improvements.

The Manufacturing sector, which is dominated by the production of soap, dental cream, and beverages, is projected to grow by 3.0 percent in 2004. At the end of September, soap production increased by 3.0 percent, beverages by 30.0 percent and dental cream contracted by 1.5 percent. In 2005, the sector is projected to grow by 3.0 percent.

In 2004, growth in Transportation was projected at approximately 7.7 percent, driven primarily by developments in Tourism. In particular, road and sea transportation are projected to grow by 10 and 4.7 percent respectively. With the projected growth in Tourism, the sector is expected to expand by 5.0 percent, on the average.
3.3 Fiscal Accounts

The preliminary outlook for 2004, without the disaster, showed a current account surplus of $9.2m (before grants), representing 1.2 per cent of GDP and an overall deficit of $11.8m, equivalent to 1.5 per cent of GDP. The favourable fiscal performance was primarily influenced by an improved revenue performance. Current revenue was expected to grow by 11.0 per cent over 2003 as a result of the expansion in economic activity. The increase in current revenue was projected to be influenced by higher yields from taxes on domestic goods and services (34.8 per cent) and taxes from international trade and transactions (11.5 per cent). The increase in revenue from taxes on domestic goods and services mainly reflect higher receipts from the sales tax associated with a broader base and an increase in the rate in the latter half of 2003. With respect to revenue from non-tax sources, revenues were also projected to expand by 7.4 per cent in 2004 compared with their level in 2003. Over the medium term, current revenue is projected to grow by 3.4 per cent, consistent with the growth in nominal GDP. Current expenditure is projected to increase by 3.6 per cent, influenced by growth in outlays on goods and services and external interest payments. Outlays on personal emoluments were estimated to decline based on the targeted reduction in the wage bill, which would also influence transfer payments - in particular, pensions. The growth in capital expenditure was estimated to increase in line with ongoing implementation of the PSIP.

In 2005, the surplus on the current account is projected to increase to 3.4 per cent of GDP influenced primarily by measures associated with the ongoing stabilization programme.

4. The Post Disaster Macroeconomic Assessment

4.1. GDP Growth

As a result of the Earthquake and Landslides GDP growth of 2% and 1.0% are expected in 2004 and 2005 in the post disaster scenario under the assumption that no reconstruction or recovery activities are undertaken. This represents a decline of one half and close to two percentage points relative to the projected rates of growth in the pre-disaster situation in 2004 and 2005 (2.6% and 2.9% respectively). Note that most of the damage would be recorded in 2005 since the disaster took place at the end of 2004. This reduction in GDP growth derives mainly from damages to agriculture, transportation and to a lesser extent housing.
Figure 23
Dominica
Rate of GDP growth in the pre and post disaster scenarios
1995-2005
Growth in the agricultural sector is expected to be 3.7 percent compared with the 4.0 percent growth rate that had been projected without these disasters. Most of the decline in the agriculture sector will be reflected in the destruction of banana plantations, as well as other crops under cultivation.

Construction was originally expected to grow by 6 percent before the disaster. However, since the occurrence of the disaster, this sector is now expected to grow by 5.5 percent.

While one would expect that a EC$ 115 million bill for damages would result in a greater dip in projected GDP performance, the fact that the November events took place so late in the fiscal year means that a significant share of the growth which had been projected for the construction, tourism and agricultural sectors for 2004, had already been realised.

4.2. Fiscal Policy

For 2004, the secondary fiscal effects will include a slight weakening of the fiscal current account surplus, now expected to be 0.8 percent of GDP down from the originally projected 1.0 percent. This represents $6 million surplus on the current account.

Overall Government surplus was projected at 1.1 percent of GDP before the disaster and has not changed significantly since.

In 2005 central government operations are likely to deteriorate resulting in a current account deficit of $6.9 million or 0.8 percent of GDP. The overall balance is projected to result in a deficit of $49.6 million representing 6.1 percent of GDP. This outturn will be driven by high capital expenditure as government undertakes reconstruction and high outlays on goods and services.

5. Debt

One of the most challenging tasks ahead for Dominica is how to cope with its existing stock of debt and the likely additional debt burden that the country would have to endure, should it have to finance the reconstruction of damaged infrastructure from existing resources.

Dominica is one of the most indebted emerging market economies. Currently, as mentioned earlier in the document, Dominica’s public debt stock to GDP stands at 127%. Of this amount 88% represents external debt while 39% is internal debt. Dominica’s debt rose in the latter part of the 1990’s from 61% of GDP during 1991-1997 to 122% for 1998-2003.
Figure 24
Dominica
The fiscal stance and the export performance ratio
1990 - 2003
Dominica’s total outstanding external debt has grown from $US 102.6 million in 1995 to $US 229.5 million in 2003. Concomitant with this growth in the external debt has been growth in the share of this debt relative to the country’s GDP, with the latter increasing from 47 percent in 1995 to 88 percent in 2003.

At the same time, this has been accompanied by an increase in the debt service, with increasing demands in the share of current government revenue that has to be allocated to service that debt. In order that the debt a country accumulates is sustainable, then the country should not take on too much debt to increase current consumption, for instance, in the hope to repay it by borrowing the money needed for debt servicing. Such a decision results in a geometric rate of increase of the country’s debt, which eventually makes debt servicing impossible\textsuperscript{25}.

\textsuperscript{25} Suppose the debtor country takes initial debt $D$ at interest rate $r$. When the debt comes due the debtor country owes: $(1 + r)D$. Now let us suppose it takes a new loan equal to $(1 + r)D$ to pay off the old lender, then it now owes a larger amount to the new lender. In fact in the next period, the debtor country will have to pay $(1 + r)^2D$. Repeated action of this type on the debtor country’s part results in further increases in the debt, so after the $n^{th}$ year, the debtor country owes $(1 + r)^nD$. 
A decomposition exercise carried out by the IMF (2004) of debt accumulation for Dominica which rose by 11.2% shows that the primary fiscal balance (excluding grants) contributed 3.4 percentage points to public debt accumulation (30% of the total) and that growth and interest rate payments contributed 2.3 and 2.2 percentage points respectively (21% and 20% of the total). However, when the evolution of debt is analyzed not only in terms of fiscal policy but also in terms of the external constraint faced by smaller economies it can be seen that the accumulation of debt is not only a product of fiscal variables such as fiscal stance, but that in fact it is also related to the performance of the external sector\(^26\) (See Box 1 below).

\(^{26}\) It can be shown that if net asset accumulation by the private sector at the aggregate level is equal to zero, there is a precise relationship between the fiscal stance and the export performance ratio. More to the point when the fiscal stance is greater than the export performance ratio, a fiscal deficit coexists with a balance of payments deficit. In the case of the OECS it can be safely assumed that the net asset accumulation of the private sector approaches zero. Commercial bank loans, which are the main source of finance in the OECS are mostly and increasingly held by households and private businesses. The ratio of loans and advances to the households and private businesses represented 52% of the total in 1985 and increased to 83% and 85% in 1990 and 1999 reaching 81% in 2001. In terms of GDP these expanded from 13% in 1985 to 71% in 1999 and 75% in 2000. Loans and advances to private businesses and households to disposable income has steadily increased over time. As shown in Figure 12 in the Annex loans and advances represented 0.46 of income in 1985. In 2001, the said ratio increased to 0.95. This coefficient, which is very close to one reflect the fact that expenditure is loan generated rather than income generated. That is, there is roughly no asset accumulation.
It is possible to demonstrate that in a ‘quasi steady state’ the value of the flow of national income is a weighted average of the export performance ratio and the fiscal stance (Godley and Cripps, 1983; Anyadike-Danes, 1996). The export performance ratio is the ratio of the value of exports to the average propensity to import. The fiscal stance is equal to the ratio of the value of government expenditure to the tax to GDP ratio. Formally,

\[ Y = \omega_1 \left( \frac{X}{\mu} \right) + \omega_2 \left( \frac{G}{\theta} \right) \]

Where,

- \( Y \) = national income
- \( \omega_1 \) and \( \omega_2 \) = weights
- \( X \) = value of exports
- \( \mu \) = average propensity to import
- \( G \) = value of government spending
- \( \theta \) = the government’s share or tax collections to national income (tax to GDP ratio)

Accordingly as stated by Anyadike-Danes (1996, p.716) since the flow of national income is a weighted average of the export performance ratio and the fiscal stance, when the fiscal stance is greater than the export performance ratio, national income is smaller than the former and greater than the latter. That is,

\[ \frac{G}{\theta} > \frac{X}{\mu} \iff \frac{G}{\theta} > Y > \frac{X}{\mu} \]

In turn this implies that a budget deficit will be by definition accompanied by a deficit in the balance of payments. In other words,

\[ \frac{G}{\theta} > Y \iff G > \theta Y \text{ and } X < \mu Y \]

Since \( \theta = \frac{T}{Y} \) and \( \mu = \frac{M}{Y} \), where \( T \) are taxes and \( M \) imports,

\[ G > \theta Y \iff G > (\frac{T}{Y})Y \iff G > T \iff G - T > 0 \text{ (Fiscal deficit)} \]
\[ X < \mu Y \iff X < (\frac{M}{Y})Y \iff X < M \iff X - M < 0 \text{ (Current account deficit)} \]

Indeed it can be shown (See Box 1), that when the fiscal stance is greater than the export performance, debt accumulates over time. The computation of the fiscal stance and the export performance ratio over time for Dominica shows that the later has always exceeded the former (See Figure 24) indicating the perennial existence of a twin deficits situation and thus the potential for debt accumulation over time. Figure 24 shows that when the external sector is incorporated in the analysis the increase in the debt stock was not only due to government spending but also to a deteriorating export performance over time. That is the debt situation is not the result of fiscal policies per se but the outcome of the standing relationship between fiscal policies and external performance. In addition it is important to take into account the growth in government spending was a
strategy to maintain a level of aggregate demand in the face of high imbalance in the current account (-18% and -16% of GDP on average between 1990-1995 and 1996-2003) and the stagnation in domestic investment (see Table 16 below).

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The natural disaster by making the fiscal stance more expansionary and through its negative effects on exports may lead to a further deterioration of the debt situation unless definite actions to confront the problem are implemented. In addition to the point made previously, a natural disaster can have additional detrimental effects on the current account when households try to offset their income losses by attempting to smooth their consumption by borrowing against future income. In such a situation aggregate savings decline and the national economy experiences a deterioration in the current account. This follows from the relationship between a country’s current account balance and its savings and investment: \[ CA = S - I \]. The country then either borrows from abroad or runs down its existing stock of foreign assets.

The recommended solution to make the debt situation a sustainable one is to increase the primary balance. Computations by the IMF show that the primary balance needs to reach 6% of GDP to stabilize the public debt in relation to GDP at its 2003 level and that a primary balance of 17% is needed to reduce the public debt to GDP ratio to 60% of GDP from 2003 to 2008. The lack of sustainability of fiscal policy in Dominica has also been noted by the Tax Reform and Administration Commission (June 2003) and ECLAC (Economic Survey of the Caribbean 2003-2004). In the latter report the sustainability gap for Dominica is estimated at 10% of GDP for 2003.

This requires very significant fiscal efforts of the country that may simply surpass the possibilities of the countries. In addition, such fiscal stance would preclude undertaking reconstruction and recovery actions that are essential to ignite growth and mitigate the effects of the natural disaster.
Figure 27 - Dominica: External debt (millions of US dollars)

External debt (millions of US dollars)

Source: Official Statistics and ECCB
Whether or not Dominica can successfully emerge from its existing debt situation depends on its success at re-negotiating its debt commitments primarily with the multilateral and commercial institutions. Yet, most of the multilateral institutions have been categorized as preferred creditors, so the scope for renegotiation is limited, except with the Caribbean Development Bank where some initial success has been reported. In this regard feasible alternatives within the existing situation must be explored. In the light of the natural disaster Dominica must be able to close or narrow significantly the financing gap without increasing its debt burden.
Finally, as stressed in this Section, it should be noted that Dominica’s debt situation and evolution also depends on the performance of its external sector. International organizations should take into account that fiscal soundness is intrinsically related to export performance. Fiscal reform or adjustment by itself is not a sufficient condition for fiscal sustainability over time. Any attempt at fiscal adjustment, reform or consolidation must also go hand in hand with efforts to develop export promotion strategies and to raise the productivity of imports. Debt reduction strategies must also incorporate options to soften the external constraint. This is particularly the case when a country as vulnerable as Dominica is hit by a natural disaster which has detrimental fiscal and external sector effects.
IV GUIDELINES FOR A RECOVERY PROGRAMME

1. Overall Context

It is clear from recent, historic and anecdotal evidence that the island of Dominica is vulnerable to damages associated with landslides and flooding as a result of heavy and sustained rainfall, as well as earthquakes and earth tremors. The main aims of the proposed projects are to assist the country to recover from the series of natural events before and after 21 November, in a manner that reduces its overall vulnerability to similar events and increases its resilience over time.

2. Risk Management

Several parts of the country are characterized by a range of topographical, geological and other variables that make them high-risk areas with respect to landslides, and flooding. Despite advances in disaster planning, preparedness and management, much work still needs to be done in the area of hazard mapping on the basis of which to formulate sound land use principles and to inform practices relating to locational choices for activities incorporated n a sector such as agriculture. A number of initiatives would be helpful in this regard:

- Implementation of a watershed management policy for the island as a whole
- Development of synergies between disaster planning and mitigation efforts in a manner which would inform principles of land use planning
- Formulation of river bank stabilization and river engineering to include:
  - Ceasing the mining of gravel and sand from upper reaches of riverbeds
  - Retaining vegetation along riverbanks
  - Stabilizing riverbanks in developed areas with necessary gabions and other preventative works to reduce potential for undermining of essential roads
- Reviewing building codes with respect to their earth-quake worthiness
- Reviewing cut and fill methods of road construction

3. Recommendations

a. Development Planning

Natural hazard management has often been conducted independently of development planning. The recent hazard events now provide Dominica the opportunity to ensure that hazard management considerations are integrated into all aspects of project cycle management. There is a greater possibility that vulnerability reduction measures will be implemented if they are a part of a development package. The possibility increases if they are part of specific development projects rather than stand-alone disaster mitigation proposals. Furthermore, including vulnerability reduction components in a development project can improve the cost-benefit of the overall project if risk considerations are included in the evaluation.

The OAS has developed a comprehensive set of guidelines and the Government of Dominica may wish to seek technical assistance and training from the OAS and the
World Bank for preparing appropriate vulnerability reduction measures for all projects being formulated within the PSIP and by private developers.

The OECS Development Charter and the St. George’s Declaration of Principles for Environmental Sustainability in the OECS are also important regional instruments that should be integrated into national attempts at hazard and risk mitigation. The St. George’s Declaration calls for the integration of natural and environmental disaster policies into national development planning processes.

b. Hazard Assessment and Mapping
Given Dominica’s proneness to landslides, landslide hazard assessments become important. Hazard assessments are estimations of an area’s susceptibility to landslides based on 3 inherent physical factors: Distribution of past landslides, slop of steepness, and type of bedrock and its structure. The zonation of the island according to these differing degrees of hazards can lead to the production of landslide hazard maps. Such landslide hazard maps provide information that can be used to identify different levels of risks due to landslides, which in turn facilitates implementation of appropriate structural and non-structural loss reduction strategies for both existing and future development.

It will also be necessary to review pertinent existing legislation to ascertain their enforceability. In addition, hazard mitigation is inter-sectoral and inter-agency; consequently, Dominica needs to identify an appropriate institutional apparatus for coordinating and facilitating all activities designed to increase the country’s resilience to hazard events.

c. Environmental Performance Indicators
It will also be useful for the Ministry of Agriculture and Environment to adopt an Environmental Performance Indicators Programme with specific reference to land management indicators. Recommended land management indicators for consideration, particularly within the framework of the proposed land zoning map, include:
Change in the extent of each land cover class
Change in land use
Change in areas susceptible to hillside erosion
Changes in slip area at selected areas
Change in area susceptible to hillside degradation
Change in area susceptible to reduction in soil health
Organic matter
pH soil test

d. National Environmental Management Strategy (NEMS)
The NEMS recommends the development of a comprehensive land use plan. Finalisation of the NEMS highlighting this as a priority area will facilitate external support for the land use plan.

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27 The Ministry of Agriculture prepared erosion Hazard and Landslip Maps, in the 1980’s. It would be necessary to review these documents in order to assess the methodologies that had been employed and to update and upgrade them for future use; technical assistance and collaboration should be sought from FAO and IICA.
d. Measurement of Soil Erosion
The Government may wish to embark on a programme to measure soil erosion which can be measured using any one or a combination of the following methods:
Field measurement with survey instruments
Field measurement with global positioning systems
Field measurement with tracers
Field measurement by soil profile description
Field measurement by soil probe
Aerial photographic measurement with stereoplotters
Aerial photographic measurement by digital techniques
Digital classification of satellite images
Measurement from run-off plots
Measurement from stream discharge
Measurement from vegetation

e. Slope Stabilisation
The frequency of landslides in Dominica compounded by the recent earthquake events requires the need for a central agency, within the Ministry of Communications and Works to regulate the whole process of investigation, design, construction monitoring and maintenance of slopes. The agency would be responsible for
1. Establishing a central regime for new works on hill slopes including road cuts and farming;
2. Upgrading of slopes that are sub-standard;
3. Supervision of works and spot checking on site that the required standard of site supervision is being met; and
4. Comparison of designs against published technical standards

f. Microfinance
Microfinance should be recognized as a measure and instrument to assist poor households and vulnerable groups to reduce their economic and social vulnerabilities to disasters. Microfinance has the potential to provide informal and flexible financial instruments and to play an important role in integrating disaster mitigation at the community-level and within the informal economy. In addition, these financial instruments can be used to develop community disaster mitigation programmes.

An important attribute of microfinance is its ability to help households diversify their income sources. It is this opportunity that can help poor Dominican households to be less reliant on a single asset-type and consequently better able to deal with disasters.

g. Debt Restructuring and Write-off
It is clear that Dominica’s debt is on a non-sustainable path, no different from that which characterized several developing countries in the late 1980s, called the debt crisis. Given the weak macro-economic performance of the economy in recent times and the extensive damage that the country has suffered from these natural disasters, the international community is called upon to forgive Dominica of its debts. Where debt forgiveness is not possible, the creditor should consider significantly restructuring the debt repayment plan.

Additionally, the international community is being called upon to provide much need capital grants to assist the government in financing the extensive capital works that needs to be undertaken in 2005-2006. The growth projections for the economy are
contingent upon receipt of grant capital and debt relief. Should such grant capital be not forthcoming, then the economy will enter into a slump in 2005. Any plan to restructure the debt and also for fiscal stabilization should also contemplate a plan to improve the performance of exports and the productivity of inputs.

4. Project Proposals

The fundamental factor regarding the viability of any reconstruction process is a country’s internal capacity to undertake the rehabilitation and reconstruction process without further imposing on its already limited capacities. Dominica knows best the time frame and priority of its actions and will surely seek to strike a balance between the urgent task of replacing what has been lost and re-building its resilience to withstand similar future shocks. In any event, reconstruction will need to be carried out on the basis of a significant qualitative improvement over previous circumstances. Observance of building codes to withstand hurricanes and other natural hazards is an essential aspect of reconstruction.

Any strategy for rehabilitation and reconstruction must rest on strengthening the basis for sustained resilience and less vulnerable development with growth. Thus, the proposed mixture of components to build resilience to natural disasters must be compatible with sound economic policies and the necessary structural reforms that will allow Dominica more effective integration into the CSME and into a liberalized global market.

Included below is a sample of priority investment projects deemed important for repair and reconstruction of the affected sections of the society and economy.

The principle objective of the proposed projects is to present a portfolio that can help to reactivate the process of social and economic development, to re-establish productive and export processes, to re-build damaged assets and to reduce social vulnerability. Each project profile provides basic information on aims, scope, expected results, activities and tasks to be carried out, investments to be made, expected financing, and special characteristics.

Each profile should be subsequently analyzed in order to draw up a definitive project that will help improve the living conditions of disaster victims, and recover the physical and economic losses stemming from the effects of the hazard events.
## Annex 1

### Proposed Landslide Methodology and Estimated Cost

<table>
<thead>
<tr>
<th>Location/Characteristics</th>
<th>Geology</th>
<th>Slope Height</th>
<th>Slope Angle</th>
<th>Type of Failure</th>
<th>Apparent Cause of Failure</th>
<th>Infrastructure Affected</th>
<th>Remedial Works</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Coast Road – Tarou Cliff (High Priority)</td>
<td>Basalt agglomerate; strong cementation</td>
<td>Greater than 20m</td>
<td>Vertical</td>
<td>Rock Fall</td>
<td>Weakened cementation; earthquake shaking</td>
<td>Main roadway</td>
<td>Rock scaling; Cable Net Drapery System (for large boulders) or Double Twisted Wire Mesh Drapery System (for smaller boulders less than 0.5m in diameter) over slope face pinned at base to control rockfall onto roadway.</td>
<td>$734,000</td>
</tr>
<tr>
<td>West Coast Road – Coulibistri Cliff (High Priority)</td>
<td>Basalt agglomerate; strong cementation</td>
<td>Greater than 20m</td>
<td>Vertical</td>
<td>Rock Fall</td>
<td>Weakened cementation; earthquake shaking</td>
<td>Main Roadway</td>
<td>Rock scaling; Cable Net Drapery System</td>
<td>EC$ 796,000</td>
</tr>
<tr>
<td>West Coast Road – Anse Gabriel/Colihaut (High Priority)</td>
<td>Basalt agglomerate; strong cementation</td>
<td>Greater than 20m</td>
<td>Vertical</td>
<td>Rockfall</td>
<td>Weakened cementation; earthquake shaking</td>
<td>Roadway</td>
<td>Rock scaling; Cable Net Drapery System</td>
<td>EC$ 734,000</td>
</tr>
<tr>
<td>West Coast Road – Mount Espanol (High Priority)</td>
<td>Basalt agglomerate; strong cementation</td>
<td>Greater than 20m</td>
<td>Vertical</td>
<td>Rockfall</td>
<td>Weakened cementation; earthquake shaking</td>
<td>Roadway</td>
<td>Rock scaling; Cable Net Drapery System</td>
<td>EC$ 734,000</td>
</tr>
<tr>
<td>Portsmouth-Penville Road - Guilet (High Priority)</td>
<td>Andesite agglomerate; strong cementation</td>
<td>Greater than 30m</td>
<td>Vertical</td>
<td>Rockfall</td>
<td>Weakened cementation; Earthquake shaking</td>
<td>Roadway</td>
<td>Rock scaling; Cable Net Drapery System</td>
<td>EC$900,000</td>
</tr>
<tr>
<td>Aux Delices - Newfoundland Road (High Priority)</td>
<td>Topsoil; Residual soil; Basalt agglomerate; Highly weathered basalt bedrock</td>
<td>Greater than 30m</td>
<td>47 degrees</td>
<td>Rockfall</td>
<td>Weakened cementation; Earthquake shaking</td>
<td>Roadway; electricity supply</td>
<td>Rock scaling; realignment of roadway by cutting into rock face</td>
<td>EC$600,000</td>
</tr>
<tr>
<td>Aux Delices – Newfoundland Road (High Priority)</td>
<td>Topsoil; residual soil, Basalt agglomerate; highly weathered basalt bedrock</td>
<td>Greater than 20m</td>
<td>45 degrees</td>
<td>Wedge slide on upper slope; debris flow on lower slope</td>
<td>Roadway; electricity supply</td>
<td>Ground saturation; undercutting by mountain river; earthquake shaking</td>
<td>Rock scaling; Realignment of roadway by cutting into upper rock face</td>
<td>EC$600,000</td>
</tr>
<tr>
<td>Location/Characteristics</td>
<td>Geology</td>
<td>Slope Height</td>
<td>Slope Angle</td>
<td>Type of Failure</td>
<td>Apparent Cause of Failure</td>
<td>Infrastructure Affected</td>
<td>Remedial Works</td>
<td>Estimated Cost</td>
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<tr>
<td>Fond Melle Castle Bruce Road (High Priority)</td>
<td>Topsoil; Agglomerate tuff with interbedded sand layers</td>
<td>Greater than 30m</td>
<td>Near Vertical</td>
<td>Debris flow; Earthquake Shaking</td>
<td>Roadway, Electricity supply</td>
<td>Ground saturation; poor roadway drainage; earthquake shaking</td>
<td>Realignment of roadway by cutting into upper slope</td>
<td>EC$400,000</td>
</tr>
<tr>
<td>Good Hope Road (Marginal Priority)</td>
<td>Topsoil, Residual Soil Highly Weathered assorted volcanic rocks</td>
<td>Greater than 30m</td>
<td>60 degrees</td>
<td>Debris flow</td>
<td>Roadway, Electricity supply</td>
<td>Ground saturation; poor roadway drainage; earthquake shaking</td>
<td>Realignment of roadway by cutting into upper</td>
<td>EC$400,000</td>
</tr>
<tr>
<td>Calibishie Primary School and Social Centre Pre-school</td>
<td>Residual Soil highly weathered Basalt bedrock</td>
<td>Greater than 40m</td>
<td>40 degrees</td>
<td>Mudslide</td>
<td>School buildings and roadway</td>
<td>Ground saturation; earthquake shaking</td>
<td>Retaining wall at toe of slope; slope reinforcement (soil nails) on upper slope</td>
<td>EC$600,000</td>
</tr>
<tr>
<td>Blenheim-Portsmouth Road - Bornes (High Priority)</td>
<td>Residual soil highly weathered basalt/ andesite bedrock</td>
<td>Greater than 20m</td>
<td>65 degrees</td>
<td>Debris flow</td>
<td>Roadway, Electricity supply</td>
<td>Ground saturation; earthquake shaking</td>
<td>Clearing of debris on slope face; application of shortcrete over slope face</td>
<td>EC$500,000</td>
</tr>
</tbody>
</table>

Source: OECS
VI PROJECT PROFILES
### PROJECT TITLE: REHABILITATION and RECONSTRUCTION OF EDUCATIONAL FACILITIES

**Sector:** EDUCATION  
**Subsector:**

**Background:** The education sector suffered considerable damage from the earthquake and Also mudslides. Schools in the parishes of St. John, St. Andrew and St. David. The Roosevelt Douglas Primary and the Salybia Primary have been deemed irreparable and have to be reconstructed. The Pre-School in Calibishie has been completely destroyed by landslides. Several schools have experienced structural damage and have to undergo extensive repaired. Close to 5000 students in seven 7 primary schools and one (1) secondary schools have been either displaced or have missed school for at least one week. Schools are also used as shelters and so there is additional loss to the community with the absence of shelters in case of emergencies.

**Project objectives:**
- Reconstruction and repair of existing structures, including reinforcement, in order to reduce vulnerability to natural disasters and repatriate students back to their original school.

**Duration of the project:** 1 year

**Date of initiation:** Immediate

**National executing agency:** Ministry of Education, Sports, Youth Affairs and Human Resource Development

**Description of activities and tasks:** Repairs and reconstruction of schools and related school facilities.

**Expected results and products:**
- Reparation of students
- Repairs of 6 schools
- Reconstruction of three schools

**Total required investments:** EC$7,500,000.00

**Financial requirements (dollars)**

<table>
<thead>
<tr>
<th>Local:</th>
<th>External:</th>
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<tbody>
<tr>
<td></td>
<td>Donation/Loan/Funding: __________________________</td>
</tr>
</tbody>
</table>

**Potential source of financing**

- External credit:
- Donor:

**Special remarks:**
PROJECT TITLE: PYSCO-SOCIAL TRAUMA

**Sector:** EDUCATION  
**Subsector:**

Background: The education sector suffered considerable damage. Schools in the parishes of St. John, St. Andrew and St. David. The Roosevelt Douglas Primary and the Salybia Primary have been deemed irreparable and have to be reconstructed. The Pre-School in Calibishie has been completely destroyed by landslides. Several schools have experienced structural damage and have to be repaired. Close to 5000 students in seven primary schools and one secondary school have been either displaced or have missed school for at least one week. Schools are also used as shelters and so there is additional loss to the community with the absence of shelters in times of emergency.

The psycho-social impact on students as result has been overwhelming. Preliminary sessions conducted with students with the Ministry of Education Counsellors have shown the need for more sustained intervention in assisting students to cope with the impact of the disaster. Students flee from classrooms each time there is tremor strong enough to be felt. Others complain of insomnia and fear of being or sleeping alone. Post-traumatic Stress appears to have set in. The disruptive nature of the student responses on instruction time and learning is cause for concern and requires immediate intervention.

**Project objectives:**

- To provide counselling support for teachers and students experiencing post-traumatic stress and to provide them with emotional skills to cope in the event of disasters.
- Develop a cadre of trained teachers to provide post trauma counselling.
- To develop a public awareness programme on the psycho-social effects of natural disasters on children.

**Duration of the project:** 1 year  
**Date of initiation:** Immediate

**National executing agency:** Ministry of Education, Sports, Youth Affairs and Human Resource Development

**Description of activities and tasks:**

1. Identify counsellors  
2. Develop a programme of counselling and support for students  
3. Deliver counselling programme to teachers and students  
4. Conduct assessment on levels of coping skills of students

**Expected results and products:**

- 5000 students supported and counselled  
- Programme of counselling and support services for students during disasters  
- Improvement and development of coping skills for teachers and students  
- Full print and electronic media campaign

**Total required investments:** EC$400,000.00

- Labour requirements  
- (Work/months)  
- National inputs:  
- Imported inputs:  

**Financial requirements (dollars):**

- Local:  
- External:
• Donation/Loan/Funding:

____________________

**Potential source of financing**

• External credit:
• Donor:
Dominica  SOC– 3
PROJECT TITLE: Psycho-social Management During and Post Disaster

Sector: SOCIAL | Sub-sector: PSYCHO-SOCIAL

Background: The Island Dominica has recently experienced a magnitude of a 6.0 earthquake. The island is also located in the Caribbean hurricane belt and is therefore remains vulnerable to natural disasters. The impact of these natural as well as man made disasters impact negatively on peoples’ health status. Such negative impacts resulting from the lost or damage of property and livelihood increase emotional stress and anxiety levels of individuals. This trauma lends itself to crisis and severe psycho-social reactions. The impact on individuals provides a basis for the advancement of mental health interventions and services for psycho-social mitigation and prevention of trauma caused by these natural disasters and other such emergencies. Community capacity building for psycho-social management in disaster serves to enhance the skills of community leaders, health care providers, educators, homemakers and other family members. This knowledge and skills enable persons to better understand and address issues of prevention and care that surrounds negative impacts of disaster. Increased sensitization, awareness and training focused on preparedness and reduction of effects and recovery from disaster will enable the nation’s people to address concerns before, during and after more proactively. In addition, such an orientation fosters coping at the level of the individual, the family, the community and beyond.

Project objectives:
- To assess the psychological impact of disaster in the general population.
- To advance mental health protection and promotion in the general population.
- To promote protection against and prevention of mental health risks.
- To assist persons to develop better coping skills in dealing with issues of displacements.
- To increase knowledge base of the community on hazards, in particular, geo-referenced data on multi-hazards and vulnerability
- To develop supportive environments for improved coping abilities to deal with issues of displacements among vulnerable groups following disasters.

Duration of the project: 24 months
Date of initiation: Immediate

National executing agency: Ministry of Health

Description of activities and tasks:
- Sensitization, awareness-raising, and education of families, educators, health care providers and community and national leaders to the normal reactions of children, youth and adults to crisis conditions.
- Training for families, educators, health care providers, and community leaders in managing grief and loss.
- Establish a network of community persons trained in crisis management.
- Implement Stress Management Programme with community persons, focus groups and one on one intervention.
- Develop protocols for group and individual counselling and referrals.
- Examine best practices for development of community warning systems.
- Develop and incorporate a stress management and reduction programme in the disaster component of NEPO.

Expected results and products: Situational diagnosis, increased awareness of crisis reactions, increased coping skills, and decreased risk for mental illness and dysfunctional behaviour associated with trauma. Increased capacity amongst the SMID Team.

Total required investments: EC$550,000.00

Labour requirements (work/months)
National inputs:

Special remarks:
• Imported inputs:

___________________

Financial requirements (dollars)
• Local:
• External:
• Donation/Loan/Funding:

___________________

Potential source of financing
• External credit:
• Donor:
PROJECT TITLE: Land Use Planning, Agricultural Production Planning and Diversification.

Sector: Agriculture  |  Sub-sector: Crop, Livestock and Fisheries.

**Background:** The high dependency of the economy on agriculture warrants that the country pursue policies and actions leading to appropriate use and management of land and water resources as an essential building block for sustainable agricultural development. The continued viability of agriculture requires that the current stock of agricultural land and water resources on the island sustain agricultural production for generations to come. In order to address this, attention must be paid to land use issues and policy and legislation, which would result in an effective land use zoning and development control for Dominica. The observations and reports after the disaster of November 21, 2004, relate to major damages occurring where appropriate land use planning and zoning legislation was not applied. It is in this light that a programme of enforcement in land use and production planning and diversification is necessary for Dominica. This program should also examine and resolve the issues of land tenure as relates to optimal use and investment in the resource base.

The events of the disaster provide an opportunity to focus on a more organized approach to national land use planning and adoption.

**Project Objectives:**

- To develop and enforce land use planning policy including agricultural production zoning and diversification.

**Description of Activities and Tasks:**

- Review existing policies and legislation on land use planning, land tenure and registration and land taxation measures.
- Encourage security of land tenure to improve investment flows in the sector.
- Effective use of databases, particularly those that will contain soil, climate and crop requirement and satellite imagery data.
- Preparation of additional land resources data, testing and correction of digitized maps, integration of environmental requirements and land use production systems.
- National land evaluations with special regard given to the existing and potential utilization of marginal or idle production lands.
- Provide training in the use of land resources information systems, particularly in land evaluation procedures and software.
- Provide training for stakeholders in the agri-business sector as relates to the selection of enterprise suited for specific environments.
- Formulation of short and medium term policy options and programmes for the acceleration of production on marginal, and lands and the rationalisation of zoning of production.

**Expected results and products:**

- Formulation of mechanisms for optimizing the use of available arable lands for agricultural production.
- Review of existing policies and legislation on land use planning, land tenure.
- Policy options on land use zoning and utilization of idle lands formulated.
- Network to support sound agricultural diversification through improved evaluation, management and conservation of natural resources.

**Duration of the Project:** 3 YEARS

**Date of Initiation:**

**National Executing Agency:** Ministry of Agriculture
Financial Requirements: **EC$ 1,750,000**

Potential source of financing:
- EU funds
- FAO
- French Technical cooperation
**PROJECT TITLE:** Mitigating the Effects of Hazards on Agricultural Production.

**Sector:** Agriculture  |  **Sub-sector:** Crop, Livestock and Fisheries.

**Background:** The effects of the recent disaster in Dominica indicate that sustainable development in agriculture can be elusive if disaster management is not considered in the agriculture development plans of the country. The soil, plant and animal loss, the sinking of fishing pirogues and the destruction of feeder roads leaves stakeholders less secure of any returns on their investment and impacts on the food security status of the country. Reducing the effects of hazards on agriculture to maintain a level of stability should entail two approaches. One is the development and implementation of a hazard mitigation strategy in the short to medium run and the other is to support the operation of an insurance facility in the long run, which would lessen the demands on the Government coffers when and if such disasters should occur. This programme relates to a national effort. However, the affected areas will be used as a pilot in the short run with the intention to replicate nationally.

**Project Objectives:** To maintain stability and food security in the agriculture sector by reducing the effects of hazards on agriculture by:
- The development and implementation of a pilot hazard mitigation strategy.
- Supporting the development and implementation of an insurance facility.

**Duration of the Project:** 2 YEARS

**Date of Initiation:**

**Description of Activities and Tasks:**
- Develop a comprehensive strategy on integrated hazard mitigation management giving consideration to the vulnerability and history of disaster events of the island.
- Develop and implement disaster management plan for the country, which includes hazard considerations.
- Develop guidelines and training in use of the collection of data and the updating of information for planning and emergency preparedness.
- Convene consultations among credit institutions, insurance firms including WINCROP, CDERA, and other relevant stakeholders in the agri-business sector.
- Develop indicative proposal and guidelines for operation of insurance facility.
- Propose options for the managerial/institutional structure for the operation of the facility.
- Encourage individual insurance companies to develop instruments relevant to the agriculture sector.

**Expected results and products:**
- Comprehensive strategy on integrated hazard mitigation management developed for Dominica.
- Disaster management plan developed and implemented.
- Operational insurance facility.
<table>
<thead>
<tr>
<th>Financial Requirements</th>
<th>ECS$2,500,000</th>
</tr>
</thead>
<tbody>
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<td>Potential source of financing:</td>
<td></td>
</tr>
<tr>
<td>• EU funds.</td>
<td></td>
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<tr>
<td>• French Technical cooperation.</td>
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<tr>
<td>• FAO.</td>
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</tbody>
</table>

Special remarks:
PROJECT TITLE: Production Resuscitation Programme

Sector: Agriculture  Sub-sector: Crop, Livestock and Fisheries.

Background: The damages and losses sustained by the sector during the recent indicate that sustainable development in agriculture can be elusive if disaster management is not considered in the agriculture development plans of the country. The soil, plant and animal loss the sinking of fishing craft secured in river estuaries and the destruction of feeder roads leaves, stakeholders less secure of any returns on their investment and impacts on the food security status of the country. Honoring market contracts in light of the disaster remains a difficult task for those affected. The affected cash flow patterns of the producers also have implications for them meeting their financial commitment. This project aims at providing assistance to those affected and to return confidence to the productive sector.

Project Objectives:
- To assist producers to re-establish production in the short run.
- To rebuild confidence and capacity to meet existing market contracts.

Description of Activities and Tasks:
- Clearing of farm access roads.
- Rapid assessment of the restoration needs of the sector.
- Sourcing appropriate inputs for the reestablishment of the food crops and small stock lost.
- Assisting in replacing inventory of inputs lost by banana and other farmers.
- Undertaking soil amelioration activities related to soil fertility and liming.
- Procurement of vegetable seeds to enhance production and stability of market supply.
- Providing assistance for the restoration of farm infrastructure.
- Assisting in slope stabilization through the use of tree crops and other grass barriers.

Expected results and products:
- Renewed confidence in the agricultural sector to meet market demands.
- Stability of production in sector.
- Producers adopting good agricultural practices under technical instruction.

Duration of the Project: 8 months

Date of Initiation: 

National Executing Agency: Ministry of Agriculture
Financial Requirements: **ECS 1,500,000**

Potential source of financing:
- FAO
- European Union through the NAO
**PROJECT TITLE: PREDICTION OF SLOPE INSTABILITY USING FIELD INSTRUMENTATION DATA**

**Sector:** Infrastructure  
**Subsector:**

**Background:**  
Ground deformation and ground water pressures are the primary parameters to be monitored in a slope instrumentation scheme. The types of instrumentation usually used for slope monitoring include survey stations, millimometers, piezometers, tensiometers, rainfall gauges, stream flow gauges. The instruments are installed to provide data which can be used to provide advance warning of an impending slope failure and this information to evacuate residents or users of potential sliding areas. Sites for instrumentation deployment would have to be agreed on through review of historical data and in consultation with the Ministry of works personnel. It is anticipated that this project will include training of field inspectors who will be required to read the instrumentation on a regular basis.

**Project objectives:** To provide data about the engineering behaviour of a slope in advance of final collapse so that areas of instability can be evacuated in advance of slope failure.

<table>
<thead>
<tr>
<th>Duration of the project: year(s)</th>
<th>National executing agency: Communications and Works</th>
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<tbody>
<tr>
<td>Long term</td>
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</tr>
</tbody>
</table>

**Date of initiation:** Immediate

**Description of activities and tasks:**
1. Selection of site locations suitable for instrumentation  
2. Drilling and sampling of subsurface soils.  
3. Installation of instrumentation  
4. Instrumentation Monitoring over the long term  
5. Training on use of instrumentation

**Expected results and products:**
1. Information on the relationship between rainfall intensity, pore water pressure, soil parameters and landslide occurrences.

**Total required investments:** EC$500,000.00

**Special remarks:**
**PROJECT TITLE: DEVELOPMENT OF A SLOPE SAFETY SYSTEM**

<table>
<thead>
<tr>
<th>Sector: Infrastructure</th>
<th>Subsector:</th>
</tr>
</thead>
</table>

**Background:** The frequency of landslides in Dominica compounded by the recent earthquake events requires the need for a central agency to regulate the whole process of investigation, design, construction monitoring and maintenance of slopes. This would also include research and educational functions.

**Project objectives:**
1. to establish a central regime for new works on hill slopes including road cuts and farming.
2. to prevent any increased risks due to defective new works by public or private sectors

<table>
<thead>
<tr>
<th>Duration of the project: year(s)</th>
<th>National executing agency: Communications and Works</th>
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<tbody>
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</tbody>
</table>

**Date of initiation:** Immediate

**Description of activities and tasks:**
4. Upgrading of slopes that are sub-standard
5. Supervision of works and spot checking on site that the required standard of site supervision is being met
6. Comparison of designs against published technical standards

**Expected results and products:**
1. Reduced hazards by maintenance programmes for existing slopes
2. Reduction overtime in the amount of harm and damage occurring annually due to landslips

**Total required investments:** EC$400,000

**Special remarks:**
Dominica has a lengthy rainy season on average, with occasional extensive flooding of rivers. During these flood events, the rivers scour their banks and carry a large amount of silt laden water out to the sea. While this process cannot be stopped, it can, however, be mitigated somewhat. This mitigation may take the form of bank stabilization and control, slight reduction in the amount of sediment being transported out to sea, and identification of flood plain boundaries, with the proper application of building or farming setbacks. It is recognized that at present, setbacks from river banks do exist, however, the problem may be one of enforcement.

Project Objectives:
1. Delineation of appropriate flood plain boundaries on a case-by-case basis.
2. Implementation of appropriate river training works at locations where these may be most needed.

Duration of the Project: 3 years
Date of Initiation:

Description of Activities and Tasks:
1. Map flood plain boundaries.
2. Implement river training works.

Expected results and products:
Reduced bank erosion and overtopping of riverbanks

Total Required Investments: EC$5,000,000

Financial Requirements (dollars)
Potential source of financing

Special remarks:

National Executing Agency:
Ministry of Works
**PROJECT TITLE: WATERSHED CONSERVATION AND PROTECTION:**

**Sector:** Forestry  
**Subsector:** Environment

**Background:** Forest lands play a critical function in protecting the water quality and supply of the country. Deforestation, as a result of the heavy rains and landslides, has caused some areas of forest reserve to be stripped of the vegetation. A major concern remains over the serious soil erosion of the un-vegetated slopes and the subsequent impact on the water supply. Urgent action is required in the very short run to ensure that vegetation in the forest and watershed areas is restored through active reforestation using native or alternative fast growing forest species.

**Project objectives:** To rehabilitate damaged forests in order to:

a. Prevent soil erosion as a result of the destruction of forest vegetation along the slopes of watersheds;

b. Improve water quantity and water quality; and

c. Re-establish biodiversity of forest eco-systems.

**Duration of the project:** 1 year  
**Date of initiation:** Immediate

**National executing agency:** Forestry Department and the Department of Environment

**Description of activities and tasks:**

a. Collection and propagation of plant material, especially of the endemic species;

b. Reforestation of watersheds with fast growing native species;

d. Appropriate policy, legal and institutional frameworks for watershed and forest management, including community based approaches.

**Expected results and products:**

1. Damaged forest areas are fully vegetated, with fast growing species.

2. Improved water quality and quantity

3. Implementation of appropriate institutional, policy and legal frameworks for integrated watershed management.

**Total required investments: US$750,000**

**Special remarks:**
PROJECT TITLE: PROTOCOL FOR THE REMOVAL AND DISPOSAL OF DEBRIS AND MUD FLOW MATERIAL

Background: The removal and disposal of the soil, rubble and waste material emanating from landslides and related soil movements is a major issue not only because of its sheer volume and associated costs but perhaps more importantly because of the unplanned and haphazard manner in which it is disposed of into waterways, along the coastline and cliffs overhanging rivers and other water systems. The damage caused to land and marine based ecosystems are uncalculated and undetermined.

Project objectives: To implement a planned and environmentally friendly system for the disposal of debris and mud flows associated with landslides and other natural disasters

Duration of the project: 1 year
Date of initiation: Immediate

National executing agency: Ministry of Communications Works and Housing and the Forestry Division

Description of activities and tasks:
1. Identification of suitable sites island wide for the safe disposal of soil and debris material;
2. Preparation of temporary sites to receive the material;
3. Collection and removal of waste to the identified sites;
4. Environmental Guidelines for removal and disposal
5. Training on the application of guidelines

Expected results and products:
1. A clean and safe environment.
2. Creation of a reserve of fill material for undertaking national land reclamation and other infrastructural projects
3. Reduced damage to rivers and river ecosystems from dredging for fill material for undertaking national infrastructural projects
4. Cadre of trained persons

Total required investments: EC$800,000

Special Remarks: