# GOVERNMENT OF GRENADA

## REGIONAL DISASTER VULNERABILITY REDUCTION PROJECTS (RDVRP)

## ENVIRONMENTAL ASSESSMENT (EA) & ENVIRONMENTAL MANAGEMENT FRAMEWORK (EMF)

**FEBRUARY 2015**

TABLE OF CONTENTS

ACRONYMS

| | |
|---|---|
| APL | Adaptable Program Loan |
| CAPRA | Central American Probabilistic Risk Assessment |
| CARICOM | Caribbean Community |
| CCCCC | Caribbean Community Climate Change Centre |
| CCRIF | Caribbean Catastrophe Risk Insurance Facility |
| CDEMA | Caribbean Disaster Emergency Management Agency |
| CDERA | Caribbean Disaster Emergency Response Agency |
| CIDA | Canadian International Development Agency |
| CIF | Climate Investment Fund |
| CIMH | Caribbean Institute for Meteorology and Hydrology |
| CUBiC | Caribbean Uniform Building Codes |

| | |
|---|---|
| DRM | Disaster Risk Management |
| DVRP | Disaster Vulnerability Reduction Projects |
| EA | Environmental Assessment |
| EC | Eastern Caribbean |
| EIA | Environmental Impact Assessment |
| EMF | Environmental Management Framework |
| EMP | Environmental Management Plan |
| ERL | Emergency Recovery Loan |
| FY | Fiscal Year |
| GDP | Gross Domestic Product |
| GFDRR | Global Facility for Disaster Reduction and Recovery |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| GRENLEC | Grenada Electric Services, Ltd. |
| IBRD | International Bank for Reconstruction and Development |
| IDA | International Development Association |
| IFC | International Finance Corporation |
| IMF | International Monetary Fund |
| IPM | Integrated Pest Management |
| MBIA | Maurice Bishop International Airport |
| MoTW | Ministry of Transportation and Works |
| NaDMA | National Disaster Management Agency |
| NAWASA | National Water and Sewage Authority |
| NOAA | National Oceanic and Atmospheric Administration |
| OAS | Organization of American States |
| OECS | Organization of Eastern Caribbean States |
| OP/BP | Operational Policy/Bank Procedure |
| PAD | Project Appraisal Document |
| PAHO | Pan American Health Organization |
| PCU | Project Coordination U nit |
| PMU | Project Management Unit |
| PPCR | Pilot Program for Climate Resilience |
| RBF | Results-Based Financing |
| RCM | Regional Climate Model |
| RDVRP | Regional Disaster Vulnerability Reduction Program |
| SCF | Strategic Climate Fund |
| SGU | Saint George's University |
| SLR | Sea Level Rise |
| SPI | Standard Precipitation Index |
| TOR | Terms of Reference |
| UNDP | United Nations Development Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| UWI | University of the West Indies |
| WHO | World Health Organisation |

**LISTS OF TABLES AND FIGURES**

**TABLES**



FIGURES

# 1.0 INTRODUCTION AND PROJECT DESCRIPTION

## 1.1 Introduction and Background

The Government of Grenada in partnership with the World Bank has embarked on a project to reduce the impacts of climate change disasters in Grenada and build resilience to adapt to such impacts. Grenada's Disaster Vulnerability Reduction Project (DVRP) provides an overview of the country circumstances, the development context and identifies climate change vulnerabilities in key sectors, for specifically vulnerable groups, for the private sector, important ecosystems and natural resources.

Grenada is exposed to a high level of risk to meteorological (high wind/excess rainfall/hurricanes and drought) and geophysical (seismic/volcanic/tsunami/landslips) hazards, which have significant negative impacts to its economic stability. These hazards often result in significant and recurrent damages to national infrastructure including housing, transportation networks, schools, hospitals as well as communications networks, water and electrical services. As is the case with most island states, a single hazard event can impact the entire population and economy of Grenada due to its small population and limited geographical area.

Disasters in Grenada have had deleterious impacts on livelihoods, destroyed infrastructure and disrupted the provision of essential services and have absorbed a growing share of the national budget to cover recovery and reconstruction efforts. Statistically, between 1980 and 2010 there were 6 natural disasters with approximately 2.4 Billion $EC in economic damage to the country. The country established the emergency response agency, the National Emergency Relief Organization (NERO) in 1985. The agency was renamed the National Disaster Management Agency in 2005 as mandated by the Cabinet.

By far the two largest natural disasters in economic terms were the hurricanes of 2004 and 2005. Prior to Hurricane Ivan in September 2004 Grenada had not seen any hurricane damage since hurricane Lenny in 1999. Prior to hurricane Lenny the most recent major hurricane to affect the island was September 1955. Hurricane Ivan cost Grenada 28 lives and 2.2 Billion $EC in damages. Hurricane Ivan was followed by hurricane Emily in July 2005 that caused 1 life and 140 million $EC in infrastructure damage. As the Minister of Tourism stated in a presentation to a meeting of OECS ministers in 2007, Grenada is living in a new reality due to climate change.

## 1.2 Project Description

The objective of the RDVRP is to measurably reduce vulnerability to natural hazards and climate change impacts on various projects being funded by the World Bank. This EA/EMF is mainly concerned with the Projects under Component 1 which would consist of civil works (new construction and rehabilitation of existing infrastructure) in order to reduce their vulnerability to natural hazards and climate change. There are also some elements in Component 2 (hydrometeorological stations) with potential impacts. This EA/EMF includes an updated project portfolio and a preliminary assessment

of impacts for all projects in the DVRP including those within the Additional Financing (AF) in 2015

DVRP infrastructural sub-projects are located in various areas of Grenada (Figure 1) and involve the following activities:

1. St. John's River Defense System (hydraulic works, flood control)
2. Old Westerhall/Chemin Water Pipeline (water tanks and pipeline)
3. Sendall Tunnel, Constantine Road and River Road (slope stabilization projects)
4. St. Patrick's School, Holy Cross R.C. School, Cardona Home for the Aged, Hills View Home for the aged, Beausejour and La Sagesse (eemergency housing and rehabilitation projects)
5. Market Square, Lance Bridge, and Hubble Bridge (bridge and river defence sites)
6. Grand Etang National Park Nursery (upgrades/warehouse)
7. Hydromet stations (rain gages, streamflow gages)

Environmental and social impacts of the sub-projects were identified in a preliminary assessment during project preparation, and should be considered during all phases of the projects. Those impacts include the following issues identified during the surveys and preliminary assessment exercises that should be given priority consideration in project design.

1. Protection of lives and property

- The physical characteristics of the project sites and in particular the very poor/hazardous condition of the houses in both La Sagesse and Beausejour Housing Settlements, are clear indicators that failure to implement appropriate mitigation measures may result in life threatening problems and damage to property.

2. Public Health and safety

- The existing sewage disposal problems in both La Sagesse and Beausejour housing settlements and the potential problems associated with construction activities on all of the Sites can become detrimental to Public Health and safety

3. Public inconvenience

- During the implementation of the project some inconveniences to the adjacent communities and the general public, especially persons living close to the Lance Bridge, will be created. Careful consideration must be given to addressing this issue.

4. Marine pollution

- Measures to solve the flooding problem in Morne Rouge and St. John's River can result in an increased volume of pollution entering the marine environment if solution does not include appropriate means of minimizing or avoiding current terrestrial flood driven pollution from getting into the sea.

### 1.2.1 Component 1: Prevention and Adaptation Investments

This component includes a broad set of investments, such as drainage improvement measures, improved water storage capacity, risk reduction, rehabilitation of critical infrastructure (, bridges, and some roads), retrofitting of critical public buildings (including schools and homes for the elderly), investments in emergency centers, etc. Civil works will be built to internationally recognized standards for hazard and climate resilience.

The project will fund supporting studies required for the development of works packages such as hydrologic/hydraulic studies, geotechnical studies, and associated pre-engineering and engineering supervision activities required to support engineering design and safeguard compliance.

### 1.2.2 Component 2: Capacity Building and Data Development, Hazard Risk Management and Evaluation

The program supports the strengthening of national capacity to integrate natural hazard and climate change impact information into the national development policies and decision-making process.

Two technical assistance programs supporting the integration of climate risk information in decision making will be piloted. This will be accomplished through the construction of open-source models for risk evaluation at the regional level to work with such models. The methodology used will allow for a horizontal transfer of experiences among the OECS countries. The project will build on data and models generated by the Caribbean Catastrophe Risk Insurance Facility (CCRIF), models generated by the Central American Probabilistic Risk Assessment (CAPRA) initiative, and will complement current work financed through a GFDRR grant to build capacity at the University of the West Indies for risk evaluation.

The project will finance data collection of geo-spatial data using an aerial platform with multiple instruments for the data collection of detailed bathymetry, topography, and hyper-spectral information. It will also support the capture of existing geo-spatial data currently spread among national institutions in the participating countries. To improve data management and sharing capacity Grenada, the project will finance capacity building in use of the open-source GeoNode software for geospatial information. The project may also finance the procurement of data collection equipment and instruments as well as computers, servers, and software as needed.

### 1.2.3 Component 3: Natural Disaster Response Investments

This provisional component would finance emergency recovery and reconstruction activities under an agreed action plan of activities in order to support rapid response in the event of an emergency.

Following an adverse natural event, this component will support the GoG's emergency response and recovery efforts through the financing of (i) post-disaster critical imports, and (ii) emergency recovery and reconstruction works and associated consulting services.

This component will be triggered following (i) the declaration of a national emergency that establishes the causal relationship between the relevant emergency and the needs to access the financing allocated to Disbursement Category 2; and (ii) the preparation and submission to the World Bank of an acceptable Recovery Action Plan detailing, *interalia*, the activities to be financed using the proceeds allocated to Disbursement Category 2.

This component is also designed to facilitate the rapid-categorization of RDVRP financing between disbursement categories and to channel additional financing resources (if available) in support of the GoG's emergency response and recovery efforts.

Since the triggering of this component will be event and demand driven, the Recovery Action Plan annexed to this POM provides the framework by which this component will be triggered, including coordination and implementation arrangements for its activities.

#### 1.2.4 Component 4: Project Management and Implementation Support

Activities under this component would support strengthening and developing the institutional capacity for Project management primarily within the Ministries of Environment and Finance. Activities include training, staffing, and development activities associated with project execution, such as consulting services and engineering support.

#### 1.2.5 Component 5: Payment of CCRIF Insurance Premium

Following the restructuring of the RDVP, this new component was added to finance the Recipient's catastrophe risk insurance premiums for the period of May 30, 2013 to May 30, 2015 for a total not to exceed US$2 million. This would cover Grenada for hurricane and earthquake insurance. The Ministry of Finance will be responsible for the management of this activity, although no Bank funds will flow directly into the government treasuries. A new disbursement category will be introduced to finance Grenada's CCRIF insurance premium as an eligible expenditure, which will be treated as an operating cost and be paid directly to the CCRIF via a direct payment. Financial support allocated under this category is to be finite and not eligible for extension.

## *1.3 Description of Sub-projects under the Components*

#### 1.3.1 Component 1: Prevention and Adaptation Investments

Activities under this component would include a 10.62 Mil US$ for a suite of civil works to improve infrastructure resilience to disaster events and climate change adaptation measures. Sub-projects to be financed under this component, through the provision of works, technical advisory services, operating costs, and acquisition of goods, include:

- Construction of water storage and distribution infrastructure
- Slope stabilization interventions
- Climate resilient rehabilitation of primary and secondary roads and bridges

- Improved climate resilient drainage systems, including maintenance of storm water drainage systems

### 1.3.2 Component 2: Capacity Building and Data Development, Hazard Risk Management and Evaluation

Core data systems to be developed under this component include:

- Design and deployment of a robust hydromet network to provide high resolution hydrologic data for use in a wide range of activities to support, for example, engineering design, national land use and coastal zone planning, disaster management, roads construction practices and design, agricultural development and others
- Community level risk mapping and training on climate adaptation measures

### 1.3.3 Component 3: Natural Disaster Response Investments

This provisional component under this Project would allow for rapid reallocation of International Development Association (IDA) funds during an emergency and includes a 1.0 Mil US$ investment, under streamlined procurement and disbursement procedures. The emergency mechanism component would be triggered, following an adverse natural event, by an official Government of the Country of Grenada declaration of a national emergency. Under this component, expenditures on critical imports (imported or locally manufactured) required by the public/private sectors, and reconstruction/rehabilitation (civil works, goods, and services) of damaged infrastructure may be financed as per (OP/BP 10.00).

### 1.3.4 Component 4: Project Management and Implementation Support

Activities under this component with 2.0 Mil US$ funding would support strengthening and developing the institutional capacity for Project management, including:

a) Financing the establishment of a new Project Coordination Unit (PCU) within the Ministry of Finance, including staffing, training, and operating costs;
b) Preparation for designs and tender documents;
c) Preparation of project reports;
d) Processing of contracts and tender evaluation;
e) Coordination of participating line Ministries;
f) Supervision of the quality of works;
g) Training of staff in project management and implementation support;
h) Monitoring and evaluation of project progress and results; and
i) Related activities to support efficient project management and implementation, through the provision of technical advisory services, training, operating costs, and acquisition of goods.

# 2.0 LEGAL AND REGULATORY FRAMEWORK

## 2.1 General Context

There are several different agencies involved in activities that impact on the environment. However, only eight (five Government Departments and three Statuary Bodies) are directly involved in environmental management activities on a daily basis, as shown in Table 1.

The current approach to Environmental management in Grenada is sectoral in nature. The Ministry of Health and the Environment has the primary responsibility for the environment along with some twenty agencies, inclusive of Government departments, nongovernmental organisations (NGOs) and statutory bodies (Physical Planning Unit – Draft Sectoral Report on the Environment, 2000).

The legislative framework for environmental management reflects the fragmentation of the institutional framework. A review of the environmental legislation in Grenada (Alexis, 2000) concluded that "… most of the laws … are sectoral and decentralized … while they have environmental application, they were not legislated to address those concerns and are mainly incidental to environmental management."

Table 1 - Agencies with responsibility for Project Approval and/or Implementation* and Environmental Management

| DEPARTMENT/MINISTRY/ORGANISATION | MANDATE/RESPONSIBILITY |
|---|---|
| **Physical Planning Unit**, Ministry of Communication, Works, Physical Development, Public Utilities, ICT and Community Development | To protect and enhance the Nation's investment in infrastructure.<br><br>Physical development, public utilities, communications, works, and community development. |
| **Fisheries Division**-Ministry of Agriculture, Natural Resources, Physical Planning & Fisheries | Provide efficient, effective, quality services to the agricultural community (farming, fishing, forestry) to stimulate maximum production for local consumption, export and increased incomes through the sustainable use of natural resources. |
| **Land Use Division**-Ministry of Agriculture, Natural Resources, Physical Planning & Fisheries | Provide efficient, effective, quality services to the agricultural community (farming, fishing, forestry) to stimulate maximum production for local consumption, export and increased incomes through the sustainable use of natural resources. |
| **Environmental Health Department**-Ministry of Health and Social Security | To encourage the improvement, protection, maintenance and preservation, of our fragile ecosystems on a sustainable basis. |

## 2.2 World Bank Safeguards and Policies

During the preparation of the project, the World Bank identified five Environmental Safeguard policies to be applied during project execution. Safeguards are applied to assure that project funds are engaged in a manner consistent with Bank institutional policies with respect to social and environmental protection and management. The application of relevant Bank safeguards is required during the preparation and execution of Bank sponsored activities.

It should be noted that Social Safeguards policies were also triggered for this project: OP/BP4.12 (Involuntary Resettlement) Those aspects are addressed in separate documents prepared specifically for that purpose.

The Environmental Safeguards policies that have been applied to this project are described below.

### 2.2.1 OP/BP 4.01 - Environmental Assessment

This project has been classified as Category B and, as such, an environmental assessment (EA) is required. Projects are classified Category B if:

"Its potential adverse environmental impacts on human populations or environmentally important areas -including wetlands, forests, grasslands, and other natural habitats--are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A EA. Like Category A EA, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance."

The EA (Environmental Assessment) for the Grenada DVRP consists of a preliminary assessment of the potential impacts of the various components, activities and elements of the DVRP, and is included within this EA/EMF document.

### 2.2.2 OP/BP 4.04 - Natural Habitats

This safeguard seeks to support the protection and rehabilitation of natural habitats associated with sponsored projects. This safeguard applies when activities are identified that may significantly affect the quality of natural habitats, which are defined as land or water areas where the biological communities are formed largely by native plant and animal species where human activity has not essentially or heavily modified the area's primary ecological functions. Particular attention is applied to critical habitats where impacts may result in ecological modifications that affect core survival requirements for resident species particularly where Endangered Species are involved. It is the Banks' Policy that any effects to critical natural habitat would be excluded from the Project.

This safeguard is triggered based on the possibility that some construction or agricultural research activities may relate to issues affecting natural habitats. In addition, Grenada is fortunate to have forest covering across about 50 percent of the island, for which reason any major civil works that involve clearing lands (for example laying of pipeline or construction of new roads) may also affect natural habitats, as well as works along sensitive coastline or riverside areas.

### 2.2.3 OP/BP 4.09 - Pest Management

Activities involving the use of pesticides or pest control measures are subject to the application of this safeguard. As a matter of policy, the safeguard promotes the use of appropriate biological or environmental pest control measures such as Integrated Pest Management and seeks to minimize the potential health risks associated with pest management activities. Additionally, the safeguard prohibits the use of internationally banned pesticides and promotes the safe application and applicator training when pesticides are employed. This safeguard is triggered owing to the possibility that agricultural activities may involve the use of pesticides, as well as possible pesticide use for emergency vector control and building treatments.

### 2.2.4 OP/BP 4.11 - Physical Cultural Resources

This safeguard is designed to avoid/ mitigate adverse impacts on cultural resources from development projects that the World Bank finances. Cultural resources are defined as objects, sites, structures, natural features or landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. They are important as sources of valuable historical and scientific information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The loss of such resources is irreversible, but fortunately, it is often avoidable.

Under this project, no known cultural sites would be impacted; however, this safeguard provides a mechanism for ensuring that in the event of 'chance findings', such resources are protected. For the Grenada DVRP, it also provides that community input be included in the design or removal of any historic buildings or sites of religious or cultural importance. This safeguard was triggered as a precaution since excavation or earthmoving may uncover such resources, and since historical buildings of importance to local communities may be rehabilitated.

### 2.2.5 OP/BP 4.36 - Forests

The forest safeguard is designed to guide Bank sponsored projects when activities may potentially affect forest resources. The safeguard seeks to enhance the use of forest management practices that promote resource conservation, renewable resource uses and inclusion of considerations for ecological services offered by forest resources. Any effect on primary forest, that is forests which are in good state of conservation and have not been logged/ harvested previously, would be excluded from the Project.

As agricultural research projects may be proposed relating to forestry and forest management, proposals will be reviewed for compliance with this safeguard.

## *2.3 Review of Relevant Legislation*

### 2.3.1 Overview

Since the 1940's several other pieces of legislation and regulation including the Public Health Ordinance have been enacted and amended with the view of providing the necessary legislative framework for the many different agencies dealing with the environmental management matters**.** However the more recent ones are as follows:

- The Beach Protection Amendment Act of 2009, prohibiting sand mining in Grenada
- The Physical Planning and Development Control Act, No 25, of 2002
- Litter Abatement Act of 1973, which has been supplemented by the passage of the waste management Act of 2001, addressing pollution control and abatement of litter
- Waste Management Act No 16 of 2001, to provide for the management of waste in conformity with best environmental practices and related matters
- Solid waste management act No 11 of 1995, which established the Solid Waste Management Authority, charged with the duty of developing the solid waste management facilities, and improving the coverage and effectiveness of solid waste storage, collection and disposal facilities of Grenada
- National parks and Protected Areas Act of 1991, for the designation and maintenance of National Parks and protected areas
- Environmental Levy Act No 5 of 1997, an act to impose and collect Environmental Levy on certain goods and services
- Fisheries Act of 1986, which provides for the protection of the marine resources in Grenada
- National Trust Act set up for the protection of the cultural heritage of Grenada

Grenada now has in place several pieces of legislation to protect its environment**.** The most relevant ones to the project are**:** the Physical Planning and Development Control Act No 25, of 2002; the Public Health Act of 1958 and the litter Abatement Act of 1973, which has been supplemented by the passage of the Waste Management Act 2001 addressing pollution control and the abatement of litter; the 1986 Fisheries Act; and the 1990, National Parks and Protected Areas Act.

All of those legislations have been playing important resource management roles, which, to some extent, have contributed to the enhancement and conservation of the natural environment and the preservation of public health and safety in Grenada. Nevertheless, only two of those legislations (the Waste Management Act No 16 of 2001 and the Physical Planning and Development Control Act, No 25, of 2002) include provisions for environmental impact assessment (EIA).

It is important to note here that according to both Acts, the legal responsibility for environmental impacts assessments and development control in general is shared between none other than the current Physical Planning and Development Control Authority (PPDA) and the Minister responsible for Planning (Act 16:15-17 and Act 25: 25 & 28). That Minister is responsible for making regulations and appeals. The PPDA is responsible for everything else, with the support of the Physical Planning Unit functioning as its staff.

In the case of the Solid Waste Facilities (Act 16), the final decision is made by the Minister. A notable provision in this Act is that the Minister must, when granting approval, designate a person or body to conduct any inspection necessary to determine whether the design, development and construction of the facility are in accordance with the program, protection plan or mitigation measures that is made a condition of the approval (Section 16(2)).

Despite the above, the Physical Planning and Development Control Act No 25, of 2002 stands out for its overall responsibility for land use management in general. It makes fresh provision for the control of physical development, to continue the Land Development Authority, to require the preparation of physical plans for Grenada, to protect the natural and cultural heritage, and for related matters. The Physical Planning and Development Authority (PPDA) is set up under the Act with regulatory powers over any development taking place in, on, under or over the land.

Part 4 of the Act makes provision for the preparation of Environmental Impacts Assessment. The second schedule, (section 25(2), lists a total of 18 matters for which an Environment Impact Assessment is normally required.

The PPDA functions as the national agency for the identification, protection, conservation and rehabilitation of the natural and cultural heritage in accordance with the United Nations Educational, Scientific and Cultural Organization. It is a convention for the protection of the World Cultural and Natural Heritage, to which Grenada is a party.

The staff of the Physical Planning Unit is deemed to be the staff of the Physical Planning and Development Authority for the purpose of the Act. The Authority meets once a month. It may delegate to any member of the committee, the Head or any other member of the staff of the Authority, or statutory body, the power and authority to carry out on its behalf such functions as the Authority determines.

Neither the Minster, any member of the Authority, any person co-opted to help the Authority in dealing with any matter, the Head or any other member of the staff of the

Authority is liable in any court for or in respect of any act or matter done, or omitted to be done in good faith in the exercise or purported exercise of any function or power conferred by this Act**.**

The environmental impact assessment component of the Act is covered in Part III (Appendix C). According to the Act, the Authority (meaning the Physical Planning and Development Control Authority) can request an EIA in respect of any development application including application for approval in principle, if the proposed development could significantly affect the environment (Subsection 1). Section 25 (1) states that the Authority must not grant permission for the development of land pursuant to an application to which this section applies unless it has first taken the report on the EIA into account.

The Act also includes a list of 17 different types of developments for which an environmental impact assessment is normally required. They are as follows:

1. Hotels of more than 50 rooms
2. Sub-divisions of more than 10 lots
3. Residential development of more than 25 units
4. Any industrial plant which in the opinion of the Authority is likely to cause significant adverse environmental impact
5. Quarrying and other mining activities
6. Marinas
7. Land reclamation, dredging and filling of ponds
8. Airports, ports and harbors
9. Dams and reservoirs
10. Hydro-electric projects and power plants
11. Desalination plants
12. Water purification plants
13. Sanitary landfill operations, solid waste disposal sites, toxic waste disposal sites and other similar sites, Gas pipeline installations
14. Any development generating or potentially generating emissions, aqueous effluent, solid waste, noise, vibration or radioactive discharges
15. Any development involving the storage and use of hazardous materials
16. Any coastal zone development
17. Any development in wetlands, marine parks conservation areas, environmental protection areas or other sensitive environmental areas.

According to the Act, the Minister may make regulations providing for:

(a) The criteria and procedures for determining whether a development is likely to significantly affect the environment and for which an Environmental Impact Assessment is required;

(b) The procedures for setting the scope of an Environmental Impact Assessment to be carried out by the applicant in respect of any development;

(c) The minimum contents of a report on an Environmental Impact Assessment;

(d) The qualifications, skills, knowledge or experience which must be possessed by persons conducting Environmental Impact Assessment for the purpose of this Act;
(e) The procedures for public participation in the Environmental Impact Assessment process and public scrutiny of any report on an Environmental Impact Assessment submitted to the Authority;
(f) The consideration by the Authority of an application in respect of which an Environmental Impact Assessment is required, including the criteria and procedures for review of the report.

Another important part of the Act is its provision for preparing physical plans for Grenada (Part III section 13). Such plans are expected to cater for the economic, social, cultural and environmental needs, as well as addressing critical and sometimes very sensitive land use problems.

The previous lack of such legislation in support of this activity was a major development control disadvantage. That situation resulted in limited emphasis on the preparation of plans, environmental degradation; increased incompatible land use, depletion of natural resources and other associated problems in many areas.

## *2.4 National Environmental Management*

The Physical Planning Department authorized under the Planning and Development Authority, authorized by Act No. 25 of 2002 has the primary responsibility to issue environmental permits for development or construction. Activities or projects that require an EIA (Environmental Impact Assessment) are listed in Annex 2. In practice an EIA is created only in private sector developments, and the relevant Line Ministries are consulted to provide input into the evaluation of the EIA.

While Grenada does not currently have comprehensive environmental management legislation in place, some level of environmental management occurs nonetheless. Although it would be preferable that this is covered by existing legislation, adherence to environmental guidelines during project implementation would ensure that environmental management is factored into all activities and by all individuals. In fact, this stipulation should be built into all contractual arrangements.

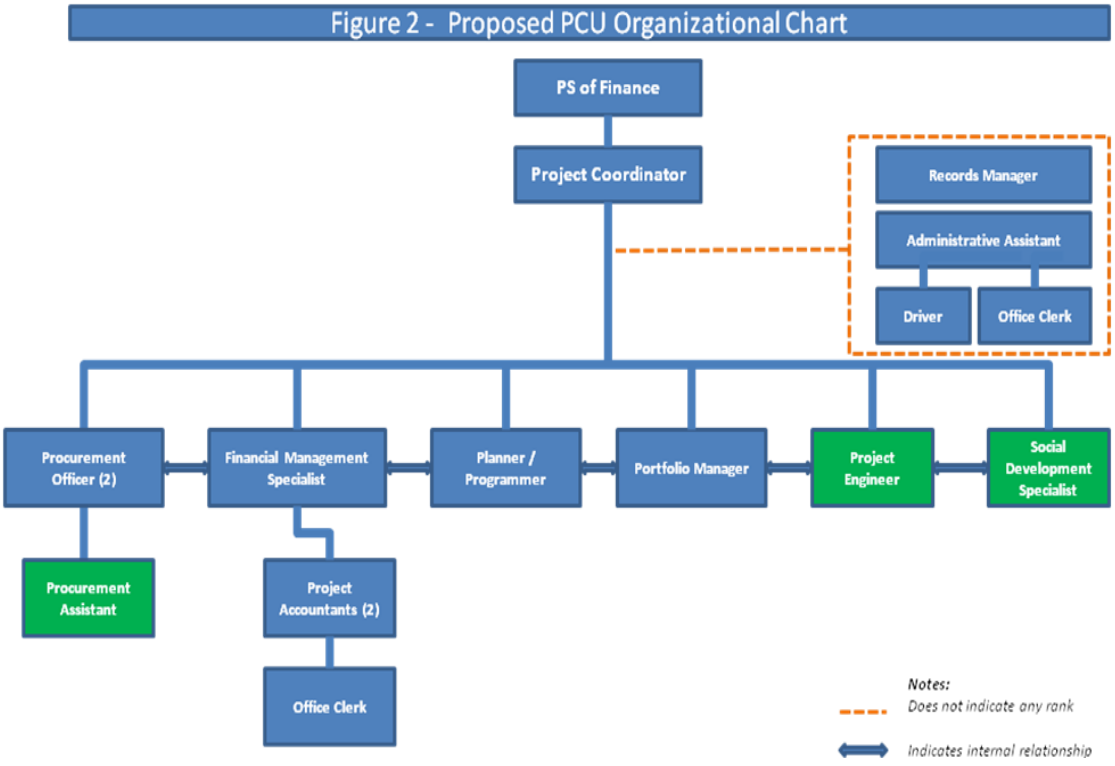
Overall, environmental management in Grenada is hampered by inadequate institutional capacity, overlap/lack of clarity of responsibilities for relevant initiatives, insufficient technical and financial resources and inadequate/outdated /legislation for enforcement.

To ensure that environmental guidelines are adhered to, the proposed projects should be examined by the agency responsible for approval of development projects in Grenada, the Physical Planning Department, as well as the Ministry of Health, Ministry of Works, Ministry of Economic Development , prior to implementation to identify proposed environmental issues and put in place mitigation measures. Other responsible agencies should also be consulted as necessary.

Figure 1 shows the proposed organisational structure of the RDVRP. Within this structure, the Physical Planning Department would be the technical lead for coordination amongst agencies in the project through the PCU. The PCU would be responsible for overseeing the day-to-day execution of activities and project development, including environmental management through the Project Coordinator, the Project Engineer, and the Social Development Specialist. An environmental consultant would be contracted as needed to provide additional support to the PCU. The various line Ministries/Agencies would also assist with project environmental management as needed.

The

Figure 1 - Organizational Structure of the PCU for the RDVRP




The Environmental Consultant (EC) would directly support the PCU for specialized consultations as well as for periodic supervision and inspection of works once activities are underway. The PCU may choose to staff the EC position or contract the position, as needed.

# 3.0 DESCRIPTION OF EXISTING ENVIRONMENT

## 3.1 Grenada General Context

Grenada is located at longitude 61° 4' W and latitude 12° 4' N, situated 110 kilometers (km) southwest of Saint Vincent and 145 km north of Trinidad and Tobago. Grenada, which includes the inhabited islands of Grenada, Carriacou, and Petite Martinique to the northeast, has an area of 344 sq km (131 sq mi) and a coastline of 121 km. Grenada is part of the Grenadines group which is divided between Saint Vincent and the Grenadines (the northern half) and Grenada (the southern half). The island is approximately 340 square kilometers and is the most southerly of the windward islands of the eastern Caribbean. Volcanic in origin, Grenada is very hilly, with the highest peak, Mt. St. Catherine, in the Central Highlands, rising to 840 m (2,756 ft). The coastline is indented with many beaches and small bays. Several short streams cross the terrain. Lake Grand Etang is formed in the crater of a volcano at 530 m (1,740 ft) above sea level and is the major lake in the ecologically protected national park type system. Dense forests populated with an abundance of natural lakes and waterfalls provide the basis for a growing eco-tourism industry. Grenada has a forest area of 15,000 hectares, about half of the three island's 33,669 hectares total land area.

Figure 2: Location and Features Map for Grenada


## 3.2 Geology

The island of Grenada consists of 13 different geological categories ranging from Great River Beds to Tufton Hall Formation (Figure 3). They are of volcanic origin consisting mainly

of volcanic products and, to a lesser degree, of sedimentary rocks formed during the Miocene to the Quaternary period of the Island's volcanic history.

They occur as dome flows and as a wide variety of pyroclastics related to eruptions with varying degrees of explosivity. Agglomerates and ashes in varying degrees are the dominant components of the pyroclastic rocks. The lava flow and rocks from eruption blasts are andesitic and basaltic in nature. (*R.J. Arculus 1973, 1976*).

Within those categories are numerous geological fault lines scattered throughout the Island. They are defined as planer brake in rock along which one side has moved relative to the other. This movement can affect the stability of the soil above and cause structural failure to buildings, walls, roads etc.

Despite the spread of fault lines, no definitive signs of associated problems were observed within the locations of the Project Sites. There are some earth movements in the vicinity of the Holy Cross R.C. School which may be associated with underground water / drainage problem. The landslips and rockfall problems of the Project Sites (See Section 2 above) also do not seem to be the result of the above mentioned fault lines. However, detailed investigation is necessary before arriving at a final conclusion.

**Soil**

There are 3 different types of soil textures in Grenada (sand, silt and clay) and 4 different types of soils based on textural classification, clay, clay loam, sandy loam and loamy sand. Loam is basically a mixture of sand, silt and clay. The percentage range for each texture is clay 7 to 27%, silt 28 to 50%, and sand 23 to 52%. Clay soil is one that at least 40% clay particles. It may have a maximum of 40% silt or 45% sand. Sandy loam is loamy soil in which sand is the dominant particle. Loamy Sand is sandy soil in which clay and silt are the dominant particle.

Clayey soil tends to hold much water for long periods and is also subject to swelling when wet and shrinking when dry. Continuous fluctuation can affect structures in the area.

## *3.3* Topography

The island of Grenada is dominated by areas of rugged topography increasing in ruggedness and gradient towards the central mountain range (Figure 4) as it rises to its highest peak at Mt. St. Catherine, an elevation of 2,756 feet above sea level. The terrain slopes down to the coast on the east and south-east. The island is watered by its many streams and springs, and a small lake, Grand Etang, occupies an old crater at 530 metres. The lands along the southern and eastern coastal areas are less rugged and also involve most of the areas that are vulnerable to flooding.

There are 6 different slope categories in Grenada ranging from A to F *(Land Use Department Ministry of Agriculture)*. Slope category E, 20-30°, is the second steepest and occupies 20,155 hectares, or 65.59%, of the total area of the Island. The flood-prone areas

are within the slope category A, 0-2□, a total of 583 hectares, or 1.9%, of the Island (Table 2).

Figure 3 - Geologic Map of Grenada

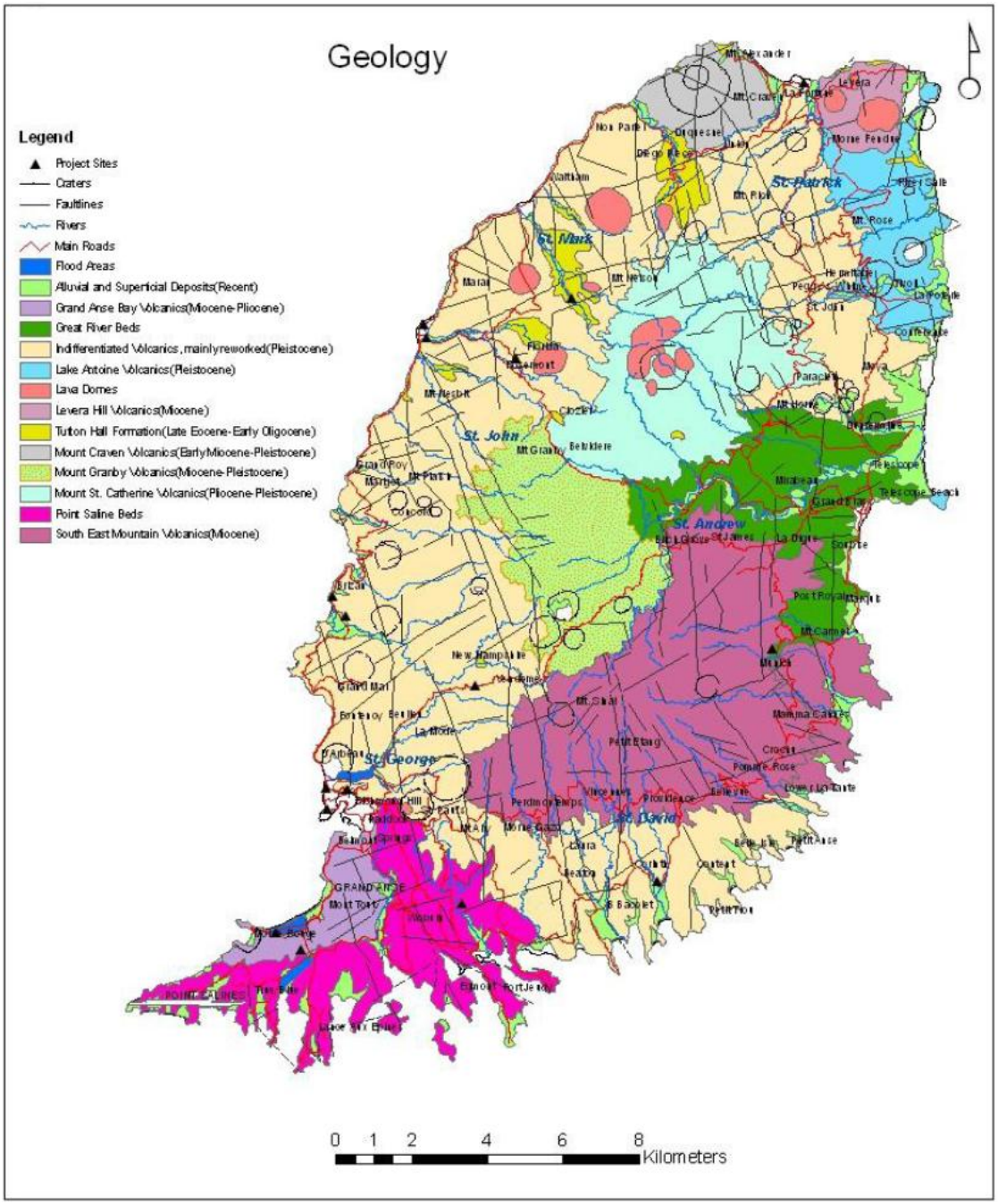
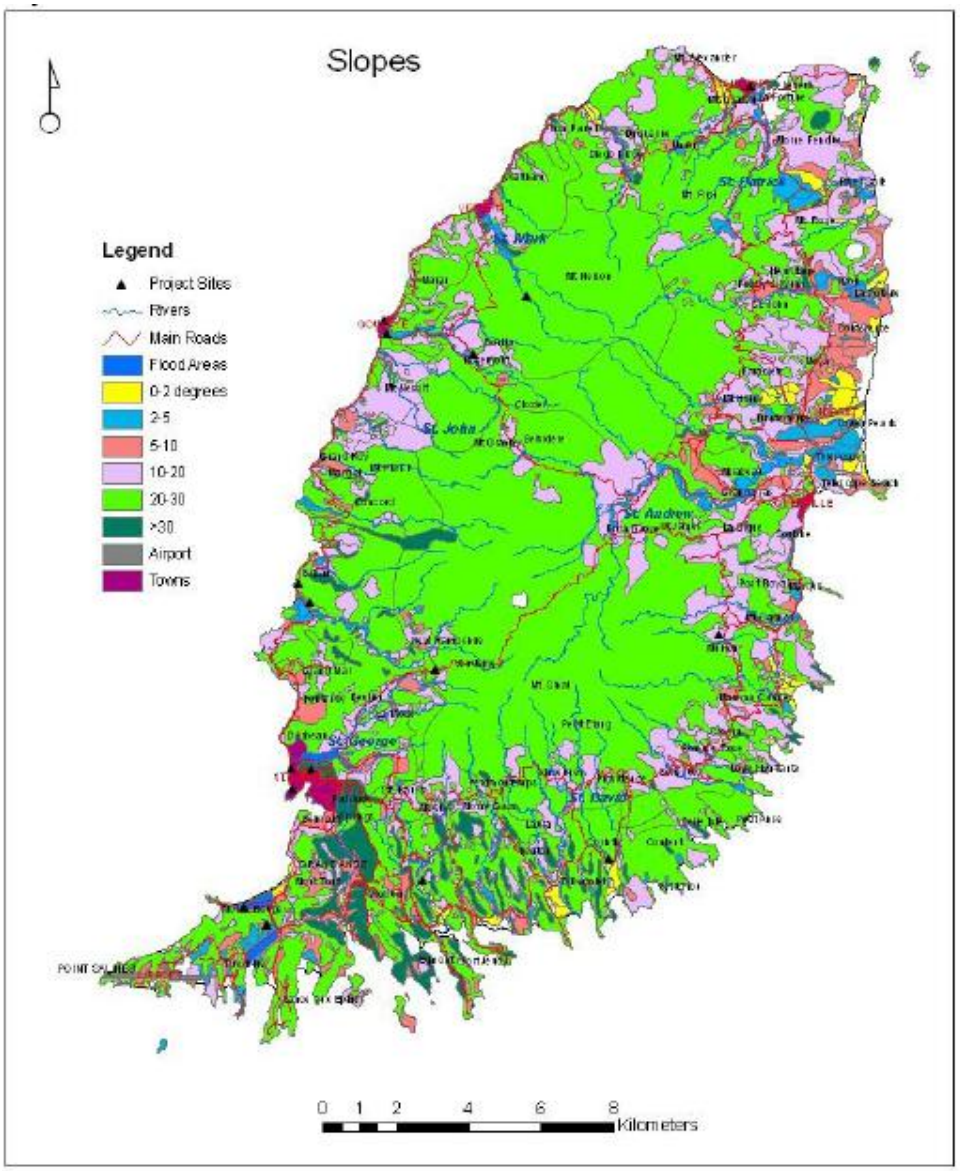


Table 2: Slopes Categories in Grenada

| • Slopes | • Class | • Area (Hectares) |
|---|---|---|
| • A | • 0-2° | • 583 |
| • B | • 2-5° | • 959 |
| • C | • 5-10° | • 1,612 |
| • D | • 10-20° | • 6,274 |
| • E | • 20-30° | • 20,155 |
| • F | • >30° | • 1146 |

Most areas within this topographical setting are vulnerable to landslide, rockfall, flooding and other natural hazards. This situation, together with the apparent inadequate land use planning and development control, have been the main cause of the abovementioned flooding, landslip and rockfall problems.

Figure 4 – Surface Relief Map of Grenada




## *3.4 Climate*

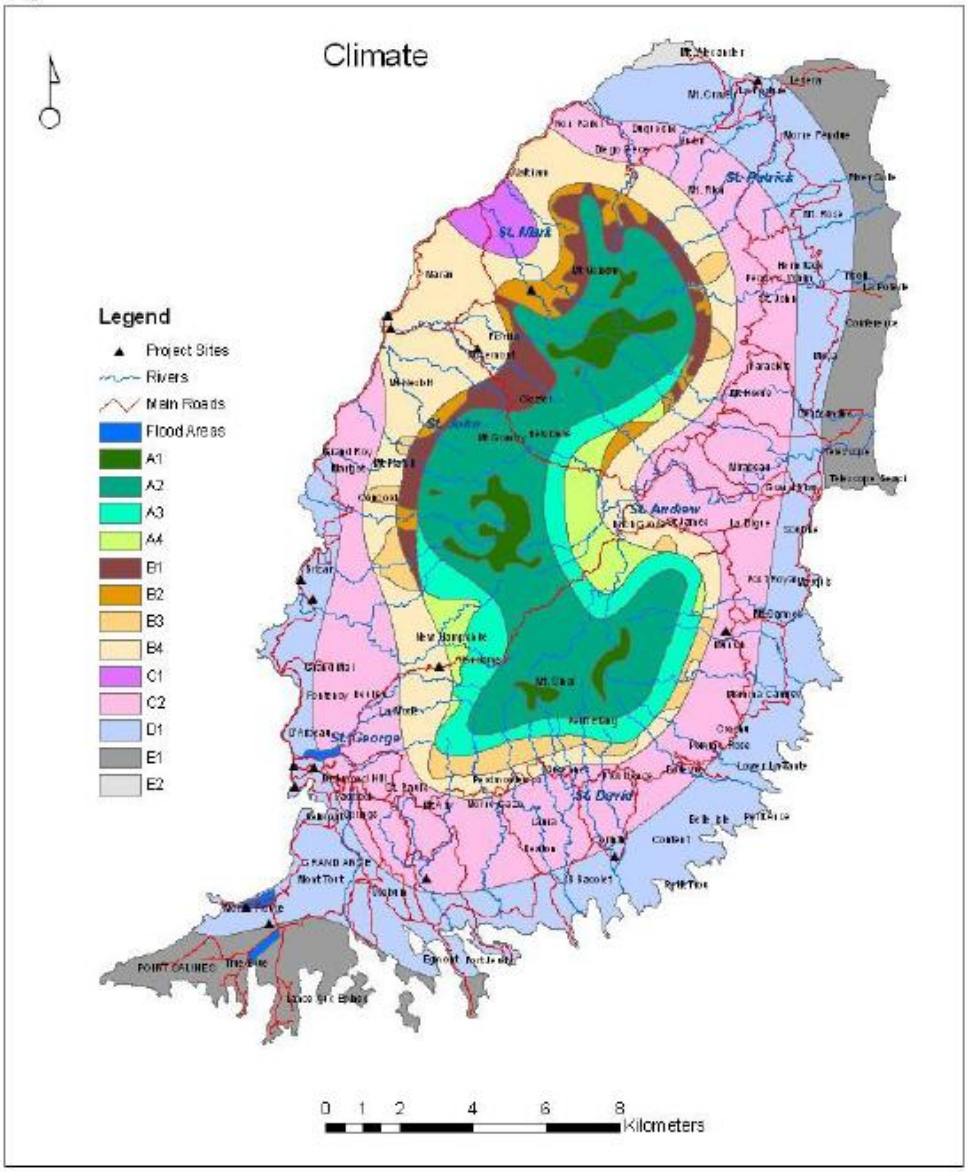
Grenada's climatic condition varies among 13 different locations referred to as Climatic Zones (Figure 5). The entire island experiences a humid tropical marine type climate with little seasonal or diurnal variation, and fairly constant, strong easterly trade winds. It is affected by the subtropical cyclone belt and inter-tropical convergence zone, which influence the climate of the region. The location of these two meteorological systems varies in a cyclical pattern.

Moderate temperatures prevail in Grenada year round with daily heights averaging around 80 F (30 C). Although annual and seasonal variations of temperature are small, the temperature at sea level is generally rather high with little seasonal, diurnal and location variation due to the dampening or stabilizing effect of the ocean mass. Annual average temperature ranges from a low of 28.3 degrees C to a high of 33.3 degrees C.

Annual rainfall in Grenada varies from approximately 1,270mm (50 in) in dry coastal locations to 4,060 mm (160 in) in wet central mountains. The lengths of the dry and wet seasons vary greatly depending on location**.** However, there tends to be a dry season from about January to May and a wet season from about June to December**.** About 75% of annual rainfall occurs during the wet season. No data is available for evapo-transpiration, but rough estimates from Grenada and neighboring islands range from 1,000- mm/year to 1,300mm/year**.**

There are some risks of hurricanes from June to December, however, Grenada lies just south of the path of most tropical storms and is only rarely affected by hurricanes. The first hurricane to hit Grenada directly after Hurricane Janet in 1955 was Hurricane Ivan on September 7, 2004. This situation puts the entire project sites at risk to hurricanes. However, their vulnerability may be increased depending on the condition of buildings, bridges and physical infrastructure.

Figure 5 - Annual Rainfall (in inches)



## 3.5 Human Settlements

Grenada was originally populated by Amerindian peoples, known as Arawak Indians when first discovered on 15 August 1498 by Christopher Columbus, who named it Concepción. By the 18th century, the island was known as Grenada. The origin of that name is unknown, possibly a corruption of the Spanish city of Granada. A secure harbor (at St. George's) attracted traders and some French settlers during the 16th century. After a few failed French private ventures in 1650 and 1657, the French government annexed Grenada in 1674. The island remained under French control until 1762, when Admiral George Rodney captured it for Great Britain. The French regained Grenada in 1779, but the Versailles treaty of 1783 returned Grenada to Britain.

Sugar was Grenada's main product until the 19th century. At that time, the development of spices, especially nutmeg, coupled with the emancipation of slaves in 1834, led to a new economic base for the island. The economy flourished during the second half of the 19th century, and the cultivation of nutmeg, cloves, ginger, and cinnamon, earned Grenada the name Isle of Spice. Grenada's colonial status ended in 1958 when it joined the ill-fated Federation of the West Indies. In 1962, the federation dissolved, and in 1967, Grenada became an associated state of the United Kingdom.

The rich culture and history of Grenada has created physical cultural resources, which are features or objects of interest and value to nation's people because of their archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. These may include Amerindian sites, relicts of forts or plantations, shipwrecks, or historic buildings which may have great local or international value, thus meriting attention and preservation.

## 3.6 Socioeconomic Aspects

The Grenada economy reflects many of the traditional features of a small open economy. This includes a high level of dependence on external trade as a proportion of gross domestic product (GDP), dependence on single sector export products (in this case agriculture) and tourism revenue, high levels of underemployment and unemployment, and dependence on foreign capital (both public and private sector) for investment into productive sectors and for infrastructural development.

The island has always been in a vulnerable position economically, socially, culturally, and environmentally. Economic developments, in particular, are significantly affected by both natural and man-made external factors as is increasingly evidenced by the negative impact on the local economy of changes associated with such international phenomenon as globalization and trade liberalization. The dependence of the economy on the constricting banana industry exposes its high economic vulnerability. Attempts to diversify are slow, however, recent trends indicate that the island is moving towards tourism/ecotourism, as it markets its unique environment and culture. In doing so Grenada has become more acutely

aware of the need to protect the environment and of the growing threat to its vulnerable natural resources presented by climate change.

Grenada, by its very nature is vulnerable, given its susceptibility to natural disasters and its ecological and economic fragility. Vulnerability to climate change in Grenada, like many developing countries, is aggravated by external pressures affecting its resilience and adaptive capacity such as terms of trade, impacts of globalisation (both positive and negative), financial crises, international conflicts, rising external debt, and internal local conditions such as rapid population growth, rising incidence of poverty, political instability, unemployment, reduced social cohesion, and a widening gap between poor and rich, together with the interactions between them. It is widely acknowledged that climate change can exacerbate natural disasters with enormous human and economic costs.

## *3.7 Geohazards*

Grenada is vulnerable to a number of natural hazards such as hurricanes, earthquakes, volcanic activity, drought, tsunamis, flooding, and landslides. The effects of these phenomena can be exacerbated by the activities of population such as deforestation, indiscriminate garbage disposal, poor building practices, and unplanned settlements in environmentally sensitive areas.

The island lies just south of the Atlantic hurricane belt. Prior to 1999 the previous recorded hurricane that affected the island was in 1955. However hurricanes caused significant damage recently in 2004 and 2005. Hurricane Ivan cost Grenada 28 lives and 2.2 Billion $EC. Hurricane Ivan was followed by hurricane Emily in July 2005 that caused 1 life and 140 million $EC in infrastructure damage.

Coastal zones are also vulnerable to storm surge during hurricanes, causing flooding and erosion from wave energy. Depending on the precise configuration of the local sea floor relative to an approaching wave or storm surge, the level of the sea could rise 3 to 5 meters (Caribbean Disaster Mitigation Project, 2000). The eastern side of Grenada is exposed to long-fetch waves across thousands of miles of open Atlantic Ocean, and consequently may be particularly vulnerable to the effects of wave erosion, but all coastal zones of Grenada are subject to coastal flooding and increased damage from wave energy during storms.

Tsunamis pose a hazard in the Eastern Caribbean and can be caused by earthquakes, by avalanches off the side of La Soufriere or other volcanoes (Le Friant and others, 2009), and by eruptions of volcanoes lying on the seafloor such as Kick-em Jenny east of Grenada, which could result in a 2-meter tsunami arriving in Grenada within minutes of eruption (Gibbs, 2001).

The University of West Indies (UWI, 2011) has produced updated maps showing seismic hazard (earth shaking) that can be used for planning purposes in the Eastern Caribbean. These seismic hazards result from tectonic activity (the subduction of the Atlantic Plate beneath the Caribbean Plate). In Grenada the peak ground acceleration (expressed as a percentage (%) of g, the acceleration of gravity), is up to 8-16%g every 475years, , and 40%g

every 1,000 years. The shaking is that typically expected from faults which cut across the island.

The offshore undersea volcano of Grenada (Kick-em Jenny), is active and poses a continuous hazard of eruption. By comparing the time of most recent eruption, the style of volcanic activity, and the potentially affected population, a composite volcanic hazard map of Grenada shows that the most vulnerable regions are to the north east that could be affected by a tsunami caused by undersea movements of rock or explosive extrusives including projectiles from the volcano. Earthquake events are considered a very low risk on Grenada although the off-shore volcano is regularly active.

Excessive rainfall as well as tectonic events may cause landslides in Grenada.

## *3.8 Biological Resources*

The true state of wild life in Grenada is unknown following the impact of the hurricanes in 2004 and 2005 as a comprehensive assessment has not been done.

Although Grenada has one established protected area (Grand Etang Forest Reserve), there is no substantive national park legislation that provides adequate authority either to establish or to manage national parks and protected areas (NPWU 1988).

| Resource | No. of species | No. of endemics |
|---|---|---|
| Plants | Approximately 2000 | 3 |
| Amphibians | 4 | 0 |
| Reptiles Snakes Lizards | 5<br>8 | 1<br>0 |
| Birds | Approximately 150 | -18 threatened<br>1 (+1 sub-species) |
| Marine and Brackish Water fauna | 233 and 69 respectively | |
| Freshwater fauna | 17 | |
| Mammals (indigenous) | 4 | 0 |

Source: ICPB 1988

Groome (1970) and Thomas (1998) indicated that Grenada's terrestrial wildlife consists of amphibians, lizards, snakes and birds. Fresh water shrimps and land crabs are also present. Monkeys (Cercopithcius mona denti), the manicou (Didelphis marsupialis insularis), the armadillo (Dasypus novemcinctus hoplites), the ramier pigeon (Columba squamosa) and iguana (Iguana iguana) are the main species hunted for recreation, a source

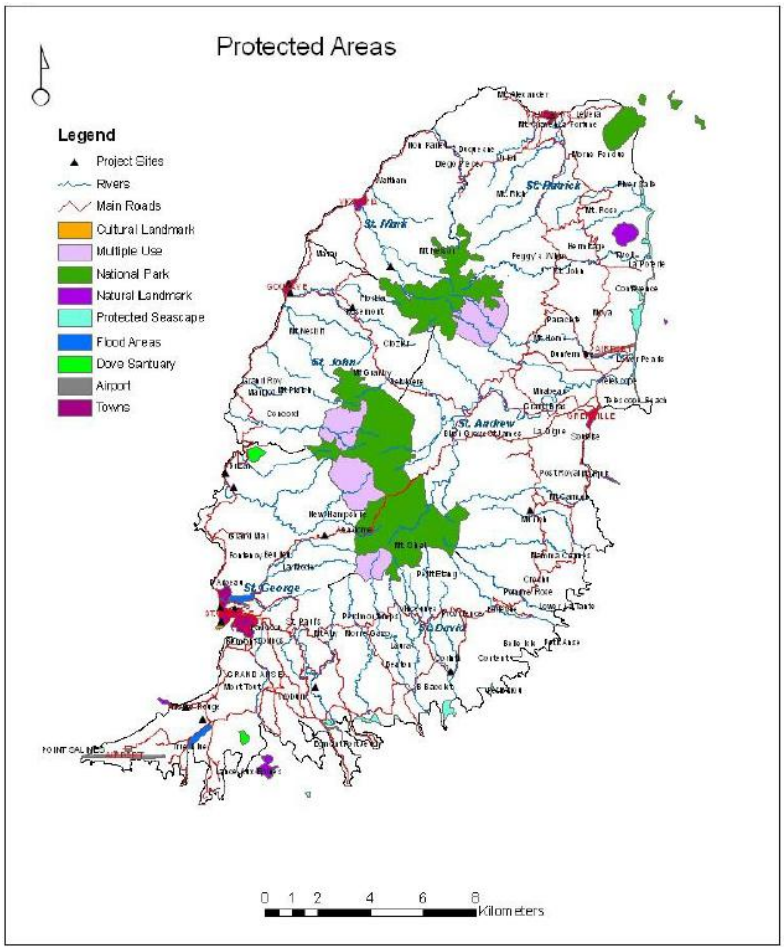
of food and income. Hunting is a popular activity in Grenada for recreation and as a source of food and income. A current ban on the hunting of most species appears to be having a positive effect on current population.

Mongoose (Herpestes auropunctatus) and rats are observed in large quantities and are posing problems to farmers as they compete for fruits and vegetables. Likewise various species of birds and bats are noticeable. In the case of the Grenada dove (Heptotilla wellsi), a rare species now protected, current number do indicate that the specie is critically endangered. In the case of seabirds, the populations primarily in the northern uninhabited rocks and island between Grenada and Carriacou appear to be thriving.

Grenada's wildlife has changed in terms of numbers and species composition during the last few years. The disappearance of animals such as the agouti, the Grenada parrot and some amphibious species demonstrates that the island-wide extinction of species is a historical fact. Known species to have become extinct in Grenada include, the Manatee (Trichecus Manatus), the Grenada parrot (Amazona sp.), the Agouti (Dasyprocta albida), Neuweid's Moon Snake (Pseudoba Neuweidi) Shaw's Racer (Liophis melanotus) and the Morocoy Tortoise (Geochelone carbonaria) (Grenada Env. Profile, 1991). Other species, such as the mona monkey, mongoose, rat and green parrot, have been introduced by man over the last few centuries, often resulting in negative impacts on the native fauna. During the Forest Policy development process, the general public expressed concern about the state of Grenada's wildlife and ranked it as the third most important issue for consideration. Although there is little hard data about species numbers and their current status, a consultative study of the wildlife situation in Grenada took place as part of the Forest Policy development process. Thus, most of the up-to-date information about wildlife in Grenada was provided by hunters in semi-structured interviews and group meetings conducted during the Forest Policy's Wildlife Conservation study ( Forteau, 1998).

The main threat to the flora and fauna are driven by are population and socio economic dynamics which increase the demand for land from wildlife habitat and income from the wildlife hunting and products from the wildlife habitats

**Figure 6 - Protected areas in Grenada**




## *3.9 Land Use*

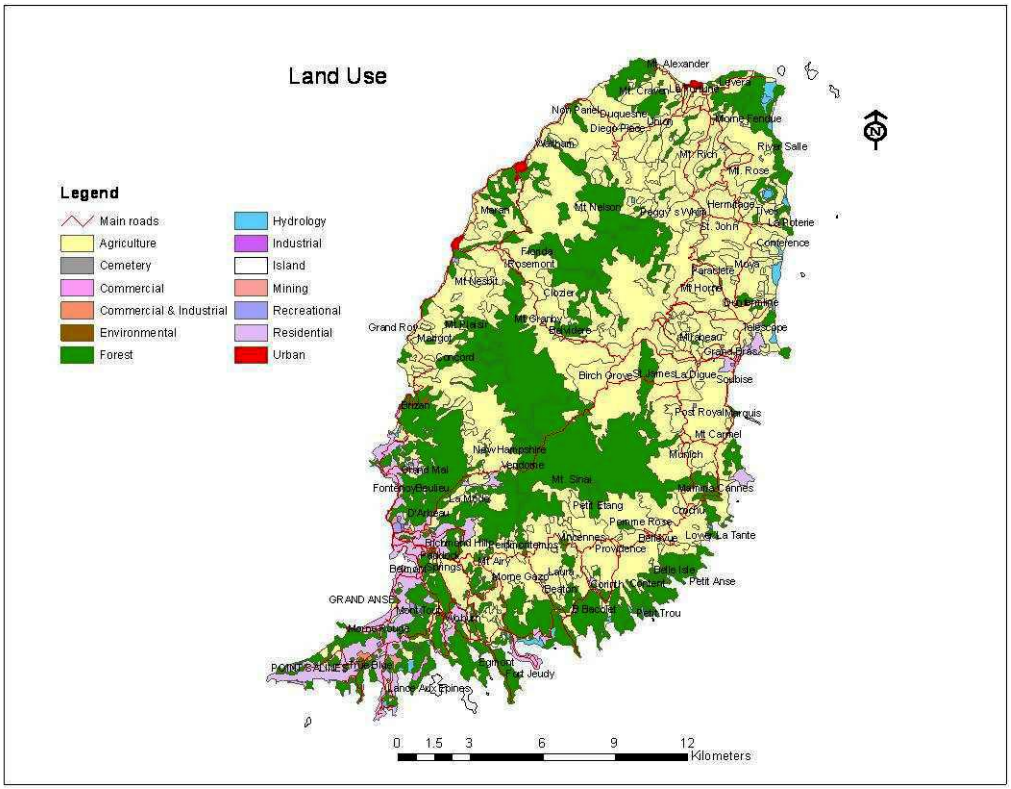
The proposed projects are compatible with the existing land use in their respective areas. The implementation of Old Westerhall/Chemin Valley Water Storage tank and Generator House Construction Project will require some clearing of vegetation and excavation which is expected to result in a minor change to the existing land use of both sites.

The remaining projects do not involve any change of use and there is no indication of potential land use problems to be created by any of the projects except for possible noise nuisance and inconveniences to the local communities likely to occur during project implementation, particularly the La Sagesse and Beausejour Community Housing and the Bridge Replacement Projects.

There will be some temporary land use modification/ adjustments to facilitate the Lance Bridge Replacement Project which may quite likely include the relocation or demolition of part of at least one of the houses close to the bridge and traffic diversion.

The Saint John's River work may require temporary land use modification as dredging will require environmental safeguards to protect downstream flora and fauna as well as human health. Temporary inconveniencies could occur to in order to protect the local community. See Figure 7 for gross land use for the Country of Grenada.

Figure 7 - Land Use Map of Grenada



# 4.0 POTENTIAL ENVIRONMENTAL IMPACTS

## 4.1 Preliminary Assessment

The impacts highlighted in this section relate to the civil works proposed on the respective sites under consideration. The proposed civil works activities with any potential impacts are generally small to midsized, except for activities to be undertaken during the St. John's improvements/dredging. None of the projects are being implemented in known historic or cultural sites. However, forested areas occur across the island, and sensitive marine and coastal environments are always downstream of any activity on land. Accordingly, care must be taken during construction and implementation activities, and pertinent environmental management measures must be implemented.

The social, cultural, historical, and socio economic impacts of these sub-projects are being detailed in a separate social impact assessment document being prepared for this DVRP.

There are both positive and negative impacts associated with the project and its components. It must be noted that the projected impacts and their significance is based on currently available information. As the project components become more defined, site visits could be made and the expected impacts would become more succinct and site specific. However, if proper environmental management plans are not in place or conversely not adhered to, then the anticipated negative impacts would become more significant. Hence, the importance of proper environmental planning, project design and implementation, in particular monitoring during implementation.

The capacity building or institutional strengthening activities (Components 2 and 4) could be considered environmentally beginning with no adverse impacts, except for the installation of hydrometeorological stations in component 2. The civil works in Component 1 (Prevention and Adaptation Investments) could have negative impacts, especially if not diligently managed. Emergency measures (Component 3) would likely involve only the purchase of goods or materials; however, it is possible that some civil works could be necessary on an urgent basis.

The discussion of impacts below is organized according to the main type or category of civil work being undertaken.

### 4.1.1 Slope stabilization

Slope stabilization work includes three projects expected to have some of the greatest anticipated safety impacts. The areas proposed under this sub project include rock stabilization at the northern (exit) end of Sendall Tunnel and landslip stabilization at Constantine Road; Market Suare, Gouyave; and along River Road in St. George

More related to the objective of vulnerability reduction to natural hazards, it was observed that multiple sites show the need for preventive actions of slope stabilization on the high side of the road. Slopes that are more like actual cliffs are subject to collapse under any

slight pressure from water or lateral effort. Rockfalls and fallen trees are then causing road obstruction then requiring costly emergency measures. This hazard is particularly evident at River Road Landslip.

Cable netting is the method of choice for most of these efforts to prevent rockfalls onto roadways. The main environmental concerns at these locations include health and safety for vehicular traffic as well as workers. Overhanging slopes with loose, wet soils present a special hazard at River Road and should be cleared and stabilized, and drains installed on slopes below the overhang, before works begin on the road or retaining walls. At the Sendall Tunnel site, extensive consultations were held with the owners of the damaged church above the work site, to further reconstruction efforts for the historic building.

River Road: area of road erosion, river defense failure

### 4.1.2 Observatory Water Tank and Old Westerhall/Chemin Valley Pipeline

In collaboration with the National Water and Sewer Authority (NAWASA), the Observatory water tank and Chemin water pipeline route require mitigation measures for traffic safety, trenching, and the prevention of runoff and erosion.

In order to minimize problems associated with the obstruction of traffic it is necessary to: Prepare a Traffic Management Plan for the affected areas in collaboration with the police traffic department and consultation with officials of the relevant Bus Drivers Association; inform the general public of the necessary traffic adjustments; Install appropriate traffic signs as proposed by the approved plan; and, Use traffic wardens to assist in regulating traffic during construction.

Trenching safety and erosion prevention plans should be included by the contractors with all proposals.

### 4.1.3 Emergency Housing Rehabilitation Projects

Sub-projects are to include St. Patrick's School, Cardona Home for the Aged, Beasejour and La Sagesse.

Emergency housing projects including foundation work on collapsing structures and suitable wastewater disposal to reduce wastewater borne pathogens effects on the local population do not require an EA. However, geotechnical tests at Beausejour and La Sagesse projects show that percolation rates are unacceptable for leach fields and an alternative design will need to be developed. The preferable solution is subject to the results of the feasibility study, but is likely to include a central collection and disposal system of some type, located in an area of appropriate soils.

La Sagesse: House foundation issues; septic tank without leach field (top right, arrow)

### 4.1.4 Bridge Sites

Projects are to include Market Square, Lance Bridge, and Hubble Bridge, as well as the St. John's River site which is discussed separately below. The main environmental concerns at these sites are the potential for erosion of sediments into the river channels. The contractor should propose how to mitigate problems with stormwater and pollution prevention (e.g. runoff control, sediment traps, berms, silt fencing, restriction of in-channel work). Measures should be developed and included in the EMPs for bidding and contracting these works (refer to section 5.2 of this EA/EMF).

Hubble Bridge

Market Square River Defense

### 4.1.5 River Defences

River defence works are planned at Market Square and at the St. John's River. Standard measures can probably be used at the Market Square site because it is a fairly simple project activity.

At the St. John's River a large area (more than 1 km) is to be constructed, and some of the environmental issues are relatively complex. All of the environmental controls required by Volume III of the Environmental Impact Assessment, St John's River Flood Mitigation Plan, Table 2 are adopted by reference and are included as Annex 2 of this document. The contractor, once awarded contract, should submit an Environmental Management Plan (EMP) prior to beginning work that includes proposed controls for issues listed in Table 2 of the EIA in addition to the following: Proposed baseline concentration study for potential contaminants of concern, compliance monitoring requirements, and a contaminated sediment/water mitigation plan.

Sediment and water baseline conditions will be evaluated prior to finalization of the management plan so that appropriate action levels can be proposed in the EMP. The baseline water quality requirement will include four (4) sediment samples and one (1) water sample for field screening of total petroleum hydrocarbons (Dexsil Petroflag or equivalent), and laboratory analysis for heavy metals.

Compliance monitoring will include periodic (as proposed in the approved EMP) sediment and water sampling for field screening of total petroleum hydrocarbons and laboratory analysis of other contaminants observed at elevated levels during the baseline study. Compliance sampling will be performed on a schedule as proposed in the approved EMP or when an oil slick is observed during excavation/construction activities. After the action levels are approved any rise in contaminant levels above the approved action levels or a visible oil slick caused by project activities will activate the mitigation plan that is included in the EMP.

The EMP should also include how solid waste and potential hazardous waste will be identified when encountered during excavation, and how that waste will be safely retrieved, stored, and disposed. Additionally, issues listed in Table 2 of the EIA should be addressed in the EMP.

St. John's River: Low lying area (left); accumulated sediment at the mouth of the river (right)

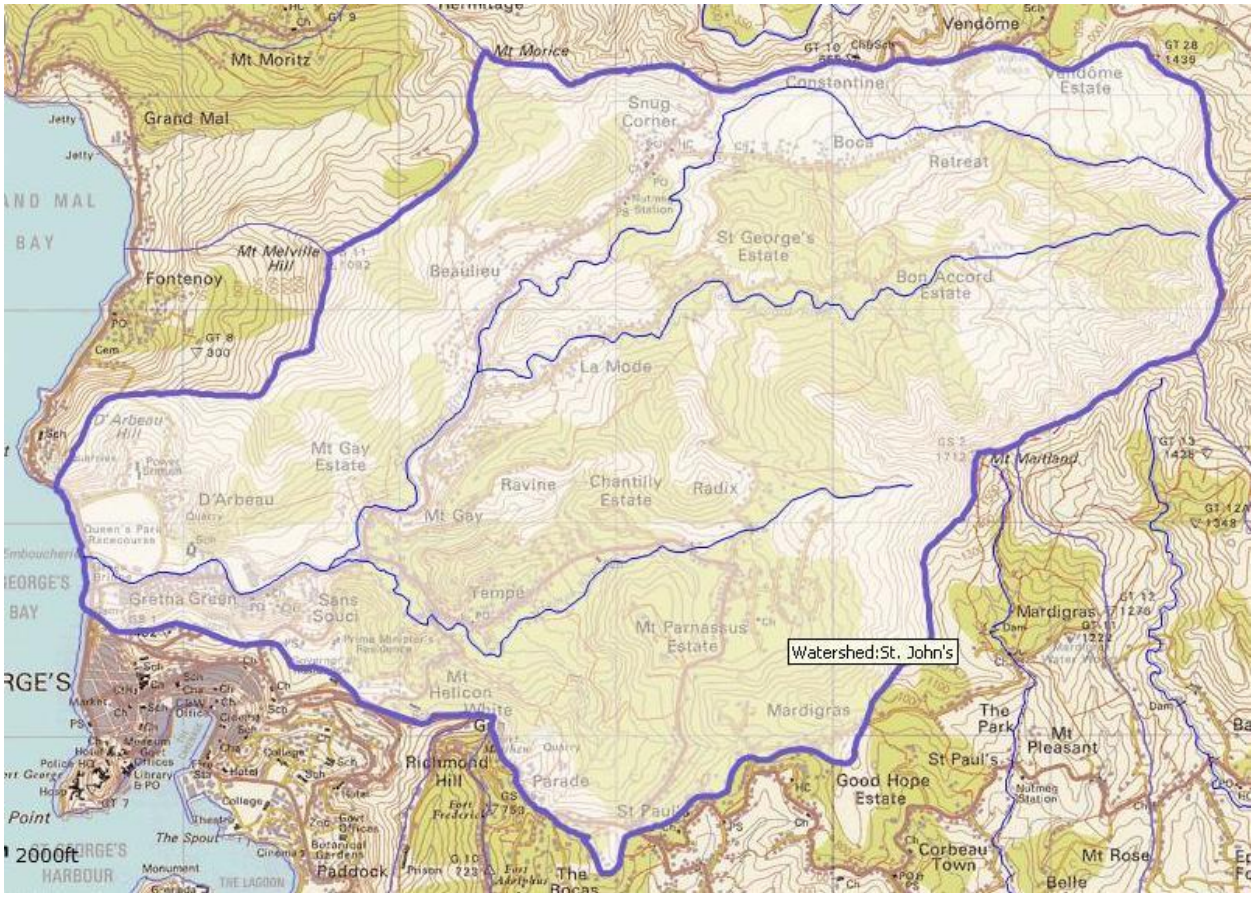



**Figure 8** - St. John's River Watershed (from EIA, Halcrow Group Ltd., Dec. 2012). Grid lines are 1 km; the works proposed for the DVRP and AF are focused in the lower 1.5 km of the watershed (west of Mt. Gay and Tempe to the mouth of the river at St. George's Bay).

### 4.1.6 Nursery Site - Grand Etang National Park

Expansion and upgrading of the nursery at Grand Etang would support strategies for watershed reforestation, biodiversity enhancement, agroforestry projects, and other priorities of the Ministry which are under development at this time. Small community-based activities such as watershed improvement projects are not being considered at this time. The nursery has ample space for expansion without affecting natural habitat in the nearby National Park – currently about one-half acre is used for seedlings, storage, and a small irrigation system, but several acres have already been cleared and could be utilized for various forestry projects. Construction of a warehouse is a priority, as fertilizers and tools are currently held in the main Forestry building in St. Georges's Town. The warehouse should contain a separate area for pesticides and herbicides as needed, so it is

recommended that a Pest Management Plan be prepared to guide the purchase, storage, and handling of any such materials purchased as part of the project, for which reason the Pest Management Policy (OP 4.09) is triggered. The nursery's activities include limited harvesting of forest resources for maintenance and demonstration projects, for which reason the Forest Policy (OP 4.36) is triggered as a precaution; however, it must be underscored that the project will not support commercial or community forestry operations, any effect on primary forest or critical natural habitat, for which the EMF will include exclusions.

### 4.1.7 Hydromet Stations

Most of the improvements to rain gage and stream gage stations will consist of equipment upgrading at existing locations, so the environmental footprint of the physical works will be minimal. If any new stations are installed, their access and construction will follow procedures included in the EMF. New stations may be required to optimize the network, as will be determined during project implementation.

Controls to minimize erosion during upgrades at the site should be minimal. Safety plans should be developed for breakage that can occur during both installation and use of mercury based gauges.

### 4.1.8 Feasibility Studies – Morne Rouge Drainage

Potential drainage works at Morne Rouge drainage basin will be evaluated. The complex and sensitive nature of coastal works, and the very high tourist and economic value of these resources, requires careful study for the selection and design of any appropriate solution. Technical design of the studies should be comprehensive and of the highest standard for the Morne Rouge watershed and the Grande Anse Bay, which would be affected by runoff from the project if improperly managed.

The Morne Rouge drainage project will require both Feasibility Studies and an independent Environmental Impact Study to consider both possible remediation activities as well as potential consequences and dangers associated with those activities. Any activities associated with the project could have lasting negative consequences on important natural resources such as beaches and off-shore fauna. However the potential negative impacts should also be considered against the current baseline of taking no action regarding the configuration of the current drainage system.

The TORs for the studies should include coastal processes, beach morphology and erosion, as well as water quality from the drainage and its effects on the recreational areas on the coast. The study should evaluate possible solutions by cost, effectiveness, and environmental and social aspects, and review design options including stormwater retention ponds or basins. Finally, an EIA for the selected alternative should be developed for the

proposed action, to include extensive consultation with local stakeholders in the tourism and business community of Grand Anse.

## *4.2 Impacts*

As noted earlier, there are both positive and negative impacts associated with this DVRP.

### 4.2.1 Positive Impacts

The positive impacts are expected to be significant. These include:

- The provision of better water supply to communities, which would provide potable water to more households in the area. Also, the storage tanks would provide sufficient water supply to communities when water intakes are shut down during extreme climate events.

- Potential economic growth and development that is likely to occur as a result of the improvement in the road network and increased income and employment opportunities from project implementation and improvement in services. Local communities would also benefit from immediate employment and income generating opportunities created during project implementation.

- Improved safety and reduced disruption from flooding events along the St. Johns river.

- Development of a safer transport route which would open the community to more development and ease concerns of risk to life and limb.

- Improvement in development planning and decision making from the data sets expected (hydrometeorological data), would help with designing and placement of appropriate sea defence and weather prediction, useful in agriculture, etc.

### 4.2.2 Negative Impacts

The following impacts are anticipated at various stages of implementation of the RDVRP's projects:

- **Soil erosion and land slippage** - Some erosion during construction is unavoidable and will occur temporarily as a result of runoff in areas of excavation or other areas of earth disturbances. Unplanned or indiscriminate land clearing, excavation and poor drainage can result in soil erosion and landslides within steep sloping areas which may eventually result in siltation and pollution of rivers and coastal areas. Since, this material may eventually find their way into the nearby streams and rivers causing increases in the suspended sediment concentration. This can be exacerbated by construction during the rainy season or improper construction methods, which leave soils exposed unnecessarily. Landslides at riverbanks could

also occur during construction which could also lead to obstruction and siltation of rivers.

- **Soil contamination** - Fuel is expected to be stored on site and there is an increased risk of spills of hazardous material which may occur, or if oily products from engines are spilled on site or due to improper disposal of used oils and lubricants. During construction, and with heavy traffic, there are likely to be increased risks of accidental spills of oils and fuels. One component of this Project includes the use of pesticides and herbicides. Therefore, there is the risk of soil contamination from these chemicals.

- **Water pollution** - surface water (rivers) or/and groundwater and coastal/marine waters may be contaminated by improper utilisation of storage of construction materials that are toxic or hazardous, such as chemicals or petroleum products. Also, materials used during construction could be accidently or intentionally dumped in the water. This can cause temporary or permanent loss of habitats or aquatic flora and fauna. Soil erosion could also lead to water pollution. One component of this Project includes the use of pesticides and herbicides. Therefore, there is the increased risk of water contamination from these chemicals.

- **Loss of Biodiversity** - Indiscriminate land clearing and excavation, improper disposal of waste materials (oil, grease etc.) could destroy flora and fauna and pollute the area, and quite possibly destroy some of the natural resources. Changes in forest management could have indirect effects, but could be substantial if carried out over broad areas and long time periods.

- **Loss of Physical Cultural Resources** - the unplanned or unintentional destruction of historic buildings, religious or culturally significant sites, could result in the loss of valuable physical cultural resources. Excavation could destroy artefacts of prehistoric age, and cause the loss of irrecoverable archaeological information, unless properly avoided.

- **Ponding** - Project activities may lead to creation of stagnant water in excavation pits or other areas. The resultant stagnant water bodies create suitable conditions for the breeding of mosquitoes and other disease vectors. Presently, in Grenada there is concern over the breeding of the Aedes aegypti mosquito since there has been an increase in the incidence of Dengue Fever and Chikungunya.

- **Noise Pollution** - Ambient noise levels in the project area have not been measured. The use of the vibration and/ or noise producing equipment that is generated from the construction site can be a potential nuisance to the local community and farmers. It may also create unacceptable disturbance to marine species.

- **Air Pollution** - The major effects on air quality during construction would be an increase in suspended particles (dust) from excavation as well as movement of heavy machinery and trucks over unpaved roads, also the dust caused when all traffic is directed to unpaved detours. This increased dust could be unfavourable to resident's

health and a nuisance for their property; it could also form layers on vegetation and reduce visibility for pedestrians and motorists. Any proposed site clearing and excavation activities and use of malfunctioning equipment and machinery can emit excessive levels of dust and carbon monoxide into the air which can be harmful to people.

- **Waste Generation** - The civil works projects are expected to generate the most waste materials. This would include both construction waste and sanitary waste from workers on site. Construction waste would include material packaging as well as earth and rocks. It would be imperative to ensure that these are correctly disposed of.

- **Traffic Congestion and Inaccessibility** - There is likely to be increased traffic and/or congestion due to some road works, excavation and construction activities. Some areas may be difficult to access.

- **Health and Safety** - Potential hazards to the health and safety of workers and other persons in the area in the event of accidents or injury due to improper use, storage and disposal of hazardous materials and waste etc, can occur. There is also the possibility of injury to workers caused by falls, falling equipment or material or from machinery and vehicles.

### 4.2.3 Summary of Impacts

The potential negative impacts described above would be the result of the civil works described under the road works, the water works, the monitoring stations, and the agroforestry projects. In large part the negative effects are minor and reversible, occurring mainly during construction, and can be avoided or minimized by the application of standard environmental management methods as described in the "Mitigation Measures" (Section 5) of this report. Some of the projects could have potentially significant or major negative effects, and thus require more detailed analysis and planning in the form of EIAs which would be done specifically for those projects, as described in the "Screening Procedures" (Section 6) later in this report.

# *5.0 MITIGATION MEASURES*

This section highlights the appropriate measures to be taken in order to minimize or eliminate negative impacts and enhance positive impacts. However, the application of good operation and management practices is of utmost importance. Public consultation is also necessary to inform the affected Communities of the potential problems and mitigation measures. Their concerns and suggestions should also be given due consideration and if possible, employment should be provided for the local residents. This could enhance cooperation and support for the project by the affected community. In general, impacts generated due to construction and civil works could be avoided or mitigated by the development and adherence to a Construction Management Plan.

## *5.1 Construction Management Plan*

Construction activities will occur over a period of time and as such, activities need to be designed so as to minimize the impacts to natural environment. While temporary in nature, construction impacts can be disruptive particularly with respect to noise, management of construction debris, traffic management and interruption of basic services such as drinking water, sanitary, and communication and also impacts on rivers and coastal shorelines. To manage these impacts, the PCU shall include in the construction contract the requirement to develop a construction management plan for all activities involving civil works. This plan shall at a minimum include:

- Construction Schedule
- Service interruption Schedule
- Logistics plan (for deliveries, storage and waste management)
- Communication Plan (to advise and alert commuters, pedestrians and other users and service providers to construction activities)
- Noise management
- Traffic Management
- Dust and other form of pollutants
- Required coordination activities (including regular meetings with communities and other service providers that may be impacted whether directly or indirectly)

This plan shall be submitted by the contractor(s) for approval by line Ministries and the PCU prior to the commencement of construction activities. To the extent possible, the contractor(s) shall schedule major disruptive activities to occur at times when commuting activities are at a minimum (e.g. between 6 am and 6 pm, or weekends and holidays).

## *5.2* **Construction Contract Clauses**

Guidelines for the plan appear below in Tables 3 and 4, which will be modified to create standard contracting clauses for civil works.

Table 3 - Standard Mitigation Measures for All Construction Sites

| |
|---|
| **Permits and Approvals.** The contractor shall be responsible for ensuring that he or she has all relevant legal approvals and permits required to commence works. |
| **Site Security.** The contractor shall be responsible for maintaining security over the construction site including the protection of stored materials and equipment. In the event of severe weather, the contractor shall secure the construction site and associated equipment in such a manner as to protect the site and adjacent areas from consequential damages. This includes the management of onsite, construction materials, construction and sanitary wastes, additional strengthening of erosion control and soil stabilization systems, and other conditions resulting from contractor activities which may increase the potential for damages. |
| **Noise Control.** The contractor(s) shall control noise emissions generated as a result of contracting activities to the extent possible. In the case of site locations where noise disturbance will be a concern, the contractor(s) shall ensure that the equipment is in good working order with manufacturer supplied noise suppression (mufflers etc.) systems functioning and in good repair. Where noise management is a concern, the contractor(s) shall make reasonable efforts to schedule activities during normal working hours (between 8 am and 5 pm). Where noise is likely to pose a risk to the surrounding community, the contractor(s) shall inform the site manager and shall develop a public notification and noise management plan for approval by the line Ministry and PCU. Elements of the hazardous materials management shall include: contractor must provide temporary storage on site of all hazardous or toxic substances in safe containers labeled with details of composition, properties and handling information; the containers of hazardous substances shall be placed in an leak-proof container to prevent spillage and leaching; the wastes shall be transported by specially licensed carriers and disposed in a licensed facility; paints with toxic ingredients or solvents or lead-based paints will not be used; banned chemicals will not be used on any project. |
| **Dust Control.** The following conditions apply to work sites for the control of air quality including dust control at construction sites: (a) construction materials such as sand, cement, or other fine suspended materials should be kept properly covered, (b) cement should be kept stored within a shed or container, (c) the sand and fines can be moistened with sprays of water, and (d), unpaved, dusty construction roads should be compacted and then wet periodically. During interior demolition, debris-chutes shall be used above the first floor; and, demolition debris shall be kept in controlled area and sprayed with water mist to reduce debris dust. During pneumatic drilling/wall destruction dust shall be suppressed by ongoing water spraying and/or installing dust screen enclosures at site. At all sites, the surrounding environment (sidewalks, roads) shall be kept free of debris to minimize dust; there will be no open burning of construction / waste material at the site; there will be no excessive idling of construction vehicles at sites; and, the bins of all haulage vehicles transporting aggregate or building materials must be covered on all public roads. |
| **Use and management of hazardous materials, fuels, solvents and petroleum products.** Any use hazardous materials excluding pesticides, oils, fuels and petroleum products shall conform to the proper use recommendations of the |

| |
|---|
| product. Waste hazardous materials and their containers shall be disposed of in a manner approved by the relevant agency. A site management plan will be developed by the contractor if the operation involves the use of these materials to include estimated quantities to be utilized in the process, storage plans, spill control plans, and waste disposal practices to be followed. This plan is subject to the approval of the line Ministry and PCU. |
| **Use of preservatives and paint substances.** All paints and preservatives shall be used only with the approval of the contract manager Information shall be provided to the contracting officer that describes the essential components of the materials to be used so that an informed determination can be made as to the potential for environmental effects and suitability can be made. Storage, use, and disposal of excess paints and preservatives shall be managed in conformance with the manufacturers' recommendations and as approved by the contracting officer. The contractor shall provide the contracting officer with a list of materials and estimated quantities to be used, storage, spill control and waste disposal plans to be observed during the execution of the contract. This plan is subject to the approval of the line Ministry and PCU. |
| **Site stabilization and erosion control.** The Contractor shall implement measures at the site of operations to manage soil erosion through minimization of excavated area, preservation of existing ground cover to the extent possible, and provision of approved ground cover. For all construction sites, standard measures such as silt fences, baffles, filters, or sedimentation basins will be used to prevent sediment from moving off site and causing excessive turbidity in nearby drains, streams, rivers, wetlands, and coastal waters. Standard erosion control measures will include (a) proper site drainage and prevention of drains being clogged by construction material or sediment to prevent overflow and flooding, (b) all construction materials, including chemicals, must be properly stored, (c) construction vehicles and machinery will be washed only in designated areas where runoff will not pollute natural surface water bodies. Where excavations are made, contractor shall implement appropriate stabilizing techniques to prevent cave-in or landslide. Where slopes are cut, (a) keep angle of slopes within limits of soil type, (b) balance cut and fill to limit steepness of slopes, (c) all slopes and excavated areas must be monitored for movement, and (d) the use of retaining structures and planting with deep rooted grasses (bio-engineering) to retain soil during and after works will be done. An erosion management plan will be required where the potential exists for significant sediment quantities to accumulate in wetlands, lakes, rivers and nearshore marine systems. This plan shall include a description of the potential threat, mitigation measures to be applied, and consideration for the effects of severe weather and an emergency response plan. If works are long coastal marine areas or near major steams and river, water quality monitoring must be done before construction, and at regular intervals to determine turbidity levels and other quality parameters. Erosion control plans shall be approved by the line Ministry and PCU. |
| **Traffic Management.** In cases where construction activities result in the disruption of area transportation services, including temporary loss of roadway, blockage due to deliveries and site related activities, the contractor(s) shall provide the line Ministry and PCU with a traffic management plan including a description of the |

| |
|---|
| anticipated service disruptions, community information plan, and traffic control strategy to be implemented so as to minimize the impact to the surrounding community. This should be done in consultation with the department of traffic of the Royal Grenada Police Force (RGPF) prior to the start of works This plan shall consider time of day for planned disruptions, and shall include consideration for access to essential services such as medical, disaster evacuation, and other critical services. The plan shall be approved by the line Ministry and the PCU. Elements of the traffic management plan to be developed and implemented by contractor shall include: alternative routes to be identified in the instance of extended road works or road blockages; the public to be notified of all disturbance to their normal routes; signposting, warning signs, barriers and traffic diversions must be clearly visible and the public warned of all potential hazards; provision must be made for the safe passages and crossings for all pedestrians where construction traffic interferes with their normal route; there must be active traffic management by trained and visible staff at the site or along roadways as required to ensure safe and convenient passage for the vehicular and pedestrian public; Adjustment of working hours to local traffic patterns, e.g. avoiding major transport activities during rush hours or times of livestock movement. |
| **Management of standing water.** Under no circumstances shall the contractor(s) permit the collection of standing water as a consequence of contractor(s) activities without the approval of the line Ministry and PCU. This will require proper landscaping, filling or drainage of the work site in order to reduce disease incidence, but not in such a way as to affect surrounding areas, water bodies, streams, wetland or coastline. |
| **Management of trash and debris.** The contractor(s) shall provide the contracting officer with a trash and debris management plan that conforms to the solid waste management policies and regulations of Grenada. Under no circumstances shall the contractor(s) allow construction wastes to accumulate so as to cause a nuisance or health risk due to the propagation of pests and disease vectors. The site waste management plan shall include a description of how wastes will be stored, collected and disposed of in accordance with current law. Additionally the contractor(s) shall provide for the regular removal and disposal of all site wastes and provide the contracting officer with a schedule for such removal. |
| **Management of Liquid Wastes.** Under no circumstances shall the contractor allow construction related liquid wastes to accumulate on or off the site, or to flow over or from the site in an uncontrolled manner or to cause a nuisance or health risk due to its content. The site waste management plan shall include a description of how these wastes will be stored, collected and disposed of in accordance with current law. Additionally the contractor shall provide for the regular removal and disposal of all site wastes and provide the contracting officer with a schedule for such removal. Liquid and chemical wastes will be stored in appropriate containers separated from the general refuse; all waste will be collected and disposed of properly in approved landfills by licensed collectors; the records of waste disposal will be maintained as proof of proper management as designed; and, construction related liquid wastes must not be allowed to accumulate on or off the site, or to flow over from the site in an uncontrolled manner or to cause a nuisance or health |

| |
|---|
| risk due to its contents. |
| **Occupational Health and Safety.** An Accident and Emergency Response Plan should be prepared and approved before commencement of work. This should be done in consultation with the Accident and Emergency Department of the Princess Margaret Hospital (PMH) and also Primary Health Care in the relevant District, as well as the Fire and Ambulance Service. The contractor shall ensure that all workers operate within a safe environment. The contractor shall ensure that there are basic medical facilities on site and that there are staff trained in basic first aid. Workers must be provided with the necessary protective gear as per their specific tasks such as hard hats, overalls, gloves, goggles, boots, etc. The contractor shall provide the contracting officer with an occupational health and safety plan for approval by the local health authority prior to the commencement of site activities. All relevant Labour and Occupational Health and Safety regulations must be adhered to ensure worker safety. Appropriate posting of information within the site must be done to inform workers of key rules and regulations to follow. |
| **Worker Sanitation.** Sanitation facilities shall be provided to site workers. All sanitary wastes generated as a result of project activities shall be managed in a manner approved by the contracting officer and the local authority responsible for public health. The contractor(s) shall provide a site sanitation plan for approval and implementation prior to the commencement of site activities. |
| **Community Relations.** Above all there must be community consultation before and during project implementation by the PCU and or line Ministry. This will allow for the development of open communication or rapport between the community and the contractor. It will allow for concerns to be addressed upfront and the affected community would have greater tolerance to the inconveniences experience. They are also the ones on the ground and their concerns and recommendations should have merit. |
| **Closure plan.** A final cleanup plan must also be defined by the contractor and approved by the PCU or line Ministry to ensure site is cleared and cleaned after project is completed. |

In addition to the standard measures in Table 3 above, there are also special mitigation measures that relate to World Banks safeguards policies, or to high risk, sensitive conditions, or complex situations that involve special care. These special measures are detailed in Table 4 below.

Table 4 - Specialized Mitigation Measures for Selected Environmental Aspects

| |
|---|
| **Discovery of Antiquities.** If, during the execution of the activities contained in this contract, any material is discovered onsite which may be considered of historical or cultural interest, such as evidence of prior settlements, native or historical activities, evidence of any existence on a site which may be of cultural significance, all work shall stop and the supervising contracting officer shall be notified immediately. The area in which the material was discovered shall be secured, cordoned off, marked, and the evidence preserved for examination by the local archaeological or cultural authority. No item believed to be an artifact must be removed or disturbed by any of the workers. Work may resume, without penalty of |

| |
|---|
| prejudice to the contractor upon permission from the contracting officer with any restrictions offered to protect the site. |
| **Use and Management of Pesticides.** Any use of pesticides shall be approved by the contracting officer and shall conform to the manufacturers' recommendations for use and application. Any person using pesticides shall demonstrate that they have read and understood these requirements and are capable of complying with the usage recommendations to the satisfaction of the contracting officer. All pesticides to be used shall conform to the list of acceptable pesticides that are not banned by the relevant local authority. If termite treatment or vector control treatment is to be utilized, ensure appropriate chemical management measures are implemented to prevent contamination of surrounding areas, and use only licensed and registered pest control professionals with training and knowledge of proper application methods and techniques. Finally, for projects or activities that may involve significant amounts of pesticides, herbicides, or agricultural chemicals, a Pest Management Plan will be prepared, in accordance with the guidelines in Annex 3 of this EMF. |
| **Asbestos.** In the event that during the course of work activities the contractor discovers asbestos as part of the existing site which requires stabilizing and/or removing it, the contractor shall contact the relevant local authorities and the contracting officer immediately. If work has already commenced, all work in the area must stop immediately. An asbestos management plan must be prepared by the contractor and approved by the relevant local health and waste management authorities and the contracting officer describing how this material will be stored, collected and disposed of in accordance with current law, and identifying the approved experienced professional who will undertake this work. The plan must include (a) description of the type and extent of asbestos, (b) site safety measures, (c) stabilization techniques to be employed, (d) storage and transport plan, (e) approved disposal procedure, and (f) worker awareness and training. In preparing the plan, the contractor should liaise with the relevant local health and waste management agencies to ensure that the adequacy of the measurements being proposed. Site management shall consist of enclosing relevant sections of the site with appropriate material by the contractor. Where possible the asbestos and its location must be appropriately contained and sealed to minimize exposure, and any asbestos shall be marked clearly as a hazardous material. Stabilizing friable asbestos will be done prior to removal (if removal is necessary) and it will be treated with a wetting agent to minimize asbestos dust. Asbestos will be handled and disposed by skilled and experienced professionals using appropriate PPE (personal protective equipment) such as respirators and tyvec suites which will be provisioned to workers to protect them and prevent contamination with asbestos fibers. Respiratory protection together with measures to prevent the |

contamination of clothing and inadvertent transport of asbestos fiber off-site shall be provided to all exposed workers. If asbestos material is be stored temporarily, the wastes should be securely enclosed inside closed containments and marked appropriately. Security measures must be implemented against unauthorized removal of asbestos from the site. No removed asbestos will be reused.

**Medical waste.** In the event that the contractor discovers medical wastes, the contractor shall provide the contracting officer with a medical waste management plan as part of a site waste management plan that conforms to the waste management policies and regulations of the relevant health and waste management authorities. The plan shall include a description of how these wastes will be stored, collected and disposed of in accordance with current law. The contractor must ensure that all persons handling medical wastes are provided with proper protective clothing. All medical wastes must be secured in specially labeled and sealed containers, and disposed of according to relevant local legislation at specified disposal sites. Medical wastes must be kept separate from the other waste streams on site. The waste management plan provided by the contractor must ensure that all persons handling medical wastes are provided with proper protective clothing. All medical wastes must be treated as hazardous. All medical wastes must be secured in specially labeled and sealed containers separate from other wastes streams. All medical wastes must be disposed of according to relevant local legislation at specified disposal sites.

**Water pipelines.** The Contractor shall utilize the following measures to mitigate potential environmental, health and safety impacts during the construction and installation of the water pipeline:

- Trenching. Soil stockpiling will be done in designated areas alongside the trench using piles no higher than 2 meters, convex in shape, and located so as to minimize disturbance and hazard to passersby or traffic. The contractor shall ensure that stockpiles do not cause damming of water or runoff, or that such stockpiles are themselves not washed away.
- Dewatering. Removal of water from trenches shall be done in such a manner to prevent the discharge of mud or sediment into any water body, or the creation of standing water bodies on lands outside the work area.
- Dust Control. During dry periods when dust is a nuisance it shall be mitigated by spraying of water onto work surfaces along the pipeline work area. Dust shall not be allowed to travel outside of the work zone.
- Traffic Control. For all works alongside roadways, appropriate safety signage and barriers shall be used to ensure the safety of any foot traffic or vehicular traffic. If the trench is exposed to foot or vehicle traffic appropriate restrictive barriers, taping, and warning signage shall be used. Traffic shall be controlled and stopped as necessary on public thoroughfares in accordance with good safety practice and national requirements. Trenches or equipment exposed to public access must be clearly demarcated and restricted to public access. Mud and sand brought onto paved public access roads shall be washed and cleared daily.
- Safety Plan. The Contactor will prepare a Health and Safety Plan which shall include emergency response and first aid procedures, awareness training suitable to the tasks being conducted, vehicle and equipment safety

provisions, and personal protective equipment information. The contractor will provide hard hats, work boots, protective eyewear and gloves to workers and will ensure that they are used by workers on the job.

- Vegetation and Topsoil Clearing. If any vegetation or brush is cleared, or topsoil removed, it shall be done in such a way as to avoid disturbance or effects outside the established work area. Herbicides or burning may not be used to dispose of any cleared vegetation, rather such vegetation must be chipped, shredded, and dispersed in approved areas or hauled to an approved landfill. Should fauna be encountered work will cease until such fauna have been safely relocated. If any agricultural land is crossed, topsoil shall be stored separately and replaced by spreading on the land surface upon completion of work.
- Access Roads. No new access roads will be opened, only existing roadways will be used for all the entry and exit of materials and equipment to and from the work zone.
- Work Areas. Contractor will delineate approved work areas for all activities including excavation, stockpiling, access, equipment placement during excavation, and materials storage. Such work areas are subject to approval by the contract manager and/or supervising engineer, and Contractor may use only those lands for which approval and access has been provided by the contracting officer and/or supervising engineer. Any rental, use or acquisition of lands from private parties is not permitted without previous notification to and express written approval by the PCU through application of relevant World Bank Policy.
- Vehicle and Equipment Fueling and Maintenance. All gasoline and diesel filling, oil changing, and maintenance of vehicles and equipment will be done outside of the project area at established facilities. If fuel trucks are used they will have adequate safety equipment and fire extinguishers, be free of leaks and be fitted with appropriate dispensers, and have spill kits and absorbent materials ready to retrieve any leaked or spilled fuels. No fuel, new oil or waste oil will be stored on the work site, and vehicles will not be washed on the work site or in adjacent areas.

**Explosives.** Use of explosives shall be at the approval of the relevant local authority and shall be supervised and undertaken by a qualified explosives technician. Blasting will be limited to between the hours of 9:00am and 4:00 pm unless specifically approved by the local authority and the contracting officer. Any use of explosives shall be permitted only after an explosives management and blasting plan has been approved by the relevant local authority and the contracting officer. This plan shall include

A. Description of the explosive agent, charge description, intended use.

B. Site safety plan including:

1. Storage of initiators, booster charges and principal blasting agents
2. Handling precautions to be observed
3. Transport to and from site
4. Security of stored materials
5. Disposal of excess or damaged explosive materials.

C. Analysis of risk to surrounding area and mitigation measures to be employed

| |
|---|
| including:<br>1. Over-pressure event<br>2. Noise<br>3. Flying debris<br>4. Seismic transmission<br>5. Accidental detonation<br>D. Name and qualifications for all persons responsible for handling explosive agents. |
| **Works in Forest Areas.** For any work in a designated Forest Reserve, or in a forest area, the following will apply:<br>▪ There must be no unnecessary clearing of natural vegetation.<br>▪ Any negative effects on primary forest are prohibited.<br>▪ Avoid the use of herbicides or other chemicals.<br>▪ Any works to be undertaken in a protected forest area must be done under the supervision of a representative of the Forestry Department.<br>▪ The contractor must ensure that any work undertaken in the forest reserve must be done by manual means.<br>▪ There must be minimal impact to flora and fauna in the forest area.<br>▪ All recognized natural habitats, wetlands and protected areas in the immediate vicinity of the activity must not be damaged or exploited.<br>▪ The contractor must ensure that all staff will be strictly prohibited from hunting, foraging, logging or other damaging activities.<br>▪ A survey and an inventory shall be made of large trees in the vicinity of the construction activity, large trees shall be marked and cordoned off with fencing, their root system protected, and any damage to the trees avoided.<br>▪ There will be no unlicensed borrow pits, quarries or waste dumps in protected areas.<br>▪ Upon completion, all wastes must be immediately removed out of the forested area. |

## *5.3 Additional Considerations*

Finally, if approval from the relevant permitting Agency has been sought and granted for any particular project or activity, then the contract language should include any additional permit conditions and/or recommendations of Physical Planning as well as those of any other statutory agency who was part of the permitting. If an EIA has been conducted for a particular sub-project due to its environmentally sensitive or complex nature (see section 6 and Table 5), then the specific recommendations for mitigation measures in that EIA should also be included in the contract language, in addition to the standard minimum mitigation measures in Table 3 above and any applicable special mitigation measures in Table 4 above.

# 6.0 ENVIRONMENTAL SCREENING PROCEDURES

## 6.1 Introduction

This section of the report provides an important element of the environmental management process, namely the screening procedure for future work activities and subprojects. At present the proposed works are known at only a general level of detail and their potential impacts are also known only in a general sense, so it is impossible to generate any detailed mitigation or management plan.

The preliminary project descriptions, impact evaluations, and generalized mitigation measures given previously in this report therefore provide a good starting point, but as is often the case details and particulars may change over time. In the future as detailed actions emerge and specific activities are ready to begin physical works, the scope, scale, and design of particular activities become fully known. At that time it will be necessary to ascertain their potential environmental impacts through a screening process, identify potential environmental impacts, and provide the appropriate mitigation measures.

As part of this process it will be critical to identify those works which could have more significant impacts, or which could affect sensitive areas or involve complex conditions, and which would merit additional evaluation, assessment, and careful planning to best manage impacts during project execution. Accordingly, this part of the report contains the screening procedures, which are the guidelines, procedures and protocols that will be used for environmental management of future subprojects or activities once they are defined in sufficient detail to allow the development of detailed planning efforts. In addition, any works in primary forest or in critical natural habitat will be identified and excluded from consideration as part of the Project.

## 6.2 National Permitting

The Physical Planning Department is the main authority with legislated responsibility for granting planning permits or approvals as highlighted earlier in this report. In doing so, this authority consults with other statutory agencies, depending on the type of project being applied for. According to Schedule II of the Physical Planning Act, there is a list of projects to determine if a proposal requires an EIA. For all World Bank projects, the requirements of the Physical Planning Act must be followed, as well as all laws and regulations and guidelines pertaining to environmental protection in Grenada.

The evaluation, screening and scoping of activities and projects by the Physical Planning Department may conclude that certain projects or activities require that an EIA be conducted. In such cases, then any mitigation requirements or conditions from that EIA should be included in the relevant contracting language to ensure that they are carried out. Any relevant permits or approvals that are necessary in accordance with law in Grenada must also be obtained.

## 6.3 World Bank Environmental Safeguards

As part of the general assessment process under the World Bank's policy on Environmental Assessment (OP/BP 4.01), the Bank, as the main project sponsor with its own internal procedures, would determine whether all of the collective suite of potential sub-projects that together create a program such as the DVRP might have a significant environmental impact or not, as was the case with this project. This would be part of the initial screening, and resulted in a classification of "Category B" meaning that while there will be some negative impacts, they can be identified and managed through fairly standard means, as described within this EMF.

Four other Bank safeguards on environmental matters have been identified as applicable to the project (Refer to Section 2.2) and include:

- Natural Habitats (OP/BP 4.04)
- Pest Management (OP/BP 4.09)
- Physical Cultural Resources (OP/BP 4.11)
- Forests (OP/BP 4.36)

These policies would not be relevant to many of the projects being considered under the DVRP program, since they involve relatively simple civil works with only limited impacts. However, each project or activity must be screened and scoped carefully during the planning process, in order to identify any cases where specific activities or projects could affect natural habitats, physical cultural resources, the management of forests, or involve the significant use of pesticides. In these cases, the policies would provide guidance and spell out the care which must be exercised to ensure that the provisions of the policies are followed. These will generally be the projects for which the possible environmental effects could be significant, where issues surrounding the proper management are more complex than previously assumed, or that involve sensitive areas or natural habitats require special attention to avoid doing harm. In those cases, during implementation, additional study is merited in the form of a separate EIA appropriate to the scale of the potential effects, which would have as its end product a specific tailor-made set of mitigation measures to best manage the project in question.

## 6.4 Screening Criteria and Checklists

The screening criteria for the DVRP projects addresses the environmental aspects and allows for flagging of the pertinent World Bank policy response if or as necessary. To begin it is necessary to determine whether a proposed project falls into one of two groups: those which involve more complex environmental conditions and/or potentially significant environmental effects (if unmitigated) and which therefore require more cautious planning efforts; or, those comprising relatively simple or uncomplicated works where the impacts are minimal (e.g., effects during construction of minor works) and which can be addressed through standardized or generic mitigation measures.

The first step of the screening procedure will be the preparation of a screening form designed to capture the necessary information about the proposed activity and its potential environmental impacts. The screening form will completed by the PCU in coordination with the associated Line Ministry. The screening form should indicate whether a sub-project or activity is environmentally complex or may have potentially significant impacts if unmitigated. These would include the following:

- Potential impact to natural habitats: whether or not a specific activity or subproject would potentially affect land or water areas where the biological communities are formed largely by native plant and animal species where human activity has not essentially or heavily modified the area's primary ecological functions, and so involve the provisions of OP/BP 4.10.

- Potential impact to physical cultural resources: whether or not a specific subproject or activity would potentially affect objects, sites, structures, natural features or landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance, and so involve the provisions of OP/BP 4.11.

- Potential for forest effects: whether project has or may have impacts on the health and quality of forests, projects that affect the rights and welfare of people and their level of dependence upon or interaction with forests, and projects that aim to bring about changes in the management, protection, or utilization of natural forests, and so involve the provisions of OP4.36.

- Pesticide Use: whether or not the project would involve procurement of pesticides or pesticide application equipment (either directly through the project, or indirectly through on-lending, co-financing, or government counterpart funding), and whether the project may (i) lead to substantially increased pesticide use and subsequent increase in health and environmental risk, (ii) maintain or expand present pest management practices that are unsustainable, not based on an IPM approach, and /or pose significant health or environmental risks, and so involve the provisions of OP4.09.

- Potential for Hazardous Waste: whether or not special or hazardous wastes would need to be handled, for example waste solvents, asbestos, medical waste, infectious or biohazard materials, or radioactive materials, and so present complex issues that may be best resolved by detailed analysis and creation of a specific plan for the issue at hand.

- Existence of extremely challenging geotechnical conditions: Would activities pose a high risk of causing landslides, slips, slumps, rockfalls, debris-flows, or excessive erosion? Is work space limited and is there a risk to workers and area residents? Are large amounts of earthwork envisaged? In such case the works would present complex issues that may be best resolved by detailed analysis and creation of a specific plan for the issue at hand.

To assist the PCU and proposing agencies in determining if a project is likely to have significant environmental impacts or presents complex conditions for which an Environmental Impact Assessment (EIA) is required, the following checklist is proposed in Table 5 below. Additional checklists and forms may be developed and used by the PCU and Line Ministries to assist with the screening process.

Table 5 - Identification of Complex/Sensitive Sub-Projects or Activities

| Characteristic of Sub-project or Activity: | Yes/No | Comments |
|---|---|---|
| 1. Does the project involve construction of new roads, or major rehabilitation of existing roads? | | |
| 2. Does the project involve dam construction, reconstruction, rehabilitation, or strengthening? | | |
| 3. Does the project involve hazardous materials management and disposal (e.g. asbestos, medical or infectious waste, solvents)or gasoline) excepting small amounts normal for construction? | | |
| 4. Will the project significantly modify any coastal zone features, reef or marine features? | | |
| 5. Could the project activities significantly affect any natural or protected areas or Forest Reserves located within 1 km of the Project? | | |
| 6. Could the project impact or affect primary rainforest or critical natural habitats or the habitat of endangered species of plants or animals? | | |
| 7. Could the project adversely affect critical resources such as primary rainforests, critical natural habitats or drinking water diversions? | | |
| 8. Could the project adversely affect natural waterways (streams, rivers, or wetlands) by sedimentation, pollution, flooding, draining, or filling)? | | |
| 9. Would the works adversely affect cultural property, including archeological and historical sites? | | |
| 10. Would the works require leveling and clearing of lands with natural habitat (those water or land areas where most of the original plant and animal species are still present), especially any habitat critical to ecological or preservation purposes? | | |
| 11. Does the project involve the use of introduced, non-native species? | | |
| 12. Does the project involve the use of pesticides, herbicides, or other agents to destroy pests? | | |
| 13. Does the project pose a high risk of causing landslides, slips, slumps, rockfalls, debris-flows, or excessive erosion? | | |
| 14. Will the project result in the violation of Grenadian law, international treaty, or Bank policy? | | |

In cases where it is suspected that a specific project or activity could meet these criteria, the screening procedure would result in a positive determination and such subproject would require closer examination to determine if a separate stand-alone EIA should be done specifically for that project. For projects requiring a stand-alone EIA, the EIA will be completed prior to initiation of the works and will establish environmental requirements for the design and construction phase of the activity in the form an EMP specific to that sub-project. World Bank staff may assist in preparing the TORs and reviewing the EIAs. The TORs for the EIAs should be adjusted to reflect the level of complexity and the degree of potential impact of each particular situation.

Based on the discussion and analysis of the DVRP sub-projects presented in Section 4 of this report, most are fairly simple and do not involve significant impacts. There are only a few which meet the criteria presented in Table 5 above and therefore merit additional analysis. Once the details of the activities encompassed in those sub-projects are known with greater precision, the screening tools should be applied and an informed decision made with respect to the need for additional assessment and planning.

Potential project activities may occur in highland forest areas, on coastlines, in sensitive riparian areas along streams or rivers, or in other areas where the policy could be triggered owing to the richness of Grenada's natural habitat. Table 5 of the EMF considers natural habitats in screening procedures, to identify areas that may trigger this policy and require additional assessment to develop site-specific mitigation and management measures. Effects on critical natural habitat, such as primary forests, would be excluded from project financing. The Forests policy is being triggered as a precaution because limited forest resource harvesting may be done.

As noted in Section 4.1.4, the term forest harvesting only refers to incidental clearing of a very limited number of trees as may be required for the agroforestry pilot plots which would also include planting of trees for slope stabilization, erosion prevention, or planting of climate resilient crops. All proposed project activities will be screened using the EMF and any negative effects on primary forest would be excluded from consideration for financing.

If none of the criteria in Table 5 apply to a particular sub-project or activity, then it is considered to have only a limited and minor environmental impact. Based on the discussion and analysis in Section 4 of this report, most of the sub-projects with minor civil works will involve only limited or minor impact, and can be easily mitigated by using standardized generic environmental controls that represent best practice for construction of civil works. For the relatively uncomplicated environmental actions required of these activities, standardized generic construction contract clauses are sufficient, and can be applied as needed to works construction contracts. The draft language for inclusion in contracts can be found in Tables 3 and 4 of this EMF.

## *6.5 Emergency Procedures*

Component 3 of the RDVP is intended to provide financing for emergency sub-projects. Because most of the elements financed under Component 3 are likely to be related to

emergency provision of critical goods, it is expected that those subprojects will fall into Category C and therefore would require no environmental screening or assessment work. However, some Component 3 activities could include demolition, removal, repair or reconstruction of damaged public infrastructure, clearing of debris, or other activities which could have potential negative impacts if not mitigated, and would therefore fall into Category B. It is even possible that there may be exceptional cases where a proposed sub-project would involve work in highly ecologically sensitive areas, potentially affect physical cultural resources, or require acquisition of substantial areas of land either temporarily or permanently for reconstruction work or relocation of a vulnerable population.

In order to ensure that Component 3 emergency subproject activities are consistent with the World Bank Safeguard Policies as outlined in this Environmental Assessment / Environmental Management Framework document, the activities identified for financing under Component 3 will be subject to an expedited review by safeguards specialists to determine if they are eligible under the safeguard policies and compliance procedures used by the PCU for all activities financed under the DVRP. This will allow the possibility to exclude certain activities if the environmental or social impacts are too great, or to include appropriate mitigation measures for a proposed activity if feasible. Having the existing safeguards screening process in place will also allow a certain degree of flexibility and efficiency in processing potential subprojects or activities.

# 7.0 PLANNING AND EXECUTION

Within any type of project there is expected to be some level of environmental and social impacts, whether positive or negative. Therefore, the intent should be to minimise or avoid any negative impacts as far as practical. This can be done through proper environmental management. However, in order to be effective, environmental management must be fully integrated with the overall project management effort at all levels. This section of the EMF discusses the roles and responsibilities of the various parties during the project execution, in the context of planning for successful implementation of the project as regards environmental performance, and can be considered the Environmental Management Plan (EMP) for the project.

## 7.1 Project Management

The Project Management structure of Grenada's DVRP includes a Project Coordinator, who would be responsible for the day-to-day management of the Project. There is also expected to be a great degree of interaction with the relevant line Ministries to oversee certain aspects of the Project. While it is expected that members would include those that have direct responsibility for the various components of the DVRP, it should also include members who have institutional and regulatory responsibility for environmental management, such as the Planning Division.

It is evident that there is an informal working relationship between responsible agencies in Grenada. As such, every effort should be made to continue/establish acceptable working relationships between the relevant agencies/Ministries in order to achieve the desired environmental management goals for this Project.

The PCU bears the ultimate responsibility to ensure a successful implementation of the mitigation measures and also to identify and address unidentified impacts of the Project. The Project Engineer and the Social Development Specialist will both work to understand and enforce the environmental provisions of the project.

The PCU will engage an Environmental Consultant (EC) who would support the PCU in ensuring the implementation of the mitigation measures and the coordination of environmental management activities (monitoring, enforcement, audits and inspection) of the Project. The EC will have various duties as assigned by the PCU. Prior to construction this may include screening of possible projects for impacts, development of management plans for dredge soils, creating procedures for proper handling of petroleum hydrocarbon waste or other types of waste, or other tasks. Once construction activities are underway the EC may conduct frequent or continuous inspections in the field, provide reports to the PCU, or otherwise assist with environmental compliance work. The PCU may staff or contract the EC as desired according to level of need and logistics.

The PCU will have overall technical responsibility for the management of project activities and in this capacity will be the lead agency for coordinating the application of environmental and social requirements under the project.

## 7.2 *Supervision and Review*

The PCU will have the ultimate responsibility for the enforcement of required safeguards under the Project. To this end, the enforcement of contract related requirements will fall to the PCU who will rely upon the Project Engineer, the Social Development Specialist, and engage the services of an Environmental Consultant (EC) to provide compliance oversight.

The PCU will be responsible for the application of safeguard requirements for the evaluation, award and execution of grant related activities using screening procedures contained in this plan. The PCU will keep records of screening activities and make them available for periodic review.

With respect to construction activities, the Line Ministries will provide coordination and supervision services to ensure works activities conform to agreed procedures and policies. While not exercising direct contract supervision in the contractual sense, the line Ministries shall report, on an agreed schedule, to the PCU, noting contractor activities. While the line Ministries will be an active participant in project implementation, ultimately, enforcement responsibility will fall to the PCU with respect to contracting obligations.

## 7.3 *Communication and Grievance Resolution*

Notwithstanding contractual and other legal grievance resolution mechanisms under national and international law, the PCU shall be ultimately responsible for the management of any conflicts arising from Project contract activities.

Construction management, as a contractual issue, will reside with the PCU; however, the line Ministries shall assume an active role in coordinating contractor activities. Responsibilities will be assigned as mutually agreed between the PCU and Line Ministries; however, the PCU shall have the sole authority to engage the contractor in disputes and modifications to contracts. For this reason, the PCU shall work closely with the line ministries in the preparation of construction contracts to assure that construction impacts are minimized, and are acceptable with respect to World Bank operations.

The Line Ministries and the PCU shall prepare a communication plan detailing specific responsibilities and communication requirements. This plan shall be submitted to the Bank for its No Objection.

## *7.4 Public Consultation and Dissemination of Information*

Above all there must be community consultation before and during project implementation. This will allow for the development of open communication or rapport between the community and developer. It will allow for concerns to be addressed upfront and the affected community would have greater tolerance to the inconveniences experience. They are also the ones on the ground and their concerns and recommendations should have

merit. Public Consultation is critical for this type of project - especially to gain community support and 'buy in'.

It should include Provisions for the PCU to organize public consultation forums with the affected communities, interested organizations and individuals as often as is necessary. A Public Consultation Plan should be prepared by the PCU, which among other things, identifies the target groups, schedule, information to be disseminated (safeguard instruments etc.) how and where it would be disseminated.

In accordance with Word Bank's procedures, both the Project details and the draft EA/EMF safeguard instrument will be publicly disclosed prior to project appraisal. Consultation on the draft EA/EMF will be done with key Agencies prior to finalizing the first draft. The first draft document will then be disseminated via email to several key individuals, Community Groups, Agencies and Ministries. It will also be placed on the website of the Government of Grenada and the World Bank, where the public and other interested persons will be invited to review and submit comments or concerns by a given date. Details of this public disclosure and consultations will be summarized in Annex 1 of this EA/EMF.

## *7.5 Incorporation of Environmental Contract Clauses*

While construction activities are inherently disruptive, actions can be taken to minimize impacts to the physical and natural environment. Based on the potential impacts identified, the PCU shall include in the construction contract specific clauses to guide contractor activities during the construction period. Tables 3 and 4 contain the draft language for environmental performance contract clauses, which shall be adjusted as needed to conform to Grenada national legal requirements, the World Bank Safeguards Policies, and any additional environmental performance clauses arising from EIAs conducted for the activity or project. The PCU will ensure that results of all these analyses and conditions are included or, are interpreted as an integral part of the Contract before signing.

# 8.0 TECHNICAL ANNEXES

## 8.1 ANNEX 1- Public Disclosure and Consultation of the EMF

During the project preparation process, discussions and workshops were held with the PCU and with Line Ministries. The results of this initial consultation process wasincluded in the draft EA/EMF.

The PCU disclosed the draft EMF on the GoG website on January 30, 2015 and notified stakeholders of the time period for which comments will be accepted. As of February 26, 2015, the PCU did not receive any comments or questions on the draft EMF. http://www.gov.gd/egov/docs/publications/daft-revised-environmental-management-framework.pdf.
Having received no feedback and comments on the draft EMF, stakeholder consultations were not held.The EMF was thus finalized on February 27, 2015, and will be disclosed on the GoG website

In the future as projects are implemented, additional public consultation will occur through the EIA process and through the interaction with communities. Those consultations will be part of the ongoing implementation process and will not be documented in this EA/EMF.

## *8.2 ANNEX 2 – EMP FOR ST. JOHNS RIVER DEFENCE WORKS*

The Environmental Management Plan (EMP) for the St. Johns River was developed in a separate EIA (Environmental Impact Assessment) prepared for the work. The tables below are reproduced from the EIA to facilitate the inclusion of the EMP into bidding and contract documents.

In addition to the measures described in the Tables below, the EMP for the project will include a procedure for the adequate management of oily soils (petroleum hydrocarbon wastes) which may or may not be encountered during excavation or other earthworks on the project. The procedure will be developed by the PCU and will also form a part of the EMP and a requirement for contractor performance.

Finally, the EMP will also include additional details on the requirements for the handling, storage, use and disposal of materials dredged from the mouth of the river. The procedure will include an estimate of the volume of dredged materials and any applicable restrictions, with the goal of preventing the runoff of sediments back into the river and into the marine environment.

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| 2. Demolition of existing bridges, site preparation and earthworks within the river. | 2.1 Increases in the silt load of drains and the watercourse, resulting in impairment of drainage system function<br>2.2 Increased sediment levels in the river and coastal area as a result of site clearance and construction activities, affecting freshwater and marine life, and water quality.<br>2.3 Increase in areas of standing/ stagnant water within the site, resulting in increased incidence of mosquito borne disease. | **Design Engineer:**<br>▪ To require contractor's programme and method statement to minimise such impacts, preferably through the timing of such works in combination with other mitigating measures to control water and minimise erosion/ sedimentation.<br>**Supervising Engineer:**<br>▪ To review and approve appropriate construction drainage plan.<br>▪ To ensure that the river walls adjacent to spoil or aggregate stockpiles are not compromised to the extent that drainage from these areas will flow directly into the river.<br>▪ To monitor (using visual assessments) contribution of sediment from the site during high rainfall events in collaboration with relevant authorities including Department of Fisheries, and instruct the Contractor to mitigate accordingly.<br>**Contractor:**<br>▪ To develop construction drainage plan to be approved by the Engineer and implemented before site clearance commences.<br>▪ To implement strategies to effectively control sediment generation within the site, minimise erosion from excavated areas, spoil and aggregate loss to protect water resources. Such measures to include use of drains around stockpiles, silt curtains in the water around activities in the river that are likely to generate sediment, temporary diversion of the watercourse away from active work areas in the river, and use of straw bales in drainage channels between | | | | - | Soils will be susceptible to erosion when disturbed by construction works, and rainfall intensities are high. If works are carried out in the dry season, these risks are lower. However, if such works are undertaken in the rainy season, erosion and sediment generation from within the site will increase considerably.<br>The marine area adjacent to this site is sensitive and/or protected. Coastal water quality in the immediate vicinity is fair. Reefs to the north of this bay are among the healthiest reefs remaining in Grenada. The Grand Anse beach to the south is a world-renowned bathing area.<br>Dengue Fever is transmitted by the mosquito, so ponding of water within the site should to be minimized in the interest of public health. |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | the site and the river. Such measures would need to be monitored and maintained to ensure they do not cause flooding of the site and environs.<br>▪ To stockpile aggregates and spoil material behind berms or river walls to minimise direct flow of runoff from these into the river.<br>▪ To minimise duration of spoil storage on site.<br>▪ To ensure that adjacent drainage systems are kept free and clear of sediment.<br>▪ To ensure that no ponding of water occurs within the site.<br>▪ To retain river bank vegetation to the extent possible.<br>**Client:**<br>▪ To work with other stakeholders to minimise erosion caused by human activity in the upstream catchment, as these are the primary contributors of sediment in this river and marine area. | | | | | |
| | 2.4 Change in river dynamics upon completion of the proposed works. | **Design Engineer:**<br>▪ To ensure that proposed works are adequate to minimise flooding in this community, without increasing flood risk elsewhere.<br>**Contractor:**<br>▪ Not to abstract water from the river for any purpose, unless approval of the engineer and relevant authorities is obtained.<br>▪ Not to dispose of any substance into the river. | | - | | | The river may be temporarily diverted away from active work areas to minimise erosion and sedimentation, but this will not affect flow volumes.<br>The Contractor is unlikely to abstract water from the watercourse for construction purposes. River water should not be used for construction in particular concrete production. Other use is also undesirable due to likely high levels of contamination of the river by industrial and other human activity along the river in the middle catchment area. |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | 2.5 Loss of access by bridge users during and after construction | **Design Engineer:**<br>▪ To ensure that all locations accessed by the existing bridges are at least as accessible using new bridges at new locations.<br>▪ Require bridge construction to be by a single contractor, to ensure repeatability gains and coordination to minimise traffic impacts.<br>**Contractor:**<br>▪ To plan to demolish existing bridges only after replacement bridges are complete and ready to be put into use by the public. | | | | - | Two bridges are to be demolished (Steele's and Humpback). New bridges will be single span, which will minimise construction time. |
| | 2.6 Smoke and odour nuisance arising from on-site burning of cleared vegetation and other construction debris.<br>2.7 Fire damage to surrounding properties/vegetation during construction.<br>2.8 Water/soil pollution arising from the use of herbicides in vegetation clearance, and damage to property/ vegetation arising from excessive clearance of vegetation during construction. | **Contractor:**<br>▪ To clear vegetation by mechanical means only.<br>▪ To dispose of all cleared vegetation at the Perseverance disposal or other SWM approved site.<br>▪ Not to burn any material on the site.<br>▪ Not to use herbicides in vegetation clearance or suppression of re-growth. | | | - | | There are significant quantities of vegetative matter within the site footprint. The possibility of causing smoke and odour nuisance to the adjacent community is unacceptably high if burning is allowed.<br>Quantities of flammable construction waste will be limited to cement bags, waste lumber, plastics. On no account should plastics be burned.<br>The use of herbicides in vegetation clearance is undesirable in view of the risks of watercourse and coastal pollution, health hazards to spray operators, especially if they are unprotected and untrained, and collateral damage to neighbours if spray drift occurs. |
| | 2.9 Noise, vibration & dust/fume nuisance | **Design Engineer:**<br>▪ To specify the manner in which the bridges | | | | - | The potential for noise and/or dust nuisance to the adjacent community is |



Halcrow GLEAN'S ENGINEERING

..

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | to local community and businesses from demolition, site preparation and earthworks. | are to be demolished to minimise the potential effects, e.g. by requiring use of thermic or hydraulic lance to cut concrete elements, disallowing demolition by blasting or heavy equipment, and salvaging of steel elements for use elsewhere.<br>▪ To restrict working hours for noise/dust generating activities in the vicinity of sensitive receptors such as the schools.<br>**Supervising engineer:**<br>▪ To require wetting down of areas that generate dust.<br>See Sections 3.5, 3.12, 3.13, 4.1, 4.2 and 5.2 this table for further recommendations. | | | | | high depending on the method in which the bridges are dismantled, as the site is within an urban setting, and in particular, in close proximity to a number of schools.<br>The bridges should be demolished in a manner that maximises salvage value, which will require extra care in how this is undertaken, likely minimising these risks. Demolition of concrete elements has the potential to produce high levels of noise and dust if an impact breaker is used. |
| | 2.10 Initiation of instability arising from changes in natural slope geometry, with adverse implications for workforce safety during construction. | **Design Engineer:**<br>▪ To design stable river bank and embankment slopes.<br>**Supervising Engineer:**<br>▪ To review and approve method statements that inter alia, mitigate instability concerns.<br>▪ To approve method statements<br>**Contractor:**<br>▪ To accept full responsibility for the adequacy, stability and safety of all operations and methods of construction, have full regard for the safety of all persons entitled to be on the site and keep the site and works in an orderly state appropriate to avoidance of dangers.<br>▪ To develop appropriate method statement for approval.<br>▪ To carry out construction such as not to promote instability during construction.<br>▪ To carry out all works in accordance with | | | - | | Significant demolition and excavation will be required to remove existing structures, prepare the site for construction of the new structures, and alter river geometry.<br>These are fairly tall, steep sided river banks of alluvial material that is inherently unstable. In many places, the River road or privately owned structures are immediately adjacent to the river bank, and care must be taken not to undermine these. |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | the approved plans and method statement.<br>▪ To batter back or shore excavation sides as required. | | | | | |
| | 2.11 Damage to other infrastructure during construction. | **Design Engineer:**<br>▪ To liaise with utility companies (water, communications, power) to ascertain location of buried infrastructure in the vicinity of the proposed works.<br>▪ Contractor:<br>▪ To verify location of buried infrastructure with utility companies.<br>▪ To advise utility companies in advance of works in proximity to their infrastructure, so that they may exercise the option to observe the works.<br>▪ To make good any damage to buried or other infrastructure (roads, drains, utility poles) damaged as a result of the works. | | | - | | This is within an urban space with buried and overhead utilities, roads and drainage. |
| | 2.12 Risk of flooding of the construction area | • Major earthworks should be scheduled for the dry season (to the extent practical). Work should be suspended during intense rainfall events or whenever surface erosion, potentially affecting adjacent watercourses occurs. Natural vegetative cover should be maintained as far as practical. Areas not required for construction should not be cleared.<br>• Adequate measures such as clearing on a phased basis should be undertaken so as to minimize soil disturbance. Furthermore, clearing should take place immediately prior to excavation and earthworks so as to minimize the length of time that soils are exposed. | | | - | | Flood risks defined by modelling, with results provided in the river and bridge works designs (flood levels marked on river section profiles to be shown on the detailed design drawings). |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | • Vegetation should be retained in the vicinity of watercourses, existing drains and steep slopes. If clearing of slopes are to be carried out, this should be done at stable angles. Where this is not possible, temporary shoring (retaining structures) should be provided, or the slope(s) should be covered using geotextiles, tarpaulin or plastic.<br>• Separate, secure, impervious bunded areas (for secondary containment) for the storage of any fuels, lubricants and/or other chemicals. These bunds shall have a capacity of at least 110% of the maximum volume of the largest tank (or 25% of the aggregate total capacity of the tanks, whichever is greater) and shall incorporate a drainage sump and an additional minimum wall height of 150 mm to accommodate rainfall and fire-fighting foam. All should be located as far as reasonably practical from any wetland area or natural water body.<br>• No fuels, lubricants, chemicals, materials or waste shall be stored in any area known to be at risk of flooding from wave over-topping or river breach. No temporary toilets or messing facilities to be established in such areas.<br>• Temporary stockpiles of cleared material should be confined using wooden "cribs" (or other means, such as geofabric screens on stakes) around the perimeter. These should be removed after the material in the stockpile has | | | | | |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | been used or removed from the site.<br>• Stockpiles shall not be located in the area known to be at risk of flooding from wave over-topping, except for aggregate materials required to implement the foreshore protection works themselves.<br>• Avoid the scheduling of cast-in-place concrete work in the vicinity of watercourses where there is a high probability of inclement weather within 72 hours of the pour.<br>• Berms should be established at the boundaries of the development. Sediment sieves and silt traps (for example stilling basins or barriers of straw bales) may be placed in drains exiting the site to reduce the migration of silt into rivers and streams following any minor flooding. | | | | | |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| 3 General construction operations. | 3.1 Land and water pollution and public health hazards arising from inappropriate/ inadequate liquid waste disposal practices and spillages/ leakages of contaminating materials at the worksite. | **Design & Supervising Engineers:**<br>▪ To prohibit washing of vehicles, plant and tools in or adjacent to the river. All washing to be carried out at designated areas within the work site which are provided with oil/grease traps.<br>**Contractor:**<br>▪ To take all necessary precautions to prevent land and water pollution.<br>▪ To apply environmentally appropriate maintenance practices.<br>▪ To minimise and carefully control use of chemicals.<br>▪ To advise engineer of type and quantity of chemicals to be stored on site for construction purposes. Storage location of permissible quantities to be approved by the relevant authorities, and appropriate precautions taken. These include provision of a dedicated chemical storage structure to be roofed with a lockable door. Other features required of the chemical storage area are as follows:<br>▪ Chemicals not to be stored near burning material or hot work (cutting, welding, grinding) or in shop areas. | | | | - | Sanitary arrangements, fuel storage/ refuelling and plant/vehicle servicing areas have the greatest potential for causing land and water pollution. There are significant marine resources in the adjacent coastal area to be protected. Groundwater resources are not significant vis a vis potable water supply, but localised contamination which affects water quality must be considered a moderate risk, in view of the costs and difficulties associated with post-contamination remedial action. |

[4] Steele's Auto within the site collects waste oils for recycling.

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | ▪ Adequate space and shelving to be provided to properly segregate chemicals.<br>▪ Dry materials to always be placed above liquids, never vice versa.<br>▪ Liquids not to be stored above eye level.<br>▪ Storage for PPE to be provided where it is easily accessible in the event of emergency, but not in the chemical storage area.<br>▪ An emergency wash area to be provided.<br>▪ Information of chemical locations, contents, appropriate emergency response and other details to be readily accessible to site management, in the event of spill or injury.<br>▪ Procedures in the handling of chemicals or other hazardous material and in event of emergency to be clearly posted on the container.<br>▪ To provide adequate non-polluting worksite sanitary facilities, and prohibit the use of worksite pit latrines.<br>▪ To install secondary containment for any fuel stored on site.<br>▪ To adopt pollution prevention measures relating to fuel and oil storage/dispensing arrangements, to prohibit other than emergency maintenance of equipment and vehicles on the site, and require usage of spillage trays during on-site re-fueling of minor equipment.<br>▪ To dispose of waste oils arising from emergency servicing of construction equipment at a licensed recycling facility4.<br>▪ To be responsible at his own cost for taking immediate remedial action and payment of compensation for any environmental damage resulting from his actions. | | | | | |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | 3.2 Land and water pollution, public health hazards, landscape degradation and reduction in amenity value, arising from inappropriate/ inadequate sewage and solid waste disposal practices. | **Contractor:**<br>▪ To abide by the provisions of the Public Health Act CAP. 263 (1925); Public Health Regulations Sec.15 (1958); Public Health Ordinance CAP. 237 (1925) and Amendments SRO No. 218 (1957); Abatement of Litter Act CAP. 1 (1974); Environmental Levy Act CAP. 5 (1997); Environmental Levy (Amendment) Act CAP. 2 (2000); Solid Waste Management Act CAP. 11 (1995); and Environmental Management Act (draft).<br>▪ To ensure that sewage and solid waste are not permitted to enter the area drainage or watercourse.<br>▪ To provide adequate non-polluting worksite sanitary facilities including provision of sufficient number of adequate waste receptacles and chemical toilets or other appropriate toilet facility on the site and regular collection services provided by a licensed collector. If contractor is hauling solid waste using his own resources, legal requirements for proper containment of the waste to be observed, and disposal to be to an approved location.<br>▪ To require all workers to use facilities provided.<br>▪ To dialogue with SWM to ensure solid wastes will be accepted there, and to ascertain conditions.<br>▪ To keep soil/spoil and other excavated material separate from other construction waste, reuse these on site where possible with appropriate sediment control, or take to Perseverance Site.<br>▪ To keep steel removed from the bridges separate from other waste, to be transported to the Perseverance Site for salvage.<br>▪ To remove concrete components of the bridge | | | - | | Green waste from this site will be significant. Spoil disposal requirements are also expected to be significant. Fly tipping of construction wastes may occur, with excavated material, spoil and other wastes being dumped down slopes or into watercourses, and onto unoccupied land.<br>The project works will generate both demolition and construction waste. Demolition waste will mainly comprise concrete rubble and steel from the existing bridge structures to be demolished, as well as other structures to be relocated. Construction waste will comprise mainly spoil and other excavated material, cement bags, timber and reinforcing steel scraps, and packaging material from material supplies.<br>The demolition waste is potentially salvageable. SWM may accept construction waste, particularly if it can used at the disposal site for cover or site haul roads. Metals should be separated as it can be salvaged at the disposal site. |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | such that they may be re-used, preferably within the site, perhaps as backfill material or river bed stabilisation. | | | | | |
| | 3.3 Interference with traffic due to haulage of materials to site, and disposal of demolition, construction and other wastes generated on site. | **Design and Supervising Engineers:**<br>▪ To require Contractor to prepare, and to approve an appropriate traffic management plan.<br>**Contractor:**<br>▪ To develop a traffic management plan for all phases of the work.<br>▪ To consult MOW and traffic police early for advice and approval in the development of the traffic management plan, and if there is likely to be any traffic disruption beyond those agreed in advance of project implementation, or if there is any deviation from the approved traffic management and diversion plans.<br>▪ To abide by all solid waste regulations in the transportation and disposal of C&D waste.<br>▪ To consider location of suppliers that minimises haul distances to site.<br>▪ To haul wastes and import materials during off-peak traffic times to the extent possible. | | | - | | It is anticipated that C&D waste will be hauled to Perseverance Disposal Site unless materials can be used, or an alternate approved disposal site is located by the contractor, for certain waste streams.<br>It is in the contractor's interest to avoid congested traffic during rush hour, as this is a waste of personnel time and fuel.<br>There is a quarry within 1 mile of the site, from which coarse aggregate and clay material for embankment construction may be sourced. Imported goods will be transported from the nearby port at St. George. |
| | 3.4 Hazards associated with roadside storage of construction materials and parking of plant and vehicles. | **Design engineer:**<br>▪ To require Contractor to plan sufficient space for storage, parking and other site amenities required in appropriate locations.<br>**Contractor:**<br>▪ To plan for the temporary storage of construction materials and wastes within the worksite only, as part of the Site Management Plan.<br>▪ To locate parking areas for employees' private vehicles and equipment within the worksite only, in approved areas. | | | - | | Builders commonly store construction materials temporarily at the roadside and make little or no provision for preventing encroachment on the carriageway or footpaths, causing a hazard to both motorists and pedestrians.<br>Plant is often left overnight close to the road margins with no lighting or warning signs, and during the day, workers vehicles and construction plant are often parked with little consideration for the safety of road |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | ▪ To not park equipment and other vehicles or stockpile materials along the public roadway.<br>▪ To not store materials so that they encroach on, or in any way adversely affect operation of, sections of roadway which are in use by the public or result in siltation or blockage of drains. | | | | | users.<br>There is sufficient space in close proximity to the site to plan to avoid these potential impacts. |
| | 3.5 Generation of road safety hazards on haul routes. | **Contractor:**<br>▪ To minimize quantities of mud tracked onto the public roadways, and conduct haulage preferably during dry periods. Wheel washing on any equipment leaving the site to be undertaken as required, with wash water passed through sedimentation control measures.<br>▪ To ensure that all tailgates and dropsides are properly secured, there is no overloading of loose materials above truck sides, and all loads are properly secured.<br>▪ To comply with speed restrictions imposed by the relevant authorities.<br>▪ To carry out all haulage using vehicles of types and capacities appropriate to task and in compliance with gross vehicle weight restrictions imposed by vehicle licensing authorities and all laws and regulations | | | - | | All haulage of construction materials and wastes will be on public roads. Loaded construction traffic moves slowly and can cause congestion. Overloading constitutes a road safety hazard. Conversely, unladen traffic often travels quickly, increasing the risk of accidents involving other vehicles and pedestrians.<br>Deposition of soil on public roads from tracks and tyres when plant and vehicles leave construction sites and borrow or quarry areas increases the risk of skidding under wet conditions and dust nuisance under dry conditions. |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | pertaining to vehicle use on public roads.<br>▪ To ensure that concrete mix trucks and fuel tankers5 are loaded and driven in a manner which does not result in spillage.<br>▪ To be responsible, at his own cost, for cleaning up spillages or shed loads without undue delay.<br>▪ To clean and keep free of mud, soil and other materials, public roads which have material deposited on them as a result of the contractor's activities. | | | | | |
| | 3.6 Damage to existing road pavements and structures caused by overloaded haulage traffic. | **Contractor:**<br>▪ To adopt every reasonable means to prevent damage to roads or bridges communicating with, or en route to the site, by his or his subcontractors' traffic.<br>▪ To be responsible for the cost of reinstatement of pavement or structures which have been damaged by his or his subcontractors' haulage traffic.<br>▪ To carry out all haulage using vehicles of types and capacities appropriate to task and in compliance with gross vehicle weight restrictions imposed by vehicle licensing | | | - | | Significant volumes of construction materials will have to be hauled on public roads. Overloading of contractors' vehicles and heavy, tracked equipment riding on pavement surfaces results in significant pavement damage. |

[5] Subject to restrictions on quantity of fuel allowed to be stored on site

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | authorities and all laws and regulations pertaining to vehicle use on public roads.<br>▪ To transport tracked equipment (if required) to site on appropriate transporters, and not to permit tracked equipment to track directly on the road pavement. | | | | | |
| | 3.7 Competition for scarce potable water resources with existing users. | **Design Engineer:**<br>▪ To provide NaWASA with estimates and timing of water supply requirements for construction purposes at the design stage, so that it may be confirmed that NaWASA has the capacity to meet the project's construction needs.<br>**Contractor:**<br>▪ To consult NaWASA if requirements are likely to significantly vary from demand estimates originally provided, so that a mutually agreeable solution may be arrived at, and the impact on the water company and adjacent communities minimised.<br>▪ To conserve water.<br>▪ To have water storage on site for construction purposes.<br>▪ To seek requisite approvals from the relevant agencies if water is to be abstracted from the water course for any purpose. | | - | | | Builders generally use NaWASA piped supplies, and river water abstraction for construction purposes is unlikely. Although water supply in this area is limited, NaWASA should easily be able to meet the limited water supply requirements for construction.<br>Water will be required for concrete mixing on site, wetting down of surfaces that generate dust, washing of equipment wheels as required before leaving the site, worker emergency washing and hygiene. |
| | 3.8 Competition with existing users for power supply during construction. | **Design Engineer:**<br>▪ To provide GRENLEC with estimates and timing of power supply requirements for construction purposes at the design stage so that appropriate agreements and provisions can be made.<br>**Contractor:**<br>▪ To consult with GRENLEC in the event requirements are likely to significantly vary | | - | | | GRENLEC system capacity is adequate to meet existing together with anticipated construction requirements. |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | from the demand estimates made at the pre-construction stage, so that the impact on the company and the adjacent community can be minimised. | | | | | |
| | 3.9 Damage to and interference with infrastructure and services. | **Design Engineer:**<br>▪ To identify existing infrastructure on tender drawings.<br>▪ To agree with service providers, least cost, acceptable risk options for temporary (if necessary) and permanent relocation of any infrastructure that may be affected.<br>▪ To agree with NaWASA, final details for replacement of water infrastructure within the new bridges.<br>**Contractor:**<br>▪ To confirm location of existing services within the site and on its boundaries, notify relevant companies when works that may affect their infrastructure are about to commence (with appropriate notice), take all reasonable precautions to protect services during construction and to repair and reinstate forthwith any damage arising from the operations, at his expense, in consultation with the relevant authorities. | | | - | | There are services presently routed within and through this site. All services are routed along River Road and water lines run across the two bridges to be demolished. |
| | 3.10 Creation of dust nuisance. | **Contractor:**<br>▪ To take all reasonable steps to protect the environment on- and off-site, and to avoid damage or nuisance to persons or property arising from pollution, noise or other causes arising as a consequence of his methods of operation.<br>▪ To take appropriate measures to minimise dust generation including regular watering of works sections where dust is likely to cause nuisance incl. aggregate and soil stockpiles. | | | - | | Dust caused by the operation of builders' equipment and construction activity, and transfer of soil from the site to the road surface on the wheels/tracks of equipment, is a major source of annoyance to nearby institutions, businesses, residents and road users. The site is located within an urban centre, so impacts of dust generation can be significant. Schools and other users on the right |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | ▪ To minimise quantum of mud and dust tracked onto public roadways from the site by washing wheels of equipment exiting site as required.<br>▪ To select aggregate sources that minimize haul distances to site, and disruption to other road users.<br>▪ To minimise duration of stockpiling of aggregates and spoil.<br>▪ To cover all construction waste taken off site, and aggregate brought onto the site with a tarpaulin to minimize dust emissions.<br>▪ To keep clean and free of mud, soil and other materials, all material to be stockpiled within the worksite.<br>▪ Not to stockpile material along the public roadway.<br>▪ To erect hoarding upwind of sensitive receptors such as schools. | | | | | bank (north side) of the River are usually upwind of the worksite, and will generally be less affected by dust than those on River Road. |
| | 3.11 Creation of noise nuisance and air pollution caused by haulage vehicles/ construction plant and machinery operation. | **Contractor:**<br>▪ To take all reasonable steps to protect the environment on- and off-site, and to avoid damage or nuisance to persons or property arising from pollution, noise or other causes arising as a consequence of his methods of operation.<br>▪ To conduct activities in a manner which minimises nuisance to the general public and occupiers of premises within 200 m of the active work site. Where construction activities in these areas take place outside the hours of 7am to 7pm, appropriate measures to be adopted by the contractor to reduce noise levels.<br>▪ To maintain all vehicles in accordance with manufacturer's original specifications.<br>▪ To immediately remove from site any | | | - | | Air pollution is not expected to be a major problem in view of the relatively constant wind speeds experienced in the project area, although the areas downwind are densely developed.<br>Plant noise does not usually give rise to significant nuisance, except in the case of pile driving. However, this site is located immediately adjacent and upwind of a dense community, and adjacent to a number of schools.<br>Haulage vehicles and equipment, if not properly maintained, emit undue smoke and noise, and may cause a nuisance to those who live and work close to the site or along haul routes. |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | vehicles/plant/ machinery which emit undue smoke or noise for repair or maintenance. | | | | | |
| | 3.12 Depletion of finite non-renewable natural resources. | **Contractor:**<br>▪ To minimise wastage.<br>▪ To maximise re-use of waste materials, thereby reducing use of new material.<br>▪ To salvage steel from demolition and transport them to Perseverance Site for salvage by SWM. | | - | | | Quantities of construction material required are not excessive, and well within the capacity of local suppliers to provide. Fine aggregate requirements are typically met from imported supplies (from Guyana). Coarse aggregate is quarried locally. Material for embankment construction is also available locally. There is a quarry within 1 mile of the site. |
| | 3.13 Increase in emissions of ODS | Contractor will select alternative materials and/or technologies to minimise the use of ODSs on this project. | - | | | | Grenada is party to the Climate Change Convention, the Montreal Protocol and the Kyoto Protocol and is committed to phasing out of ODSs. CFCs used in cleaning solvents, adhesives and coatings contribute to the accumulation of ozone-depleting substances (ODS) in the atmosphere. Alternatives exist for many ODSs. |
| | 3.14 Land sterilisation/ reduction in post-construction land use options, adverse roadside or landscape visual impact and public health and safety hazards, arising from inadequate worksite clearance on | **Design Engineer:**<br>▪ To design in community spaces (improved pedestrian pathways and sidewalks, bus stops and open spaces) within available budgets.<br>▪ Contractor:<br>▪ To clear away and remove from the site and its environs all equipment, surplus material, rubbish and temporary works, and leave the area in a clean and workmanlike condition.<br>▪ To level and grade banks and verges as required for improved drainage and reinstate grass.<br>▪ To properly clear and remediate upon works completion, any lands beyond the boundaries of the worksite that have been approved by the | | | - | | It must be ensured that the site and its environs are left, upon job completion, in a state that is as aesthetically pleasing as possible.<br>This project has the potential to improve amenity spaces within this community. |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | completion of construction. | relevant statutory authorities for use by the Contractor for any purpose. | | | | | |
| | 3.15 Damage to archaeological sites and protected areas.<br>3.16 Damage to cultural heritage. | **Supervising Engineer:**<br>Will meet with GNT in advance of construction commencement, to agree procedures in the event of discovery of a hitherto unknown archaeological site.<br>**Contractor:**<br>Will take all reasonable precautions to prevent damage to articles of antiquity etc. arising from accidental discoveries of such on the site, for such finds to be reported immediately to the MOW as well as the GNT, for works to cease pending agreement on the way forward between MOW and the GNT, and for discoveries to be dealt with in accordance with the instructions of the GNT. | | - | | | It is possible that works will unearth historical artefacts as this area was reportedly used by Amerindians and Europeans in the past. |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| 4 Concrete and asphalting works. | 4.1 Dust and other air pollution arising from the operation of concrete plant. | **Contractor:**<br>▪ To fit all moveable plant with effective dust suppression equipment, and operate and maintain these in accordance with the manufacturer's manuals. | | | - | | Concrete will be required for construction of bridges and river walls. Large concrete batch requirements will likely be met by one of the local readymix suppliers. Small pours will likely be mixed on site. |
| | 4.2 Pollution of watercourse and fish kills resulting from entry of cement dust, fresh concrete and mixer wash water. | **Contractor:**<br>▪ To take particular care as the site is in the vicinity of drainage systems as well as within the St. John's river, to ensure that pollution does not occur.<br>▪ To take special precautions to ensure that materials such as cement dust, fresh concrete, lime and petroleum products do not pollute water bodies.<br>▪ To construct concrete mixing bays at required locations to minimize concrete losses.<br>▪ Not to wash readymix equipment or dump excess concrete on site. | | | - | | Cement dust, fresh concrete and mixer wash water can give rise to significant pollution of watercourses and major fish kills. The marine environment beyond the site is ecologically, commercially and recreationally significant, and is to be protected. |
| | 4.3 Occupational health and safety issues associated with asphalt cement application. | **Supervising Engineer:**<br>▪ To ensure compliance of supplier/sub-contractor with approved recommendations made in contractor's Occupational Health and Safety Plan.<br>**Contractor:**<br>▪ To require suppliers to abide by his Occupational Health and Safety Plan.<br>▪ Supplier of asphalt cement:<br>▪ To abide by provisions made in Contractor's approved Occupational Health and Safety Plan, including:<br>▪ Training of workers<br>▪ Availability of MSDS sheets<br>▪ Use of mechanization and automation where possible<br>▪ Use of local exhaust ventilation<br>▪ Provision of protective clothing, face and eye protection | | | - | | The extent of paving required is quite small but the main contractor is unlikely to be able to undertake these works in-house. There are only a small number of contractors with the equipment and expertise to carry out this work. |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| 5 Road closure and diversion of vehicular and pedestrian traffic | Public inconvenience due to diversion of pedestrian traffic. | **Design Engineer:**<br>▪ To provide in the contract for continuous, safe and convenient pedestrian access around the works.<br>▪ To consult the community regarding preferred location and pedestrian path access points, if it is determined that there is sufficient funding to provide a pedestrian bridge and upgraded pedestrian access along the right bank.<br>▪ To ensure that any pedestrian bridge constructed meets the same design criteria as the new bridges, so as not to compromise drainage performance.<br>**Contractor:**<br>▪ To provide safe continuous and convenient pedestrian access around the works.<br>▪ To erect appropriate signage to guide pedestrians to pass works safely.<br>▪ To provide sufficient lighting around work areas to improve user safety.<br>**Client:**<br>▪ To ensure that police are informed so that they do patrol, enforcing the requirements of the Contractor.<br>▪ To convene public meeting(s) to inform all residents and other area users of duration and scope of proposed works, including diversion plans and other proposed mitigation measures. | | | - | | Persons within the community, and in particular children attending the three schools in the Queens Park area, routinely use the River Road and the pathway along the right river bank. These pedestrian routes need to be made and/or kept safe for these and other area users.<br>Many persons in the community also cross the river at a location just upstream of the post office. There are steps built into the wall on the left bank for this purpose.<br>While some noted that the path on the right bank was used by many persons in communities on both sides of the river, concern was expressed by school management and some of the business owners regarding safety of this pedestrian route, and antisocial behavior by some of the path users. School management indicated that if the path is to be improved, it should not provide direct access to the schools. |
| | Public inconvenience due to diversion of vehicular traffic. | **Supervising Engineer:**<br>▪ To ensure that emergency services are informed of any diversions, to minimise disruption to their services.<br>▪ To monitor dust generation along diversion routes, particularly in vicinity of school zones, and instruct road wetting to control this as required.<br>▪ To require police approval of the contractor's traffic | | | | - | Although there are alternate routes available should a full road closure be required at any point along the River Road within the project area, this is an important route for many commuters beyond the project area, and loss of this route will increase congestion on other routes unless appropriate |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | | management plan, and to provide police with at least 2 days notice of any change in diversion plan.<br>**Contractor:**<br>▪ To develop traffic management plan for all phases of the works.<br>▪ To erect appropriate signage on the site boundary and around active work areas to warn road users of possible movement of construction traffic.<br>▪ To erect "No entry signs" on both ends of a road closure required to facilitate construction. To erect appropriately worded signage at junctions located back from road closures, to enable motorists to select suitable alternate routes without having to turn back.<br>▪ To make and erect a sufficient number of "no parking" signs at approved locations on the diversion route.<br>▪ To hire traffic wardens to manage traffic and assist pedestrians during road closures.<br>▪ To keep existing bridges open and operating until replacements can be made operational.<br>▪ To implement works to agreed programme to minimise length of time public is inconvenienced.<br>▪ To plan the works to minimise frequency and duration of road closures.<br>▪ Client:<br>▪ To re-paint/paint double yellow lines in all areas where 'no parking" will be instituted in the long term.<br>▪ To implement a public awareness programme to inform all River Road users of duration and scope of proposed works, including diversion plans and other mitigation measures. | | | | | measures are instituted.<br>The condition of these alternate roads is acceptable and they can accommodate two way traffic if parking is limited. Dust generation in those areas along alternate routes may increase. |

**Table 2 Anticipated construction impacts and recommended impact mitigation/benefit enhancement measures**

| Actions affecting environmental resources & values | Potential environmental impact | Mitigation/benefit enhancement measures | Non -Sig. | Low | Med | High | Comments |
|---|---|---|---|---|---|---|---|
| | Impedance of access to/from business places and other services adjacent to the worksite. | **Contractor:**<br>▪ To ensure that works are confined to the boundaries of the worksite, and duration(s) of works on River Road (for bridge approach ramp construction, junction and drainage improvement) are minimised.<br>▪ To maintain uninterrupted vehicular access to Mental Hospital, as well as to businesses on River Road that are on the river banks.<br>▪ To inform community and proprietors in advance of any activity that has the potential to impede access to these properties.<br>▪ Dialogue with the business owners (Purcell's, supermarket) to arrange suitable construction access and material storage requirements to facilitate the works on the river bank behind these structures. | | | - | | There are a number of businesses along River Road. Vehicular traffic diversion proposed could conceivably reduce their custom. However, there are limited options available for goods and services in the immediate area, and diverted traffic is likely to make its way to these via the proposed diversions, or to park and walk to the required location.<br>A number of businesses are located on the left bank of the river, between River Road and the river (Purcell's and the supermarket). Access to the river bank to construct requisite works will likely be via these properties. Care must be taken not to adversely affect these business operations. |

## *8.3 ANNEX 3 - PEST MANAGEMENT INFORMATION*

Operational Policy 4.09 on Pest Management seeks to ensure that projects avoid using harmful pesticides. A preferred solution is to use Integrated Pest Management (IPM) techniques and encourage their use in the whole of the sectors concerned. The Bank requires that any pesticides it finances be manufactured, packaged, labelled, handled, stored, disposed of, and applied according to standards acceptable to the Bank. The Bank does not finance formulated products that fall in WHO classes IA and IB, or formulations of products in Class II, if (a) the country lacks restrictions on their distribution and use; or (b) they are likely to be used by, or be accessible to, lay personnel, farmers, or others without training, equipment, and facilities to handle, store, and apply these products properly.

For the majority of projects considered in the RDVRP, pesticides will not be used, or only small amounts may be used for such activities as building extermination or termite foundation treatments. For these routine activities, the following procedures apply:

- Any use of pesticides shall be approved by the contracting officer and shall conform to the manufacturers' recommendations for use and application.
- Any person using pesticides shall demonstrate that they have read and understood these requirements and are capable of complying with the usage recommendations to the satisfaction of the contracting officer.
- All pesticides to be used shall conform to the list of acceptable pesticides that are not banned by the relevant local authority.
- If termite treatment or vector control treatment is to be utilized, ensure appropriate chemical management measures are implemented to prevent contamination of surrounding areas, and use only licensed and registered pest control professionals with training and knowledge of proper application methods and techniques.

However, for projects or activities that may involve more significant amounts of pesticides, herbicides, or agricultural chemicals, a Pest Management Plan will be prepared. The determination of whether or not a Pest Management Plan should be prepared is whether or not the project would involve procurement of pesticides or pesticide application equipment (either directly through the project, or indirectly through on-lending, co-financing, or government counterpart funding), and whether the project may (i) lead to substantially increased pesticide use and subsequent increase in health and environmental risk, (ii) maintain or expand present pest management practices that are unsustainable, not based on an IPM approach, and /or pose significant health or environmental risks.

A pest management plan is a comprehensive plan, developed when there are significant pest management issues such as:

1. New land-use development or changed cultivation practices in an area;

2. Significant expansion into new areas;
3. Diversification into new crops in agriculture, particularly if these tend to receive high usage of pesticide, like cotton, vegetables, rice, etc.;
4. Intensification of existing low-technology systems;
5. Proposed procurement of relatively hazardous pest control products or methods;
6. Specific environmental or health concerns (e.g., proximity of protected areas or important aquatic resources; worker safety).

A pest management plan is also developed when proposed financing of pest control products represents a large component of the project. The plan is designed to minimize potential adverse impacts on human health and the environment and to advance ecologically based IPM. The plan is based on on-site evaluations of local conditions conducted by appropriate technical specialists with experience in participatory IPM. The first phase of the plan was an initial reconnaissance to identify the main pest problems and their contexts, which for the DVRP include the possible use of pesticides and herbicides for agroforestry projects. It is not known how significant these issues may be, therefore this Annex to the EA/EMF provides guidance the second phase, which is development of specific operational plans to address the pest problems identified, as well as specific procedures for screening pest control products.

The procurement of any pesticide in a Bank-financed project is contingent on an assessment of the nature and degree of associated risks, taking into account the proposed use and the intended users. With respect to the classification of pesticides and their specific formulations, the Bank refers to the World Health Organization's Recommended Classification of Pesticides by Hazard and Guidelines to Classification (Geneva: WHO 1994-95). The following criteria apply to the selection and use of pesticides in Bank-financed projects:

a) They must have negligible adverse human health effects.
b) They must be shown to be effective against the target species.
c) They must have minimal effect on non-target species and the natural environment. The methods, timing, and frequency of pesticide application are aimed to minimize damage to natural enemies. Pesticides used in public health programs must be demonstrated to be safe for inhabitants and domestic animals in the treated areas, as well as for personnel applying them.
d) Their use must take into account the need to prevent the development of resistance in pests.

The Bank requires that any pesticides it finances be manufactured, packaged, labeled, handled, stored, disposed of, and applied according to standards acceptable to the Bank. The Bank does not finance formulated products that fall in WHO classes IA and IB, or formulations of products in Class II, if (a) the country lacks restrictions on their distribution and use; or (b) they are likely to be used by, or be accessible to, lay personnel, farmers, or others without training, equipment, and facilities to handle, store, and apply these products properly.

As an exception, the Pest Management Plan may be limited to pest control product screening when all of the following conditions are met:

1. Expected quantities of pest control products are not significant from a health or environment standpoint (for a description of the term 'significant' see section on EA).
2. No significant environmental or health concerns related to pest control need to be addressed.
3. The project will not introduce pesticide use or other non-indigenous biological control into an area, or significantly increase the level of pesticide use.
4. Products to be financed fall in Class III or table 5 of the WHO Classification of Pesticides by Hazard. Table 5 refers to pesticides unlikely to present acute hazard in normal use.

It is considered most likely that projects within the RDVRP will only use minimal amounts of pesticides, and typically for routine uses, such that the standard mitigation measures described previously are necessary. However, if a project proposed for financing is identified during the screening procedures as meeting the criteria to trigger the Pest Management Policy as described in this Annex, then such project would require an EIA with specific mitigation and management measures for the pesticide use envisaged. The EIA would include a Pesticide Management Plan as described in this Annex, and would be forwarded to the Bank for no-objection.