



IMPLEMENTATION OF THE MODEL SAFE SCHOOL PROGRAMME IN THE CARIBBEAN

HAZARD RISK ASSESSMENT REPORT AND COSTED ACTION PLAN

CAYON HIGH SCHOOL ST. KITTS AND NEVIS



An initiative of the African, Caribbean and Pacific Group, funded by the European Union, and implemented by:



SUBMITTED BY:

Environmental Solutions Limited

TO:

The Caribbean Disaster Emergency Management Agency Coordinating Unit

Hazard Risk Assessment Report and Costed Action Plan – Cayon High School, St. Kitts and Nevis for the Consultancy to Develop National Safe School Policies, Assess School Vulnerability to Hazards and Develop School Costed Action Plans in Six Borrowing Member Countries.



CARIBBEAN DISASTER EMERGENCY MANAGEMENT AGENCY COORDINATING UNIT

Resilience Way, Lower Estate
St. Michael
Barbados, W.I.

REPORT PREPARED BY ENVIRONMENTAL SOLUTIONS LIMITED



ENVIRONMENTAL SOLUTIONS LIMITED

7 Hillview Avenue
Kingston 10, Jamaica, W.I
Tel : (876) 978-9519, 978-6297, 978-5902
Fax : (876) 946-3745
E-Mail : envirsol@cwjamaica.com
Website : www.eslcaribbean.com

Original Submission Date: January 20, 2020

Revision Date: June 20, 2020

TABLE OF CONTENTS

1	INTRODUCTION	5
	1.1 PURPOSE	9
	1.2 METHODOLOGY	9
	1.2.1 HAZARD RISK ASSESSMENT	9
	1.3 LIMITATIONS	13
2	COUNTRY RISK PROFILE/SITUATIONAL CONTEXT	14
3	HAZARD IDENTIFICATION/ASSESSMENT	14
	3.1 WIND	15
	3.2 STORM SURGE	16
	3.3 FLOODING	17
	3.4 EARTHQUAKES	18
	3.5 TSUNAMI	18
	3.6 LANDSLIDES/INLAND EROSION	19
	3.7 DROUGHT	20
	3.8 VOLCANIC ACTIVITY	20
	3.9 CLIMATE PROJECTIONS	22
4	EXPOSURE ANALYSIS	22
	4.1 OTHER HAZARDS	25
5	ADAPTIVE CAPACITY	26
	5.1 DESCRIPTION OF STRUCTURE	31
	5.1.1 SITE OBSERVATIONS/DISCUSSION	33
6	VULNERABILITY ASSESSMENT	34
7	SUMMARY RECOMMENDATIONS	34
8	COSTED ACTION/IMPROVEMENT PLAN	37
9	REFERENCES	38
10	APPENDIX	39
	10.1 SAFETY ASSESSMENT	39
	10.1.1 SCHOOL SAFETY COMPLIANCE ASSESSMENT	40
	10.2 GREEN ASSESSMENT	40
	10.3 PHOTOGRAPHS	41
	APPENDIX 2	
	NATIONAL SAFE SCHOOL PROGRAMME COMMITTEE (NSSPC) MEMBERS	54
	APPENDIX 3	
	ORGANIZATIONS CONSULTED	56

1. INTRODUCTION

This document presents the Hazard Risk Assessment Report and Costed Action Plan for Cayon High School one of the seven (7) schools assessed in St. Kitts and Nevis. The report forms a part of the second and fourth deliverables (D2 and D4) under this Consultancy, and has been divided into eight main sections. Section 1 describes the method and approach the consultants used to undertake the assessment. Section 2 outlines the Country Risk Profile which presents the natural hazards each country and school is exposed to. Sections 3 to 6 summarize the vulnerability analysis of the identified hazards and Sections 7 and 8 present the summary findings, proposed recommendations and the Costed Action Plan. The results of the school safety and green assessments are presented in the Appendices.

The following schools were visited by the assessment team on regular school days, and as such the consultants were able to assess the schools during normal operational conditions:

TABLE 1.1: SCHOOL ASSESSMENT SCHEDULE

SCHOOL NAME	LOCATION	DATE VISITED
Washington Archibald High School	Basseterre, St. Kitts 17°18'12.78"N 62°43'26.42"W	Monday May 20, 2019
Charlestown Secondary	Charlestown, Nevis 17° 8'1.79"N 62°37'29.41"W	Tuesday May 21, 2019
Elizabeth Pemberton Primary	St. John's Parish, Nevis 17° 7'33.27"N 62°35'17.60"W	Tuesday May 21, 2019
Saddlers Primary	Saddlers, St. Kitts 17°24'20.72"N 62°47'39.58"W	Wednesday May 22, 2019
Cayon High School	Cayon, St. Kitts 17°21'8.83"N 62°44'0.66"W	Wednesday May 22, 2019
Tucker Clarke Primary School	Basseterre, St. Kitts 17°17'42.33"N 62°42'55.12"W	Thursday May 23, 2019
Sandy Point Primary	Sandy Point – Rural West, St. Kitts 17°21'28.05"N 62°50'56.72"W	Thursday May 23, 2019

FIGURE 1.1: SCHOOL LOCATION MAP – ST. KITTS

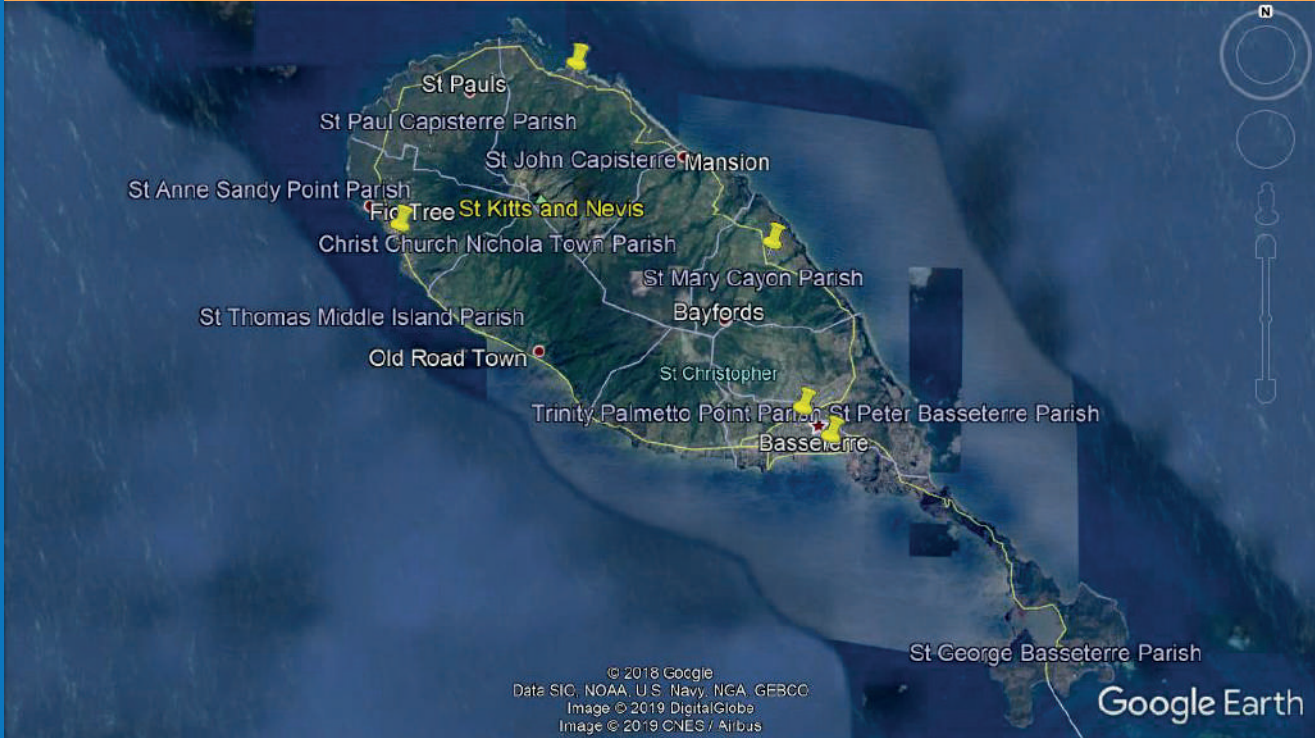
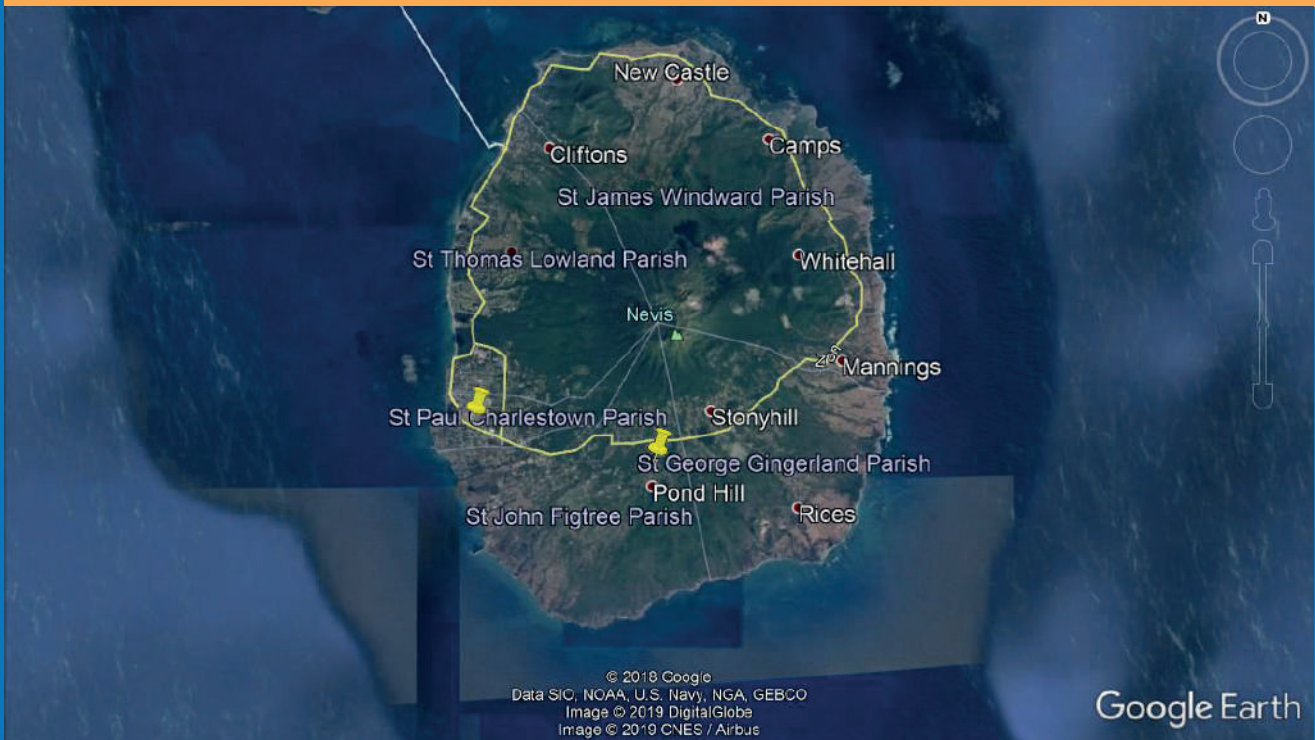
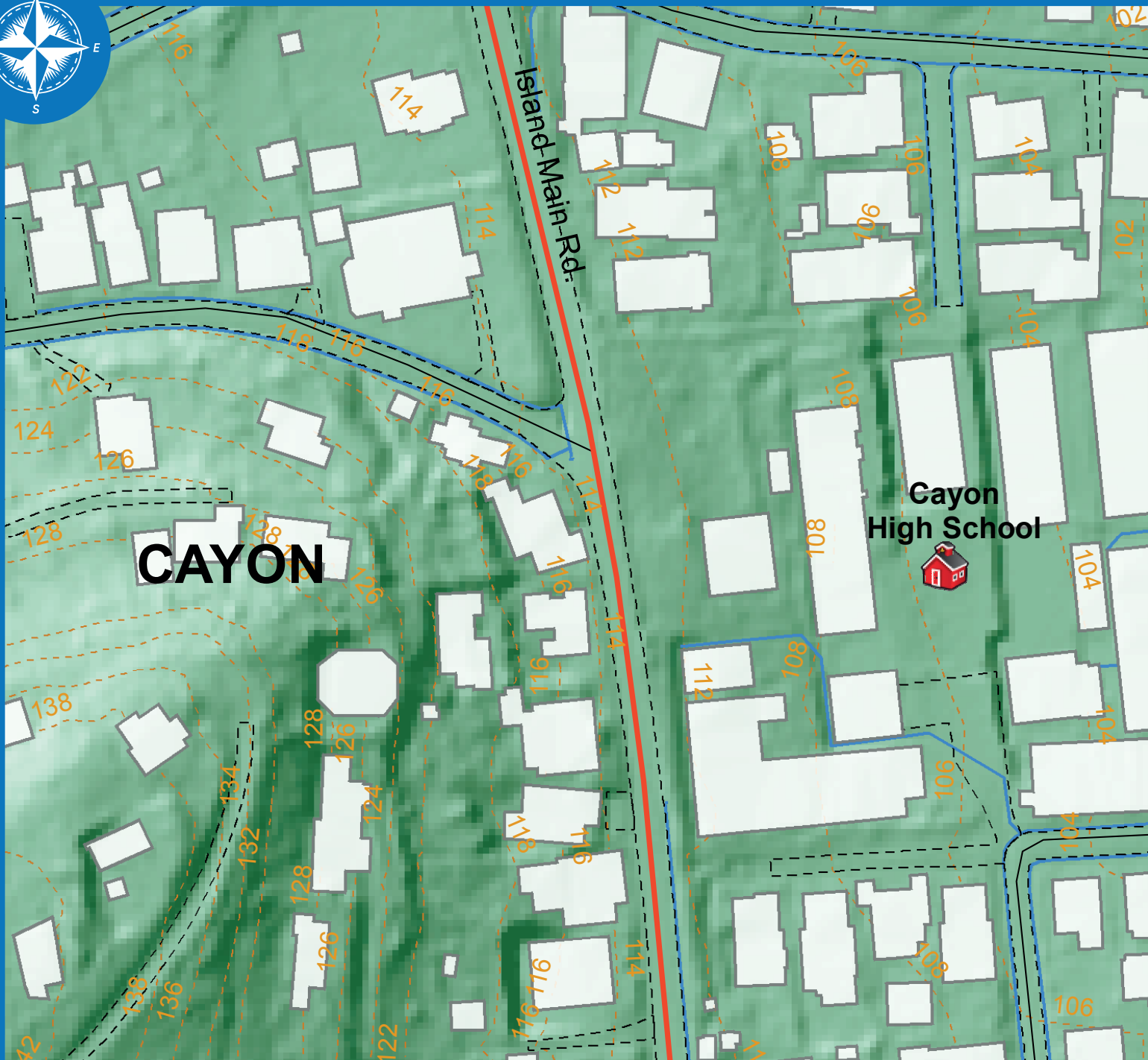
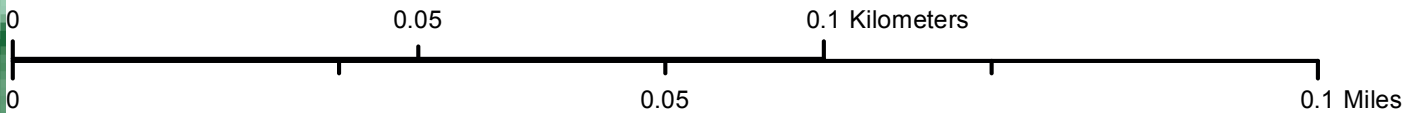


FIGURE 1.2: SCHOOL LOCATION MAP - NEVIS





Scale: 1:1,500



Geographic Position

The island of St. Kitts is located at approximately 17 degrees 19 minutes latitude and 62 degrees and 45 minutes west longitude

General Information

The representation of road or track is no evidence of the existence of a right of way.
When buildings are shown according to roof outline. The representation of boundary line do not necessarily depict the legal boundary on the ground.

Height Depiction

Contours are in meters and shown at 2 meter intervals. The accuracy of contours cannot be guaranteed in areas of high vegetation. Contours are shown through buildings for the purpose of continuity only.

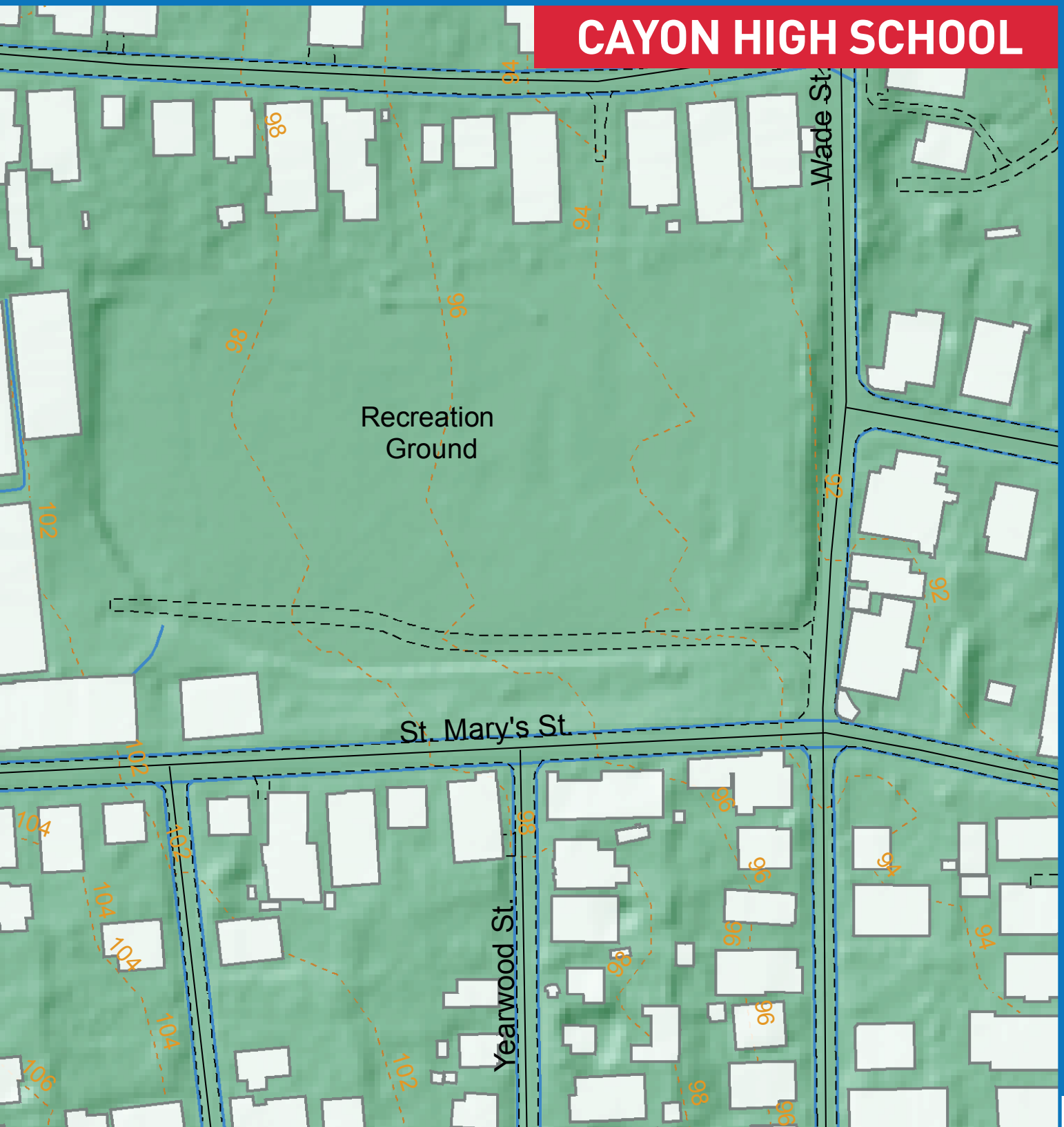
Data Source

GIS Database 2001/19
Department of Physical Planning
Ministry of Education

Grid Data

Grid: St. Kitts 2001 Grid
Local Datums: NAD 1983
Spheroid: GRS 1980
Projection: Transverse Mercator
Latitude of Origin: Equator
Longitude of Origin: 62 deg 30 min West of Greenwich
Scale factor on Meter: 1.0000
False Easting: 304,800 m, False Northing: 0.0000 m

CAYON HIGH SCHOOL



Legend

Road Network	--- Edge of Road	Buildings	Participating Schools
Main	Drainage	StKitts Is.	
Highway	- - - - Contour Lines		
Secondary			

The assessments consisted of interviews with senior administrators, a site walk-through to make general observations and take pictures, as well as a building condition survey described below.

The results of the school assessments are found in Appendix 1.

These deliverables have been prepared for the Project Implementing Agency, CDEMA, as well as the National Safe School Programme Committee (NSSPC) and national focal point in St. Kitts and Nevis. The list of NSSPC members are included in Appendix 2.

1.1 PURPOSE

The Model Safe School Programme (MSSP) Toolkit states that “in a region that is prone to various hazards, many schools may be located in hazardous locations. Wherever possible, Hazard and Vulnerability Assessments should be performed for schools to guide the inclusion of preparedness and mitigation measures in the design, construction and operational phases. Disaster and emergency planning should be founded on a thorough understanding of the specific hazards faced by the education sector in general and at the individual institutions.”

The purpose of this hazard risk assessment report is to identify and analyze the hazard vulnerability of the **Cayon High School** and to make recommendations to inform decision-making.

1.2 METHODOLOGY

The vulnerability assessment tool (VAT) used draws on the methodology developed by the National Oceanic and Atmospheric Association (NOAA). Some adaptations were made to take into account the local situation as well as data quality and availability.

1.2.1 HAZARD RISK ASSESSMENT

The consultants undertook the hazard risk assessments through a 3-step process elaborated below.

1.2.1.1 STEP 1 - CHARACTERIZING HAZARDS

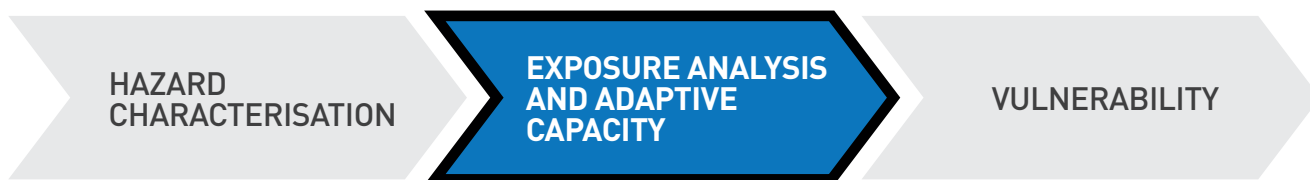


The first step involved the identification of the hazards (hydro-meteorological, geological, etc.) to which each of the countries, and by extension each school, may be exposed. To characterise hazards for each country, the Consultants conducted comprehensive desk research and stakeholder consultations with key agencies and various stakeholder groups (See Appendix 3) to acquire the necessary information, which included but was not limited to:

- Existing spatial data from local and regional Geographic Information Systems (GIS) databases e.g. Caribbean Risk Information System, CHARIM Handbook & Geo-node, PITCA, CARDIN etc.
- Multi-hazard maps, including:
 - Wind and cyclone hazard maps
 - Seismic zoning
 - Flood hazard maps
- Location of critical infrastructure and supporting infrastructure
- Historical and projected information on hazards for each country
- Damage history of each institution
- Previously conducted studies or country reports

Site visits were also conducted to the respective schools. These visits focused primarily on collecting physical infrastructure data and assessing the vulnerability of the facilities as they relate to the various hazards.

1.2.1.2 STEP 2 - EXPOSURE ANALYSIS AND ADAPTIVE CAPACITY



EXPOSURE ANALYSIS

Exposure analysis involved accessing various databases, including geospatial mapping using GIS, to identify the hazards to which the schools were exposed, as well as site assessments and discussions with stakeholders to ascertain history of hazard events.

Mapping hazard exposure enables stakeholders to visualise individual hazardous settings and identify cumulative hazard scenarios. This mapping also provides an effective tool to anticipate, plan and manage resources effectively in advance of these hazards. This geospatial framework is the foundation of the vulnerability assessment process.

The Consultants used the assessment tools from the MSSP toolkit to gather relevant information to help to inform exposure.

ADAPTIVE CAPACITY ASSESSMENT

The adaptive capacity for each school was determined by examining the characteristics that influence the school's capacity to prepare for, respond to and recover from hazards and disasters. The interaction between natural processes and the built environment is intrinsically linked, and it is the adaptive capacity that determines the risks and burdens created by hazards.

Some of the major factors assessed that influence adaptive capacity included:

- Are the proposed systems associated with each asset/facility designed to anticipate a hazard, cope with it, resist it and recover from its impact?
- Conversely, are there barriers to the ability to anticipate, cope, resist or recover?
- Are the systems associated with the school's assets/facilities already stressed in ways that will limit their capacity to anticipate, cope, resist or recover?
- Is the rate of impact from hazards likely to be faster than the adaptability of the systems?
- Are there efforts already underway to address impacts of hazards of interest related to the school's assets/facilities?

These variables outlined above were adopted for this project along with other indices. A systematic examination of building elements (as elaborated below), facilities, population and other components was carried out to identify features that are susceptible to damage from the effects of specific hazards. A qualitative scoring method was developed to determine the vulnerability of specific structures, exposed population and selected geographic areas. This data was analysed and used to prioritize mitigation activities and to guide disaster risk management within the schools.

The Consultants conducted targeted interviews with school administrators to identify gaps and needs for each school (institutional framework, physical infrastructure, human and financial resources). During the adaptive capacity analysis, the Consultants used the MSSP toolkit to identify gaps, needs and recommendations for capacity building measures and other interventions. Additionally, the Consultants provided a qualitative summary for each school.

Building Condition Assessment Methodology

The structural condition assessment was limited to visual observations and included both non-structural and structural-related issues. No finishes were removed to reveal hidden conditions, and no material or load tests were conducted to ascertain the structural capacity of the buildings' components. Moreover, the survey was limited to cursory inspection of electrical and mechanical systems such as ventilation, water services, plumbing and sewer utilities; egress, fire-suppression, or fire rating of the building components.

As such, any comments offered regarding concealed construction are the professional opinions of the Consultants based on analyses, and our joint engineering experience and judgment, and are derived in accordance with the standard of care and practice for evaluations of building structures.

The following standard conditions assessment definitions were used in describing the general state of the elements.

Good condition:

- It is intact, structurally sound and performing its intended purpose
- There are a few or no cosmetic imperfections
- It needs no repairs and only minor or routine maintenance.

Fair condition:

- There are early signs of wear, failure or deterioration, although the feature or element is generally structurally sound and performing its intended purpose.
- There is failure of a sub-component of the feature or element.
- Replacement of up to 25% of the feature or element is required.
- Replacement of a defective sub-component of the feature or element is required.

Poor condition:

- It is no longer performing its intended purpose.
- It is missing
- It shows signs of imminent failure or breakdown
- Deterioration or damage affects more than 25% of the feature or element and cannot be adjusted or repaired.
- It requires major repair or replacement.

The above was used qualitatively in conjunction with CDEMA's Enhanced Building Condition Assessment Tool (EBCAT) and the findings are contained in Section 5.1.

1.2.1.3 STEP 3 - VULNERABILITY ASSESSMENT



The data and information collected from Step 1 (Hazard Characterisation) and Step 2 (Exposure Analysis and Adaptive Capacity) were combined to determine how and where each school is vulnerable to hazards using the following formula:

$$\text{HAZARD EXPOSURE} + \text{ADAPTIVE CAPACITY} = \text{VULNERABILITY}$$

1.3 LIMITATIONS

This assessment represents a one-day snapshot of the schools that may or may not be the total depiction of what occurs daily. The team based its findings on the data provided and individual observations made during this one-day time frame. Please be mindful that this assessment is not binding but is merely an independent review to assist school officials in their quest to examine practices and procedures to better serve their student population. It is therefore incumbent upon the Ministry of Education, education officers and school staff to consider the report and determine what they believe is legitimate and critical to address when considering school safety management issues.

Comments in this report are intended to be representative of observed conditions. The consultants have made every effort to reasonably inspect and analyze the main structural components as well the non-structural components which form part of the building envelope. If there are perceived omissions or misstatements in this report regarding the observations made, we ask that they be brought to our attention as soon as possible so that we have the opportunity to address them fully and in a timely manner.

2. COUNTRY RISK PROFILE / SITUATIONAL CONTEXT

According to 2001 census data, the population of the Federation stood at just over 46,000 (34,930 on St. Kitts, 11,181 on Nevis) (Poverty Research Unit, 2006) and this increased to a mid-year population estimate for 2009 of 51,967 (ECCB, 2009). Although St. Kitts is not a low-lying island, over 60% of the population is located in coastal areas (Jeffers and Hughes, n.d.), with small villages strung along the main coastal road. This is partly due to the rugged, forest covered nature of the interior. The major urban areas are Basseterre (40% of the population), Sandy Point and Cayon (MOE, 2001).

The World Bank places St. Kitts and Nevis at position 21 of countries at high economic risk from multiple hazards (Global Facility for Disaster Reduction and Recovery, 2010). Over the years, the islands of St Kitts and Nevis have been impacted by a number of natural hazards, some of which have increased significantly in frequency over the past ten years. These include:

- Earthquake
- Volcanic activity
- Wind/tropical cyclone
- Flooding – coastal, riverine, flash flood
- Coastal erosion
- Drought

Detailed climate modelling projections for St. Kitts and Nevis predict:

- an increase in average atmospheric temperature;
- reduced average annual rainfall;
- increased Sea Surface Temperatures (SST); and
- the potential for an increase in the intensity of tropical storms.

And the extent of such changes is expected to be worse than what is being experienced now.

3. HAZARD IDENTIFICATION/ASSESSMENT

As with many other countries in the Caribbean, there are two broad categories of hazards that can cause potentially minor to significant impacts at any given time in St. Kitts and Nevis. These are:

- Hydro-meteorological hazards
 - Hurricanes and Tropical Storms
 - Flooding
 - Drought
 - Storm Surge
 - Landslide
- Geological hazards
 - Earthquake
 - Volcano
 - Tsunami

Based on a review of reports, site visits and consultation with key stakeholders, the main hazards that affect the schools found within the project area are presented below.

3.1 WIND

Since 1989, at least ten storms (see Table 3.1) have inflicted varying degrees of damage on both islands. The damage caused by those storms has occurred largely as a result of the impact from high velocity winds, with speeds in excess of 75 miles per hour. Damage has included coastal erosion, destruction of infrastructure – roads, bridges, water and electricity facilities, public property e.g. schools, hospitals, community buildings, as well as destruction of private property. Damage costs also include the opportunity cost of lost revenues due to interruption of commercial business activities such as tourism, a major revenue earner for the Federation. Human lives have also been affected through physical injuries, psychological trauma, and indeed on occasion, actual loss of life.

Prior to 1989, the incidence of wind hazard impacting St Kitts and Nevis was relatively infrequent (Table 3.1).

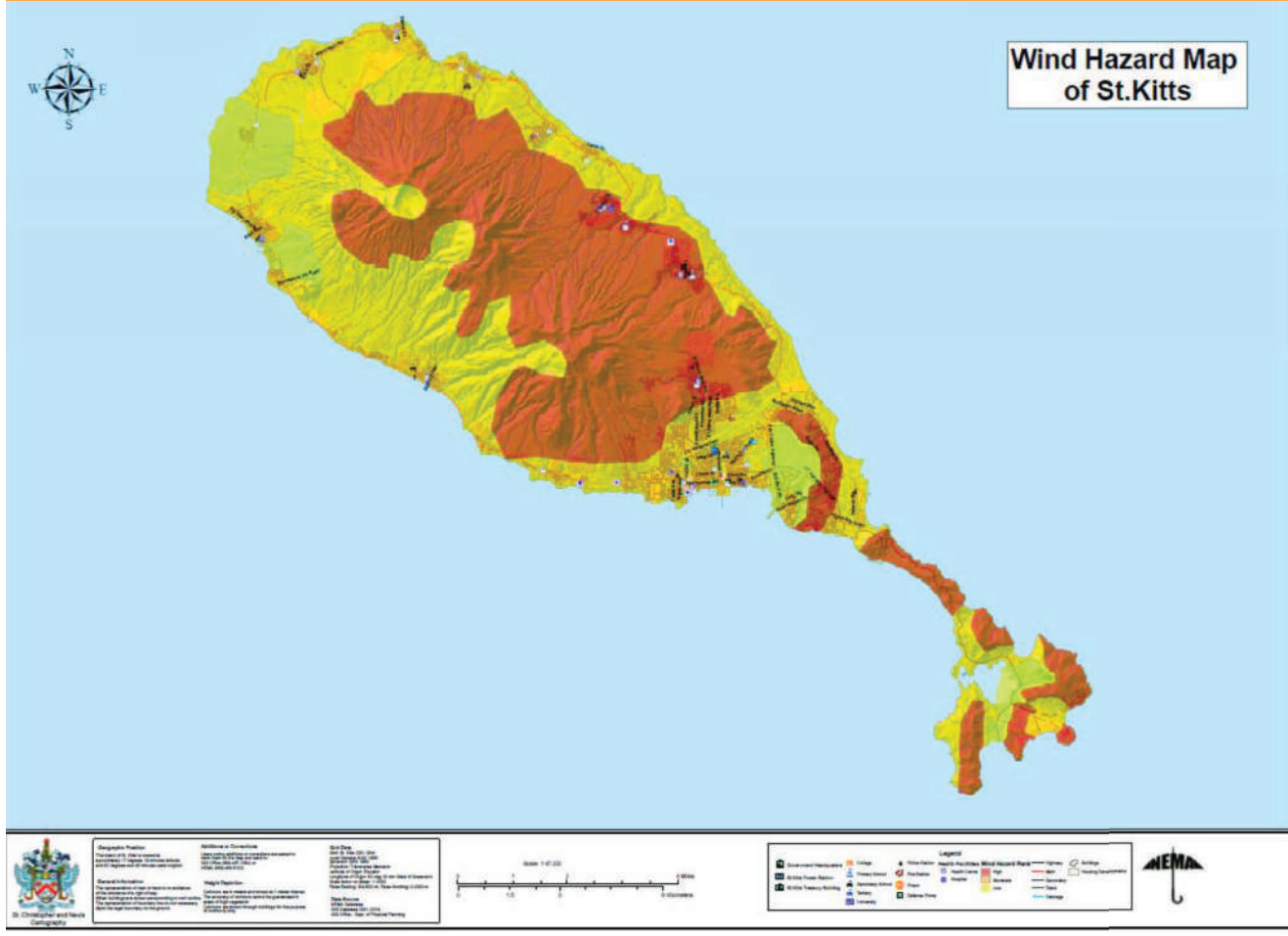
TABLE 3.1: MAJOR HAZARDS WHICH HAVE STRUCK ST. KITTS] AND NEVIS SINCE 1899

PERIOD	HAZARD TYPE	COMMENTS
1928	Hurricane	
1950	Earthquake	
1955	Hurricane Alice	
1961	Earthquake	6+ magnitude
1974	Earthquake	7.4 Richter Scale
1984	Flood	Basseterre SK only
1985	Earthquake	6.6 Richter Scale
1987	Flood (major)	
1989	Hurricane Hugo	
1989	Storm Felix	
1989	Hurricane Gilbert	
1989	Hurricane Iris	
1995	Hurricane Luis	
1995	Hurricane Marilyn	
1996	Hurricane Bertha	
1998	Hurricane Georges	
1998	Flood (severe)	
1999	Hurricane Jose	
1999	Flood (minor)	
1999	Hurricane Lenny	

There are a number of facilities in St. Kitts with relatively high vulnerability to wind in the areas of Basseterre, Cayon and Sandy Point. With regard to educational facilities, high scores were noted for the High Schools of Basseterre, Verchilds and Cayon, indicating the need for a review of the capacity of those buildings to withstand wind from storms (including hurricanes). Of note also of relatively high vulnerability, are two medical facilities, namely - the Pogson Hospital, Sandy Point and to a lesser extent the JNF General Hospital, Basseterre.

There are a number of facilities on the eastern side of Nevis with relatively high vulnerability to wind including Churches and Educational facilities which are also used as Emergency Shelters. Of particularly high vulnerability also, are the Community Centres at Hickman and Hard Times respectively and the Grove Park Pavilion in Charlestown.

FIGURE 3.1: WIND HAZARD MAP – ST. KITTS (SOURCE: NEMA)



3.2 STORM SURGE

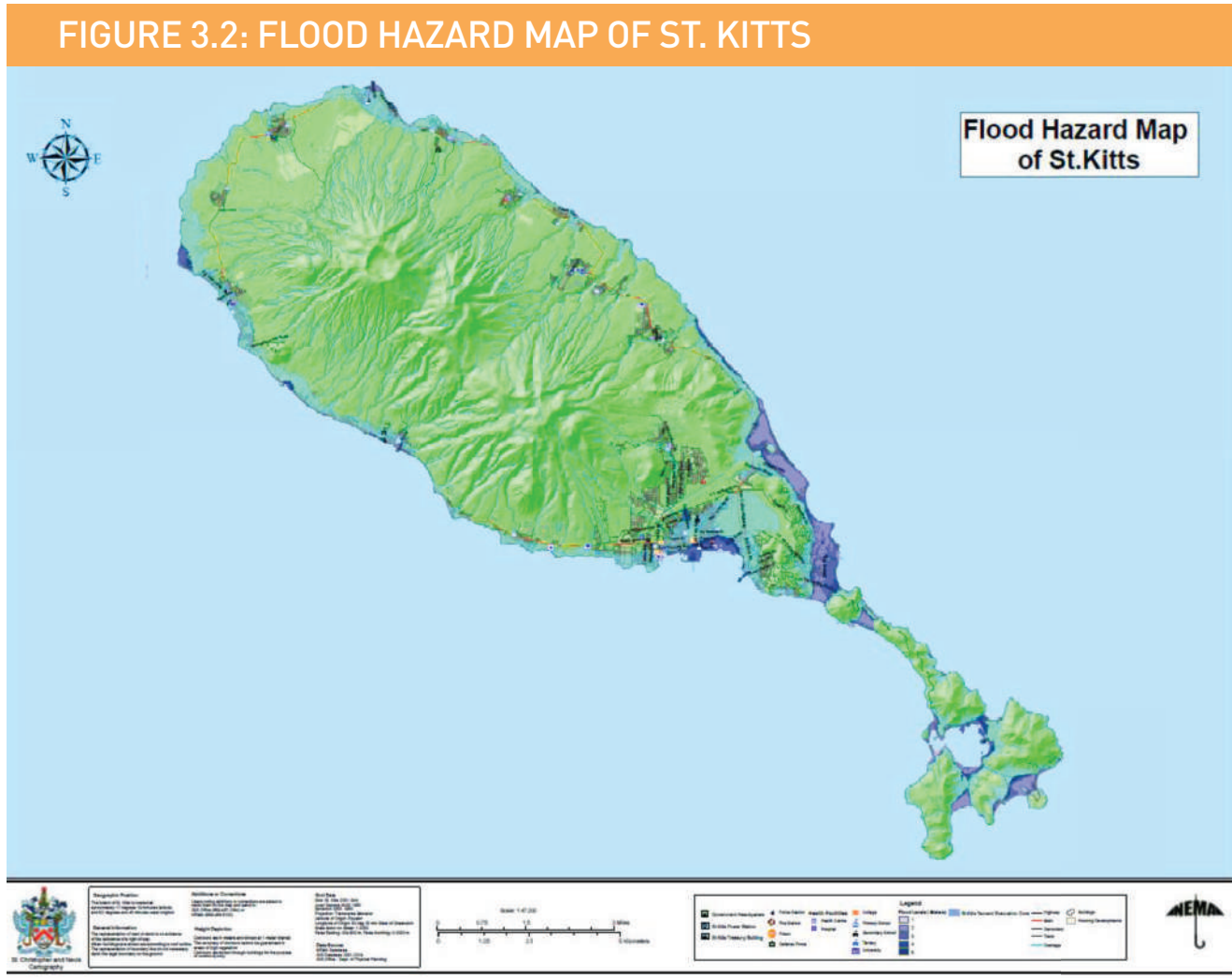
St Kitts and Nevis is exposed to coastal erosion with varying degrees of damage, resulting from the effects of storms and storm surge. As a result of Hurricane Luis (1995), the western coastal area of Nevis suffered significant damage through erosion brought upon by the force of waves. The western coastal areas of St Kitts and Nevis suffered most significantly as a result of the impact of Hurricane Lenny (1999) which approached from a westerly direction, an unusual development.

3.3 FLOODING

Flooding is largely localised in St Kitts. Heavy rainfall normally results in the overflow of Ghauts, as well as the retention of water in some sections of Basseterre. In 1998 severe flooding of one of the Ghauts in Basseterre resulted in significant damage and one loss of life was recorded. Flooding has been recorded in 1987 and more recently minor flooding in 1999. Prior to 1998 the last severe flooding was in 1880.

For Nevis, the Charlestown area along the Bath Ghaut has experienced relatively high flooding. Other areas where flooding has been experienced include the Stoney Grove to Charlestown road and the Newcastle International Airport.

FIGURE 3.2: FLOOD HAZARD MAP OF ST. KITTS



Government Headquarters	Police Station	Health Facilities	College	Legend Flood Levels (Meters) 1 2 3 4 5	St. Kitts Tsunami Evacuation Zone	Highway	Buildings	
St. Kitts Power Station	Fire Station	Health Centre	Primary School		Main	Secondary	Track	Housing Developments
St. Kitts Treasury Building	Prison	Hospital	Secondary School		Tertiary	Drainage		
Defense Force			University					

3.4 EARTHQUAKES

St Kitts as well as Nevis is prone to earthquakes. Relatively minor tremors have been felt infrequently, with little or no damage having been reported. Seismic activity is being monitored through the Seismic Research Unit in Trinidad and Tobago, West Indies.

Nevis experienced significant volcanic earthquake swarms in 1926, 1947-48, 1950-51, and 1961-63. These earthquakes were relatively shallow and originated at depths between 1-11 km. No earthquakes other than regional tectonic earthquakes have been reportedly felt in Nevis since May 1963. The permanent seismograph station at Gingerland has been in continuous operation since 1980 detecting local volcanic earthquakes once/twice per year.

3.5 TSUNAMI

The hazard maps below show tsunami evacuation zones for both St. Kitts and Nevis.

FIGURE 3.3: TSUNAMI HAZARD MAP – ST. KITTS (SHOWING BASSETERRE WHICH IS CONSIDERED A HIGH RISK ZONE)

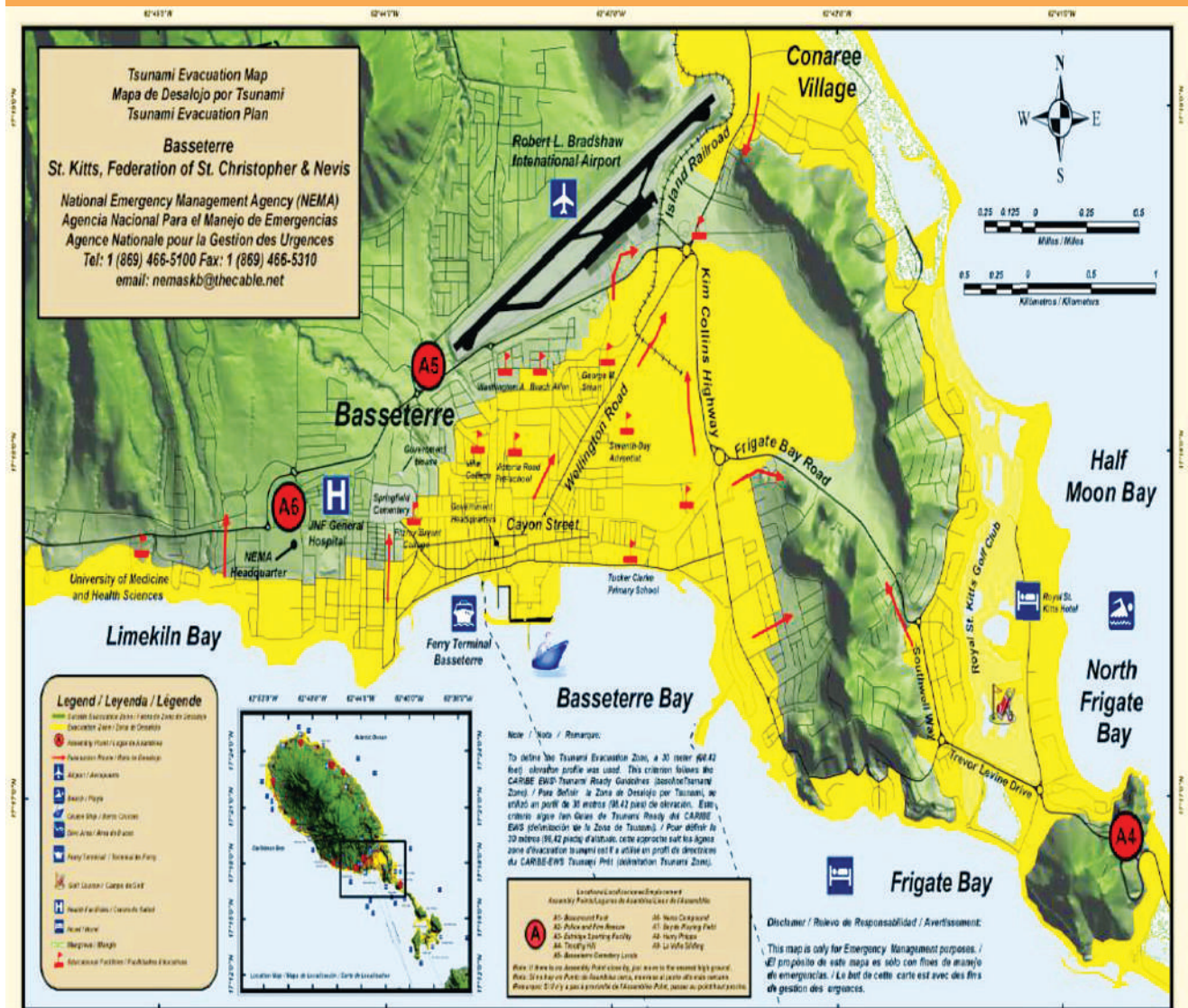
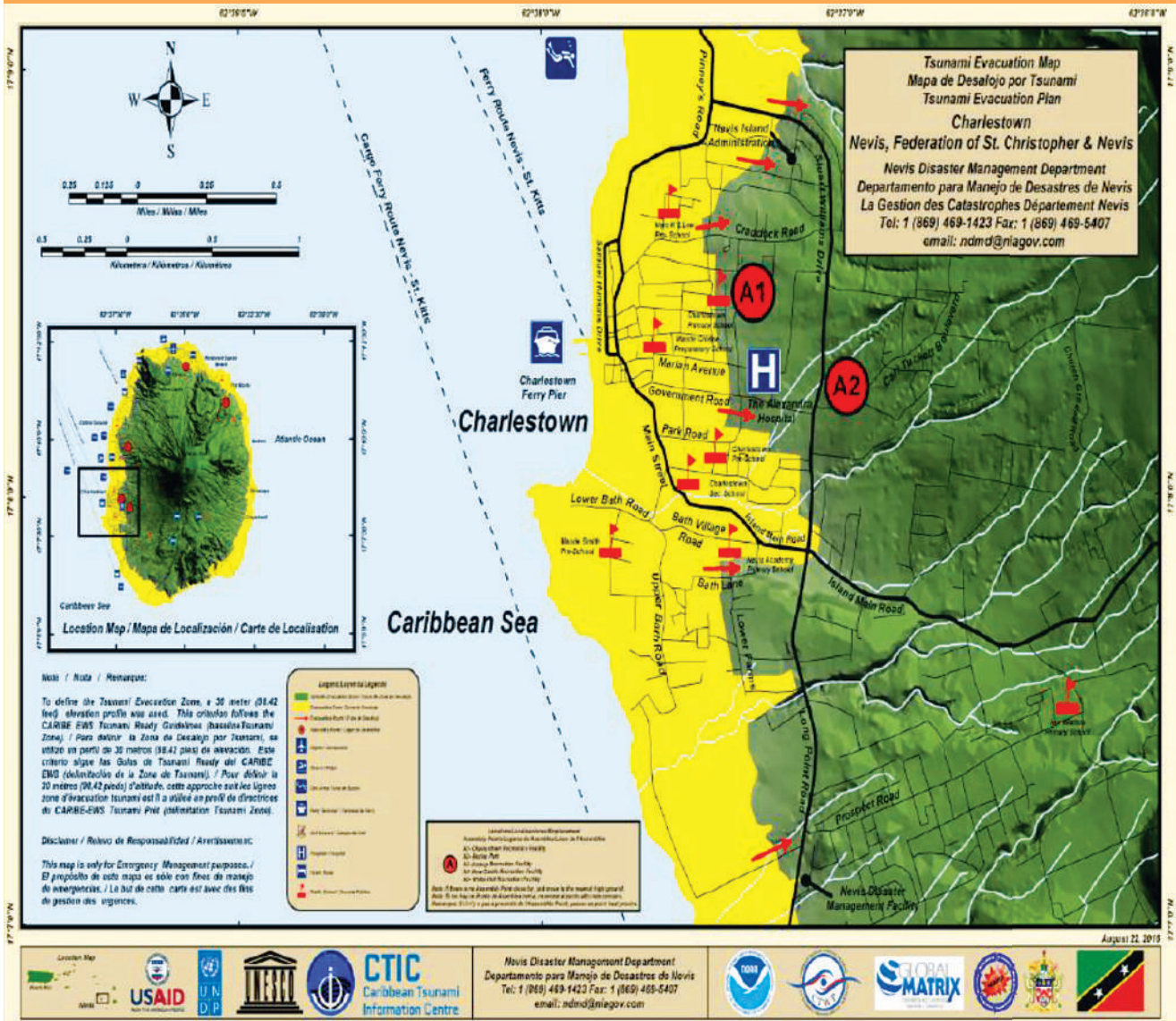


FIGURE 3.4 TSUNAMI HAZARD MAP – NEVIS (SHOWING CHARLESTOWN WHICH IS CONSIDERED A HIGH RISK ZONE)



3.6 LANDSLIDES / INLAND EROSION

St Kitts has been subject to inland erosion as a result of storm winds and ghaut flooding. The areas along ghaut levels have been susceptible to landslides and damage has been suffered particularly in areas where sub-standard housing has been erected, generally by squatters without official planning authority (Bentley Associates 1998).

Facilities with the highest vulnerability to Inland Erosion are spread around the island, with a greater concentration towards the south. It is noted that five of the six main water intakes, as well as six Emergency Shelters show high vulnerability to inland erosion.

3.7 DROUGHT

Drought was previously identified as a critical hazard for Nevis only. More than one-half of the island receives less than fifty (50) inches of rainfall per year. Rainfall per year has been known to average forty-six (46) inches as compared to an average of 64 inches for St Kitts. Rainfall is lowest on the eastern side of the island and increases in areas of higher altitude. Although short periods of drought may occur throughout the year, extended periods of drought are more often experienced from the months of February through April.

The central mountain area of moist forest has the lowest risk to drought. Moderate risk areas include the northwest and north of the island. High-risk areas include the Charlestown water zone and the Butlers/Mannings water zone on the east of the island. The south and southeast section of the island is considered to be of very high risk to drought.

Drought frequency is not well documented in St. Kitts. Aside from the 2010 drought event, another severe drought occurred between 1999 and 2000. Such droughts last between 1-2 months (Dr Sahely, personal communication, April 12, 2011). Other recorded instances of dry spells include 2003, when water yield from wells was 40% of its normal output. This highlighted the necessity for more water storage across the island (ECLAC, 2003).

3.8 VOLCANIC ACTIVITY

The islands of St Kitts and Nevis lie along a volcanic chain passing through the Lesser Antilles. Cones with crater formation include Mount Olivees, the Verchilds Mountain and Mount Liamuiga. It is believed that Mount Liamuiga (formerly known as Mount Misery) may have erupted in 1692 and in 1843 (Bender 1986 with reference to World Data Centre, 1981).

Seven volcanic centres have been identified on Nevis: Hurricane Hill, Round Hill, Cades Bay, Saddle Hill, Red Cliff, Butlers Mountain and Nevis Peak. Nevis Peak is the only volcanic centre likely to erupt in the future.

FIGURE 3.5: VOLCANIC HAZARD ZONES (NEVIS)

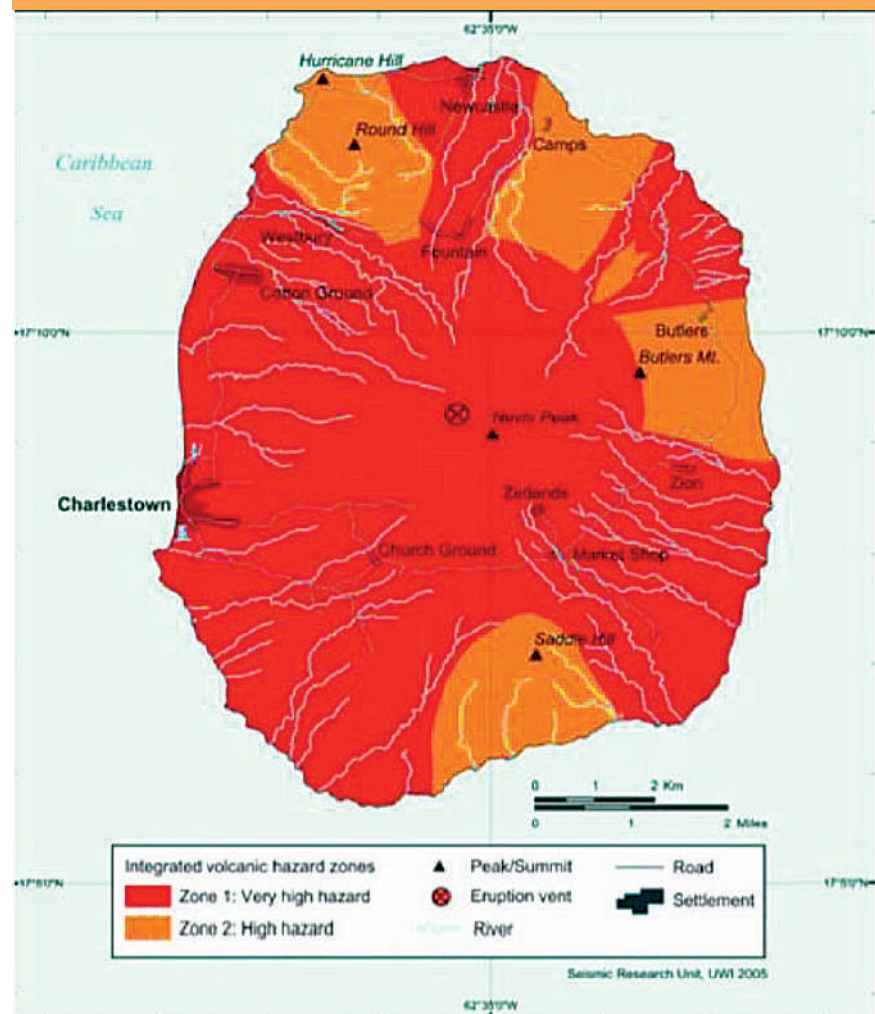
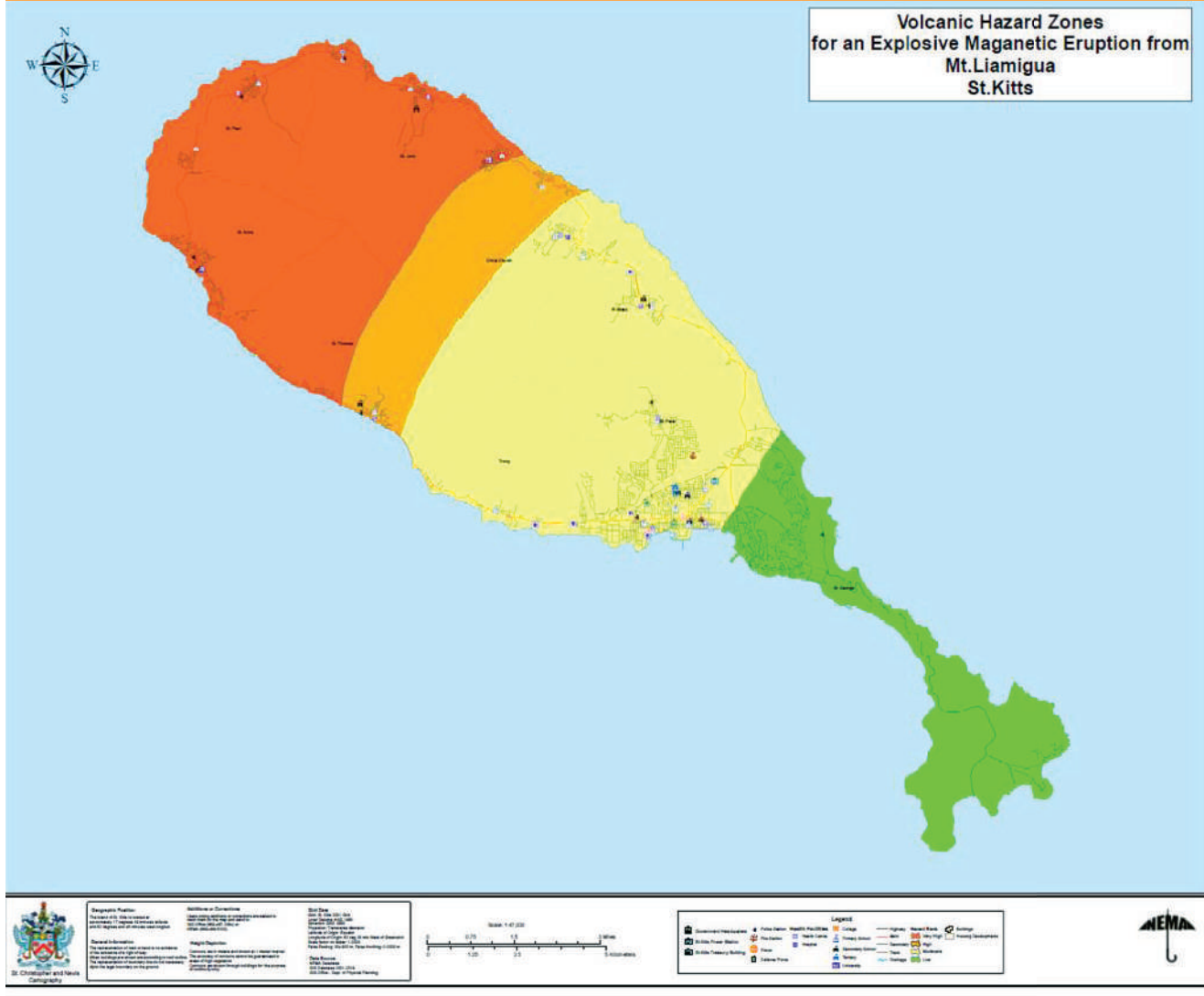


FIGURE 3.6: VOLCANIC HAZARD ZONES (ST. KITTS)



- | | | | | | | |
|-----------------------------|----------------|--------------------------|------------------|-----------|--------------------|----------------------|
| Government Headquarters | Police Station | Health Facilities | College | Highway | Hazard Rank | Buildings |
| St. Kitts Power Station | Fire Station | Health Centre | Primary School | Main | Very High | Housing Developments |
| St. Kitts Treasury Building | Prison | Hospital | Secondary School | Secondary | High | |
| | Defense Force | | Tertiary | Track | Moderate | |
| | | | University | Drainage | Low | |

3.9 CLIMATE PROJECTIONS

Detailed climate modelling projections for St. Kitts and Nevis predict the following:

- **Temperature:** Regional Climate Model (RCMs) projections indicate increases ranging from 2.4 - 3.2 °C by the 2080s in the higher emissions scenario.
- **Precipitation:** General Circulation Models (GCM) projections indicate overall decreases in annual rainfall of between -41 to +13 mm per month by 2080 for the higher emissions scenario. RCM projections indicate a decrease of 7-22% in total annual rainfall.
- **Sea Surface Temperatures (SST):** GCM projections indicate increases from +0.7 °C and +2.8°C by the 2080s.
- **Tropical Storms and Hurricanes:** North Atlantic hurricanes and tropical storms appear to have increased in intensity over the last 30 years. Observed and projected increases in SSTs indicate potential for continuing increases in hurricane activity and model projections indicate that this may occur through increases in intensity of events but not necessarily through increases in frequency of storms.

4. EXPOSURE ANALYSIS

The term exposure is used to indicate those elements-at-risk that are subject to potential losses. Important elements-at-risk that should be considered in analysing potential damage of hazards are population, building stock, essential facilities and critical infrastructure. Critical infrastructure consists of the primary physical structures, technical facilities and systems which are socially, economically or operationally essential to the functioning of a society or community, both in routine circumstances and in the extreme circumstances of an emergency (UN-ISDR, 2009).

This exposure analysis involves developing a hazard profile for the school by assigning ratings (from 0 to 3) to the parameters¹ listed in Table 4.1 below and averaging the parameter scores for each hazards. Based on the average scores, the school is characterized by the degree of exposure to each hazard and further assigned an **Overall Exposure Index** (sum of the average scores for all hazards).

The objective is to quantify the schools' level of exposure and subsequently the potential impact (direct or indirect) of a specific hazard on people, essential facilities, and property. This will enable school administrators, the Ministry of Education and other key decision makers to have a better understanding of the hazards that present the highest risk to the school and focus planning efforts on making schools safer in this context.

Based on the rankings given, the schools are characterized by the degree of exposure to each hazard and further assigned an overall exposure index of Low, Moderate or High:






OVERALL EXPOSURE INDEX		
0 - 4	VERY LOW	
5 - 9	LOW	
10 - 14	MODERATE	
15 - 19	HIGH	
20 - 24	VERY HIGH	

TABLE 4.1: PARAMETERS AND RANKINGS USED IN EXPOSURE ANALYSIS

PARAMETER	RANKINGS	SCORE
Frequency	Highly Likely: Near 100% probability in next year.	3
	Likely: Between 10 and 100% probability in next year, or at least one chance in 10 years.	2
	Possible: Between 1 and 10% probability in next year, or at least one chance in next 100 years.	1
	Unlikely: Less than 1% probability in next 100 years.	0
Warning (potential speed of onset)	Minimal (or no) warning.	3
	6 to 12 hours warning.	2
	12 to 24 hours warning.	1
	More than 24 hours warning	0
Severity	Catastrophic: Multiple deaths; Complete shutdown of facilities for 30 days or more; More than 50%of property is severely damaged.	3
	Critical: Injuries and/or illnesses result in permanent disability; Complete shutdown of critical facilities for at least two weeks; More than 25%of property is severely damaged.	2
	Limited: Injuries and/or illnesses do not result in permanent disability; Complete shutdown of critical facilities for more than 1 week; More than 10%of property is severely damaged.	1
	Negligible: Injuries and/or illnesses are treatable with first aid; Minor quality of life lost; Shutdown of critical facilities and services for 24 hours or less; Less than 10% of property is severely damaged.	0

The consultants used existing data and available hazard maps to determine the level of exposure of the school to specific hazards. Table 4.2 presents the findings of the exposure analysis.

TABLE 4.2: EXPOSURE ANALYSIS – CAYON HIGH SCHOOL

HAZARD	COMMENTS	FREQUENCY		WARNING TIME		SEVERITY		DEGREE OF EXPOSURE	
		RANKING	SCORE	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE
Hurricanes and Tropical Storms/Wind	The school is located in the high wind hazard zone.	Highly Likely	3	More than 24 hours warning	0	Catastrophic	3	HIGH	2.00
Flooding/inland erosion (from hurricanes, storms or extreme rainfall events)	The school not considered to be within a flood risk zone. However it may experience localized flooding during a heavy rainfall event.	Likely	2	6-12 hrs	2	Limited	1	MODERATE	1.67
Drought	St. Kitts and Nevis has been impacted by drought and this is expected to be exacerbated by climate change.	Likely	2	More than 24 hours warning	0	Limited	1	MODERATE	1.00
Storm Surge	Cayon High is located relatively near to the coast but is not considered at risk for storm surge.	Unlikely	0	-	-	-	-	NOT EXPOSED	0.00
Landslide	This school is not exposed to the landslide hazard.	Unlikely	0	-	-	-	-	NOT EXPOSED	0.00
Earthquake	St Kitts and Nevis are prone to earthquakes.	Likely	2	Minimal (or no warning)	3	Catastrophic	3	HIGH	2.67
Volcano	The school is located in the moderate volcanic hazard zone.	Possible	1	Minimal (or no warning)	3	Limited	1	MODERATE	1.67
Tsunamis	Cayon High is located relatively near to the coast but is not considered at risk for tsunamis.	Unlikely	0	-	-	-	-	-	-

OVERALL EXPOSURE INDEX

9.01

Based on the above, the overall multi-hazard exposure is **low**.

While the development of the modern building code has progressed, many of the schools were built before the adoption of modern building codes, placing them at great risk for hurricane damage. Technologies exist today that allow older buildings to be retrofitted to become more hurricane resistant. Examples of these technologies include reinforcing gabled roofs, creating secondary water barriers in roofs, and installing hurricane straps and clips to ensure a roof stays in place despite high winds.

The school was assessed against the National Building Code which is common for the Organisation of Eastern Caribbean States (OECS) territory.

Flood mitigation was identified as a definite necessity in this and many of the schools assessed throughout the region. Due to the nature of the flood hazard, it cannot be addressed in isolation of its immediate environs and more generally, the storm water management of each school should be analyzed in the context of the run-off characteristics of the water catchment in which it is located. This may mean that focusing only on the school in attempting to resolve the flooding problem may not yield the required results and Community-based initiatives with specific focus on empowerment of the local community, and linking the community based activities to local development policies may be more effective.

Seismic hazard may or may not be mitigated. For example, fault rupture and ground motion cannot be mitigated because tectonic movement (the main cause of earthquakes) cannot be stopped, but liquefaction at a site can be mitigated by engineering measures. Seismic risk can be reduced through either mitigation of seismic hazard or reduction of exposure or both. For the purposes of this assignment the assessment was concerned more with building form and to a lesser extent soil type as it relates to susceptibility of liquefaction. It is recommended that a detailed structural analysis be conducted if 'as-built' drawings do not exist. It is based on that analysis that a determination of the need to retrofit will be made.

4.1 OTHER HAZARDS

Comprehensive school emergency planning utilizes an “all-hazards” approach, which considers a wide range of possible threats and hazards. It includes those that might take place in the community and surrounding area that could impact the school. Examples include:

1. Technological Hazards

- Hazardous materials in the community from industrial plants, major highways or railroads
- Hazardous materials in the school e.g. gas leaks, sewage breaks or laboratory spills
- Infrastructure failure e.g. dam, electricity, water, communications or technology systems

2. Biological Hazards

- Infectious diseases
- Contaminated food outbreak
- Water contamination
- Toxic materials present in schools e.g. mould, asbestos, substances in school science laboratories

3. Adversarial, Incidental and Human-Caused Hazards

- Fire
- Medical Emergency
- Intruder
- Active shooter/Threats of violence
- Fights
- Gang violence
- Bomb threat
- Child abuse
- Cyber attack
- Suicide
- Missing student or kidnapping
- Off-site emergencies
- Dangerous animal
- Riots

Issues relating to Occupational Health and Safety, particularly mould contamination, was reported during the school assessment. It is recommended that the school determine which of the above are considered priority hazards to be included in the School Safety Plan.

5. ADAPTIVE CAPACITY

The adaptive capacity analysis describes the ability of the school to accommodate potential damage, to take advantage of opportunities, or to respond to consequences with minimum disruption or minimum additional cost (Climate Impacts Group, King County, Washington, and ICLEI-Local Governments for Sustainability, 2007). It describes the capacity of the school to learn from previous experiences and to apply those lessons to cope in future.

In the context of what each school may be exposed to (see Section 3), the analysis below, among other things, seeks to determine:

- If the school is already able to accommodate changes
- If there are any barriers to the school to accommodate changes
- If the rate of the projected change is likely to be faster than the adaptability of the school
- If there are efforts already underway to address impacts of various hazards in the school

To develop an overall index of adaptive capacity, 24 indicators were selected and grouped according to five determinants of adaptive capacity in the context of the hazards that may impact each school (Section 3). The indicators were selected using information garnered using the MSSP toolkit checklists, interviews and desk review of other existing data and information (Smit et al 2001, Yohe and Tol, 2002). The index was calculated by first aggregating the scores for the individual indicators to obtain a determinant value, which were then aggregated to an overall score to obtain an **Overall Adaptive Capacity Index**.

OVERALL ADAPTIVE CAPACITY INDEX		
0 - 4	VERY LOW	
5 - 9	LOW	
10 - 14	MODERATE	
15 - 19	HIGH	
20 - 24	VERY HIGH	

This approach provides a holistic perspective on the school's ability to plan for, design and implement effective adaptation strategies or to react to evolving hazards and stresses which may ultimately reduce the likelihood of the occurrence and or the severity of harmful outcomes resulting from hazards.

TABLE 5.1: DETERMINANTS OF ADAPTIVE CAPACITY USED IN SCHOOL ASSESSMENT

DETERMINANT	RATIONALE
Economic	<ul style="list-style-type: none"> ■ Greater economic resources increase adaptive capacity ■ Lack of financial resources limits adaptation options
Information and skills	<ul style="list-style-type: none"> ■ Lack of informed, skilled and trained personnel reduces adaptive capacity ■ Greater access to information increases likelihood of timely and appropriate adaptation
Infrastructure and Technology	<ul style="list-style-type: none"> ■ Lack of technology limits range of potential adaptation options ■ Less technologically advanced regions are less likely to develop and/or implement technological adaptations ■ Greater variety of infrastructure can enhance adaptive capacity, since it provides more options ■ Characteristics and location of infrastructure also affect adaptive capacity
Institutional	<ul style="list-style-type: none"> ■ Well-developed social institutions help to reduce impacts of climate- related risks and therefore increase adaptive capacity ■ Policies and regulations may constrain or enhance adaptive capacity
Physical/Ecological	<ul style="list-style-type: none"> ■ Elements of the physical or ecological environment of a region may enhance or limit the possibilities for adaptation

TABLE 5.2: SUMMARY OF ADAPTIVE CAPACITY ANALYSIS FOR CAYON HIGH SCHOOL

DETERMINANT	INDICATOR	SCORE	COMMENTS
Institutional	<p>1. Is there a national policy on climate change adaptation and/or comprehensive disaster management (or related) for the education sector? [YES = 1; NO = 0]</p>	1	<p>Though not specific to the education sector, St. Kitts & Nevis has national policies which address climate change adaptation and/or comprehensive disaster management. These include but are not limited to:</p> <ul style="list-style-type: none"> ■ Natural Hazard Mitigation Policy and Plan for the Federation of St Kitts & Nevis ■ St. Kitts-Nevis National Disaster Plan
	<p>2. Have there been additions to the curriculum that integrate climate change/disaster preparedness/emergency management? [YES = 1; NO = 0]</p>	1	<p>There have been additions to the curriculum that integrate climate change/disaster preparedness/emergency management.</p>
	<p>3. Is an updated emergency management or disaster management plan in place? [YES = 1; NO = 0]</p>	0	<p>The school does not have an emergency/disaster management plan in place. It is reportedly a work in progress.</p>
	<p>4. Do the plans address priority hazards based on previous assessment(s)? [YES = 1; NO = 0]</p>	0	N/A
	<p>5. Is there a designated environmental/health & safety officer, emergency response team or related position/team? [YES = 1; NO = 0]</p>	0	<p>The school does not have a designated environmental/health & safety officer in place.</p>
Information and Skills	<p>6. Has the school done a walk through to identify and prioritize hazards for the population and visitors? [YES = 1; NO = 0]</p>	1	<p>The school reports that they have assessed and documented the risks to the safety of their staff at work, as well as students and visitors.</p>
	<p>7. Are all teachers and school staff assigned roles in the overall response, pre-, during and post-hazard event? [YES = 1; NO = 0]</p>	0	<p>The school indicated that all teachers and school staff are not assigned roles in the overall response, pre-, during and post-hazard event.</p>
	<p>8. Have staff received training in emergency/disaster management? [YES = 1; NO = 0]</p>	1	<p>Staff have reportedly been trained in at least one aspect of disaster management or health and safety.</p>

TABLE 5.2: SUMMARY OF ADAPTIVE CAPACITY ANALYSIS FOR CAYON HIGH SCHOOL

DETERMINANT	INDICATOR	SCORE	COMMENTS
Information and Skills	<p>9. Are there regular drills with staff, students and/or parents? [YES = 1; NO = 0]</p>	0	Regular drills are not conducted.
	<p>10. Is the school able to manage an event independently if help is not immediately available? E.g. fire extinguishers, first aid kits, triage? [YES = 1; NO = 0]</p>	1	At the time of the assessment, the school has access to fire extinguishers (though not mounted) and 2 first aid kits. There are qualified first aiders on staff.
Infrastructure and Technology	<p>11. Does the school have reserve water storage with adequate supply for at least 3 days? [YES = 1; NO = 0]</p>	0	<p>The school indicated that they do not have adequate cistern/reserve water storage for 3 days.</p> <p>The observed cistern needs repair.</p>
	<p>12. Does the school employ water conservation strategies to adapt to current usage or plan for future changes to water supply? [YES = 1; NO = 0]</p>	0	Attempts have been made in the past at water conservation efforts, eg. some buildings were guttered, and a storage tank put in place. However, some maintenance work needs to be done to get these systems back in working order.
	<p>13. Does the school actively harvest rainwater? [YES = 1; NO = 0]</p>	0	Rainwater is not currently collected.
	<p>14. Does the school employ energy conservation/efficiency mechanism? [YES = 1; NO = 0]</p>	1	The use of energy efficient light bulbs was reported.
	<p>15. Is there back up electrical power? [YES = 1; NO = 0]</p>	0	No there is no back up electricity supply, but the school has a desire to implement solar panels.
	<p>16. Does the school employ other green practices? E.g. recycling, greenhouse/garden, green policy etc? [YES = 1; NO = 0]</p>	1	<p>The school reported that they have a Green Policy as well as a champion/coordinator to oversee green initiatives.</p> <p>The school has sought recognition for its green efforts and has integrated its green programme into its operations and the curriculum.</p>

TABLE 5.2: SUMMARY OF ADAPTIVE CAPACITY ANALYSIS FOR CAYON HIGH SCHOOL

DETERMINANT	INDICATOR	SCORE	COMMENTS
Infrastructure and Technology	17. Can the building withstand the impacts of a hazard in its current condition? [YES = 1; NO = 0]	1	<p>Generally, the buildings were in satisfactory condition. There were however a few buildings that were in poor condition, particularly the wooden buildings which can become airborne during a severe wind event.</p> <p>The most serious area of deficiency was the Aluzinc roof covering on some of the buildings which appeared to lack the required hurricane straps. There were also cases of missing or broken windows which will put the entire building at risk in an extreme wind event. The main roof structures were found to be in generally good condition.</p>
	18. Have school buildings/plant been repaired or retrofitted to the building code? [YES = 1; NO = 0]	0	<p>Recent repairs/additions have reportedly been the cause of some moisture intrusion problems which has in turn led to a mould issue. Further repairs and retrofits are recommended in the Costed Action Plan (Section 8).</p>
ARE THERE ANY EXISTING BARRIERS TO ADAPTATION?			
Physical/ Ecological/ Climate	19. Physical or ecological limits? E.g. Does the landscape/physical location/age range and size of the school population limit the range of adaptation options to priority hazards? [YES = 1; NO = 0]	1	<p>The school does not have any significant physical limitations. Noticeably however, is the limited accessibility for persons with disabilities. There are numerous stairs due to the sloping nature of the property.</p>
	20. Is climate change likely to exacerbate any of the current hazards? [YES = 1; NO = 0]	0	<p>Based on climate projections, the current hazards are projected to be exacerbated.</p>
	21. Is the rate of climate change likely to outpace adaptation efforts? [YES = 1; NO = 0]	0	<p>Climate change impacts are already being experienced, and adaptation efforts, though available, may be costly to implement.</p>
Technological	22. Technological limits? Availability of technological options for adaptation e.g. public address system for warning/early warning; electronic data storage. [YES = 1; NO = 0]	0	<p>These technologies are available, though not presently in place at the school.</p>

TABLE 5.2: SUMMARY OF ADAPTIVE CAPACITY ANALYSIS FOR CAYON HIGH SCHOOL

DETERMINANT	INDICATOR	SCORE	COMMENTS
Economic	<p>23. Financial barriers? E.g. Lack of resources may limit the ability of some schools to afford proposed adaptation mechanisms.</p> <p>[YES = 1; NO = 0]</p>	0	The school is funded by the government, as a result funding is limited.
Information and Skills	<p>24. Information or cognitive barriers (individuals tend to prioritize the risks they face, focusing on those they consider – rightly or wrongly – to be the most significant to them at that point in time)? E.g. concern about one type of risk is heightened while worry about other risks decreases; lack of experience of climate-related events inhibits adequate responses.</p> <p>[YES = 1; NO = 0]</p>	1	The awareness levels at this school in terms of general health and safety is high.
TOTAL		10	MODERATE

5.1 DESCRIPTION OF STRUCTURE

The investigation consisted of a visual review of the exterior and interior elements such as walls, slab, columns and beams as well as a general walk-through to examine the existing cracks and other defects which may exist. The results of the building condition assessment are presented below.

NAME OF SCHOOL:	CAYON HIGH SCHOOL
SCHOOL ADDRESS:	Cayon, St. Mary, St. Kitts
TOTAL NUMBER OF BUILDINGS:	Sixteen (16)
SPECIAL HAZARD RISK:	Wind
GENERAL COMMENTS:	Most of the Buildings are in generally good condition. However, major repairs and retrofit are recommended.

	BUILDING 1 & 2	BUILDING 3 TO 6	BUILDING 7 TO 11	BUILDING 12	BUILDING 13 & 14	BUILDING 15 & 16	
Number of Storeys per Building:	1	1	2	1	1	1	
Floor Type:	Description: Reinforced concrete Observation: Floor slab in generally good condition with some spalling concrete at some areas.	Description: Reinforced concrete Observation: Floor slab in generally good condition with some spalling concrete at some areas.	Description: Reinforced concrete Observation: Floor slab in generally fair condition.	Description: Reinforced concrete Observation: Floor slab in generally good condition.	Description: Reinforced concrete Observation: Floor slab in generally good condition.	Description: Reinforced concrete Observation: Floor slab in generally good condition.	Description: Timber Observation: Floor in fair condition.
Wall/ Partition Type:	Description: Reinforced masonry in fair condition. Hairline cracks were not uncommon.	Description: Reinforced masonry in fair condition. Hairline cracks were not uncommon.	Description: Reinforced masonry in fair condition. Hairline cracks were not uncommon.	Description: Reinforced masonry in good condition.	Description: Reinforced masonry in fair condition. Hairline cracks were not uncommon.	Description: Timber panels in fair condition.	
Roof Structure:	Description: Timber and structural steel in generally fair condition.	Description: Timber and structural steel in generally fair condition.	Description: Timber and structural steel in generally fair condition.	Description: Reinforced concrete in generally good condition.	Description: Timber in fair condition.	Description: Timber structure in fair condition.	
Roof Covering:	Description: Aluzinc sheets in generally fair condition.	Description: Aluzinc sheets in generally fair condition.	Description: Aluzinc sheets in generally fair condition.	Description: Reinforced concrete in generally good condition.	Description: Aluzinc sheets in poor condition.	Description: Aluzinc sheets in fair condition.	
Repairs/ Retrofitting Conducted:	None	None	None	None	None	None	
Is there Disabled Access/ Special Needs Access to the Building?	None	None	None	None	None	None	
Approx. Age of Each Building	More than 40 years	More than 40 years	More than 20 years	More than 20 years	More than 20 years	More than 20 years	
Building Use	Administration	Classroom	Classroom	Classroom	Toilets	Classroom	
Overall Condition	Fair	Fair	Fair	Good	Poor	Poor	

5.1.1 SITE OBSERVATIONS / DISCUSSION

EXTERIOR

WALLS

There were some signs of water ingress through the external walls that may be porous, and the affected areas can be corrected by re-plastering of defective areas.

SLAB & BEAMS

Slab and beams were found to be in generally good condition with some isolated areas of spalling concrete.

COLUMNS

Columns were found to be in good condition generally.

INTERIOR

WALLS

Interior walls were of both masonry and timber. Masonry walls were in good condition as were the timber panels.

WINDOWS

Several broken windows were observed, the timely repairs of which will be critical in order to ensure that the building envelope is not compromised during an extreme wind event.

DOORS

Doors were all of timber in conditions varying from good to poor. The problems ranged from termite infestation to broken or missing ironmongery and for which the timely repairs will be critical in order to ensure that the building envelope is not compromised during an extreme wind event.

GENERAL CONDITION

The summary of the main observations is as follows:

1. Historically, the issue of water ingress is normally not associated with structural assessments, however in recent times a direct link between water ingress and structural deterioration has been established. Generally, water ingress through inadequate seals around windows and doors as well as wall flashing need to be addressed. Water ingress around windows was identified as the main defect to be addressed.
2. There is also the need to repair roof and roof drainage as there are signs of deterioration, crude repairs and in some cases leaks.
3. There were some signs of water ingress through the external walls that may be porous and the affected areas can be corrected by re-plastering of defective areas.

6. VULNERABILITY ASSESSMENT

The final step in the vulnerability assessment process is to combine the findings of exposure and adaptability to determine how and where the school is vulnerable. It is important to note that the vulnerability assessment does not remain static, it can improve or worsen with time. Changes can occur within the school, such as implementation of preparedness activities, and/or new threats may emerge. These can all influence the school's overall vulnerability.

Cayon High School has been classified as having an overall **low** exposure (Table 4.2). The analysis of the adaptive capacity (Table 5.2) revealed that while the school may have some barriers and limitations, their capacity to adjust to change (induced by the hazards to which they are exposed), moderate potential damages, take advantage of opportunities, and/or to cope with the consequences is **moderate**. While the administration has taken active measures towards disaster management and the physical plant of the school has not been structurally compromised, there are additional strategies that the school can employ to improve their adaptive capacity, however these may come at significant cost (presented in Section 8). As the school is government funded, this may further constrain the school's capacity to adapt. As such, Cayon High School can be characterised as having **low to moderate** vulnerability.

7. SUMMARY RECOMMENDATIONS

The following represent key strengths and areas for improvement that have been identified in an effort to improve school safety.

KEY STRENGTHS:

- The School Safety Plan is a work in progress. Awareness levels are high with regards to Occupational Health and Safety.
- There are qualified first aiders on staff.
- The school also has immediate access to emergency medical services at the nearby health centre.
- First aid kits are present and accessible.
- There is a visitor sign in policy in place, however it needs greater enforcement.
- The school has embarked on numerous "Green" initiatives. These include purchasing special receptacles for recycling, Trained litter wardens, Planted local fruit trees and other plants.
- The school has identified space for students to "relax" and has built benches under a large shade tree.
- Water supply is reportedly good, however the Principal would like to improve this by having the back up water storage tank and the roof gutters repaired.
- The Principal has also expressed a great desire to implement solar panels as a source of back up electricity supply.

AREAS FOR IMPROVEMENT:

Grounds and Facilities

- There were some noticeable areas for infrastructural improvements.
- Some broken windows were observed which need to be replaced.
- Open floor drains were observed, which can become a hazard during heavy rainfall events.
- Exposed electrical wires were observed which is a safety issue.
- Construction debris was not removed from compound by contractors.
- Decommissioned equipment/damaged furniture etc. has not been removed from the compound.

- The school has pest issues including mice and termites. Traps were reportedly obtained from the Ministry of Health and this has reportedly minimized the rodent sightings.
- Extensive termite damage was observed in the wooden buildings, but at the time of the assessment no treatment had yet been done.
- The lack of proper perimeter fencing allows for larger animals to enter the property as well. Animal droppings (mainly goat) were observed throughout the compound. Animals were also observed during the assessment.
- Buildings are not accessible for persons with disabilities (PWDs). Due to the sloping nature of the property, a lot of stairs are present. Many of the steps are unevenly spaced which is also a hazard.
- It was noted that maintenance work by the relevant authorities is mainly reactive rather than preventative. There is no set maintenance schedule or checklist.
- Daily on-site maintenance is carried out by 1 groundsman and 2 cleaners. However, there are issues as the ancillary workers don't have job descriptions and are reportedly reluctant to do certain assigned tasks.

Chemical/hazardous materials Management

- The school reported that over time many of the labels on the bottles become illegible. The school had some old chemicals that they were unable to identify.
- The Ministry of Education (MOE) procures chemicals, however the school indicates that the Ministry sends too much chemicals that are not always used up. They also send unnecessary chemicals that are not used in the practicals.

Occupational Health and Safety

- There were reports of mould issues, particularly in the science lab area as a result of an on-going leak. The building was not occupied during the time of the assessment due to the elevated mould levels.
- The school has identified the lack of personal protective equipment such as safety coats, goggles, gloves etc. emergency showers and eye wash stations as a concern and an area for improvement.
- The Principal indicated that they need a nurse on staff. The nearby clinic is currently utilized.

Safety and Security

- There are breaches in the perimeter fencing which need to be repaired.
- Security officers on staff are not trained security guards. The MOE has also not provided job descriptions for the security officers.
- The school has security cameras however during the time of the assessment they were not working.

FIGURE 7.1: EXAMPLES OF AREAS FOR IMPROVEMENT IDENTIFIED



8. COSTED ACTION / IMPROVEMENT PLAN

Table 8.1 summarizes the recommended improvements and budgets for capital expenditures (remedial works, repairs, retrofitting) identified by this report. Expenditures that are expected to be managed as part of normal operations are not shown. The budgets assume a prudent level of ongoing maintenance. It should be noted that costs excluded engineering indirect costs and any local taxes.

TABLE 8.1: COSTED ACTION / IMPROVEMENT PLAN

RECOMMENDATION	TASK	RESPONSIBLE PARTY	FUNDS REQUIRED (\$EC)	TIMEFRAME SHORT-MEDIUM -LONG TERM	RESULT
Chemical / Hazardous Materials Management	Re-organize science lab chemical storage area: <ul style="list-style-type: none"> ■ Re-label illegible containers and properly store chemicals² (consult Material Safety Data Sheets as well for proper storage) ■ Separate containers to be discarded Ensure Material Safety Data Sheets for each chemical are available and easily accessible	Principal and/or Safety Committee in collaboration with Chemistry Teacher	None	Short Term	Improved safety with regards to chemical management
	Install emergency eye-wash station and shower	Principal and/or Safety Committee in collaboration with Chemistry Teacher	4,000	Medium Term	

TABLE 8.1: COSTED ACTION / IMPROVEMENT PLAN

RECOMMENDATION	TASK	RESPONSIBLE PARTY	FUNDS REQUIRED (\$EC)	TIMEFRAME SHORT-MEDIUM -LONG TERM	RESULT
Grounds and Facilities	Obtain a cost proposal for termite treatment and replacing termite damaged infrastructure	Ministry of Education in collaboration with Department of Works	Ministry of Education to obtain	Short Term	Improved safety of Physical Plant
	Repair perimeter fencing				
	Upgrade of storm drains to include additional flood protection from adjacent existing waterway		120,000	Medium Term	
	Repair roof covering, ceiling and roof drains to current Building Code Standards		220,800	Medium Term	
	Upgrade of doors and windows to hurricane resistant standards		196,500	Short - Medium Term	
	Expand and upgrade toilet block to include new septic tank and soakaway		220,600	Medium Term	
	Construct new water storage		160,000	Medium - Long Term	
	Electrical rewiring complete with new fixtures		248,000	Medium Term	
	Repair defective or damaged external and internal walls and slabs		168,400	Medium Term	
	Painting		174,600	Medium Term	
	Contingency		100,000		
TOTAL			1,612,900		

9. REFERENCES

- Natural Hazard Mitigation Policy and Plan for The Federation of St Kitts & Nevis (undated), USAID and OAS Nevis Disaster Management Department Website
- The Caribsave Climate Change Risk Atlas (CCCRA) - Climate Change Risk Profile for St. Kitts (2012)

10. APPENDIX

10.1 SAFETY ASSESSMENT

TABLE 10.1: VITAL INFORMATION TABLE

NAME OF SCHOOL	CAYON HIGH SCHOOL
Type of school (Pre-school, primary, secondary, tertiary)	SECONDARY
Is facility private and public?	PUBLIC
Location	OSBOURNE STREET, CAYON, ST.KITTS
Name of Head Teacher or Principal	MR. FRANCIL A. MORRIS
Telephone	(869)-465-7204
Email	cayonhighschool@moeskn.org
Year building(s) constructed	1971, 1980s, 1990s, 2000 onwards
How many buildings are contained on the school compound?	11
How many classrooms are within each school building?	Some buildings have 4 classrooms others have 5
What is the total school population?	445
Students	Male: 180 Female: 182
Teachers	Male: 20 Female: 48
Non-teaching staff	Male: 4 Female: 11
How many first aid kits are available for use?	2
How many fire extinguishers are installed throughout the buildings?	Fire extinguishers are available but not mounted
Was the school affected by any natural disaster in the past?	YES
If yes, what type of event was it and when did it occur?	HURRICANE
Were there any repairs as a result of the event?	YES
Is the school designated as an emergency shelter?	NO

10.1.1 SCHOOL SAFETY COMPLIANCE ASSESSMENT

TABLE 10.2: SCHOOL SAFETY ASSESSMENT SUMMARY

CAYON HIGH SCHOOL			
	SCORE	%	CRITICAL STANDARDS MET
Safety Assessment	113	20%	NO
Green Assessment	154	29%	NO

TABLE 10.3: SCHOOL SAFETY COMPLIANCE ASSESSMENT

	%	CRITICAL STANDARDS MET
Disaster Planning	14%	NO
Emergency Planning	4%	NO
Safety Admin	35%	
Medical Emergencies	47%	NO
Physical Plant	19%	NO
Physical Safety	59%	
Protection of the Person	6%	
Hazardous chemicals and materials	16%	NO

10.2 GREEN ASSESSMENT

TABLE 10.4: GREEN ASSESSMENT SUMMARY SCORES

	%	CRITICAL STANDARDS MET
Sustainability Management	68%	NO
Natural Resources	25%	NO
Indoor Environment	36%	NO
Hazardous Chemicals and Materials	0%	NO
Facility and Grounds Management	30%	NO
Food Service	23%	NO

10.3 PHOTOGRAPHS



■ TWO STOREY RECTANGULAR BUILDING WITH GABLE TYPE ROOF



■ SINGLE STOREY ADMINISTRATIVE BUILDING



■ SINGLE STOREY ADMINISTRATIVE BUILDING



■ COVERED AND UNCOVERED CIRCULATION



■ CORRODED ROOF SHEETING



■ UNCOVERED CIRCULATION



■ UNCOVERED CIRCULATION



■ UNCOVERED CIRCULATION



■ MAKESHIFT SUN AND RAIN BARRIER – VERTICAL ALUZINC SHEETS



■ MAKESHIFT SUN AND RAIN BARRIER – VERTICAL ALUZINC SHEETS



■ WOODEN WINDOWS



■ TOILET BLOCK



■ LIGHT WEIGHT ROOF
IN A STATE OF DESPAIR



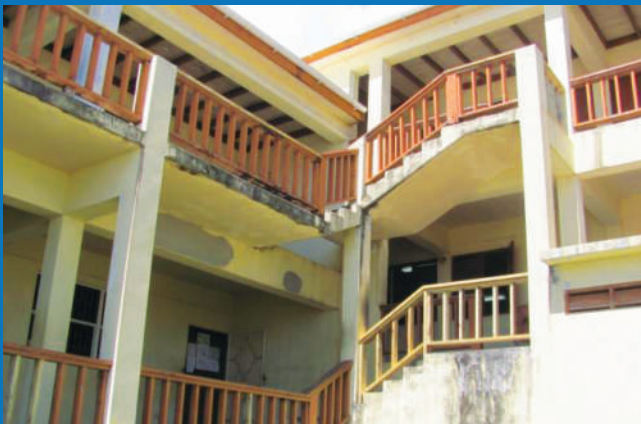
■ THE NEWER
BUILDINGS



■ THE NEWER
BUILDINGS



■ THE NEWER
BUILDINGS



■ THE NEWER
BUILDINGS



■ THE NEWER
BUILDINGS



■ THE NEWER BUILDINGS



■ PANORAMIC VIEW
- SECTIONS OF COMPOUND



■ PANORAMIC VIEW
- SECTIONS OF COMPOUND



■ PANORAMIC VIEW
- SECTIONS OF COMPOUND



■ PANORAMIC VIEW
- SECTIONS OF COMPOUND



■ BUILDING WITH
CONCRETE ROOF



■ FIRE HOSE REEL



■ VIEW OF MAIN COURTYARD



■ EXAMPLE OF INCREMENTAL CONSTRUCTION



■ SINGLE STOREY CLASSROOM BLOCK



■ SINGLE STOREY CLASSROOM BLOCK



■ BUILDING WITH SHORT EAVES



■ TIMBER BUILDING



■ TIMBER BUILDING



■ TIMBER BUILDING



■ TIMBER BUILDING



■ TIMBER BUILDING



■ TIMBER BUILDING



■ **TIMBER BUILDING**
- GARBAGE DISPOSAL AND OTHER SAFETY ISSUES



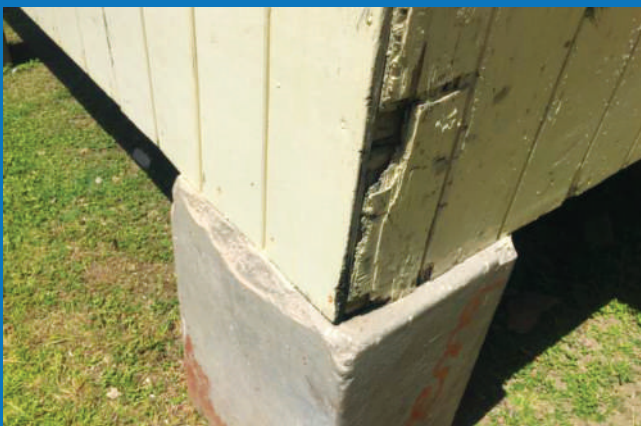
■ **TIMBER BUILDING**



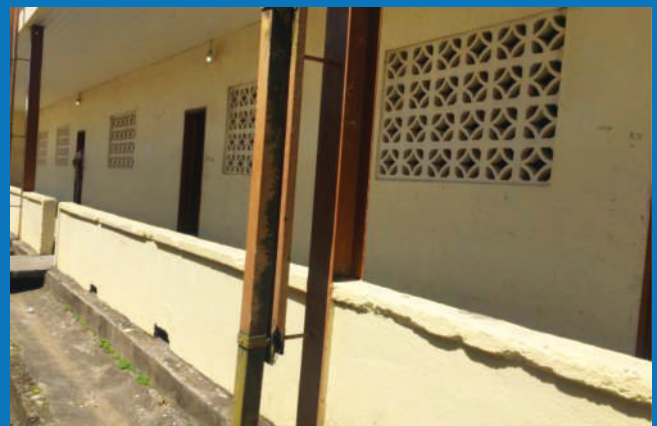
■ **TIMBER BUILDING**
- TERMITE DAMAGE



■ **TIMBER BUILDING**
- TERMITE DAMAGE



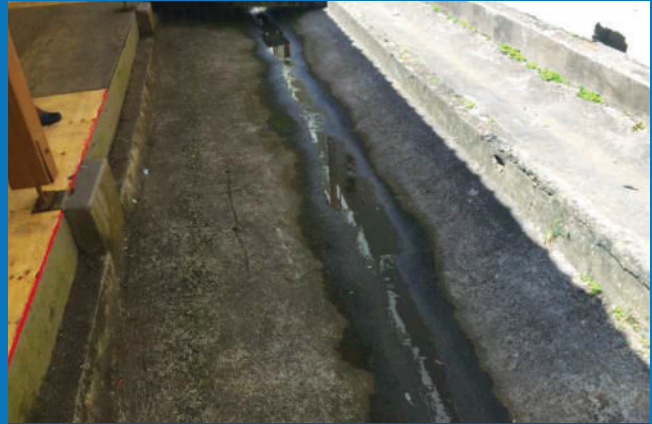
■ **TIMBER BUILDING**



■ **STRUCTURAL STEEL SUPPORTS**



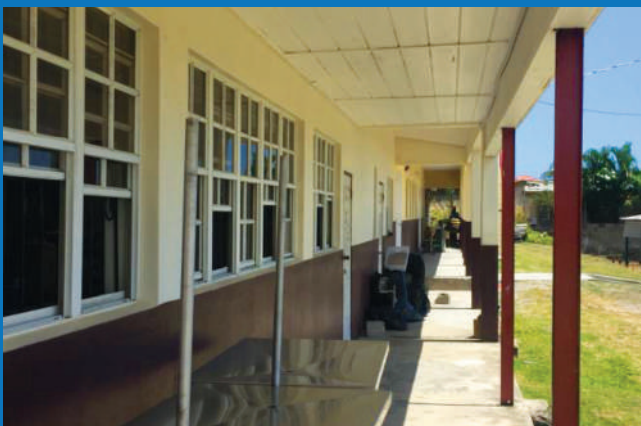
■ DRAINS
- PART OF EXTERNAL DRAINAGE NETWORK



■ DRAINS
- PART OF EXTERNAL DRAINAGE NETWORK



■ GLAZED
WINDOWS



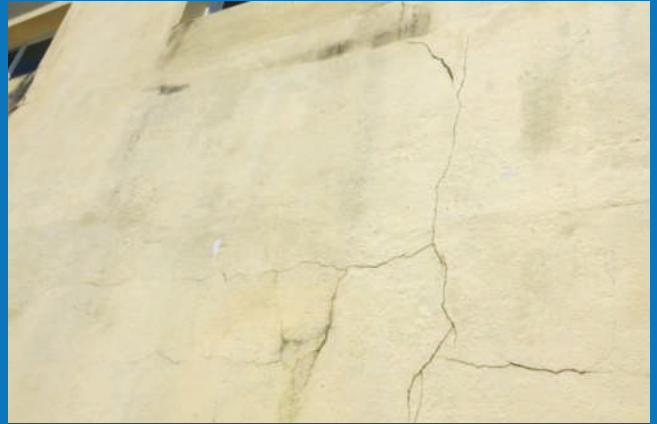
■ GLAZED
WINDOWS



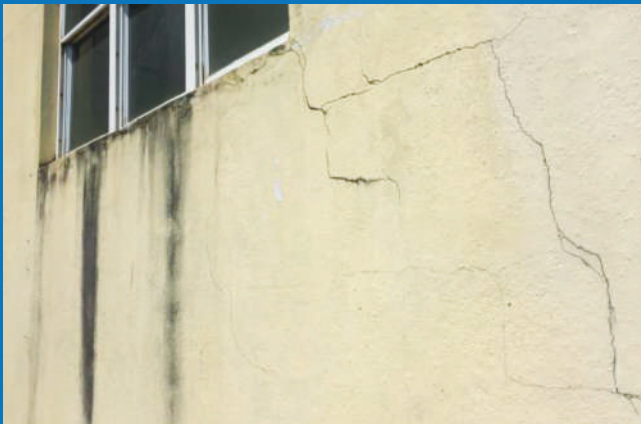
■ GLAZED
WINDOWS



■ SIGNS OF MOISTURE PENETRATION
- CRACKS



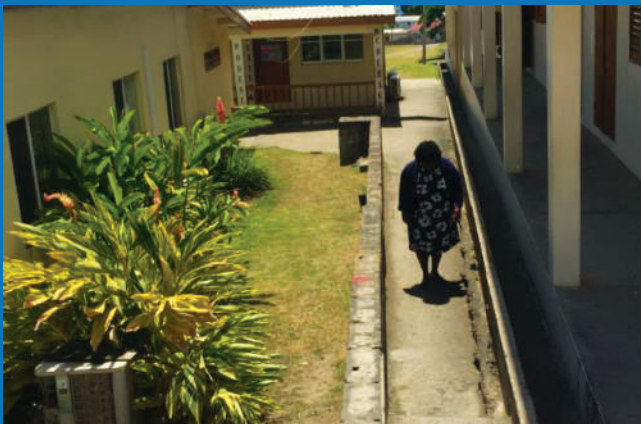
■ SIGNS OF MOISTURE PENETRATION
- CRACKS



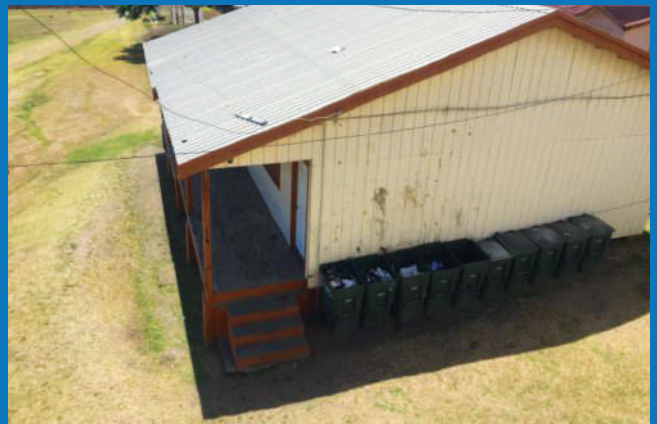
■ SIGNS OF MOISTURE PENETRATION
- CRACKS



■ NARROW PASSAGES - CONSEQUENCE OF
UNPLANNED INCREMENTAL CONSTRUCTION



■ NARROW PASSAGES - CONSEQUENCE OF
UNPLANNED INCREMENTAL CONSTRUCTION



■ TIMBER
BUILDING



■ TYPICAL CLASSROOM LIGHTING



■ TYPICAL CLASSROOM LIGHTING



■ CRACKS TO FLOOR SLAB



■ SIGNS OF BIRD INFESTATION



■ EXPOSED ELECTRICAL WIRES



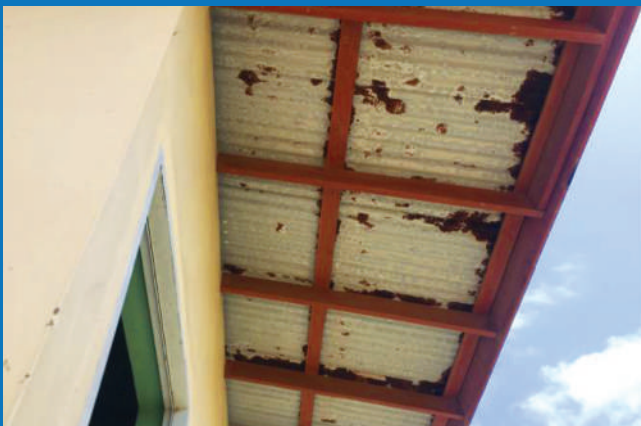
■ MINIMUM LANDSCAPING



■ MAIN ENTRANCE GATE



■ CORRODING METAL DOOR



■ CORRODED ROOF SHEETING



■ ROOF DAMAGE - NEEDS ATTENTION



■ BROKEN WINDOWS



■ STRUCTURAL STEEL FRAME BUILDING



■ STRUCTURAL STEEL FRAME BUILDING



■ STEEL FRAME BUILDING WITH CORRODED ROOF SHEETS



■ VERTICAL HAIRLINE CRACKS TO WALL



■ STEEL FRAME BUILDING WITH CORRODED ROOF SHEETS



■ CISTERN
- IN NEED OF REPAIRS



■ CISTERN
- IN NEED OF REPAIRS

10. APPENDIX 2: NATIONAL SAFE SCHOOL PROGRAMME COMMITTEE (NSSPC) MEMBERS

COUNTRY: ST. KITTS AND NEVIS

#	FIRST NAME	LAST NAME	GENDER	JOB TITLE	ORGANIZATION	CONTACT EMAIL	CONTACT PHONE NUMBER
1	Tricia	Esdaille	Female	Senior Assistant Secretary	Ministry of Education (MOE)	tricia.esdaille@moeskn.org	(869)-467-1406
2	Sylvester	Charles	Male	Education Officer	Ministry of Education (MOE)	sylvester.charles@moeskn.org	(869)-467-1486
3	Amanda	Edmead	Female	Education Officer	Ministry of Education (MOE)	amanda.edmead@moeskn.org	(869)-467-1508
4	Christopher	Herbert	Male	Director, EMIS	Ministry of Education (MOE) - EMIS	christopher.herbert@emisskn.org	(869)-467-1329
5	Timothy	Martin	Male	Fire Sub Station Officer	St. Kitts-Nevis Fire and Rescue Services (SNFNRS)	-	(869)-465-2515
6	Livingston	Pemberton	Male	Engineer	Public Works – St.Kitts	livipembo@hotmail.com	(869)-465-5100
7	Adriansen	Hendrickson	Male	Draftsman	Public Works – Nevis	adriansenh93@gmail.com	(869)-469-5521
8	Vesta	Southwell	Female	Public Relations Officer	National Emergency Management Agency (NEMA)	scorpio_vesta@yahoo.com	(869)-466-5100
9	Gracelyn	Elliott	Female	Community Liaison Officer	National Disaster Management Department (NDMD)	elliottgrace31@gmail.com	(869)-469-1423
10	Marissa	Carty	Female	Health Disaster Focal Point	Ministry of Health	marissacartynd@gmail.com	(869)-467-1283

COUNTRY: ST. KITTS AND NEVIS

#	FIRST NAME	LAST NAME	GENDER	JOB TITLE	ORGANIZATION	CONTACT EMAIL	CONTACT PHONE NUMBER
11	Patricia	Peets	Female	Disaster Coordinator	Red Cross	patriciafahie_2@hotmail.com	(869)-467-1486
12	Laurence	Richards	Male	Education Officer	Department of Education, Nevis	kinglearleo@yahoo.com	(869)-469-4651
13	Claricia	Stevens	Female	Deputy National Disaster Coordinator	National Emergency Management Agency (NEMA)	lady.langleystevens@gmail.com	(869)-465-5100
14	James	Stevens	Male	Inspector	Royal St. Kitts Nevis Police Force	jamesstephen70@yahoo.com	(869)-465-2241
15	Carl	Francis	Male	Engineer	Ministry of Education (MOE) – Project Planning	carl.francis@moeskn.org	(869)-467-1402
16	Carl	Greaux	Male	Inspector	Royal St. Kitts Nevis Police Force	greaux_jr@hotmail.com	(869)-465-2241
17	Andrea	Liddie	Female	Resource Teacher	Ministry of Education (MOE) – Early Childhood Development Unit	andre.liddie@moeskn.org	(869)-466-2810
18	Milton	Nisbett	Male	-	-	dockerstm@hotmail.com	-

10. APPENDIX 3: ORGANIZATIONS CONSULTED

St. Kitts and Nevis

- National Safe Schools Programme Committee Ministry of Education
- Project Planning Division, MOE
- St. Kitts and Nevis Association of Principals Ministry of Health
- Red Cross
- St. Kitts Teachers Union
- NEMA
- Early Childhood Development Unit
- St. Kitts Nevis Association of Persons with Disabilities Council Department of Physical Planning
- Nevis
 - Disaster Management Department
 - Physical Planning Dept
 - Public Works Dept
 - Public Health Dept
 - Water Department
 - Early Childhood Education Department
 - Nevis Teachers Union

