



IMPLEMENTATION OF THE MODEL SAFE SCHOOL PROGRAMME IN THE CARIBBEAN

HAZARD RISK ASSESSMENT REPORT AND COSTED ACTION PLAN

OTTOS COMPREHENSIVE SECONDARY SCHOOL

ANTIGUA AND BARBUDA



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 – Ottos Comprehensive Secondary School, Antigua and Barbuda 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



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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	17
	3.5 TSUNAMI	18
	3.6 LANDSLIDES/INLAND EROSION	18
	3.7 DROUGHT	19
	3.8 CLIMATE PROJECTIONS	20
4	EXPOSURE ANALYSIS	20
	4.1 OTHER HAZARDS	23
5	ADAPTIVE CAPACITY	24
	5.1 DESCRIPTION OF STRUCTURE	29
	5.1.1 SITE OBSERVATIONS/DISCUSSION	31
6	VULNERABILITY ASSESSMENT	32
7	SUMMARY FINDINGS	32
8	COSTED ACTION / IMPROVEMENT PLAN	36
9	REFERENCES	38
10	APPENDIX 1	39
	10.1 SAFETY ASSESSMENT	39
	10.2 GREEN ASSESSMENT	40
	10.3 PHOTOGRAPHS	41
	APPENDIX 2: NATIONAL SAFE SCHOOL PROGRAMME COMMITTEE (NSSPC) MEMBERS	49
	APPENDIX 3: ORGANIZATIONS CONSULTED	51

1. INTRODUCTION

Environmental Solutions Ltd. (ESL) has been contracted by the Caribbean Disaster Emergency Management Agency (CDEMA) to develop/enhance National Safe School Polices in four Caribbean Development Bank (CDB) Borrowing Member Countries (BMCs), conduct hazard assessments of 33 schools across six BMCs, and prepare costed action plans for each of the schools based on the results of the assessments.

This document presents the Hazard Risk Assessment Report and Costed Action Plan for the **Ottos Comprehensive Secondary School**, one of seven (7) schools assessed in Antigua and Barbuda (See Figure 1.1). 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.

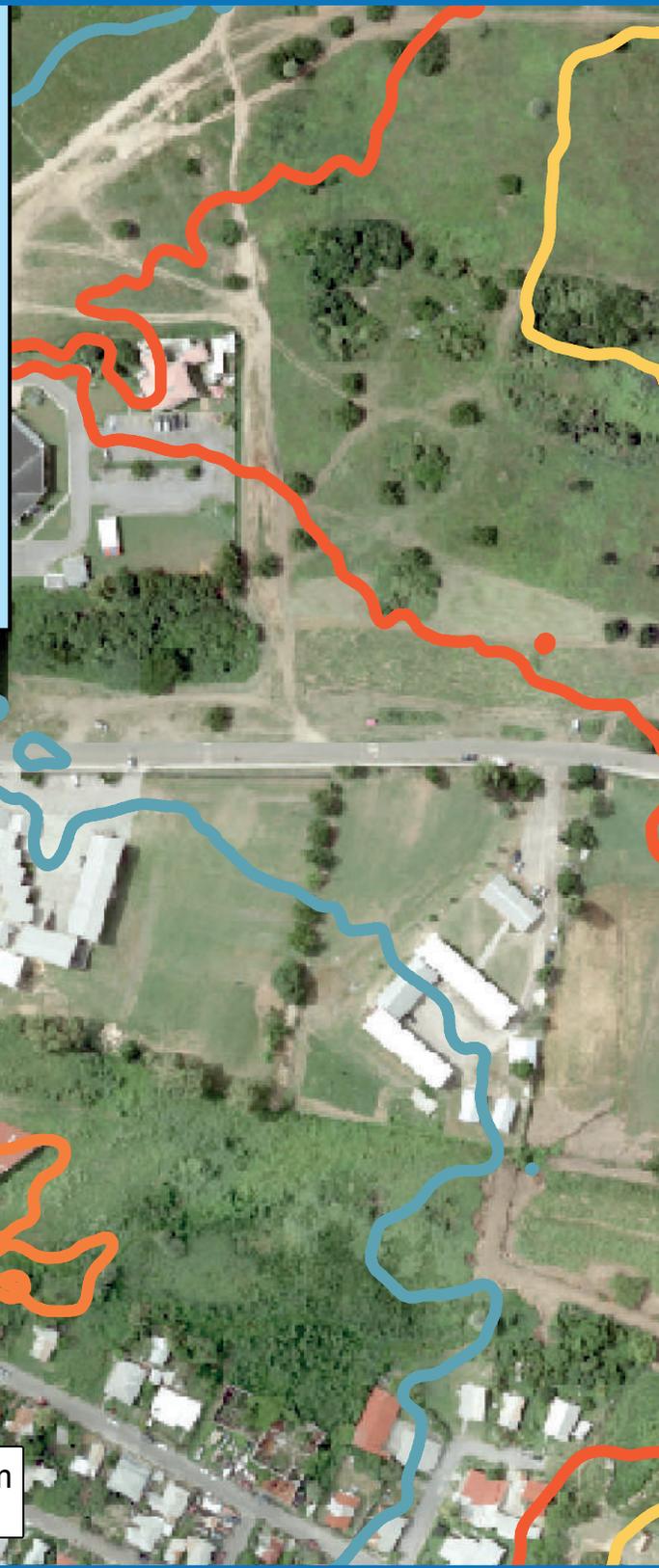
The following schools were visited by the assessment team on regular school days, and as such the consultants were able to assess the schools during normal operational conditions:

TABLE 1.1: SCHOOL ASSESSMENT SCHEDULE

SCHOOL NAME	LOCATION	DATE VISITED
Mary E. Pigott Primary School	St. John's 17° 6'56.30"N 61°50'8.84"W	Tuesday May 14, 2019
Antigua Girls' High School	St. John's 17° 7'22.92"N 61°50'33.92"W	Wednesday May 15, 2019
Golden Grove Primary	St. John's 17° 6'23.77"N 61°50'31.83"W	Wednesday May 15, 2019
Nelvie N. Gore Primary	Willikies 17° 5'2.86"N 61°42'41.86"W	Thursday May 16, 2019
Ottos Comprehensive School	St. John's 17° 6'55.74"N 61°50'5.07"W	Friday May 17, 2019
Adele School for Special Children	St. John's 17° 7'40.40"N 61°50'15.43"W	Friday May 17, 2019
Buckleys Primary	Buckleys 17° 4'0.02"N 61°48'37.22"W	Friday May 17, 2019

FIGURE 1.1: SCHOOL LOCATION MAP - ANTIGUA





Name of School

★ Ottos Comprehensive Secondary

Contour (m)

- 15
- 20
- 25
- 30
- 35
- 40
- 45
- 50
- 55
- 60
- 65

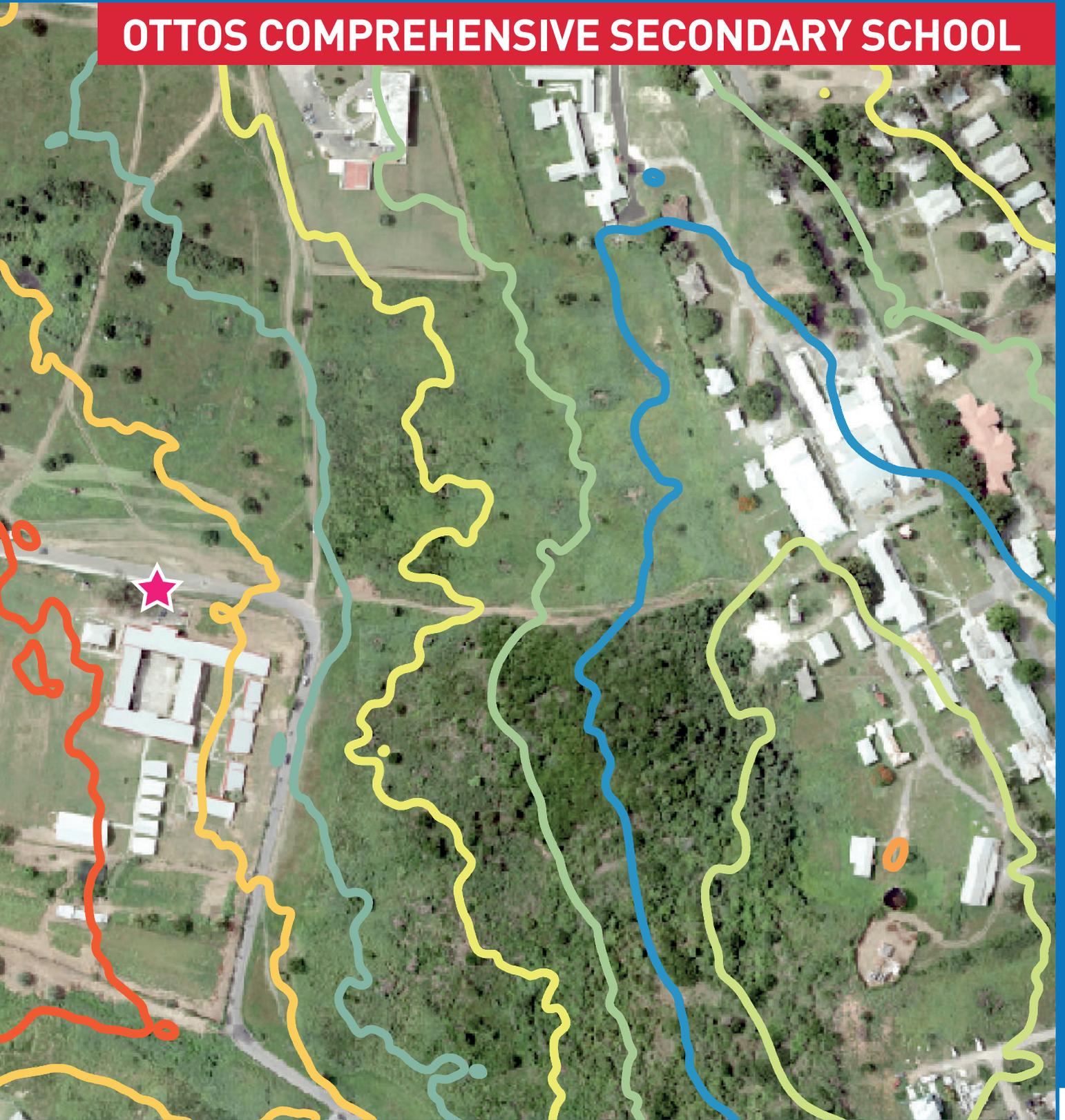


Created by:
Jason Williams - Data Manager, Department of Environment

Purpose: To identify location of school along with 5m interval contour

Date Created: 9 June 2019

OTTOS COMPREHENSIVE SECONDARY SCHOOL



Data sourced from the Environmental Information Management & Advisory System - EIMAS and/or data points collected in the field using GPS Technology. Base Map source: 2010 Aerial Imagery

Published by the Department of Environment, Ministry of Health & the Environment, Government of Antigua & Barbuda



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 Antigua and Barbuda. 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 assessment report is to identify and analyze the hazard vulnerability of the **Ottos Comprehensive Secondary School** and to make recommendations to inform decision-making.

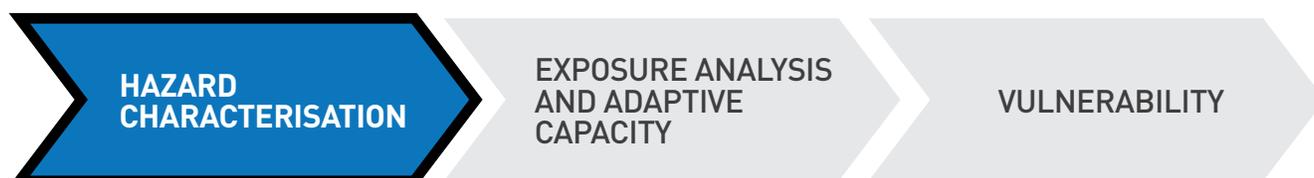
1.2 METHODOLOGY

The vulnerability assessment tool (VAT) 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:

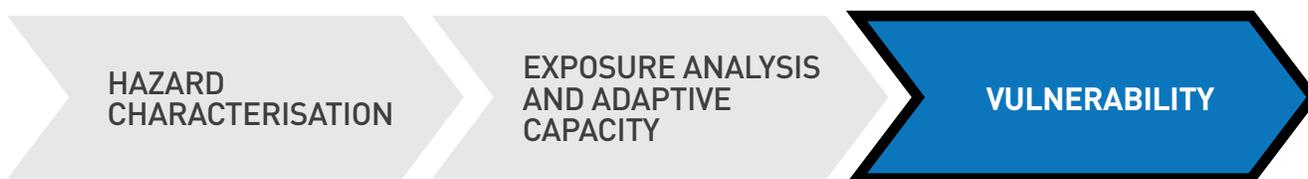
- There are early signs of wear, failure or deterioration, although the feature or element is generally structurally sound and performing its intended purpose.
- There is failure of a sub-component of the feature or element.
- Replacement of up to 25% of the feature or element is required.
- Replacement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

Multiple hazards impact Antigua and Barbuda, including storms, earthquakes and drought. The most common threat is the potential for hurricanes and tropical storms. Due to the size of the islands, a single storm has the potential for directly impacting the entire population. High winds and rainfall are the principal risk factors. The islands' lack of significant topographic variability results in open exposures to the effects of wind and rain (GFDRR, 2010).

Earthquake hazards are also high, with a seismically active area of the Caribbean plate boundary located east of Barbuda. Landslide hazards are low. Inland flooding occurs in low-lying areas during heavy rain. There is no direct volcanic hazard, although the active Soufrière Hills volcano on Montserrat does occasionally deposit ash on Antigua and poses some tsunami hazard (CCRIF, 2013).

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 Antigua and Barbuda. 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

Antigua and Barbuda has been exposed to a number of storms whose track has passed within 40 km of the two islands. These include notably intense storms which passed directly over the islands such as Donna (1960, Category 4); Luis (1995, Category 4); and Georges (1998, Category 3). Damages estimated in the aftermath of Luis, for example, were placed at approximately 2/3 of the country's GDP (GFDRR, 2010). In 2017, Hurricane Irma hit the islands of Antigua and Barbuda with catastrophic effects. The storm's eye passed directly over Barbuda exposing the island to the extraordinary eye wall winds for more than three hours. While out of the path of the eye, Antigua, located approximately 29 miles to the south of Barbuda, experienced tropical storm force winds. Compounding the situation, on September 18, Hurricane Maria (also a category 5 storm) affected the island of Antigua. Although Hurricane Maria did not make landfall, Antigua was exposed to the north-eastern quadrant of storm and experienced again tropical storm force winds and associated rainfall.¹

FIGURE 3.1: ANTIGUA WIND / HURRICANE VULNERABILITY BY RETURN PERIOD (SOURCE: OAS, 2001)

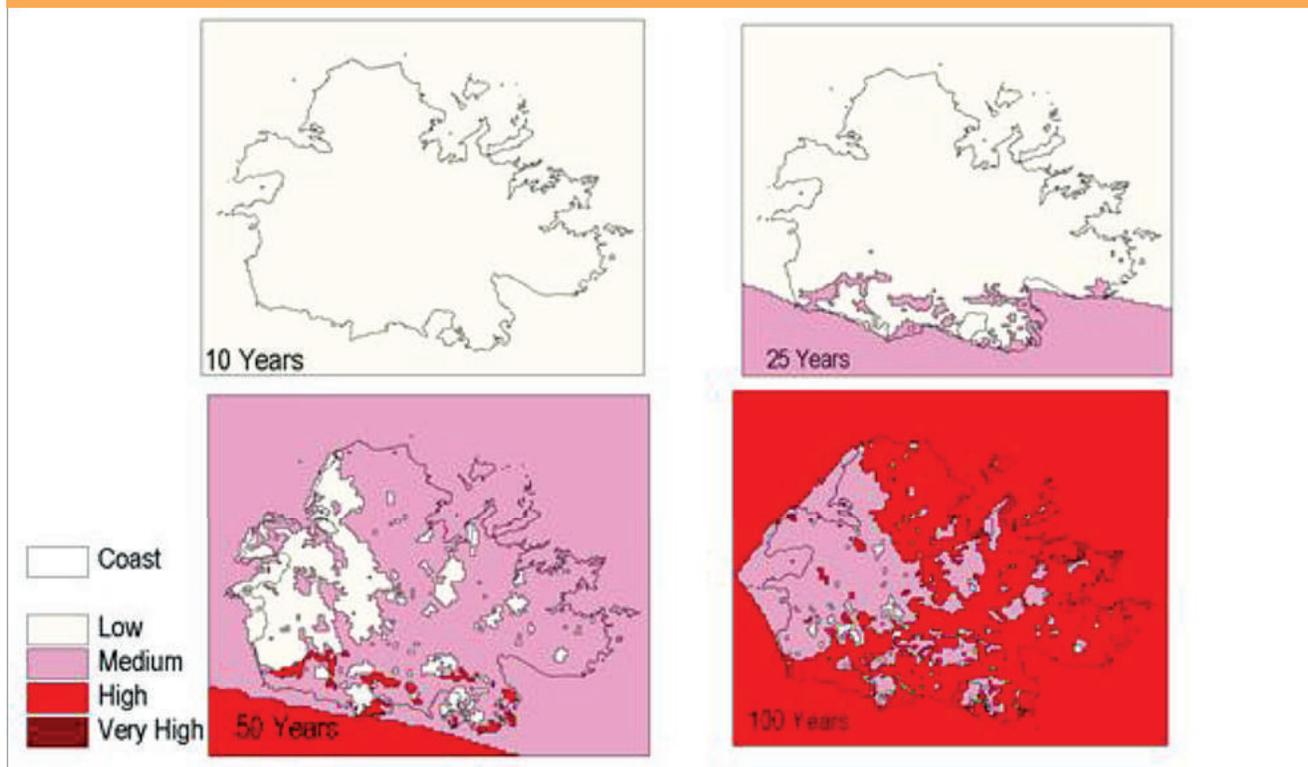


Figure 3.1 above indicates the vulnerability of Antigua to winds by the return periods of 10 years, 25 years, 50 years and 100 years. The 10-year return period subjects the entire island to low vulnerability that is of the tropical storm and hurricane category 2 wind strength. Minimal damage would be expected. The 25-year return period would generate low vulnerability for most of the island with some sections of the southern range experiencing moderate vulnerability. This would create hurricane category 2 winds and moderate damage. For the 50-year return period most of Antigua would be of moderate vulnerability. The western coast would have a low vulnerability with sections of the southern coast subjected to high vulnerability. Category 3 and 4 winds would be expected with extensive and extreme damage. The 100-year storm would place most of the island within the high vulnerability zone. The western third of the island and pockets in the central and eastern districts would have a medium vulnerability. Category 4 winds with extreme damage would be expected (OAS, 2001).

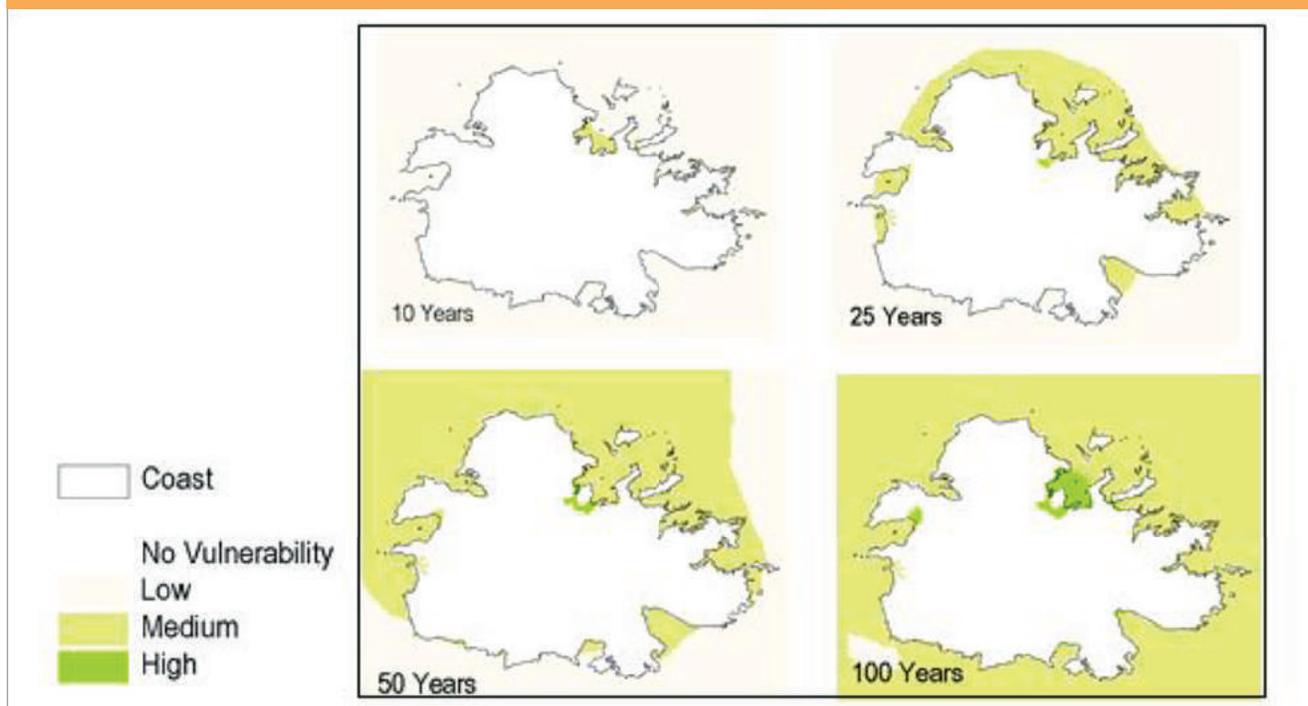
¹ https://www.gfdr.org/sites/default/files/publication/Antigua%20and%20Barbuda%20executive%20summary_print_text%282%29.pdf

3.2 STORM SURGE

Figure 3.2 indicates storm surge vulnerability by return period. It indicates that for the 10-year period the entire coast with the exception of the Fitches Creek / Parham Harbour area would experience low storm surge vulnerability. It would be similar to that experienced in a tropical storm with some damage and surge to the heights of 0.1 to 0.5 meters. The Fitches Creek / Parham Harbour area would experience medium storm surge vulnerability with surge varying between 0.5 and 1.5m minimal damage.

The 25-year return period would place most of the coast within a moderate vulnerability storm surge zone and the southwestern section of Parham Harbour would be subjected to High vulnerability. Intrusions of moderate storm surge would be expected in the Hanson's Bay and Jolly Harbour areas. The sea would surge in Parham Harbour to 3.0 meters and cause extensive damage. The 50-year return period increases the area of intrusion around Parham Harbour, Hanson's Bay and Jolly Harbour. The 100-year return period increases the vulnerability of the Hanson's Bay area to high and results in high storm surge throughout Parham Harbour (OAS, 2001).

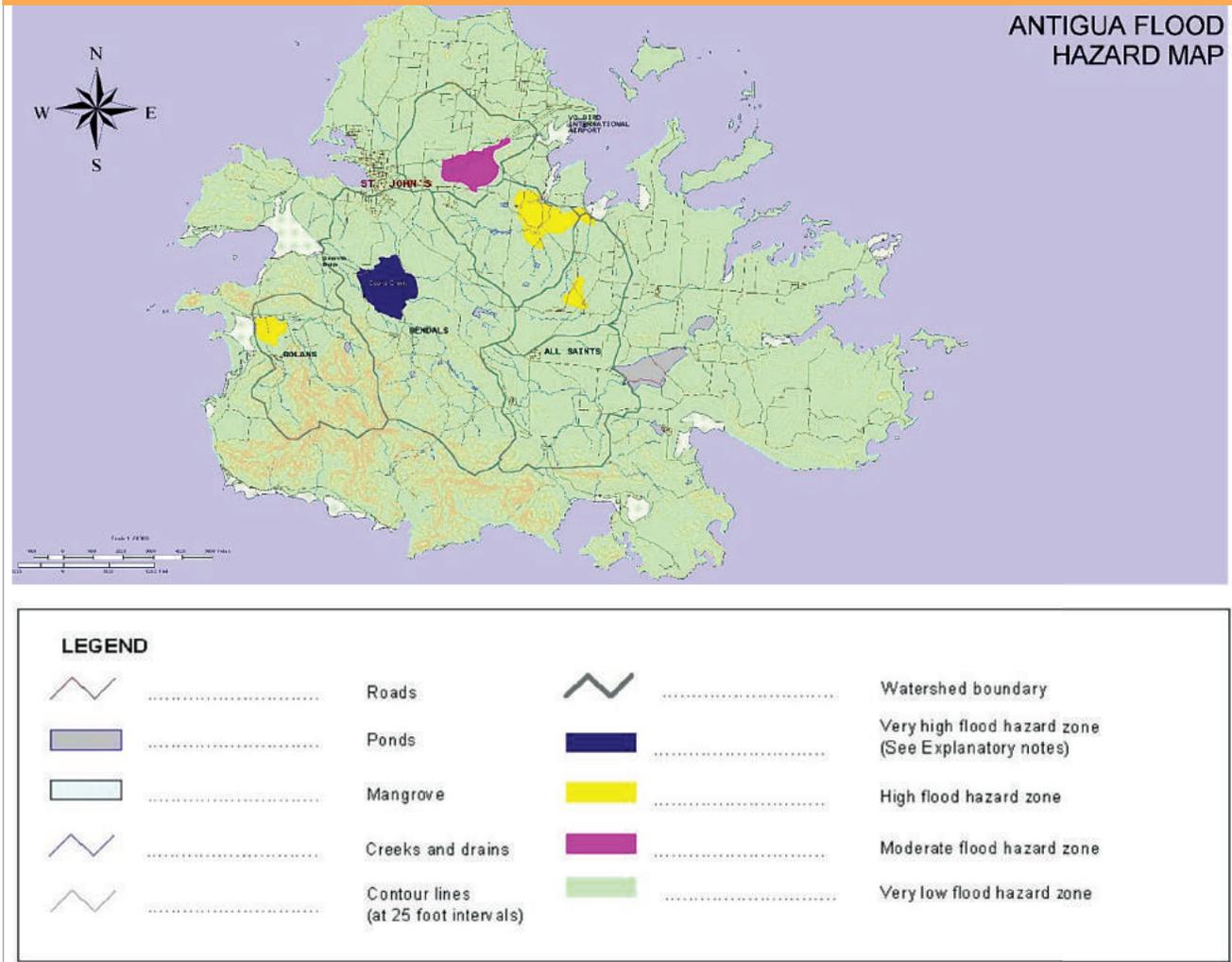
FIGURE 3.2: ANTIGUA STORM SURGE VULNERABILITY BY RETURN PERIOD (SOURCE: OAS, 2001)



3.3 FLOODING

Most of the island has been categorized as a low vulnerability zone for flooding. Flooding occurs in the communities of Point, Grays Farm, Bendals, Urlings and Piggots due mainly to poor drainage in these areas (Kairi Consultants Limited, 2007b). Figure 3.3 shows a Flood Map for Antigua. Important areas are described as follows. The floodplain of Cooks Creek Watershed, seen in dark blue on the diagram is defined as a very high flood zone area. In yellow, are three high flood hazard zone areas and in pink in the central north is a moderate flood hazard zone. Codrington, Barbuda’s main city is also located in a high hazard flood zone.

FIGURE 3.3: ANTIGUA FLOOD HAZARD MAP (SOURCE: CARIBSAVE, 2012)



3.4 EARTHQUAKES

Antigua and Barbuda are regularly exposed to seismic risk and are located in seismic zone 4 (on a 0-4 scale), a high-risk earthquake zone. The islands are located along the eastern margin of the Caribbean plate and as recently as 1974, were hit with a 7.5-magnitude earthquake which caused structural damages estimated in the millions (GFDRR, 2010).

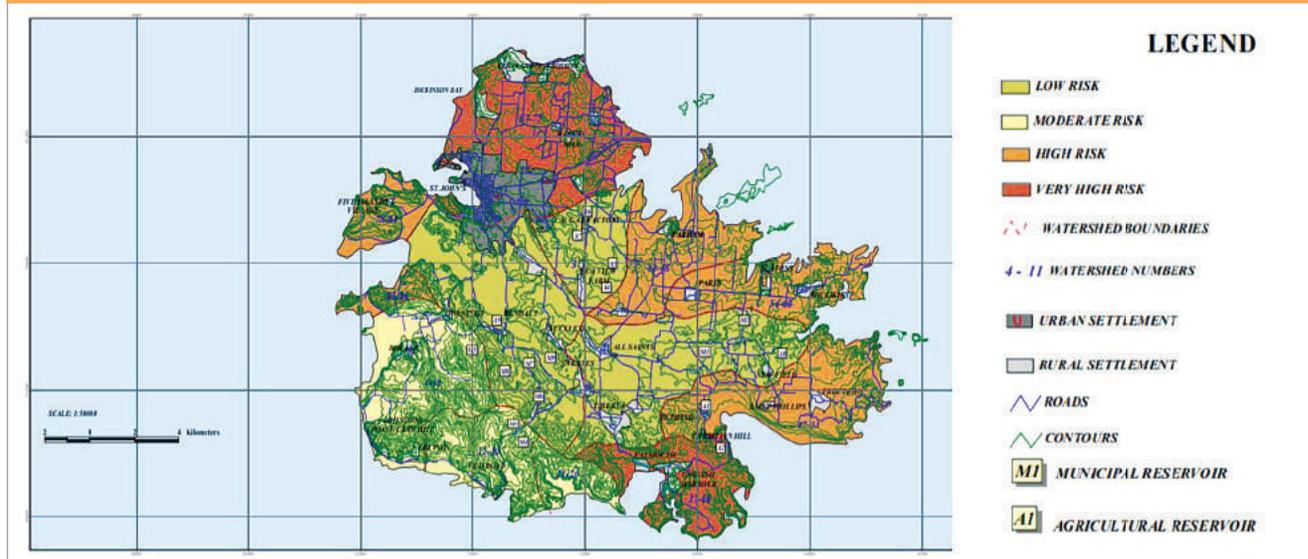
3.7 DROUGHT

Antigua and Barbuda are two of the driest islands in the region owing to their geographic position and topographic features (MPUHATIT, 2001; USACE, 2004). This is due to the geology of the islands, which consists largely of limestone plains. As much of the topography is relatively low-lying, these islands lack a significant stream network. Groundwater is the principal source for freshwater which is recharged by direct infiltration of rainwater through the surface. The islands have added desalination systems to augment freshwater supplies (GFDRR, 2010).

In Antigua and Barbuda, drought is defined as the occurrence of less than 826 mm of rainfall in a given year. The annual rainfall for Antigua ranges from 890 to 1,400 mm and from 508 to 991 mm in Barbuda, with the dry season spanning December to April (USACE, 2004). Additionally, potential evaporation rates are high, being higher than precipitation for roughly 11 months of the year (USACE, 2004). Increasing variability in rainfall patterns also contributes to drought conditions.

The country has a history of drought events and water shortages particularly in the 1960's, but also in 1983, 1993-1994 and 2001-2002 (Meade and Destin, 2008; USACE, 2004). Between 1983 and 1984 water had to be brought via barges from neighbouring islands (USACE, 2004). The 2001 – 2002 drought periods were so intense that Potworks Reservoir was 85% below its average volume in September 2002 (USACE, 2004). The recurrence of drought in Antigua and Barbuda is estimated at once in every three years (Meade and Destin, 2008). However, Barbuda is usually worse affected. Between 1965 and 2000, annual rainfall records indicate totals less than 706 mm for ten years (USACE, 2004). During the dry season groundwater resources can be as low as 30% of yield potential and desalination output can be as high as 83% of demand (USACE, 2004). In Barbuda, drought conditions affect wells and therefore ground water, as they are prone to over pumping and saltwater intrusion (USACE, 2004). Tourism is one of the main revenue generators in Antigua and Barbuda accounting for 60% of GDP (ECLAC, 2007) and is also a heavy water using sector. Sea level rise (SLR) is expected to place additional burden on water supplies due to the threat of saltwater intrusion of coastal aquifers (MPUHATIT, 2001).

FIGURE 3.5: DROUGHT RISK MAP



The northeast and southwest of Antigua are most vulnerable to drought. The eastern and western areas are within a high zone of vulnerability. The southeast of Antigua between English Harbour and St. James Club has been identified as the watershed most vulnerable to drought (OAS, 2001).

3.8 CLIMATE PROJECTIONS

Antigua and Barbuda is already experiencing some of the effects of climate variability and change through damage from severe weather systems and other extreme events, as well as more subtle changes in temperature and rainfall patterns (CARIBSAVE, 2012).

Detailed climate modelling projections for Antigua and Barbuda 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.

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 analyzing 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 parameters² listed in Table 4.1 below and averaging the parameter scores for each hazard. 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 school's 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 school is 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 – OTTOS COMPREHENSIVE SECONDARY SCHOOL

HAZARD	COMMENTS	FREQUENCY		WARNING TIME		SEVERITY		DEGREE OF EXPOSURE	
		RANKING	SCORE	RANKING	SCORE	RANKING	SCORE	RANKING	SCORE
Hurricanes and Tropical Storms/Wind	The most common threat is the potential for hurricanes and tropical storms.	Likely	2	More than 24 hours	0	Catastrophic	3	MODERATE	1.67
Storm Surge	The Ottos Comprehensive School is located relatively near to the coast.	Possible	1	12-24 hours	1	Limited	1	MODERATE	1.00
Flooding (from hurricanes, storms or extreme rainfall events)	St. Johns is located in a "Very Low Risk" flood hazard zone, but flash-flooding due to very heavy rainfall is possible. The school courtyard has experienced flooding in the recent past.	Likely	2	6-12 hours	2	Limited	1	MODERATE	1.67
Earthquake	Antigua and Barbuda is located in a "high risk" earthquake zone.	Likely	2	Minimal (or no warning)	3	Critical	2	HIGH	2.33
Tsunamis	Tsunami is not considered a major recurrent risk, however the school is located in a low lying area relatively near to the coast.	Possible	1	Minimal (or no warning)	3	Limited	1	MODERATE	1.67
Landslide /Inland Erosion	School is located in a "very low hazard risk zone" for Landslide/ Inland Erosion.	Unlikely	0					NOT EXPOSED	
Drought	The recurrence of drought in Antigua and Barbuda is estimated at once in every three years.	Highly Likely	3	More than 24 hours	0	Limited	1	MODERATE	1.33
Volcano	There is no direct volcanic hazard, although the active Soufrière Hills volcano on Montserrat does occasionally deposit ash on Antigua and poses some tsunami hazard.	Unlikely	0					NOT EXPOSED	
OVERALL EXPOSURE INDEX									9.67

Based on the above, the overall multi-hazard exposure was determined to be **moderate**.

While the development of the modern building code has progressed, many of the schools assessed 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 **Ottos Comprehensive Secondary School** was assessed against its National Building Code which is common for the Organisation of Eastern Caribbean States (OECS) territory. The most serious area of deficiency observed was the Aluzinc roof covering on some of the buildings which appeared to lack the required hurricane straps. The main roof structures were found to be in generally good condition.

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. 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

At present the school's Draft Safety/Disaster Plan only factors in earthquakes and fires. It is recommended that the school determine which of the above are priority hazards to be included in the revised 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 climate change and variability. 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
– OTTOS COMPREHENSIVE SECONDARY 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>The following represent some of the many national policies in place that address climate change adaptation and comprehensive disaster management for the education sector:</p> <ul style="list-style-type: none"> ■ The Disaster Management Act of 2002 ■ Antigua and Barbuda’s National Plan to Reduce the Vulnerability of School Buildings to Natural Disasters (1998) ■ Signatory to Antigua and Barbuda Declaration on School Safety in the Caribbean
	<p>2. Have there been additions to the curriculum that integrate climate change/disaster preparedness/emergency management? [YES = 1; NO = 0]</p>	1	
	<p>3. Is an updated emergency management or disaster management plan in place? [YES = 1; NO = 0]</p>	0	A draft plan has been prepared.
	<p>4. Do the plans address priority hazards based on previous assessment(s)? [YES = 1; NO = 0]</p>	0	Only includes earthquakes and fires.
	<p>5. Is there a designated environmental/health & safety officer, emergency response team or related position/team? [YES = 1; NO = 0]</p>	0	
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	Informally and not yet documented.
	<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	This has not yet occurred as the plan has not been finalized.
	<p>8. Have staff received training in emergency/disaster management? [YES = 1; NO = 0]</p>	1	A few teachers have received external training from NODS, others are trained in First Aid.

**TABLE 5.2: SUMMARY OF ADAPTIVE CAPACITY ANALYSIS
– OTTOS COMPREHENSIVE SECONDARY SCHOOL**

DETERMINANT	INDICATOR	SCORE	COMMENTS
Information and Skills	9. Are there regular drills with staff, students and/or parents? [YES = 1; NO = 0]	0	No drills have been conducted in the recent past.
	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]	1	Fire extinguishers and first aid kits are available. The school is in close proximity to the hospital.
Infrastructure and Technology	11. Does the school have reserve water storage with adequate supply for at least 3 days? [YES = 1; NO = 0]	1	The school's cistern has significant capacity but relies on infrequent public water supply for it to be recharged.
	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]	1	Culturally, water conservation is ingrained in the mindset as Antigua and Barbuda is a generally water scarce country.
	13. Does the school actively harvest rainwater? [YES = 1; NO = 0]	1	Rainwater gutters were observed that fed into the cistern.
	14. Does the school employ energy conservation/efficiency mechanism? [YES = 1; NO = 0]	1	LED bulbs have been installed by the Board of Education.
	15. Is there back up electrical power? [YES = 1; NO = 0]	0	
	16. Does the school employ other green practices? E.g. recycling, greenhouse/garden, green policy etc? [YES = 1; NO = 0]	1	The school employs techniques such as mulching using grass clippings. Occasionally there are plastic collection drives. However due to security issues receptacles for recycling and lines used for drip irrigation were stolen. Evidence of at greenhouse gardening was observed. The school had made attempts to create a green space but due to a breach in the perimeter fence, animals destroyed the trees planted.

**TABLE 5.2: SUMMARY OF ADAPTIVE CAPACITY ANALYSIS
– OTTOS COMPREHENSIVE SECONDARY 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	Based on the observations made during the building condition assessment, there is no immediate concern about the structural integrity of the buildings. The buildings are in generally fair condition. Nonetheless, it is recommended that the observed defects be remedied as well as some flood mitigation interventions.
	18. Have school buildings/plant been repaired or retrofitted to the building code? [YES = 1; NO = 0]	0	There are planned upgrades to the school, particularly the addition of new classrooms.
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	
	20. Is climate change likely to exacerbate any of the current hazards? [YES = 1; NO = 0]	0	
	21. Is the rate of climate change likely to outpace adaptation efforts? [YES = 1; NO = 0]	1	
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]	1	

**TABLE 5.2: SUMMARY OF ADAPTIVE CAPACITY ANALYSIS
– OTTOS COMPREHENSIVE SECONDARY 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 government funded so available funds are 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>	0	
TOTAL		14	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:	OTTOS COMPREHENSIVE SECONDARY SCHOOL
SCHOOL ADDRESS:	St. Johns, Antigua
TOTAL NUMBER OF BUILDINGS:	Sixteen (16)
SPECIAL HAZARD RISK:	Wind and flooding
GENERAL COMMENTS:	Buildings are in generally fair condition. Major repairs and retrofit are recommended as well as some flood mitigation interventions.

	BUILDING 1	BUILDING 2, 3 & 4	BUILDING 5, 6, 7 & 8	BUILDING 9	BUILDING 10 to 16
Number of Storeys per Building:	3	2	1	1	1
Floor Type:	Description: Reinforced concrete Observation: Floor slab in generally good condition with spalling concrete at some areas.	Description: Reinforced concrete Observation: Floor slab in generally good condition with spalling concrete at some areas.	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 generally fair condition.
Wall/Partition Type:	Description: Reinforced masonry in fair condition.	Description: Reinforced masonry in fair condition.	Description: Reinforced masonry in fair condition.	Description: Reinforced masonry in good condition.	Description: Timber panels in fair condition.
Roof Structure:	Description: Reinforced concrete roof slab and beam in generally fair condition.	Description: Reinforced concrete roof slab and beam in generally fair condition.	Description: Reinforced concrete roof slab and beam in generally fair condition.	Description: Steel and Timber structure in generally good condition.	Description: Timber structure in generally fair condition.
Roof Covering:	Description: Aluzinc sheets in generally good condition.	Description: Aluzinc sheets in generally good condition.	Description: Aluzinc sheets in generally good condition.	Description: Aluzinc sheets in generally good condition.	Description: Aluzinc sheets in fair condition.
Repairs/ Retrofitting Conducted:	None	None	None	None	None
Is there Disabled Access/ Special Needs Access to the Building?	None	None	None	None	None
Approx. Age of Each Building	More than 40 years	More than 40 years	More than 40 years	More than 10 years	More than 10 years
Building Use	Classrooms, Admin	Classrooms, Toilets	Classrooms, Laboratories	Classrooms	Classrooms
Overall Condition	Fair	Fair	Fair	Good	Fair

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

WINDOWS

Several broken windows were also 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.

Ottos Comprehensive Secondary School has been classified as having an **overall moderate 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 ability to adapt. As such, Ottos Comprehensive Secondary School can be characterised as having **moderate vulnerability**.

7. SUMMARY FINDINGS

The Ottos Secondary School, despite having a negative stigma as being "one of the worst schools", has made significant strides in improving the quality of education and the school environment. Several barriers however still exist which are hindering the school from being fully resilient, sustainable and ultimately considered a safe school.

KEY STRENGTHS:

Disaster Management

- The school has made much progress with the development of a disaster plan. The plan was developed based on a template provided by the National Office of Disaster Services (NODS) and includes fire and earthquakes as the only priority hazards. It is recommended that the plan be updated to include other priority hazards as identified by the school, and measures taken to implement the plan.
- Two teachers have received training by NODS specifically in how to develop a disaster plan. Additional disaster management training such as in the conduct of drills is recommended.
- Despite not having a nurse on staff, the school can respond quickly to medical emergencies as they are relatively close to hospital.
- 4 Physical Education teachers are trained in first aid as well as 2 other teachers.

The school's cistern has significant storage capacity. There are 2 chambers and if one chamber is full, the school can reportedly run for the entire year. The cistern has manholes which can be opened to check the water levels.

'Greening' Efforts

- There is a "Champions for Change" initiative which, from time to time, has plastic collection drives. The National Solid Waste Management Authority is called in to collect the plastic. The school also previously had special recycling receptacles; however, these were stolen.
- A lot of work was done in creating a green space, including tree planting and other activities. However, due to the breach in fencing, cows, donkeys and other animals came in and destroyed most of the trees that were put in.
- Agricultural science is a part of the syllabus. Many practices such as using grass clippings as mulch on the garden beds are employed. The school also had drip irrigation lines however the pipes were stolen.
- It was indicated that the school would like to embark on a project with the Environment Department which would be more geared towards agriculture. The school would like to secure grant funding to do aquaponics and ultimately would like to generate revenue by selling the produce.
- The light bulbs used at the school are LED. This has been an initiative of the Board of Education to change light fixtures to use LED bulbs.
- Solar panels are also on the roof however the energy generated goes directly to the grid. All/most government buildings reportedly have solar panels installed by APUA to tie directly into their grid, but in this instance the school doesn't directly benefit from it.

Student/Staff Health and Wellness

- The school through grant funding and special fundraising initiatives, provides one a meal a day for students who are not able to afford meals. This programme has been successful as students are reportedly performing better.
- Personal protective equipment such as masks and gloves are provided, and special gears are in place for the operation of the heavy machinery for some of the technical/vocational subjects.
- There is a staff social and welfare committee, as well as a teacher rep who liaises directly with the principal regarding the needs of the teachers.

FIGURE 7.1: SOME EXAMPLES OF KEY STRENGTHS AT THE OTTOS COMPREHENSIVE SECONDARY SCHOOL (E.G. PROPERLY SECURED LPG TANKS, SOLAR PANELS, FILTRATION SYSTEM OBSERVED ON WATER DISPENSERS)



BARRIERS/AREAS FOR IMPROVEMENT

General Safety and Security

- Theft is a major issue on this campus. The school has 24hr security, with 3 guards on every shift. This was a specially designed contract between the school and the Ministry to address the safety issues.
- The major issue however is the lack of proper perimeter fencing particularly at the back of the school (see Figure 7.2 below). One security is reportedly posted there after school hours.
- There are still challenges as perimeter lighting is considered inadequate, particularly at the back of the school.
- The school has tried to implement a visitor sign in policy which includes the use of passes, but greater enforcement is needed. Due to breach in the fence, anyone can come in through the back, so enforcement of the visitor pass is a necessity.

Staff and student well-being

- The school has had significant issues with bullying. As such, the school has been included as a part of an anti-bullying campaign which was launched last year October (2018) by the HALO Foundation.
- The incidence of fights and use of weapons etc. has also reportedly decreased. Other support groups include the "Champions for Change" Initiative, and church groups, who have sessions with the students. There are also 2 counsellors on staff, however the Principal would like to see more positive male role models particularly for the male students whether it be teachers or counsellors.
- Some parents have also reported issues with the public school bus system, particularly the long wait times, and/or the inability to maintain consistent schedules.
- There are only 2 bathrooms with 2 toilet stalls each that serve the 93 teachers. One for males and one for the 74 female teachers. The female teachers often have to use the male bathroom.

Disaster/Emergency Management

- The school has not conducted any emergency drills in the recent past.
- There is no dedicated safety committee to lead the implementation of the Disaster Plan/School Safety Plan once finalized. The School Safety Plan needs to critically examine information about the student population (such as number of students broken down by age group and sex), as the number and age of the students can make a significant difference in the event of an emergency.
- Some teachers utilize whatsapp groups to communicate notices to parents, however the school usually uses the media (particularly radio) to indicate to parents that school may be closed (for example if there is no water). It is recommended that a mechanism be put in place that will allow emergencies to quickly be reported to parents/guardians.

Grounds and Facilities

- In the event of a loss of electricity, the water pumps go down and the school is unable to get water.
- The school gets water infrequently from the public main. The system has therefore been set up for the main to flow directly into the cistern and recharges it whenever there is supply.
- The school has reported some pest issues, specifically rats. This is because a lot of food waste is generated, although the garbage is collected twice per week. Other pests such as ants and a few roaches were also reported. The Ministry supplies ants powder/spray to tackle this.
- The Principal reported the lack of sufficient classroom space is a major challenge. One of the greatest needs is a new home economics lab as a result of the large number of students who do that subject and have to do many practicals. The Principal indicated that they have been promised new classrooms by the Ministry to replace the temporary wooden structures.

- The management of the kitchen is cause for great concern (see images below). There was a general lack of cleanliness and proper organization, and a lack of adequate food preparation space in the kitchen which is rented by a concessionaire. The consultants recommend that stricter controls be enforced by the school on their concessionaires with regard to the maintenance of food preparation spaces.
- Some plumbing issues and broken/unmaintained fixtures were observed on the bathroom block. A proliferation of algal growth was observed due to recurring leaks and moisture intrusion issues (see image below).
- There is an overgrowth of vegetation in the waterway that borders the back of the school, which although not the direct responsibility of the school, has security implications and can be a flood risk during heavy rainfall events.

Chemical/Hazardous Materials Management

- At the time of the assessment, the school did not have a proper chemical storage space for cleaning products. The cleaners keep some chemicals in sections of the student bathrooms. The principal indicate that he was working on getting special cupboards to store chemicals in the existing pump room which a secure room.
- Chemical management in the labs needs much improvement. Some chemicals were not properly stored, and labels are no longer visible (see images below).
- No emergency eyewash station or showers were observed.

FIGURE 7.2: EXAMPLES OF AREAS FOR IMPROVEMENT



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
Disaster/Emergency Management	Update draft plans, policies and guidelines. Include in the school safety plan disaggregated data on student population (age, gender) as this will better inform disaster and emergency planning. This can be updated as needed and appended to the plan.	Principal and/or Safety Committee in collaboration with National Disaster Office and MOE.	None	Short Term	Improved culture of safety within the school community.
General Safety and Security	<ul style="list-style-type: none"> Repair fencing 	Ministry of Education.	Ministry of Education to obtain.	Medium Term	Improved safety and security in schools island-wide.
Chemical/Hazardous Materials Management	Re-organize science lab chemical storage area: <ul style="list-style-type: none"> Re-label illegible containers and properly store chemicals³ (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.	\$4000	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	Upgrade of storm drains to include additional flood protection from adjacent existing waterway.	Ministry of Education in collaboration with Department of Works.	\$115,600	Medium Term	Improved safety of Physical Plant.
	Retrofit roof covering, ceiling and roof drains to current Building Code Standards.		\$264,400	Medium Term	
	Upgrade of doors and windows to hurricane resistant standards.		\$196,700	Short – Medium Term	
	Expand and upgrade toilet block to include new septic tank and soakaway.		\$240,000	Medium Term	
	Repairs to water storage.		\$64,000	Medium – Long Term	
	Electrical rewiring complete with new electrical fixtures.		\$315,000	Medium Term	
	General repairs to external and internal walls.		\$275,300	Medium Term	
	Painting.		\$186,000	Medium Term	
	Contingency		\$100,000		
TOTAL			\$1,761,000		

9. REFERENCES

Antigua/Barbuda Hazard Vulnerability Assessment Project: Final Report; Post-Georges Disaster Mitigation Project in Antigua & Barbuda and St. Kitts & Nevis. Organization of American States, 2001

Antigua and Barbuda Country Risk Profile. Caribbean Catastrophe Risk Insurance Facility (CCRIF), 2013

Antigua and Barbuda Sustainable Island Resource Management Zoning Plan for Antigua and Barbuda (including Redonda). GENIVAR in Association with Ivor Jackson and Associates and Kingdome Consultants Inc., 2011

Disaster Risk Management in Latin America and the Caribbean Region: GFDRR Country Notes- Antigua and Barbuda. Global Facility for Disaster Reduction and Recovery (GFDRR), 2010

The CARIBSAVE Climate Change Risk Atlas (CCCRA) Climate Change Risk Profile for Antigua and Barbuda. CARIBSAVE, 2012

10. APPENDIX 1

10.1 SAFETY ASSESSMENT

TABLE 10.1: VITAL INFORMATION TABLE

NAME OF SCHOOL	OTTOS COMPREHENSIVE SECONDARY SCHOOL	
Type of school (Pre-school, primary, secondary, tertiary)	SECONDARY	
Is facility private and public?	PUBLIC	
Location	ST. JOHNS	
Name of Head Teacher or Principal	FOSTER ROBERTS	
Telephone	(268) 462-3570	
Email	ottoscomprehensive@gmail.com	
Year building(s) constructed	Constructed in 1976	
How many buildings are contained on the school compound?	16	
How many classrooms are within each school building?	24 in total	
What is the total school population?	687	
Students	Male: 48%	Female: 52%
Teachers	Male: 19	Female: 74
Non-teaching staff	Male: 2	Female: 4
How many first aid kits are available for use?	1	
How many fire extinguishers are installed	6	
Was the school affected by any natural disaster in the past?	NOT AWARE	
If yes, what type of event was it and when did it occur?	-	
Were there any repairs as a result of the event?	-	
Is the school designated as an emergency shelter?	YES	

10.1.1 SCHOOL SAFETY COMPLIANCE ASSESSMENT

TABLE 10.2: SCHOOL SAFETY ASSESSMENT SUMMARY

OTTOS COMPREHENSIVE SECONDARY SCHOOL			
	SCORE	%	CRITICAL STANDARDS MET
Safety Assessment	218	39%	NO
Green Assessment	245	46%	NO

TABLE 10.3: SCHOOL SAFETY COMPLIANCE ASSESSMENT

	%	CRITICAL STANDARDS MET
Disaster Planning	21%	NO
Emergency Planning	21%	NO
Safety Admin	26%	-
Medical Emergencies	68%	NO
Physical Plant	45%	NO
Physical Safety	68%	-
Protection of the Person	36%	-
Hazardous chemicals and materials	42%	NO

10.2 GREEN ASSESSMENT

TABLE 10.4: GREEN ASSESSMENT SUMMARY SCORES

	%	CRITICAL STANDARDS MET
Sustainability Management	29%	NO
Natural Resources	51%	NO
Indoor Environment	28%	NO
Hazardous Chemicals and Materials	56%	NO
Facility and Grounds Management	53%	YES
Food Service	45%	NO

10.3 PHOTOGRAPHS



■ FRONT FAÇADE OF MAIN BLOCK AT MAIN ENTRANCE



■ MAIN ENTRANCE



■ SIDE VIEW OF MAIN BLOCK



■ SIDE VIEW OF MAIN BLOCK



■ SIDE VIEW OF MAIN BLOCK



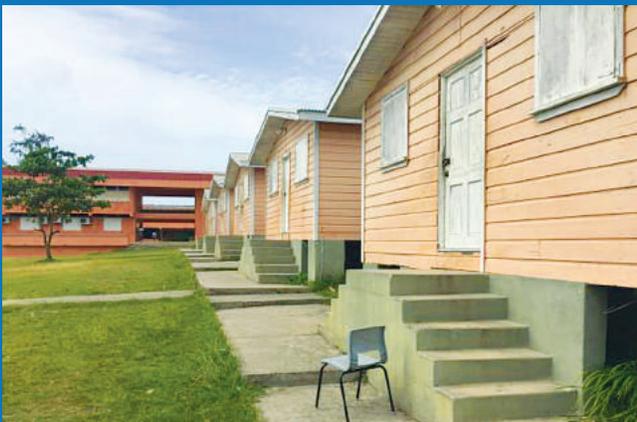
■ TYPICAL TO SEVERAL SMALL TIMBER STRUCTURES SITUATED ON SCHOOL COMPOUND



■ TYPICAL TO SEVERAL SMALL TIMBER STRUCTURES SITUATED ON SCHOOL COMPOUND



■ MANY SMALL TIMBER STRUCTURES ON SCHOOL COMPOUND



■ MANY SMALL TIMBER STRUCTURES ON SCHOOL COMPOUND



■ BASEMENT LEVEL WITH MOISTURE RELATED PROBLEMS



■ MAIN COURTYARD



■ MAIN COURTYARD



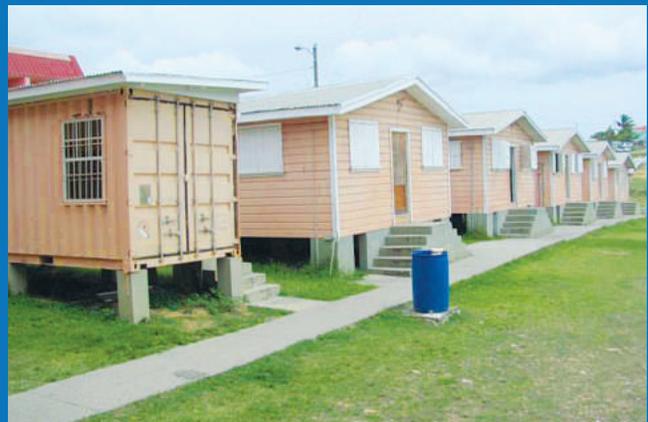
■ MAIN COURTYARD



■ CLASSROOM BLOCK
- REDUCED NATURAL VENTILATION



■ ONE OF THE MANY DETACHED BUILDINGS



■ SMALL TIMBER BUILDINGS
- "TEMPORARY" SOLUTIONS TO OVERCROWDING



■ GLAZED WINDOWS AT UPPER LEVEL
WOODEN WINDOWS AT LOWER LEVEL



■ GLAZED WINDOWS AT UPPER LEVEL
WOODEN WINDOWS AT LOWER LEVEL



■ GLAZED WINDOWS TO BOTH LEVELS



■ TIMBER WINDOWS AT BOTH LEVELS



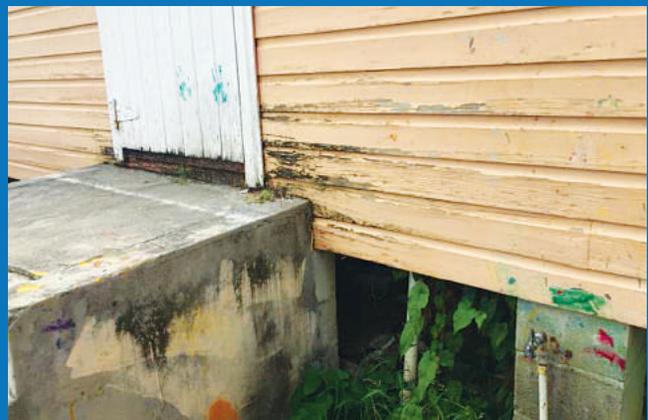
■ REPAIRS TO FLOOR SLAB



■ SPALLING CONCRETE



■ SPALLING CONCRETE



■ WATER-DAMAGED TIMBER STRUCTURE



■ LIGHTWEIGHT ALUZINC SHEETS ON SECTIONS OF BUILDING



■ DOOR LOCKS ARE A MAJOR PROBLEM



■ BROKEN PLUMBING



■ OPEN CORRIDORS



■ ENCLOSED CORRIDORS



■ BROKEN WINDOW



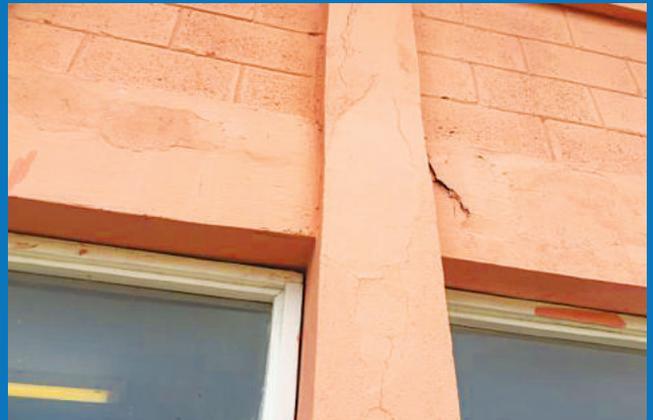
■ BROKEN WINDOW



■ CORRODED HINGES



■ VERTICAL CRACKS IN STRUCTURAL MEMBER



■ SPALLING CONCRETE IN BEAMS



■ VERTICAL CRACKS IN COLUMNS



■ LAND EROSION UNDER WALKWAY



■ INTERNAL CIRCULATION OPENED TO THE ELEMENTS



■ INTERNAL CIRCULATION OPENED TO THE ELEMENTS



■ SOME LANDSCAPED AREAS



■ SOME LANDSCAPED AREAS



■ SECTION OF YARD OVERGROWN BY SHRUBBERY



■ UTILITY POLES IN CLOSE PROXIMITY TO BUILDINGS



■ UTILITY POLES IN CLOSE PROXIMITY TO BUILDINGS



■ ALUZINC SHEET ROOF COVERING ON STRUCTURAL STEEL AND TIMBER COMPOSITE ROOF STRUCTURE



■ ALUZINC SHEET ROOF COVERING ON STRUCTURAL STEEL AND TIMBER COMPOSITE ROOF STRUCTURE

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

COUNTRY: ANTIGUA AND BARBUDA

#	FIRST NAME	LAST NAME	JOB TITLE	ORGANIZATION	CONTACT EMAIL	CONTACT PHONE NUMBER
1	Rolston	Nickeo	-	Ministry of Education	rnickeo@yahoo.com	721-8373
2	Alvacea	Burton	-	Ministry of Education	alvaceaburton@gmail.com	720-7217
3	Desiree	Antonio	-	Ministry of Education	zone3education@gmail.com	462-5972
4	Emil	Michael	-	Ministry of Education	emilmichael@gmail.com	723-4464
5	E. Jonah	Greene	-	Ministry of Education	ejonahgreene@gmail.com	728-0755
6	Priscilla	Nicholas	-	Ministry of Education	prisca143@hotmail.com	722-4129
7	Jessie	Purcell	-	Ministry of Education	jessiegeorge98@hotmail.com	771-1331
8	Mervin	Browne	-	Board of Education	mbrowne@apuainet.ag	727-6877
9	Kadian	Camacho	-	Ministry of Education	kadiancamacho@yahoo.com	722-6541
10	Randel	Pyle	-	Ministry of Works	randell.pyle@ab.gov.ag	764-8331
11	Kaye	Tomlinson	-	Ministry of Health	dmonkay@yahoo.com	770-5100
12	Emile	Floyd	-	Ministry of Health	emile.floyd@gmail.com	764-3436
13	Joycelyn	James	-	ABUT	stress_release@yahoo.com	723-7214
14	Michal	Francois	-	Holy Trinity	angelo francois@gmail.com	732-7385
15	Rexford	Harry	-	Sir McChesney George	rmharry0711@hotmail.com	772-0673
16	Alvah	Guishard	-	Ministry of Social Transformation	alvahguishard@gmail.com	464-2024

COUNTRY: ANTIGUA AND BARBUDA

#	FIRST NAME	LAST NAME	JOB TITLE	ORGANIZATION	CONTACT EMAIL	CONTACT PHONE NUMBER
17	Chevaughn	Burton	Teacher Zone One	S.R Olivia David	chevaughnburton26@gmail.com	789-4178 462-7400
18	Chelo	Francis	-	Ministry of Education	chichif@live.com	-
19	Dornett	Defoe	Teacher Zone Two	Potters	successful_dornett@hotmail.com	764-4054
20	Chaka	Grant	Teacher Zone Two	Willikies	chakagrانت@yahoo.com	775-2803
21	Sheresa	Knowles	Teacher Zone Three	C.T. Samuel	gloriousme_454@hotmail.com	770-6121
22	Sonilda	Burton	Teacher Zone Three	J.T. Ambrose	sonildab@yahoo.com	773-1696
23	Anthea	Anthony	Teacher Zone Four	Mary E. Pigott	m.e.p.school@hotmail.com antheaanthony468@gmail.com	789-4718
24	Foster	Roberts	Teacher Secondary	Ottos Comprehensive	fosterroberts@yahoo.com	729-7081
25	Oral	Evanson	-	Ministry of Education	evansonoral@gmail.com	764-2550
26	Stacy	Mascall	-	Ministry of Education	stacymascall@hotmail.com	770-4436
27	Wendy	Valentine	-	Disability Association	wendyvalentine74@gmail.com	725-7260
28	Diana	Martin	-	National PTA	diandivine@gmail.com	775-1578
29	Eloise	Hughes	-	Ministry of Education	esilston@hotmail.com	782-2415
30	Embler	Spencer	-	Ministry of Education	1emblerspencer@gmail.com	783-4049

10. APPENDIX 3: ORGANIZATIONS CONSULTED

Antigua and Barbuda

- National Youth Council
- Antigua and Barbuda Union of Teachers
- Department of Environment
- Ministry of Education
- Central Board of Health
- Ministry of Health
- National Safe Schools Programme Committee
- Principals, Teachers
- Board of Education
- Early Childhood Unit
- Barbuda Council
- Ministry of Works
- Development Control Authority
- Antigua and Barbuda Institute of Architects
- UNDP
- National Parent Teachers Association

