

PN-ACT-417



**Structural Vulnerability Assessment of Selected  
Government Facilities:  
Antigua and Barbuda**

**Post-Georges Disaster Mitigation Project  
in Antigua & Barbuda and St. Kitts & Nevis**

**July 2001**

Post-Georges Disaster Mitigation in Antigua & Barbuda and St. Kitts & Nevis is implemented by the Organization of American States, Unit for Sustainable Development and Environment for USAID-Jamaica/Caribbean Regional Program

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FAC ID	GIS ID	BUILDING/SCHOOL	LOCATION	# FLOORS	YEAR BUILT
2	5	Antigua Girls High School	St. John's	2	1886
110	98	Bendals Primary School	Bendals Village	1	1970
143	212	Bishopgate Street Clinic	St. John's	1	1994
114	122	Clare Hall Secondary School	Clare Hall	1	1969
181	220	Fiennes Institute	St. John's	1	1929
36	102	Fire Station - St. John's	St. John's	2	1956
264	134	Freemans Village Primary School	Freemans Village	1	1962
48	34	General Post Office	St. John's	2	1967
119	196	Golden Grove Primary School	Golden Grove	1	1961
148	39	Grays Farm Health Center	Grays Farm	1	1955
11	11	Hanna Thomas Hospital - BARBUDA	Barbuda	1	1970
123	163	Irene B. Williams	Swetes Village	2	1993
149	202	Jennings Clinic	Jennings	1	1996
125	142	Jennings Primary School	Jennings	2	1998
266	145	John Hughes Primary School	John Hughes Village	1	1965
128	147	Liberta Primary School	Liberta Village	1	1960
129	155	Mary E. Pigott School	St. John's	2	1980
180	221	Mental Hospital	Sutherlands Development	1	1929
49	77	Ministry of Finance	St. John's	3	1968
184	214	Ministry of Public Works	St. John's	2	1965
297	247	National Archives	St. John's	2	1985
161	76	National Office of Disaster Services	St. John's	2	1975
104	75	New Winthropes Primary School	New Winthropes Village	1	1946
131	153	Old Road Primary School	Old Road Village	1	1952
155	81	Pares Clinic	Pares Village	1	1969
133	80	Pares Primary School	Pares Village	1	1991
18	82	Pares Secondary School	Pares Village	2	1970
134	85	Parham Primary School	Parham Town	1	1970
185	90	Police Headquarters	St. John's	2	1971
135	92	Potters Primary School	Potters Village	1	1946
8	8	School - BARBUDA	Barbuda	1	1743
137	158	Sea View Farm Primary School	Sea View Farm Village	1	1988
68	42	St. John's Health Center	St. John's	2	1955
10	10	Treasury - BARBUDA	Barbuda	1	1743
56	107	Treasury Department - ANTIGUA	St. John's	2	1932
138	162	Urlings Primary School	Urlings Village	1	1984
139	113	Willikies Primary School	Willikies Village	1	1964

## **1.2 INTRODUCTION:**

Antigua and Barbuda is situated in the North Eastern Caribbean. Antigua is situated between latitude 17.0 degrees and longitude 61.47 degrees with an average yearly temperature of 85 degrees Fahrenheit, and an average yearly rainfall between 35 inches and 41 inches.

Barbuda is located between latitude 17.08 degrees and longitude 61.40 degrees. The average yearly rainfall on Barbuda is between 20 inches and 25 inches. These two islands share a total of 170 square miles, with Antigua occupying 108 square miles and Barbuda, 62 square miles.

The economy of the islands is based on tourism, with the lesser emphasis being on construction.

The results of the last census placed the total population at sixty-five thousand (65,000).

The islands are located in the North Atlantic hurricane region, with the official hurricane season being from June to November, annually.

The islands of the Caribbean have always been under the threat of hurricanes, earthquakes, and other natural disasters. Over the last several years, these threats have manifested themselves in the form of earthquakes and hurricanes.

In 1974, an earthquake of magnitude 7.4 shook Antigua and Barbuda, causing severe damage to some important historical buildings and private dwellings.

Over the past decade the islands have been impacted by the following storms and hurricanes: Hugo (1989); Luis and Marilyn (1995); Georges (1998); José and Lenny (1999). These hurricanes cause extensive damage to the island, leaving some people homeless, and causing damage in the billions of E.C. dollars.

It is therefore of utmost importance that special attention is given to our design concepts, such as the structural configuration of buildings. This will determine how they will perform under seismic and hurricane loads.

The various components of the buildings were examined to determine whether the connections such as rafters to beams and plate had adequate anchorage. These include the use of hurricane straps, bolts and steel through the foot of the rafters. In cases where these are not present, it is recommended that retrofitting is conducted.

Window types varied from wooden shutters to Miami and glass louvers. Vent blocks, which are located on the windward side of these facilities, were most prevalent. These however increase the vulnerability of the buildings to the negative effects of hurricane winds and rain. It is therefore recommended that these be replaced with wooden and Miami shutters, which offer the best protection during hurricanes.

A further examination was made of the roofs of selected buildings to determine whether there were corroded sheets, and adequate anchorage of the roof covering. In cases where inadequacies were found, retrofitting is recommended.

### **1.3 METHODOLOGY:**

In undertaking the structural assessment of these selected Government facilities in the island of Antigua and Barbuda, it was with an understanding that a determination would be made as to whether these buildings are capable of resisting lateral and vertical loads that may be brought to bear upon them during a hurricane or an earthquake.

In our deliberations, the structural integrity of the buildings as well as their ability to withstand storms was considered. However, the structural integrity is not the only thing to be considered when conferring its capability. Therefore, we examined the different components of the building to include the beams, columns, walls, and foundation. In addition, the roof frame and its connection were isolated to determine adequacy and the meeting of the standards set out in the building code. For example, the use of metal straps and appropriate anchoring of rafters in concrete beams. Furthermore, the windows and doors were examined as well to determine whether the hardware was operable, and if the windows and door type would offer sufficient protection to the building during a hurricane.

The other aspect of the building that was considered other than the physical appearance was the damage history of the building and the method of repairs or reconstruction that was employed. This further helped to determine the building's vulnerability to these natural hazards.

One other aspect of the building which was considered was whether or not the building was suitable for temporary housing during and after a hurricane. We recognised that there are respective factors other than structural safety. Some of these components are sanitary and kitchen facilities, water storage and supply and standby power. The main focus of this assessment is on the structural vulnerability of these buildings to hurricane force winds and earthquakes.

However, a further look at the environmental impact on the buildings was taken to ascertain how the surroundings may influence the impact of hurricane on these facilities. For example, in many cases, trees are a common feature between and among these buildings. During hurricanes, leaves and branches can become dislodged and form missiles, thus impacting the buildings negatively.

## **1.4 TERMS OF REFERENCE - VULNERABILITY ASSESSMENT**

- 1 The Independent Contractor (hereinafter referred to as "The Consultant") will be technically responsible to the Director of the Unit for Sustainable Development and Environment ("USDE") of the General Secretariat of the Organization of American States ("GS/OAS"), for fulfilling the obligations established by the following terms of reference of this contract.
- 2 Appropriate building practices (design, construction and maintenance) are a critical determinant of the resilience of the built environment when faced with the stresses imposed by natural hazards. A thorough audit of existing buildings can identify significant vulnerabilities prior to the advent of a hazardous event. To identify retrofit needs and suitability for insurance, the Post-Georges Disaster Mitigation (PGDM) project is supporting, through this contract, structural vulnerability assessments of selected government buildings and buildings used as emergency shelters.
- 3 Under this contract, the consultant will undertake the following tasks. The consultant will likely subcontract portions of this work to other local experts, but the consultant is responsible for all contract deliverables.
  - Prepare vulnerability assessment survey forms, to include sections on wind resistance, earthquake resistance and site vulnerability. These forms should be built upon existing work, such as the school vulnerability assessment forms developed by Eng. Tony Gibbs.
  - Compile a list of facilities to be assessed, including all facilities listed in Attachment 1. This list is to be compiled in a database form and to include locational (geographic coordinate) information.
  - Prepare a work plan for completion of the vulnerability assessment. The workplan will show the time line for all work to be carried out for the principal consultant and the individual subcontractors. Terms of reference and qualifications for subcontractors are to be submitted with the work plan.
  - Carry out a sample vulnerability assessment on one building, following the guidelines outlined under §§III.e.
  - Incorporating the comments from the GS/OAS on the draft work plan, assessment forms and the sample building assessment (described above), carry out the structural vulnerability assessment. For each structure/facility:
    - Where available, collect copies of building plans. Assess whether the plans reflect the as-built structure. Identify, if possible, the building standard used in design of the building. Photograph the building.
    - Inspect the building site to identify vulnerability to natural hazards, including flooding, landslides, storm surge, wind and wind-blown hazards.
    - Collect general building design and construction information, including age, geometry, materials, roof design, foundation type, window type, detailing and damage history.
    - Inspect the status of the building connections, maintenance and other characteristics that increase or decrease structural vulnerability.

- . Analyze the ability of the structure to withstand wind hazards and earthquake hazards, using current structural assessment models.
  - . Identify alternative methods for retrofitting against both wind and earthquake hazards, and describe the most appropriate course of action. Estimate retrofit needs and costs.
  - . For facilities identified as emergency shelters:
    - . Document the occupancy capacity and availability of facilities required for proper shelter operation, including the number/location of bathrooms, kitchen, water storage capacity and electrical generation capacity.
    - . Classify the facility according to the following classification:
      - 1 Category A: safe for use during and after hazard events
      - 2 Category B: For use after a hazard event, if serviceable
      - 3 Discontinue status as emergency shelter
    - . Develop recommendations for use in future selection of facilities and for design of new facilities for use as emergency shelters.
  - . Prepare a final report, documenting the information and recommendations developed above, and an electronic database of facilities, with associated characteristics and vulnerability assessment findings.
- 4 The consultant shall submit the following documents to GS/OAS' satisfaction:
- . Copies of the vulnerability assessment forms (§§III.a.), the list of buildings to be surveyed (§§III.b.), the workplan for undertaking the vulnerability assessments (§§III.c.) and one completed assessment of one building listed in Attachment I (§§III.d.). These materials are to be delivered in electronic format, within three weeks of the inception of this contract.
  - . Reports on the results of the assessment for each building, as described in §§III.d-e. These reports are to be submitted for review by GS/OAS in four groups (10 per group), and are to be submitted in electronic format.
  - . A draft report and database of facilities, covering all items identified under §§III.d.-e. above, for review by GS/OAS and the government of Antigua and Barbuda. These materials are to be delivered in electronic format three weeks prior to the scheduled close of this contract.
  - . A final report and facilities database, documenting the information collected and recommendations developed under this contract. The report is to include an executive summary, which is suitable for distribution separate from the full report. The database is to be delivered in electronic format and the report, in electronic and hardcopy formats.

## 1.5

## EXECUTIVE SUMMARY

The buildings assessed comprised of twenty (20) school facilities, eight (8) Medical facilities and nine (9) Governmental Offices, varying in age from seven (7) years to seventy-two (72) years.

The buildings for most part are rectangular in shape and have excellent structural characteristics. The thickness of the walls vary from 6" masonry blocks to 2' masonry stone walls.

The buildings generally have gable-pitched roofs of twenty (25) degrees to thirty (30) degrees, with rafters anchored in reinforced concrete beams. This makes these facilities for most part, capable of resisting lateral and vertical loads from hurricane force winds and seismic activity. However, there is need for general maintenance to these facilities.

The school buildings are fitted with a combination of window-types to include vent blocks, wooden shutters, awning windows and Miami shutters. The awning windows and vent blocks are unprotected. (See Parham Primary School.)

The buildings owned by Government are fitted with glass-type windows which in some cases are unprotected. The buildings are fitted with a combination of doors varying from solid wood to metal.

Designated sections of the schools' facilities are used as transitory hurricane shelters. These facilities for most part are not equipped with the necessary amenities and in many cases the sanitary facilities are not accessible during a hurricane. This creates some measure of difficulty for shelterees.

There is an absence of "as built" plans for most of these buildings. However, available plans are kept at the Ministry of Public Works, unless otherwise stated.

## **2.0 NATURAL HAZARDS OF THE CARIBBEAN**

### **2.1 HURRICANE**

A hurricane is a low pressure weather system which derives its energy from the latent heat over the warm tropical seas. The forces that accompany a hurricane are storm surge, wind, rain and flooding. During the past ten (10) years Antigua and Barbuda has experienced several hurricanes. Included in this number are Hugo in 1989, Luis and Marilyn in 1995, Georges in 1998 and José and Lenny in 1999. Some of the foregoing have brought wide-spread damage to the islands. Of these, Luis and Georges were the two most destructive hurricanes. The damages caused by these hurricanes were estimated in the millions of dollars. The majority of the Government facilities damaged were schools. Many of these buildings lost their roofs, causing some schools to be closed for several months, while some Government buildings and privately owned buildings met the same fate. Several roads were severely damaged by floodwaters. The impact of these storms was quite evident on the agricultural and livestock sector. Many crops were destroyed, and animals lost their lives.

### **2.2 Storm Surge**

A storm surge is created by the low pressure and strong winds around the hurricane eye, which raises the ocean's above the surrounding ocean surface, thus forming a dome of water as much as fifty (50) to sixty (60) miles across. As the wave moves into shallow coastal water, the decrease in water depth transforms the dome into a storm surge that can rise up to 20' (twenty feet) above normal sea level, causing enormous flooding and destruction along the coast line and as much as one mile inland.

It is quite common to see hotels and beach front houses built along the coastline. Many of these buildings fall within close proximity of the areas vulnerable to storm surge.

## 2.3 Earthquake

In order to understand the pattern of earthquakes in Antigua and Barbuda, it would be not acceptable to look at this geographical area alone since the origin of earthquakes are commonly related to movement along the existing "faults" or fractures occurring in the earth's crust, and considering that the sudden movement along faults is the cause of most earthquakes.

There are many ways to measure the size of an earthquake. Presently, earthquakes are measured in **magnitude**, and the effect is measured using **intensity scales**.

Antigua and Barbuda have experienced many minor earthquakes over forty years, the most significant of which is the 1974 earthquake which had a magnitude of 7.4. This earthquake caused extensive damage to the Court House, which is now used as the museum, the Public Library and St. John's Cathedral, which is one of our historical sites. These buildings had to undergo repairs to restore their structural integrity. It should also be noted that many other buildings, both public and private, were damaged beyond repair and had to be demolished.

## 2.4 Flood

Flooding is brought about when surface runoff exceeds the capacity of existing drainage channels.

As the demand for lands for housing development increases in Antigua and Barbuda, very little attention is given to the natural watercourses and flood plains. On many occasions these lands are sold for housing development. When this happens, many of the waterways become blocked, causing flooding in times of unusually heavy rainfall.

This was quite evident in Antigua after Hurricane Lenny showered the island with over twenty-one inches (21") of rain. The Piggotts New Extension, which is located on a flood plain and is also blocking some major natural water courses, was flooded under some six feet (6') of water, causing wide spread damage to many properties.

## **2.5 Landslides**

Landslides occur when portions of hill slope become over saturated with water thereby reducing the shear strength of the material. Other causes of landslides are earthquake, removal of vegetation from hill slopes, or where development alters the natural slope or ground water condition.

According to a study done by Cassandra T. Rogers Ph.D. and Derek Gay Ph.D., there were some sixty (60) documented cases of landslides that occurred on hill-slopes in the south and southwest of the island as a result of the near twenty-five inches of rain associated with Hurricane Lenny. The occurrence of landslides can impact buildings negatively. Buildings built on hill slopes are most vulnerable to this hazard. In cases where the soil becomes over-saturated with water and loses its shear strength, buildings can become uprooted from their foundations and slide down the slope, often, to their total demise. It should be noted that buildings located at the foot of hills can be buried, or be severely damaged by landslides.

## **2.6 Drought**

A prolonged period of unusually dry weather that is sufficiently perpetuated to cause a serious imbalance in the hydro logic cycle, results in a drought. This can result in water shortages, crop loss, diminishing of ground water and depletion of soil moisture. In 1984 and 1995 Antigua and Barbuda witnessed two of the most severe periods of drought in its history. This almost brought total collapse to the agricultural sector. The livestock industry suffered loss in the range of 40% and water had to be barged to the island from Dominica.

Drought can have a negative impact on many of our buildings. For example, the depletion of moisture from around the foundation of some buildings causes differential settlement of the buildings. In some cases, these buildings can develop cracks in the foundation or walls, thus making the building vulnerable to earthquake action.

**DESCRIPTIVE COMMENTARY  
ON ASSESSED BUILDINGS**

## REPORTS ON BUILDINGS ASSESSED

This section describes, from the visual perspective, the relevant features of each transitory shelter and building which contribute to its resistance or resistivity against hazardous conditions such as hurricane and earthquake forces.

The buildings are assessed on their individual merit, taking the following into account:

- **The environment** - to determine what impact it may have on the building
- **The location** - whether or not it is located in a coastal area, or if it is situated on a hill, undulating slope, or in a sheltered position.
- **Its components** - for example, the building frame, the roof system, foundation, walls, windows and doors. This helped in the determination of the vulnerability of each component to hurricane and earthquake forces.
- **General state of building/facility**

In the introduction to each facility/building, the present state of the building was highlighted.

Recommendations were made for the effecting of repairs, additions, or renovations required to bring each to the standard which will allow for smooth operation before, during and after a hurricane or other disaster.

<b>Name of facility</b>	<b>ANTIGUA GIRLS HIGH SCHOOL</b>
<b>Address</b>	<b>ST. JOHN'S CITY</b>
<b>Facility ID Number</b>	<b>2</b>
<b>GIS ID Number</b>	<b>5</b>
<b>Survey Date</b>	<b>5<sup>th</sup> June, 2001</b>
<b>Date Constructed</b>	<b>1886</b>
<b>Year of major addition or change</b>	<b>1999</b>
<b>Was facility formally engineered?</b>	<b>NOT KNOWN</b>
<b>Wind Code</b>	<b>NOT KNOWN</b>
<b>Number of buildings</b>	<b>SIX (6)</b>
<b>Total Square Footage</b>	<b>20,640</b>
<b>Facility Damage History</b>	

- **HURRICANE LUIS**

**Introduction:**

This facility is comprised of six (6) buildings. Three (3) timber frame, two (2) masonry and one (1) steel frame with external cladding being 75% timber and 25% masonry of reinforced concrete blocks. The windows in the steel frame building and in the masonry buildings are of louver glass. However, the Science building is also fitted with vent blocks on the windward side, making the building vulnerable to flooding. The wooden buildings are fitted with wooden windows and louver windows with wooden blades.

These types of windows offer good protection from airborne missiles and other flying debris during a hurricane. The buildings in general have excellent structural attributes. The rafters of the wooden buildings are toe-nailed to the wood plate, and further held in place with hurricane straps, while the rafters of the masonry buildings are anchored in reinforced concrete beams, thus making the buildings capable of resisting vertical and lateral loads from hurricanes and earthquakes. There are signs of weakness in the roof covering. Some sheets have become loose at the foot, making it vulnerable to hurricane winds. It is recommended that the entire roof be examined for loose sheets and that these be properly secured in place with screws.

This facility is used as a transitory shelter. The wooden buildings are an excellent choice for such purpose.

## **Environment:**

The area around this facility has other buildings, trees and debris within a 300-ft radius that could impact the facility negatively during a hurricane.

The facility's surrounding terrain is of a town setting, and is located on a gentle undulating slope from east to west.

## **Foundation:**

The foundations of the masonry buildings are constructed of reinforced masonry blocks.

The floor is a 5-in thick reinforced concrete slab, and the wood structures are of timber, which have little or no defect in the surfaces.

## **Frame/ walls:**

The masonry building frames are constructed of reinforced concrete columns and the wooden building frame is of 2" x 4" wood studs, with a timber exterior cladding.

The columns are 8" x 12" x 20'- high spacing at twenty feet (20') on center. The beams are 10" x 24" with a span of twenty feet (20'). The intermediate beams are 6" x 16". The exterior walls are 6" masonry blocks and are load-bearing.

## **Roofs:**

The roofs are frame with 2" x 6" rafters and has a 30-degree pitch. The rafters are connected in reinforced concrete beams at their base. The roof covering is plywood decking, 2" x 4" purlins and galvanized metal profile sheet. The sheets are secured in place with clout nails in every other corrugation, connected into 2' x 4" purlins. The roof's components and its connections to the rafters are all capable of resisting vertical load from hurricane.

## **Windows/Doors:**

The buildings fitted with louver windows are 2' x 4' with wooden mullion. The wooden windows are 2' x 4' and the wooden doors are 3' x 6' 8".

**Shelter**

There is a cistern under one building. The kitchen is in a separate building, and so are the toilet facilities. There is no shower facility.

**RETROFITTING:**

Replace vent blocks with wooden windows

**Cost:           \$ 5,250.00**

**MAINTENANCE:**

Check roof and secure loose sheets

**Cost:           \$850.00**

<b>Name of Facility</b>	<b>BENDALS PRIMARY SCHOOL</b>
<b>Address</b>	BENDALS VILLAGE
<b>Facility ID Number</b>	110
<b>GIS ID Number</b>	98
<b>Survey Date</b>	28 <sup>th</sup> April, 2001
<b>Date Constructed</b>	1970
<b>Year of Major Additions or Changes</b>	1999
<b>Was Facility Formally Engineered?</b>	NOT KNOWN
<b>Wind code</b>	NOT KNOWN
<b>Number of Buildings</b>	FIVE (5)
<b>Total Square Footage</b>	12,953
<b>Facility Damage History</b>	
	• none

**Introduction:**

This facility was constructed in 1970. These buildings have excellent structural characteristics and good hurricane-resistant features. However, the exposed steel members are showing signs of corrosion. It is recommended that these components be cleaned of the rust, and that two coats of anti-rust paint be applied.

The building has two cisterns with two water pumps attached. One of those pumps is not in working order. It should also be noted that most of the spouts/guttering are missing from the buildings, and that none of the cisterns are attached to the remaining spouts/guttering.

The doors are in good condition, but some of them need proper locks.

The building has a kitchen and toilets, but there are no showers.

**Environment:**

The areas around this facility have other buildings within a 300-ft radius which could impact the facility negatively in the event of a hurricane.

The facility is located on flat land. The land slopes gently to the east, following the natural contour of the land.

There is a drain on the eastern side which connects to a drain on the northern side, which takes away any excess surface water during unusually heavy rainfall. The hill range on the south and the east gives protection to the facility during a hurricane.

**Foundation:**

The foundations of the buildings are constructed of reinforced masonry blocks. The floors are of 5" reinforced concrete slabs.

**Frame/Walls:**

The lateral load resistance systems are of a steel portal frame. The columns and beams are encased in reinforced concrete. The columns are 10" x 12" at 12' centers. The beam is 12" x 24".

**Roofs:**

The roofs are gable design with pitches of 25 degrees. The rafters are of 2" x 6" timber bolted to steel purlin 3-foot center. The ceiling is a flat ceiling of plywood. The roof is covered with galvanized sheets which are all fixed in place by nailing into 2" x 6" purlin in every other corrugation throughout the roofs.

**Windows/Doors:**

The buildings are fitted with wooden shutters and wooden doors, all of which are in excellent condition. These components offer excellent protection to the buildings during a hurricane.

**Shelter:**

This facility is an excellent choice for a transitory shelter, however, the toilet facility is not accessible from the inside.

**Retrofit:**

Install spouts/guttering and water pump.

**Cost:            \$6,587.00**

**Maintenance:**

Repair metal frames and paint.

**Cost:**                    \$ 4,589.00

<b>Name of Facility</b>	<b>BISHOPGATE CLINIC</b>
<b>Address</b>	Bishopgate Street, St. John's
<b>Facility ID Number</b>	143
<b>GIS ID Number</b>	212
<b>Survey Date</b>	17 <sup>th</sup> February, 2001
<b>Date Constructed</b>	1994
<b>Year of Major Additions or Changes</b>	none
<b>Was Facility Formally Engineered?</b>	Not known
<b>Wind code</b>	NOT KNOWN
<b>Number of Buildings</b>	ONE (1)
<b>Total Square Footage</b>	800
<b>Facility Damage History</b>	
	<ul style="list-style-type: none"> <li>• NONE</li> </ul>

**Introduction:**

This fairly new building was constructed in 1994. The building has good hurricane-resistance features. However, the floor has a crack down the center. This is due in part to the lack of adequate compaction of the fill. The perimeter grade beam designed to retain the fill is not at a safe depth to prevent resettlement when the soil is saturated around the beam.

It is recommended that around the perimeter of the building be excavated and that ten (10) inches of reinforced concrete be poured to pin the beam to stop any further settlement. There is severe cracking in the external wall which is due mainly to settlement and foundation-related problems. It is recommended that an epoxy be used to repair the cracks.

The building has a water heater which has never been commissioned. The building does not have an emergency water supply.

Some of the external wooden windows need to be repaired along with one wooden door which are dry-rotten.

**Environment:**

The area around this building has many buildings within a 300-ft radius which could impact the facility negatively in the event of a hurricane.

The facility is located in a residential area on relatively flat land.

**Foundation:**

The foundation is a two-way concrete slab on concrete grade. The floor is a 5"-thick reinforced concrete slab.

**Frame:**

The building is a timber frame of 2' x 6' studs, with its exterior covering being wire mesh (high rib) and with a portland cement plaster finish. The frame of the building is structurally sound and is capable of resisting lateral load from hurricane force winds.

**Roof:**

The roof is a twenty-five degree (25°) gable roof constructed of 2" x 6" rafters, fastened to a 2" x 6" wooden plate and further held in place by hurricane straps. The roof covering is of corrugated galvanized sheets affixed to 2' x 4' purlin. Its ceiling is a T-111 plywood suspended ceiling.

**Windows:**

The windows are Miami shutters with wooden shutters fitted to protect the building from hurricane. Two of the shutters are rotten. There are two doors - one metal and one wood panel which is rotten and should be changed.

**Maintenance:**

- **Repair the water heater**
- **Repair wooden shutters**
- **Replace one door**
- **Painting should be done**

**Cost:**                   **\$ 4,675.00**

**Retrofit:**

- Pin foundation and repair cracks
- 1000 gallon water tank
- ½ hp water pump

**Cost:**                   **\$14,500.00**

<b>Name of Facility</b>	<b>CLARE HALL SECONDARY SCHOOL</b>
<b>Address</b>	Clare Hall School Road
<b>Facility ID Number</b>	114
<b>GIS ID Number</b>	122
<b>Survey Date</b>	17 <sup>th</sup> February, 2001
<b>Date Constructed</b>	1969
<b>Year of Major Additions or Changes</b>	1998
<b>Was Facility formally engineered?</b>	Yes
<b>Wind code</b>	BNS CP28- Code of Practice for Wind Loads for Structural Design.
<b>Number of Buildings</b>	Nine (9)
<b>Total Square Footage</b>	29,248
<b>Facility Damage History</b>	
	<ul style="list-style-type: none"> <li>• Hurricane Luis</li> <li>• Hurricane Georges</li> <li>• Hurricane José</li> </ul>

**Introduction:**

This facility was constructed in 1970, and has a total number of seven (7) buildings which include two wooden buildings.

Five (5) of the buildings are constructed of structural steel, four (4) of steel portal frame and one (1) of structural steel.

Although the structural characteristics of the building is excellent and the exterior load-bearing wall along with its columns offer good resistance to lateral loads, the critical area of the buildings are the windows, which in a severe storm can cause flooding.

The windows of the building are a combination of wooden shutters, awning glass windows and Miami shutters. However, in many cases, blades are missing or bent out of shape, inhibiting the windows from closing. The wooden shutters need new hardware such as hinges and hooks. The doors need proper locks while others need to be changed completely.

It is recommended that all of the Miami windows be replaced with wooden shutters.

The roofs on some buildings have loose galvanized sheets, and there are signs of corrosion. It is recommended that all of the roofs be checked for defects, and that roof screws be used to secure sheets in place.

The cistern, which is located under the auditorium, is not connected to the rain water system, and the vast majority of the guttering is missing from the buildings.

The wooden building is exhibiting signs of weakness in the external cladding, and dry rot in the fascia.

**Environment:**

East of the facility is an open area used as a play field.

Around this facility are other buildings within a 300' radius which could impact the facility negatively in the event of a hurricane.

There is a drain on the eastern side of the facility, but it is not clearly defined.

The facility is located on a very gentle north to south slope in the District of St. John's Rural East.

**Foundation/floor:**

The foundation is constructed of reinforced concrete blocks and reinforced concrete footing 20-feet on center. The floor slab is 5"-thick reinforced concrete.

**Frame:**

The building's structure comprises a steel portal frame, at 20' on centers. The structural components such as columns and beams are encased in reinforced concrete. These frames are able to resist lateral and vertical loads from hurricanes and earthquakes.

**Roof:**

The roofs are gable design with a 25-30 degree pitch. The roof frame is a combination of steel rafters and 2" x 6" timber, 3 ft on centers acting as purlin and the ceiling is of T-111 plywood. The roofs' external cladding is corrugated metal sheets.

**Windows/Doors:**

The remaining buildings are fitted with a combination of wooden shutters and wooden doors to the front. Miami shutters are fitted to the rear.

**Shelter:**

The auditorium is used as the designated shelter during the hurricane season, but has several problems that inhibit its effectiveness as a shelter. The windows are damaged, the toilet facility is inaccessible from the inside of the building, and there are no showers.

**Retrofitting Cost:**

Install wooden shutters and new doors

**Cost:            \$28,600.00**

**Maintenance:**

Replace roof sheets  
Install guttering to buildings.  
Repair wooden building.

**Cost:            \$25, 000.00**

<b>NAME OF FACILITY</b>	<b>FIENNES INSTITUTE</b>
<b>Address</b>	Queen Elizabeth Highway
<b>Facility ID Number</b>	181
<b>GIS ID Number</b>	220
<b>Survey Date</b>	28 <sup>th</sup> April, 2001
<b>Date Constructed</b>	1929
<b>Year of major addition or change</b>	1999
<b>Was facility formally engineered?</b>	NOT KNOWN
<b>Wind Code</b>	NOT KNOWN
<b>Number of buildings</b>	FOURTEEN (14)
<b>Total Square Footage</b>	20,808
<b>Facility Damage History</b>	
	• Hurricanes LUIS and GEORGES

**Introduction:**

This facility was constructed in 1929, and is comprised of fourteen (14) buildings. The earlier buildings are constructed of solid masonry blocks, while the new buildings are of reinforced concrete blocks. The roofs are timber-framed deck in part in 1" x 12" groove and tongue timber and in part by T-111 plywood. The older building has solid wooden shutters protecting louver glass windows and the new buildings are equipped with Miami shutters. The doors are of solid wood. The general condition of the buildings is good.

**Environment:**

The area around this facility has other buildings within a 300-ft radius that could impact the buildings negatively during a hurricane.

The facility is located on a gentle slope from west to east, approximately one hundred (100) meters from Holberton Hospital. The land slopes gently to the east, draining into the natural watercourse.

### **Foundation:**

The foundation, for most part, is constructed of reinforced masonry blocks. The existing structure was constructed in solid masonry blocks.

### **Frame/Walls:**

The earlier buildings are constructed with a combination of 18" masonry stone walls and 8" solid masonry blocks. The ring-beams are 8' x 20" thick. These buildings are symmetrically shaped, and have no internal partition walls to help resist lateral load. However, the roof braces, placed at 8-foot spacing, assist in resisting both lateral and vertical load. The earlier buildings, from all appearance, have good structural characteristics. This enables these buildings to withstand hurricane force winds. However, the aging and weathering of the walls over the years make these buildings vulnerable to earthquake action.

### **Roofs:**

The roofs are hip design of 30-degree pitch. The roof frames are a combination of 3" x 4" rafters bolted to a wooden plate at the wall, while at the corridor, the rafters are nailed to the wooden plate and further supported by hurricane straps. The new building's roof frames are constructed of 2" x 6" rafters, anchored in a 6" x 20" thick reinforced concrete beam. The roofs are covered with galvanized sheets, affixed by nailing to 1" x 4" purlin or 2" x 4" purlin. These roofs are capable of resisting vertical load from hurricane force winds. However, the age of the roofs from the earlier buildings is of concern, because most of the sheets and their connections are corroded.

It is recommended that these roofs' connections be changed to wooden screws specially suited for corrugated galvanized and replacing the wooden plates with reinforced concrete ring beams.

### **Windows/Doors:**

The buildings are fitted with an assortment of windows, namely louver glass windows and Miami shutters, and are protected on the outside with wooden shutters. These windows with their added protection offer good security to the buildings from hurricane force winds and flying debris. However, the buildings fitted with Miami shutters would experience water seepage during a hurricane that can cause flooding. This type of window is most prevalent on the new buildings, namely the kitchen and the laundry. These buildings have no fixed outer shutters to give protection during a hurricane.

### **Operational Vulnerability:**

The buildings are surrounded by trees that could impact them during a storm. The buildings are all detached, with spacing of twenty feet (20') to twenty-five feet (25') apart, and are not accessible during a hurricane. The facility does not have its own cistern or stand-by power. This service is currently provided by the Holberton Hospital.

**Retrofitting:**

Install wooden shutters

**Cost:           \$3,500.00**

**Maintenance:**

Replace louver glasses and repair the Matron's quarters.

**Cost:           \$4,850.00**

<b>Name of Facility:</b>	<b>ST JOHN'S FIRE STATION</b>
<b>Address:</b>	ST JOHN'S CITY
<b>Facility ID Number</b>	36
<b>GIS IS Number</b>	102
<b>Survey Date</b>	17 <sup>th</sup> February, 2001
<b>Date Constructed</b>	Not Known
<b>Year of Major Additions or Changes</b>	1990
<b>Was Facility formally engineered?</b>	Yes
<b>Wind code:</b>	BNS CP28- Code of Practice for wind Loads for Structural Design.
<b>Number of Buildings</b>	ONE
<b>Total Square Footage</b>	5,685
<b>Facility Damage History</b>	

- **Damage by Hurricane HUGO**

**Introduction:**

There are no structural deficiencies in the main building. However there are a few minor superficial cracks in the external plastering. The attachment is showing signs of separation between the floor and blocks. This is due to lack of reinforcement and concrete grout in the blocks. It is recommended that this space be filled with a sand and cement mix.

The attachment connection to the main building is of concern. It is recommended that the new columns and beam be placed where the two structures are joined, and the new beam be connected to the original beam. This will allow both buildings to act independent of each other.

The windows are unprotected, and the kitchen and bathroom facilities need to be upgraded.

**Environment:**

The area around this facility has many large trees that could impact the building negatively in a hurricane.

It is located less than 150 ft from the main sporting venue, which can make it quite difficult to get to an emergency when the venue is being used for National or International events.

The building is located on a gentle slope outside the city of St John's, which eliminates any chance of flooding.

It is an emergency facility. The main building is a two-storey structure with an attachment to house a generator and to provide additional storage.

**Foundation/floor:**

The foundation is constructed of reinforced concrete and 8" masonry blocks. The floor is a reinforced concrete slab 5" thick.

**Frame/walls:**

The main building is constructed of 12" x 12" x 15' columns and 20" x 12" reinforced concrete beams. The exterior wall for is constructed of reinforced concrete - 4" thick. The intermediate walls are of 6" masonry blocks.

A recent attachment to the main building was constructed of 6" masonry blocks to accommodate a standby generator and to provide additional storage space.

**Roof:**

The main roof is made of 2" x 6" rafters in a hip style design of 25 degrees with a suspended ceiling. The annexed roof is of the same material, but expose rafters deck with T - 111 plywood. The roof covering is of corrugated galvanized sheets.

**Windows/Doors:**

The window frames are made of cast iron with inserted glass panels. There are no shutters to protect the windows from wind borne missiles or flying debris during a storm.

It is recommended that wooden shutters or storm panels be provided to protect the windows in the event of a hurricane

**Operational vulnerability:**

The kitchen and toilet facilities need to be renovated. The showerhead is missing, a new face basin needs to be installed and the bathroom floor and walls need to be tiled.

The kitchen walls and floor also need to be tiled, and the cupboards need to be replaced.

**Cost of retrofitting:            \$5,475.00**

- **Install kitchen cupboards and tile floor.**
- **Toilet fitted with new showers and walls to be tiled.**

**Maintenance:**

- **Repair plastering and minor cracks**

**Cost :            \$2,576.00**

**NAME OF FACILITY**                      **FREEMAN'S VILLAGE PRIMARY  
SCHOOL**

Address                                      Freeman's Village  
**Facility ID Number**                      264  
**GIS ID Number**                            134  
**Survey Date**                              23<sup>rd</sup> March, 2001  
**Date Constructed**                        1962  
**Year of major addition or change**    1988  
**Was facility formally engineered**    YES  
**Wind Code**  
**Number of buildings**                    ONE (1)  
**Total Square Footage**                  3,100  
**Facility Damage History**  
    •        **HUGO**

**Introduction:**

This building, once used as a school, is now a community center and shelter facility. It has good hurricane-resistant features and shows no signs of defect in its structural components.

The building is in good condition to be used as an emergency shelter. However, toilet, kitchen and bathroom facilities are non-existent. These facilities can be provided within the building for the convenience of the occupants and other users of the shelter.

The building has no rainwater guttering or catchment.

The floor elevation is of concern since it falls below the level of the road. There is a possibility that this situation can cause flooding in times of unusually high rainfall.

**Space requirement: 190 sq ft. at an estimated cost of E.C. \$27, 550.00**

**Environment:**

The area around this facility has houses within a 300-ft radius that could impact the buildings negatively in case of a hurricane. The facility is located in a residential area on a gentle slope from west to east with an open field on the side.

**Foundation:**

There is no "as built" plan available to determine the footing details. However, the foundation is constructed of masonry blocks and reinforced concrete. The floor is of 5" thick reinforced concrete and has no defects.

**Frame:**

The building has good structural characteristics and shows no defect in its walls, beams or columns. Its end walls are 20" thick, making it capable of withstanding vertical loads at its corners. However, the building being symmetrically shaped, has no internal walls to assist in resisting horizontal loads on its external walls. This open hall design is susceptible to internal pressure that can cause the roof to be blown off. It is recommended that air vents be placed in the roof to release internal pressure.

**Roof:**

This facility's roof was badly damaged during the passage of hurricane Hugo in 1985. The roof was subsequently renovated in 1990. A new reinforced concrete ring-beam was placed and the rafters fixed in the beam with ½" steel straps for positive anchorage at the foot. The roof is constructed of 2" x 6" rafters with a gable pitch of 30-degrees, decked with T-111 plywood 2" x 4" purlin and metal sheet covering. The building is in an excellent condition.

**Windows:**

The building is fitted with wooden shutters on the sheltered side and vent blocks on the windward side, making it vulnerable to wind-blown debris and rain. The doors are of metal and are in excellent condition. It is recommended that the vent blocks be replaced with wooden shutters to conform to the rest of the windows.

**Shelter:**

Structurally, the building is suited for a shelter but it has several weaknesses that inhibit its effectiveness as a shelter. There are vent blocks on the windward side and the building is not equipped with any of the amenities such as kitchen, shower, toilet and water tank or cistern. It would therefore be impossible to house anyone for a period beyond the active time of a hurricane.

It is recommended that these facilities be built as an addition to the existing building, which will enhance its effectiveness as a shelter.

**Retrofitting:**

Install rainwater guttering and build a cistern.

**Cost:**           **\$100,000.00**

Install shutters.

**Cost:**           **\$6, 500.00**

**Maintenance:**

NONE

<b>Name of Facility</b>	<b>GENERAL POST OFFICE</b>
<b>Address</b>	ST JOHN'S CITY
<b>Facility ID Number</b>	48
<b>GIS ID Number</b>	34
<b>Survey Date</b>	17 <sup>th</sup> February, 2001
<b>Date Constructed</b>	1965
<b>Year of Major Additions or Changes</b>	NONE
<b>Was Facility formally engineered</b>	Yes
<b>Wind code</b>	BNS CP28- Code of Practice for wind Loads for Structural Design.
<b>Number of Buildings</b>	TWO (2)
<b>Total Square Footage</b>	14,871

**Facility Damage History**

- NONE

**Introduction:**

Constructed in 1965, this two-storey facility is complex-shaped. This makes it vulnerable to hurricane force winds. The building is located approximately 300 feet from the coastline, making it vulnerable to wave action and storm surge. The ground floor of the building is below the road level and the external walkway and the first floor are at the same level. The building is fitted with louver glass windows which are unprotected.

**Environment:**

The area around this facility has other buildings within a 300-ft radius which could impact the facility negatively in the event of a Hurricane.

The building are located on the western coast of downtown St John's, about 300' from the shoreline.

**Frame/Walls:**

The building's frame is constructed of 10" x 12" reinforced concrete columns and 10" x 2' reinforced concrete beams. The walls are a combination of 6" and 8" masonry blocks. There are minor surface cracks in the walls, and one column on

the southern side has become dislodged, exposing the reinforcement to the weather. It is recommended that this be fixed to stop further weakening of the member, which would make the structure more vulnerable to earthquake action.

**Roof:**

The roof is a shed design with its rafters acting as purlins. The roof covering is galvanized sheet.

The roof has a suspended ceiling which is constructed of cedar plywood and part 1x6 V-joint all in very good condition.

**Windows/Doors:**

The building is fitted with louver windows and there are no shutters making the building vulnerable to wind-borne missiles and flying debris. The two main entrances to the public-service area are below the level of the road making this area vulnerable to flooding from storm surge and tidal wave. The first floor walkway and the floor of the offices are at the same level, making these areas vulnerable to flooding from hurricane force rains and winds above 20 knots.

The facility is equipped with all of its amenities to allow it to function without interruption after a hurricane.

It is recommended that shutters be installed or storm panels be provided to be installed in the event of a hurricane. It is also recommended that four inches (4") of concrete be placed on all of the office and toilet floors on the first floor of the building to raise these floors above the walkway level.

**Retrofitting:**

Change shutters and exterior doors from flush panel to metal.  
Install concrete slab.

**Cost:           \$55,000.00**

**Maintenance:**

Repair cracks in walls, replace missing louver glass and paint the building.

**Cost:           \$ 35,650.00**

<b>Name of Facility</b>	<b>GOLDEN GROVE PRIMARY</b>
<b>Address</b>	GOLDEN GROVE
<b>Facility ID Number</b>	119
<b>GIS ID Number</b>	196
<b>Survey Date</b>	28 <sup>th</sup> April, 2001
<b>Date Constructed</b>	1965
<b>Year of Major Additions or Changes</b>	1995
<b>Was Facility Formally Engineered?</b>	NOT KNOWN
<b>Wind code</b>	NOT KNOWN
<b>Number of Buildings</b>	SEVEN (7)
<b>Total Square Footage</b>	11,537
<b>Facility Damage History</b>	

- Damage by hurricanes LUIS and GEORGES

**Introduction:**

This facility is comprised of three (3) wooden buildings and four (4) masonry block buildings. Although the structural characteristics of the buildings are excellent, some buildings exhibit signs of weakness in the windows and doors. Fifty per cent (50%) of the windows and the window openings are fitted with vent blocks, making that portion of the buildings vulnerable to wind and rain. Some doors need to be properly secured on their hinges and new locks fitted. The building lacks storage. This can be provided by using space within one of the existing buildings.

**Environment:**

The areas around this facility have other buildings within a 300-ft radius which could impact the facility negatively in the event of a hurricane.

The facility is located on flat land. The land slopes gently to the east, following the natural contour of the land.

### **Foundation:**

The foundations of the early buildings are constructed of reinforced masonry blocks. The new structures are wooden, and the foundation is constructed of masonry block pillars.

### **Frame/Walls:**

This facility is comprised of buildings constructed of masonry blocks and buildings of wood. The wooden buildings are framed with 2" x 4" studs and anchored on masonry pillars. The external cladding is plywood. The existing building's frame is constructed of reinforced concrete columns - 6" x 24" x 10' spacing at 14 feet on center and reinforced concrete beams 6" x 12". These components all have good structural characteristics and show little sign of structural defects. These structural components are capable of resisting lateral and vertical loads from hurricane force winds and earthquake.

### **Roofs:**

The roofs are gable design with pitches of 30 degrees. The rafters are of 2" x 6" in the wooden buildings and 2" x 12" in the masonry structures. The decking of the roofs is T-111 plywood. The roof is covered with galvanized sheets which are all fixed in place by nailing into 2" x 4" purlins. The roofs of the earlier buildings were recently repaired and are adequately connected to the purlins by galvanized clout nail in every other corrugation throughout the roof.

### **Windows/Doors:**

The buildings are fitted with an assortment of windows, namely louver glass windows, wooden shutters and vent blocks. These windows in most cases provide good protection for the buildings from hurricane force winds, flying debris and rain. However, some buildings are fitted with vent blocks and wooden shutters. This combination of windows does not offer adequate protection to these buildings during a hurricane. It is recommended that the vent blocks be replaced with wooden shutters in the buildings that are designated shelters. This will allow for adequate protection from hurricane winds. The doors are a combination of wood and metal. The locks and hinges on some doors are missing.

### **Shelter:**

The buildings designated as shelters are structurally sound, and should offer adequate resistance against hurricane force winds. However, the type of windows inhibit the effectiveness of the building, making them vulnerable to storm force winds and flooding. It should also be noted that the wooden buildings are fitted

with wooden doors, which should offer adequate protection during a hurricane.  
There is no emergency power.

**Retrofit:**

Replace vent blocks with wooden shutters.

**Cost:            \$4,785.00**

**Maintenance:**

**Cost            \$17,460.00**

<b>Name of Facility</b>	GRAYS FARM HEALTH CENTER
<b>Address</b>	UNION ROAD GREEN BAY
<b>Facility ID Number</b>	148
<b>GIS ID Number</b>	39
<b>Survey Date</b>	23 February, 2001
<b>Date constructed</b>	1940
<b>Year of Major Additions or Changes</b>	1983
<b>Was Facility formally engineered?</b>	NOT KNOWN
<b>Wind code</b>	Not known
<b>Number of Buildings</b>	ONE (1)
<b>Total Square Footage</b>	2,635
<b>Facility Damage History</b>	
	• HURRICANE GEORGES

**Introduction:**

This single-storey building with an attachment was constructed in 1940. The building has excellent structural characteristics and hurricane-resistant features. It is however showing signs of corrosion and leaks in the roof covering. The windows in the attachment are of louver glass, and some have fallen out, leaving the windows unprotected.

The building lacks shower facilities. Space can be created on the inside of the building by eliminating one of the many toilets. There is no cistern, but there is a tank that is not connected to the rain water system. Modification needs to be done to the plumbing. The facility needs to be fitted with showers, a water pump and a 1000-gallon water tank. It is also recommended that one of the toilets be converted to the shower. The plumbing drainpipes need to be repaired and extended to the drain field.

**Cost of adding shower facility is \$7, 500.00**

**Environment:**

The area around this Facility has many buildings within a 300-ft radius which could impact the facility negatively in the event of a hurricane.

It is located in a residential area on relatively flat land sloping from north to south.

### **Foundation:**

The foundation is constructed of masonry stone and 8" masonry blocks. The floor is a 5" thick reinforced concrete slab. These components show no sign of structural defects.

### **Frame/Walls:**

The walls' construction is a combination of stone and masonry blocks. The stone building walls, being 20" thick, are capable of resisting lateral load from hurricane and earthquake forces.

The attached building is constructed of reinforced masonry blocks. Its internal walls are 6" x 20" reinforced concrete beams, along with moderate openings for windows and doors. This makes this building capable of resisting lateral loads from hurricane force winds. There is no sign of structural defect in its walls or beams.

### **Roof:**

The roof is a gable design with 2" x 6" rafters deck with T - 111 plywood and 1" x 4" purlin covered with galvanized sheets.

There are some apparent signs of leaking in the roof, even though the roof covering is not revealing any sign of defect. The roof needs to be checked for loose galvanized. The fascia board is rotten and needs to be changed.

Portions of this facility's roof were damaged from hurricane Georges in 1995, and were subsequently replaced. The entire roof was taken off and a new reinforced concrete ring beam was added. The rafters were affixed in the beam by placing 3/8" steel straps over it.

### **Windows:**

The windows are fitted with a combination of Miami shutters and 4" louver glass. There are no wooden shutters to the building to protect the windows from hurricane force winds and wind-borne missiles. Some of the glass has already fallen out. There are protective bars being placed over the windows for security reasons.

### **Retrofitting:**

Shutters, Water pump and Tank,

**Cost:**            \$12,000.00

**Maintenance:**

- Repair roof
- Repair plumbing pipes
- Replace louver glass

**Cost:            \$3,500.00**

<b>Name of Facility</b>	<b>HANNA THOMAS HOSPITAL</b>
<b>Address</b>	CODRINGTON, Barbuda
<b>Facility ID Number</b>	11
<b>GIS ID Number</b>	11
<b>Survey Date</b>	28 <sup>th</sup> April, 2001
<b>Date Constructed</b>	1970
<b>Year of Major Additions or Changes</b>	1998
<b>Was Facility Formally Engineered?</b>	Yes
<b>Wind code</b>	Not known
<b>Number of Buildings</b>	FOUR (4)
<b>Total Square Footage</b>	7,433
<b>Facility Damage History</b>	

- **Hurricane Georges**

**Introduction:**

This facility has excellent structural characteristics and very good hurricane-resistant features.

The windows of this facility are suited for hurricane panels which are readily available to be installed in the event of a hurricane.

The pitch of the roofs are below the allowable standard specified by the Caribbean Uniform Building Code (CUBiC), thus making these buildings vulnerable to vertical loads.

It is recommended that all un-nailed corrugation at the heel of the roof be fitted with screws to further secure the roof covering to its base.

**Environment:**

The facility is located in an open field with relative land.

There is a drain on the western side of the facility, which takes away all surface water from the surroundings and minimizes any possibility of flooding.

The surrounding area has trees within a 300-ft radius which could impact the facility negatively in the event of a hurricane.

**Foundation:**

The foundation is constructed of 8" masonry blocks. The floor is a reinforced concrete slab five inches (5") thick, and shows no sign of defect in its surface.

**Frame/Walls:**

The main facility is constructed of 18" x 32" of reinforced concrete beams and 9" x 9" x 10' columns, spaced fourteen feet (14') apart. The intermediate walls along with its 8" x 24" beams make this facility capable of resisting lateral load from hurricane force winds and earthquake activity. The other surrounding buildings are constructed of reinforced masonry blocks and all have good structural characteristics. There is no sign of defect in the walls, beams or floors.

**Roofs:**

The roofs are constructed of 2" x 6" rafters which are a combination of gable and hip designs of twenty-degree (20°) slope. This is below the recommended design standard, making these roofs vulnerable to storm force winds. The roof-covering is of corrugated galvanized, fastened in place by nails. The ceiling is suspended, and is constructed of hardboard. The components are well maintained, and show no signs of defect.

**Windows/Doors:**

The facility is fitted with two different types of windows, namely, louver glass windows and Miami shutters. The louver windows are suited for hurricane panels which will be installed in the event of a hurricane. The Miami shutters are unprotected, but can withstand storm force winds. However, these types of windows are known to cause water seepage in storm force conditions.

**Operational Vulnerability:**

The facility is located close to the coastline in an open field. There is no protection from hurricane force winds approaching from any direction, thus making it vulnerable to storm force winds. However, the facility is equipped with all of the essential amenities.

**Maintenance:**

Change fascia.

**Cost:        \$850.00**

<b>Name of facility</b>	<b>IRENE B. WILLIAMS PRIMARY SCHOOL</b>
<b>Address</b>	SWETES VILLAGE
<b>Facility ID Number</b>	123
<b>GIS ID Number</b>	163
<b>Survey Date</b>	23 <sup>rd</sup> February, 2001
<b>Date Constructed</b>	1992
<b>Year of major addition or change</b>	NONE
<b>Was facility formally engineered?</b>	YES
<b>Are Plans Available?</b>	YES
<b>Wind Code</b>	BNS CP28 - Code of Practice for Wind Load for Structural Design
<b>Number of buildings</b>	ONE (1)
<b>Total Square Footage</b>	20,800
<b>Facility Damage History</b>	<ul style="list-style-type: none"> <li>• NONE</li> </ul>

**Introduction:**

This well constructed facility was built in 1992. It has excellent hurricane-resistant features. However, its windows are unprotected. Some galvanized sheets on the roof are loose, and need to be properly secured in place.

The toilet facility, which is fitted with British Standard-type toilets, is eighty percent (80%) inoperable. This is due to the fact that the parts are not readily accessible/available on the local market to effect repairs to these units. It is recommended that these toilets be removed and replaced with American-Standard toilets, allowing for easy/expeditious repair.

Some doors are without locks, and some roof sheets are loose at the foot. It is recommended that the loose sheets be secured by the use of screws.

### **Environment:**

The area around this facility has many houses that could impact the building negatively in a hurricane. It is located in a residential area on a gentle North to South slope. This eliminates any possibility of flooding during heavy rains or hurricanes.

### **Foundation/ Floor:**

The foundation is constructed of 2' x 8" thick reinforced concrete strip footing with 4' x 4' x 10" reinforced concrete pad at 12 feet on center for columns the walls are constructed of 8" reinforced masonry blocks. The floor is a 5-in thick concrete slab reinforced with # 66 B.R.C. which is in keeping with the required standard.

### **Frame:**

The building's frame consists of 8" x 10" reinforced concrete columns from foundation to ring-beam of the first floor and 10" x 24" ring-beam. This allows for good transfer of lateral load to the foundation.

### **Roof:**

The roof system is a shed-pitched 28-degree gable-pitched for the greater portion. The frame has 3" x 6" rafters, 32" on center. The administration and toilet block is a combination of steel 12w x 26w steel rafter at 12-feet on center and with timber rafters, 3" x 6" bolted between these steel rafters. Decked with T-111 5/8" plywood the roof covering is 24 gauge pre-coated corrugated sheet nail to 2" x 4" purlin, 4 feet on center.

### **Windows/Doors:**

The windows are a combination of awning and vent blocks. Minor repairs are needed to a few of the awning blade arms. The doors are of metal and some have missing locks.

### **Shelter facility:**

The designated shelter area is located on the ground floor with a concrete roof, which is the floor of the first floor. It is well protected from impact of any flying debris and air borne missiles. The toilet facility is not accessible during a hurricane or storm. There is a kitchen and cistern with an electrical pump, but there are no showers.

**Retrofitting:**

Install toilets and roof screws.

**Cost:            \$10,500.00**

**Maintenance:**

Complete painting and install new locks.

**Cost:            \$25,675.00**

<b>Name of facility</b>	<b>JENNINGS CLINIC</b>
<b>Address</b>	<b>JENNINGS VILLAGE</b>
<b>Facility ID Number</b>	149
<b>GIS ID Number</b>	202
<b>Survey Date</b>	23 <sup>rd</sup> March, 2001
<b>Date Constructed</b>	1996
<b>Year of major addition or change</b>	
<b>Was facility formally engineered?</b>	YES
<b>Wind Code</b>	
<b>Number of buildings</b>	ONE (1)
<b>Total Square Footage</b>	2,264
<b>Facility Damage History</b>	
	<ul style="list-style-type: none"> <li>• NONE</li> </ul>

**Introduction:**

This building is well constructed and has very good hurricane-resistant features. The building is well-suited to be a clinic. However, there is a cistern beneath the building which does not have any overflow or water pump. The windows are unprotected, and the building is in need of painting.

**Environment:**

The area around this facility has houses and trees with in a 300-ft radius that could impact the buildings negatively in a hurricane.

The facility is located in a residential area on a gentle slope from north to south.

It was constructed in 1994. The building plans indicate that there has not been any changes made to the original building.

**Foundation:**

The foundation is a reinforced concrete strip footing. Its walls are of 8" reinforced masonry blocks and there are no signs of defect. The floor is of a 5" thick reinforced concrete slab, with a rubber tile finish.

### **Frame/walls:**

The building is symmetrically shaped. The frame consists of 8" x 8" reinforced concrete columns, spacing at 14' on center and 6" x 16" reinforced concrete ring-beam. The walls are constructed of 6" reinforced masonry blocks. These structural members show no signs of defect, making them capable of resisting lateral and horizontal forces from hurricane. The building has a cistern but there is no electrical water pump attached to give service to the facility in the event that the Government's water supply is suppressed. There is no overflow pipe to the cistern to allow excess water to escape. This puts additional pressure on the walls of the cistern when it is full. This situation, if left unattended, can cause structural damage to the building. Flooding to the floor is caused by excess water escaping through the internal manhole due to the absence of an external overflow pipe. This situation is critical and needs immediate attention. It is also recommended that an electrical water pump and storm shutters are installed.

### **Roof:**

The roof is a 28-degree gable pitched, constructed of 2' x 6" rafters fixed at its foot in reinforced concrete beam with ½" steel strap. The decking is of T-111 plywood and its covering is galvanized sheets fastened to 2" x 4" purlin. Parapet walls protect the eaves of the roof. This minimizes the vulnerability to hurricane force winds.

### **Windows:**

The building is fitted with awning windows and solid-core flush doors on the outside. There are no hurricane shutters. This makes the building vulnerable to wind blown missiles and flying debris.

It is recommended that the building be fitted with installable shutters in the event of a hurricane.

### **Hazard potential:**

The facility is surrounded by trees and houses from which missile can become airborne and cause damage to the building.

### **Maintenance:**

Painting needs to be done.

**Cost:**            \$6,000.00

**Retrofitting:**

Install shutters.

**Cost:           \$ 4,850.00**

Install water pump and overflow pipe.

**Cost:           \$7,950.00**

<b>Name of facility</b>	<b>JENNINGS PRIMARY SCHOOL</b>
<b>Address</b>	JENNINGS VILLAGE
<b>Facility ID Number</b>	125
<b>GIS ID Number</b>	142
<b>Survey Date</b>	23 <sup>rd</sup> March, 2001
<b>Date Constructed</b>	1996
<b>Year of major addition or change</b>	None
<b>Was facility formally engineered?</b>	YES
<b>Wind Code</b>	
<b>Number of buildings</b>	FOUR (4)
<b>Plans Available</b>	YES
<b>Total Square Footage</b>	12,983
<b>Facility Damage History</b>	
•	NONE

### **Introduction:**

This facility consists of two (2) two-storey buildings and two (2) single-storey. This building was recently constructed. The buildings have excellent structural characteristics and good hurricane-resistant features. However, there are awning glass windows in the classroom and one part has vent blocks. It is equipped with all of its amenities. This allows it to function as a school and, if needs be, as a hurricane shelter. There is some maintenance needed.

The building in which the sanitary facilities are housed has cracks. The concrete roof leaks. It is recommended that hydraulic cement be used to repair the cracks and the entire concrete roof be sealed with three coats of an elastomeric sealant.

### **Environment:**

The area around this facility has trees with in a 300-ft radius that could impact the buildings negatively in a hurricane.

The facility is located in an open field on relatively flat land. There is a drain on the northern side to take away the excess surface water and reduce its vulnerability to flooding.

**Foundation/Floor:**

The foundation of the building is of 5' x 5' reinforced concrete footing with columns at 20 feet on center. The foundation's walls are 8" reinforced masonry blocks and the floor slabs are 5" thick reinforced concrete.

**Frame/ wall:**

The buildings for the most part are symmetrically shaped except for one complex-shaped building. The frame consists of 8" x 12" by 10' reinforced concrete columns and ring beam 8" x 24". The walls are of 6" masonry blocks. Its internal walls and beams help to resist lateral loads to the external walls. The facility has survived two major hurricanes with no damage to its structural or non-structural members.

**Roof:**

The roofs are a gable pitch with 35-degree slope and a flat concrete roof over the toilet block, which has a crack in it. The main roof is constructed of 3" x 6" rafter 2' – 8" on center fixed in the concrete ring-beam by a ½" steel bar strap over the rafter for anchorage, decked with T-111 plywood. Galvanized sheets are used as covering. These are screwed in place to the 2" x 4" purlin. The buildings have good structural features to resist vertical loads from hurricane force winds. The auditorium's roof has a leak in its southwestern corner that needs to be repaired.

**Windows/Doors:**

The administration block and the auditorium are fitted with awning windows. There are no shutters. The classrooms are 50% awning and 50% vent blocks. This makes the classrooms vulnerable to storm force rains, wind-blown debris and flooding. It is recommended that the vent blocks be replaced with wooden shutters to the area identified as a shelter.

**Hazard Potential:**

The building is susceptible to flooding, because it is located on relatively flat land, which lends itself to very slow draining of surface water. The drain on the southern side, if becomes blocked, will also contribute to flooding in times of heavy rains.

**Maintenance:**

Fix leaks and cracks.

**Cost:            \$3,500.00**

**Retrofitting:**

Install shutters to specified areas and replace vent blocks.

**Cost                \$24,650.00**

<b>Name of Facility</b>	<b>JOHN HUGHES PRIMARY SCHOOL</b>
<b>Address</b>	<b>JOHN HUGHES VILLAGE</b>
<b>Facility ID Number</b>	266
<b>GIS ID Number</b>	145
<b>Survey Date</b>	28 <sup>th</sup> April, 2001
<b>Date Constructed</b>	1968
<b>Year of Major Additions or Changes</b>	1998
<b>Was Facility Formally Engineered?</b>	YES
<b>Wind code</b>	NOT KNOWN
<b>Number of Buildings</b>	TWO (2)
<b>Total Square Footage</b>	5,152
<b>Facility Damage History</b>	<ul style="list-style-type: none"> <li>• <b>HURRICANE LUIS</b></li> </ul>

**Introduction:**

This facility, constructed in 1968, is comprised of two buildings connected by a covered walkway between both buildings. The buildings are constructed of a steel portal frame.

The external cladding is masonry blocks on the two end walls and portion of the back. The remaining portion of the buildings has vent blocks. However, the buildings located in the western corner are refitted with wooden shutters which make up 5% of the external cladding.

These wooden windows are of concern, since the frame for the windows span some thirty-two feet (32' ), and it is not properly secured to the wall. This frame is very loose and can be easily blown out by hurricane force winds. It is recommended that the frame be affixed to the steel frame by the use of J-Bolts counter sink into the timber frame and then anchored into the frame.

The other area of concern is the vent blocks at the rear of the buildings. These blocks have no header, and are self-supported, making them vulnerable to earthquake action. It is recommended all of the vent blocks be replaced with wooden shutters, and that reinforced concrete headers be placed over the window frames.

The roof of the covered area between both buildings is leaking, and some of the rafters are rotten.

The roof is supported by steel pipe columns with a flat plate welded to the top, to which the roof is anchored by upward-driven nails, passing through holes in the timber plate. This mode of connection makes the roof vulnerable to hurricane force winds. It is recommended that metal L-straps be welded on to the top portion of the columns to allow for proper anchorage of the roof, and that the defective rafters and plate be replaced.

This facility in its present state should not be used as a temporary shelter because of its vulnerability to flooding and flying debris.

The building lacks kitchen and shower facility.

### **Environment:**

The areas around this facility have other buildings and trees within a 300-ft radius which could impact the facility negatively in the event of a hurricane.

The facility is located on the side of a hill. The land slopes gently to the north, following the hill range on the south, and the east gives protection to the facility during a hurricane.

### **Foundation:**

The foundations of the buildings are constructed of reinforced masonry blocks. The floors are of 5" reinforced concrete slabs.

### **Frame/Walls:**

The lateral load resistance systems are of a steel portal frame. The columns and beams are encased in reinforced concrete. The columns are 8" x 8" at 7' centers. The 8" x 8" beam acts as a frame for the vent blocks on the front.

### **Roofs:**

The roofs are gable design with pitches of 25 degrees. The rafters are of 2" x 6" timber bolted to steel purlin 4-foot center timber bolted to steel purlin at 3 feet on center. T-111 plywood is used as decking. The roof is covered with galvanized sheets which are all fixed in place by nailing into 2" x 4" purlin in every corrugation through the roofs.

### **Windows/Doors:**

The buildings are fitted with vent blocks for light and ventilation. The doors are also in good condition and offer excellent protection to the building.

### **Shelter:**

This facility's use as a transitory shelter should be discontinued.

**Retrofit:**

Install wooden windows.

**Cost:           \$67,750.00**

**Maintenance:**

Repair roof for the covered walkway.

**Cost:                 \$ 6,589.00**

<b>Name of facility</b>	<b>LIBERTA PRIMARY SCHOOL</b>
<b>Address</b>	LIBERTA VILLAGE
<b>Facility ID Number</b>	128
<b>GIS ID Number</b>	147
<b>Survey Date</b>	23 <sup>rd</sup> March, 2001
<b>Date Constructed</b>	1960
<b>Year of major addition or change</b>	NONE
<b>Was facility formally engineered?</b>	NOT KNOWN
<b>Wind Code</b>	
<b>Number of buildings</b>	FOUR (4)
<b>Plans Available</b>	NO
<b>Total Square Footage</b>	9,681
<b>Facility Damage History</b>	
	<ul style="list-style-type: none"> <li>• NONE</li> </ul>

**Introduction:**

Constructed since 1960, the buildings are showing signs of aging in its walls, beams, and columns. This makes the buildings vulnerable to earthquake action. The windows' hardware is loose, while others have fallen off, leaving some windows unable to close properly.

The building's rain water system is not attached to the cistern, and there is no water pump attached.

The building designated as a shelter is fitted with wooden shutters. This gives excellent protection from flying debris and wind-borne missiles. The toilets are inaccessible from within the building.

**Environment:**

The area around this facility has houses within a 300-ft radius that could impact the buildings negatively in a hurricane.

It is located in an open field on a north to south slope. There is a drain on the northeastern side that takes away excess surface water, thereby reducing its vulnerability to flooding.

**Foundation / floor:**

The foundation is constructed of reinforced concrete and masonry blocks. The floor is 5" thick and is constructed of reinforced concrete. There are signs of cracking in the floor slab which needs to be repaired. It is recommended that a 4" reinforcing concrete cap with # 66 BRC wire mesh be placed over all the floors.

**Walls/ frame:**

The building's frame consists of 8" x 12" columns and 8" x 16" reinforced concrete beams. The external walls are constructed of 6" masonry blocks.

**Roof:**

This is a gable pitch of 28-degree constructed of 3" x 12" timber frame spacing, twelve feet (12') on center, with 2" x 8" intermediate rafters about 32" on center toe-nailed to the main members. The roof's cladding is corrugated galvanized sheets.

**Windows/Doors:**

The buildings are fitted with a combination of wooden shutters and vent blocks. Some windows have loose hinges, bolts and nuts and are showing signs of dry rot.

**Doors:**

The doors are constructed of timber, and many of them are without locks.

**Retrofit:**

Replace windows and hardware, rotting windows and electrical water pump.

**Cost:**            \$9, 500.00

**Maintenance:**

Connect spouting to cistern.

**Cost:**            \$850.00

<b>Name of Facility</b>	<b>MARY E. PIGGOTT SCHOOL</b>
<b>Address</b>	Otto's New Extension
<b>Facility ID Number</b>	129
<b>GIS ID Number</b>	155
<b>Survey Date</b>	18 <sup>th</sup> Feb, 2001
<b>Date Constructed</b>	1983
<b>Year of Major Additions or Changes</b>	1996
<b>Was Facility formally engineered</b>	Yes
<b>Wind code</b>	BNS CP28- Code of Practice for wind Loads for Structural Design.
<b>Number of Buildings</b>	FOUR (4)
<b>Total Square Footage</b>	16,324
<b>Facility Damage History</b>	

- Damage by Hurricane Luis

### **Introduction:**

This facility is comprised of two (2) two-storey buildings and two (2) single-storey buildings constructed 1980.

It is well constructed with excellent structural attributes. This facility is an excellent choice to function as a temporary shelter. The building has a few limitations, since it lacks the basic amenities, and the toilet is not accessible from the inside. This is therefore not accommodative for use by persons as a shelter after a hurricane.

The administration building is still fitted with Miami shutters, which type tends to allow water to enter the building under hurricane conditions.

It is therefore recommended that storm panels be provided to cover these windows in the event of a hurricane.

### **Environment:**

The Facility is located in an open field on a gentle east to west slope. There is a drain on the west side of the facility, which takes away all surface water from the surroundings and minimizes any possibility of flooding.

The surrounding area has other buildings within a 300-ft radius which could impact the facility negatively in a Hurricane.

**Foundation:**

The foundation is constructed of reinforced concrete and 8" masonry blocks. The floor is 5" thick with reinforced concrete slabs laid on compact fill. The first floor is also 5" thick with reinforced concrete slabs supported by columns and beams. These components are in good condition showing no signs of weakness or defects.

**Frame:**

The frame of the building consists of 8" x 10" reinforced concrete columns and reinforced concrete beams - 10" x 2'. The external cladding is of 6" masonry blocks. Its internal walls and beams being 6" and "x 20" respectively. These are capable of resisting lateral loads from hurricane. The buildings are in excellent structural condition.

**Roof:**

The roof covering was changed from asphalt shingles to corrugated metal sheets affixed to 2" x 4" purlin. This was done after the roof was damaged during the passage of hurricane Luis. The roof is constructed of 2" x 6" rafters and is secured in place by a ½" steel through the foot, anchored in a reinforced concrete beam. The ceiling is of T-111 plywood. This roof-structure is capable of resisting vertical load from hurricane force winds.

**Windows:**

The windows were changed from Miami shutters to fixed wooden shutters and the doors from semi-solid panels to solid wood. These changes to the facility have made it less vulnerable to storm force winds and flying debris.

**Retrofitting:**

Install storm panels

**Cost:           \$ 1,629.00**

<b>Name of facility</b>	<b>MENTAL HOSPITAL</b>
<b>Address</b>	Skerritts Pasture
<b>Facility ID Number</b>	180
<b>GIS ID Number</b>	221
<b>Survey Date</b>	28 <sup>th</sup> April, 2001
<b>Date Constructed</b>	1929
<b>Year of major addition or change</b>	1999
<b>Was facility formally engineered?</b>	Not Known
<b>Wind Code</b>	Not known
<b>Number of buildings</b>	FOURTEEN (14)
<b>Total Square Footage</b>	30,250
<b>Facility Damage History</b>	
	<ul style="list-style-type: none"> <li>• Hurricanes Luis and Georges</li> </ul>

**Introduction:**

Constructed in 1929, these buildings have excellent structural characteristics. However, the older buildings exhibit signs of weakness and dry rot in the roof members and some galvanized sheets are corroded.

There are still buildings that were damaged during hurricane Georges that have not been repaired. These could become quite hazardous during a hurricane. The newly-constructed buildings are still without hurricane shutters. These are necessary to provide protection to the glass windows.

**Environment:**

The area around this facility has other buildings within a 300-ft radius that could impact the facility negatively in a hurricane.

The facility is located on a gentle slope from west to east approximately one hundred meters (100 m) from Holberton hospital. The land slopes gently to the east, draining into the natural water course.

**Foundation:**

The foundations for most part are constructed of masonry stones. The existing floors are of stone, with a concrete cap finish.

### **Frame/walls:**

The early buildings are constructed with a combination of 20" masonry stonewalls and 8" solid masonry blocks. The ring-beams are of concrete 8" x 20" thick. These buildings have good structural characteristics. The frames are symmetrically shaped, and the internal partition walls help to resist lateral load. However, these buildings are showing signs of aging and weathering of the wall surface. This is of concern since the stones are only fixed in place with lime mortar, and have become weak over the years, making these buildings vulnerable to earthquake action. There are four (4) new structures ranging from ages two (2) to fifteen (15) years. The walls are constructed of 6" masonry blocks. The ring-beams are also constructed of reinforced concrete 6" x 20" thick. These features, along with its intermediate and 6" x 16' beams are all capable of resisting lateral and vertical load of hurricane and earthquake.

### **Roofs:**

The roofs are a 30-degree pitch with a hip design. The frames are a combination of 3" x 4' rafters bolted to a wooden plate at the wall, while at the corridor the rafters are nailed to the wooden plate and are further supported by hurricane straps. The new buildings' roof frames are constructed of 2" x 6" rafters anchored in a 6" x 20" - thick reinforced concrete beam. The roofs are covered with galvanized sheets affixed by nailing to 1" x 4" and 2" x 4" purlins. These roofs are capable of resisting vertical load from hurricane force winds. However, the age of the roof frames of the earlier buildings is of concern. It is recommended that these roof connections be changed to a more conventional type by replacing the wooden plates with a reinforced concrete ring beam.

### **Windows/Doors:**

The buildings are fitted with an assortment of windows namely awning glass windows, Miami shutters and steel bars on the inside which are protected on the outside with wooden shutters. These windows with their added protection offer good security to the buildings from hurricane force winds and flying debris. However, the buildings fitted with Miami shutters would experience water seepage during a hurricane that can cause flooding. This type of windows is more prevalent on the new buildings. They have no fixed shutters to give protection from hurricanes.

### **Operational Vulnerability:**

The buildings are surrounded by trees that could impact them during a storm. The buildings are all detached with spacing of twenty to twenty-five feet, and are not accessible during a hurricane.

The facility does not have its own 'stand-by' power. This service is currently provided by the Antigua Public Utilities Authority (A.P.U.A.).

**Retrofitting:**

**Install wooded shutters and stand-by power.**

**Cost            \$35,000.00**

**Maintenance:**

Repair four (4) damaged buildings.

**Cost:            \$500,000.00**

<b>Name of Facility</b>	<b>MINISTRY OF FINANCE</b>
<b>Address</b>	<b>ST JOHN'S CITY</b>
<b>Facility ID Number</b>	<b>49</b>
<b>GIS ID Number</b>	<b>77</b>
<b>Survey Date</b>	<b>17<sup>th</sup> February, 2001</b>
<b>Date Constructed</b>	<b>1955</b>
<b>Year of Major Additions or Changes</b>	<b>1998</b>
<b>Was Facility formally engineered?</b>	<b>Yes</b>
<b>Wind code</b>	<b>BNS CP28- Code of Practice for wind Loads for Structural Design.</b>
<b>Number of Buildings</b>	<b>One (1)</b>
<b>Total Square Footage</b>	<b>14,871</b>
<b>Facility Damage History</b>	

- NONE

**Introduction:**

The location of this building is only 150 feet from the coastline and less than ten feet (10') above mean sea level. This puts the building at risk from storm surge and tidal wave which can be generated during a hurricane or storm.

In addition, the standby generator room is at ground level and is located about two hundred feet (200') from the coastline, making the generator susceptible to wave action and storm surge.

The windows are unprotected, making them vulnerable to airborne missiles and flying debris. Because of the building's proximity to the shoreline, serious consideration must be given to the type of activities that are conducted on the ground floor.

Recommendations are being made as follows:

- 1) That the generator room be removed from its present location to a higher elevation.
- 2) That storm panels be provided to be installed in the event of a hurricane threat.

- 3) That a break wall be built between the sea and the building to minimize the impact of wave action against the building during a storm.

**Environment:**

The area around this facility has other buildings within a 300-ft radius, which could impact the facility negatively in the event of a Hurricane.

The building is located on the west coast of downtown St John's about 200 ft from the shore line.

Constructed in 1955, this building is a three storey L-shaped structure, which has an unconventional shape. This makes this building very vulnerable to hurricane force winds.

**Frame:**

The external walls of the building are about sixteen inches thick and are capable of resisting lateral load from earthquake and hurricane.

The location of the building is about 6 ft above mean sea-level making it vulnerable to wave action, storm surge and tidal wave.

Even in its present location the building shows no sign of aging or structural deficiency.

**Roof:**

The roof is a 25-degree gable, constructed of 2" x 6" timber deck with T - 111 plywood and its covering is metal sheeting, the ends being secured around by a parapet wall.

**Windows/Doors:**

The windows are of aluminum frame with glass panels. There are no storm shutters for protection.

The building was renovated and retrofitted in 1998 to house the Ministry, however because of its proximity to the coastline, serious attention should be given to what activity should take place on the ground floor.

**Retrofitting:**

**Construct a break wall**

**Cost:           \$250,000.00**

**Install Storm panels**

**Cost:           \$15,875.00**

**Relocate generator room.**

**Cost:           \$30, 000.00**

<b>Name of Facility</b>	<b>MINISTRY OF PUBLIC WORKS</b>
<b>Address</b>	<b>ST. JOHN'S STREET</b>
<b>Facility ID Number</b>	184
<b>GIS ID Number</b>	214
<b>Survey Date</b>	7 <sup>th</sup> April, 2001
<b>Date Constructed</b>	1930
<b>Year of Major Additions or Changes</b>	1984 and 2000
<b>Was Facility Formally Engineered?</b>	YES
<b>Wind code</b>	NOT KNOWN
<b>Number of Buildings</b>	TWO (2)
<b>Total Square Footage</b>	13,800
<b>Facility Damage History</b>	
	<ul style="list-style-type: none"> <li>• NONE</li> </ul>

**Introduction:**

This facility was constructed in 1930. These buildings have recently undergone extensive renovation to include the changing of its roof, windows and doors, and replacing its timber roof with reinforced concrete.

There are no hurricane shutters or storm panels to protect the glass windows during a hurricane. These panels can be provided at a cost of EC \$3.75 per square foot.

**Environment:**

The area around this facility has other buildings and trees within a 300-ft radius, and debris that could impact the facility negatively in the event of a hurricane.

The facility's surrounding terrain is of a town setting. It is located on a gentle slope from east to west. This allows excess surface water to drain into the sea.

**Foundation:**

The foundations of buildings are constructed of 8" reinforced masonry blocks and reinforced concrete. There are no "as built" plans for the greater portion of the facility. However, there are plans for the recently built offices.

The first floors are constructed of 5"-thick reinforced concrete. These elements have little or no defect on the surface.

**Frame/Wall:**

The structural system of the buildings are constructed of 20"-thick stone wall for one of the earlier buildings and 12" x 12" x 20' reinforced concrete columns and the beams are 12" x 18" made of reinforced concrete spanning an average of 18' for the new building. The windows openings are of a moderate size. The structural characteristics of these components are sound and show no signs of defects in its members. These attributes, along with its moderate opening for the windows are capable of resisting vertical and lateral loads from hurricanes and earthquakes.

**Roofs:**

The roofs are of two types, gable and hip, both having a pitch of thirty degrees (30°). The rafters are 3" x 6" timber, connected at the base in the reinforced concrete beam. The roofs are covered with corrugated galvanized sheets, and are connected to 2" x 4" purlin by galvanized clout nails in every other corrugation at the heel, and every fourth corrugation. The roof has excellent structural characteristics, making it capable of resisting vertical loads from hurricane. However, there is need for regular maintenance to preserve its present integrity.

**Windows/Doors:**

The windows are a combination of louver glass and sliding glass windows. These windows are unprotected, making them vulnerable to air-borne missiles and flying debris. The doors are a combination of solid wood and metal glass inserts. It is therefore recommended that wooden shutters or storm panels be provided for these windows and doors, to be installed in the event of a hurricane.

**Operational vulnerability:**

The facility is comprised of two (2) two-storey buildings. The greater portion of their external cladding is masonry blocks. The original building's ground floor and walls are of stone. The building is equipped with all of the essential amenities, such as standby power and emergency water supply to allow it to function effectively after a hurricane without interruption. The building is well sited in a location that enhances its functionality.

**Retrofit:**

Install storm panels for doors and windows.

**Cost:           \$12,450.00**

**Maintenance:**

**Cost:           \$35,400.00**

<b>Name of Facility</b>	<b>NATIONAL ARCHIVES</b>
<b>Address</b>	<b>FACTORY ROAD</b>
<b>Facility ID Number</b>	297
<b>GIS ID Number</b>	247
<b>Survey Date</b>	5 <sup>th</sup> June, 2001
<b>Date Constructed</b>	1990
<b>Year of Major Additions or Changes</b>	NA
<b>Was Facility Formally Engineered?</b>	YES
<b>Wind code</b>	NOT KNOWN
<b>Number of Buildings</b>	ONE (1)
<b>Total Square Footage</b>	8,741
<b>Facility Damage History</b>	
	<ul style="list-style-type: none"> <li>• <b>Damage by Hurricane HUGO</b></li> </ul>

**Introduction:**

The building has excellent hurricane-resistant features. The columns and beams along with its load-bearing walls are capable of resisting lateral and vertical loads from hurricanes and earthquakes. However, the building is fitted with glass windows and doors, none of which have any protection. There are no shutters or storm panels readily available to be installed in the event of a hurricane.

The ceiling, constructed of sheet rock, was damaged during hurricane José. Water seeped through the roof vent and caused portions of the ceiling to collapse. This is yet to be repaired.

The flat roof of the building is leaking, and is causing further damage to the ceiling. It is therefore recommended that three coats of elastomeric roof sealant be applied to stop the leaks, and that the missing sheet rocks be replaced.

The outer walkway at the main entrance to the conference room is at the same elevation of the floor, causing these areas to be flooded during heavy rain. It is recommended that both walkways be dug up and re-established three to four inches below the floor level.

**Environment:**

The area around this facility has many trees within a 300-ft radius which could impact the facility negatively in the event of a hurricane.

The facility's surrounding terrain is of a town setting. It is located on the top of a gentle rise. The land slopes towards the west.

**Foundation:**

The foundation of buildings is constructed of masonry blocks and reinforced concrete. The thickness of the floor varies from five to six inches (5"- 6") thick, with a tile finish that is in very good condition.

**Frame/Walls:**

The external walls are constructed of 8" masonry blocks. These are load-bearing walls. The internal walls are constructed of metal studs with a sheet rock cover.

**Roof:**

The roofs are gable-pitched at 35-degrees. They are constructed of timber. The covering is galvanized sheets screwed in place to purlins. They are in excellent condition. However, there is need for regular maintenance to preserve their integrity.

**Windows/Doors:**

The windows and doors have timber frames with glass inserts.

**Retrofit:**

Install storm panels for doors and windows.

**Cost:            \$5, 450.00**

**Maintenance:**

Seal the concrete roof and repair cracks and ceiling.

**Cost:            \$ 18,450.00**

<b>Name of Facility</b>	<b>NATIONAL OFFICE OF DISASTER SERVICES</b>
<b>Address</b>	AMERICAN ROAD, ST. JOHN'S
<b>Facility ID Number</b>	161
<b>GIS ID Number</b>	76
<b>Survey Date</b>	7 <sup>th</sup> April, 2001
<b>Date Constructed</b>	1970
<b>Year of Major Additions or Changes</b>	NA
<b>Was Facility Formally Engineered?</b>	YES
<b>Wind code</b>	NOT KNOWN
<b>Number of Buildings</b>	ONE (1)
<b>Total Square Footage</b>	4,540
<b>Facility Damage History</b>	

- DAMAGE BY HURRICANES HUGO and LUIS

**Introduction:**

This building has excellent hurricane-resistant features. However, the front of the building is fitted with temper glass panels which are unprotected.

This building houses the offices of the National Office of Disaster Services (NODS). It is from this location that all the functions of the office are carried out.

The building is equipped with all of the essential amenities to allow it to function effectively during a hurricane without interruption. The building is well sited in a location that enhances its functionality.

The building has two (2) storeys including a 3000-sq. ft. basement, which is used as storage for Emergency Supplies to include those for the Sub-Regional stockpile. Antigua and Barbuda is the Focal Point for the North Eastern Caribbean and the British Virgin Islands.

The concrete roof of the building leaks whenever it rains, since there are hairline fractures in it.

The toilet facilities are inadequate for the number of staff, generally, but mostly in times of disaster, and especially when the Emergency Operations Center (EOC) has to be activated.

Secondary water supply is stored in two small tanks, with less than seventy-two hours (72 hrs) supply. There is a very large cistern on the compound which just needs to be cleaned and fitted with an electrical pump.

### **Environment:**

The area around this building has many trees and debris within a 300-ft radius which could impact the facility negatively in the event of a hurricane.

The facility's surrounding terrain is of a town setting. It is located on a gentle undulating slope. At the front and the back there is a cliff-like drop. The facility is somewhat protected by the hill range on the east.

### **Foundation:**

The foundations of buildings are constructed of reinforced masonry blocks and reinforced concrete. The floor's thickness is unknown and no building plans are available. However, the ground floor is of reinforced concrete. The first floor is constructed of timber. These elements have little or no defect on the surface.

### **Frame/Wall:**

The external walls are constructed of 8" masonry blocks with an insulation foam placed on the inside, protected by wire mesh with a plaster finish. The structural system is constructed of 12" x 12" x 14" reinforced concrete columns, spacing 12 feet on center to the front, and 20 feet on center along the longitudinal side. The beams are 12" x 16" reinforced concrete. The structural characteristics of these components are sound and show no signs of defect on its members. These attributes, along with its moderate openings for windows are capable of resisting vertical and lateral load from hurricane and earthquake.

### **Roofs:**

The roof is of reinforced concrete and is flat. It is in fairly good condition, but has hairline fractures which are causing leaks in some areas. There is need for regular maintenance, however, to preserve its integrity, and to identify cracks, and correct this problem accordingly.

**Windows/Doors:**

The windows are a combination of louver glass and store-front type at the front of the building. The louver glass windows are fitted with wooden shutters and the glass to the front is protected by burglar bars, covered with wire mesh. The single entrance and exit door to the facility is not protected. It is recommended that storm panels be provided for installation in the event of a hurricane.

**Retrofit:**

Install storm panels for doors and windows.

**Cost:           \$2, 575.00**

**Maintenance:**

Sealing of concrete roof.

**Cost:           \$ 4, 589.00**

<b>Name of facility</b>	<b>NEW WINTHROPES PRIMARY SCHOOL</b>
<b>Address</b>	NEW WINTHROPES VILLAGE
<b>Facility ID Number</b>	104
<b>GIS ID Number</b>	75
<b>Survey Date</b>	23 <sup>rd</sup> MARCH 2001
<b>Date Constructed</b>	1946
<b>Year of major addition or change</b>	1996
<b>Was facility formally engineered?</b>	NOT KNOWN
<b>Wind Code</b>	Not known
<b>Number of buildings</b>	THREE (3)
<b>Total Square Footage</b>	5,090
<b>Facility Damage History</b>	<ul style="list-style-type: none"> <li>• NO KNOWN DAMAGES</li> </ul>

### **Introduction:**

This facility was constructed in 1950, and is comprised of three (3) single-storey buildings. These buildings are symmetrically shaped, and have good structural characteristics to resist hurricane force winds. However, there are a number of factors that inhibit its effectiveness.

There are three water catchments. One is an above-ground reinforced concrete cistern and there are two rubber tanks. There is no water pump and the rainwater guttering needs to be properly connected to these tanks, to allow for maximum collection of water when it rains. It is recommended that a water pump be installed to service the facility when the government's water supply is suppressed.

The main toilet facility is not connected to the building. It is located approximately forty (40) feet away on the slope of a hill. The teachers' toilet facility, which is attached to the main building, is inadequate. The area is too small and very uncomfortable to the users. It is recommended that a new toilet facility be added to the northern end of the school.

The facility has a concrete roof that needs to be cleaned and sealed. The exposed reinforcement around the edge of the roof needs to be covered with a sand and cement plaster.

The other aspect of the buildings are the windows openings which are fitted with vent blocks and fixed wooden louvers. This makes the buildings vulnerable to hurricane force winds coming in from the north east. The impact of landslide and soil creep on the buildings is of concern, because of their location at the foot of the hill. During unusually heavy rains, the facility can be impacted negatively by landslide or soil creep during the dry season.

**Space requirement: 285 sq. ft. at an estimated cost of E.C. \$49, 500.00**

### **Environment:**

The area around this facility has houses within a 300-ft radius that could impact the buildings negatively in a hurricane. It is located on a hill with a gentle slope, which eliminates any possibility of flooding.

However, it is vulnerable to storm force winds coming in from the north east, land slides and soil creep. This is due to the fact that the school is below a hill, and during heavy rains the facility can be impact negatively by land slide, or soil creep during the dry season.

### **Foundation:**

The foundation is constructed of reinforced concrete and 8" masonry blocks and the floor is a 5" thick reinforced concrete slab which is in good condition.

### **Frame/walls:**

Their frames consist of 10" x 12" reinforced concrete columns and 8" x 18" reinforced concrete ring-beams. The external cladding is of part reinforced concrete and part masonry blocks. However, there are some minor surface cracks in the block wall that need to be repaired before they get to a more advanced stage. This, left unattended, can make the buildings vulnerable to earthquake.

### **Roof:**

The roofs are a combination of gable and shed. The shed roof is constructed of reinforced concrete and ha a few cracks around the edges, exposing the

reinforcement to the elements. It is recommended that the loose concrete around the defected areas be chipped off and the exposed reinforcement be treated with an anti- corrosive paint before recovering it.

The gable-pitched roof is approximately 30 degrees. It is constructed of 2" x 6" rafters anchored by nailing to a wooden beam and further secure in place with hurricane straps. The roof is decked with T-111 plywood and has metal corrugated sheets for its covering, fastened to 1" x 4" purlin.

**Windows/Doors:**

The windows are a combination of vent blocks and fixed wooden louvers, making the buildings vulnerable to storm-force winds and rain. It is recommended that the vent blocks be removed, and that fixed wooden louvers be replaced with wooden shutters. The doors are made of timber and are in fairly good condition.

**Shelter:**

This facility is as a designated shelter during a hurricane. It has no kitchen or shower, and the toilet facility is inadequate.

**Retrofitting:**

Install wooden shutters, electrical water pump, and new toilet block.

**Cost:            \$65,800.00**

**MAINTENANCE:**

Install rain-water guttering, repair cracks in beam and concrete roof.

**Cost:            \$ 3,567.00**

<b>Name of facility</b>	<b>OLD ROAD PRIMARY SCHOOL</b>
<b>Address</b>	Old Road Village
<b>Facility ID Number</b>	131
<b>GIS ID Number</b>	153
<b>Survey Date</b>	23 <sup>rd</sup> February, 2001
<b>Date Constructed</b>	1952
<b>Year of major addition or change</b>	NO
<b>Was facility formally engineered?</b>	YES
<b>Wind Code</b>	BNS CP28 – Code of Practice for Wind Load for Structural Design
<b>Number of buildings</b>	THREE (3)
<b>Total Square Footage</b>	8,840
<b>Facility Damage History</b>	<ul style="list-style-type: none"> <li>• Hurricane Georges</li> </ul>

**Introduction:**

Constructed in 1952, this facility is a combination of three buildings connected by a covered walkway. The buildings are well maintained, and show no sign of structural defect in its walls, beams or columns. Its proximity from the coastline makes the buildings vulnerable to storm force winds coming from the south.

The hills on the east and south side give protection to the buildings during a hurricane.

Approximately fifteen feet (15') of the covered walk roof was damaged from hurricane Luis. This portion of roof is still not repaired and could cause further deterioration of the exposed members from the elements.

The building is showing signs of erosion around the curtain areas of the foundation. This can be stopped by spouting the entire building. It is recommended that the affected areas be landscaped to cover up the exposed foundation. Some of the fascia boards are dry rotten, causing the rain water guttering to become loose and fall off.

## **Environment:**

The area around this facility has many houses and trees that could impact the building negatively in a hurricane

It is located about 500' from the coastline on a gentle east to west slope. This eliminates any possibility of flooding.

## **Foundation:**

The foundation is constructed of reinforced concrete and 8" masonry blocks. The floor slab is a 5" thick reinforced concrete slab. It is in fairly good condition, except for some minor surface cracks, which does not weaken the slab in any way.

## **Frame/ Wall:**

The building frame consists of 6" reinforced masonry blocks and 8" x 2' reinforced concrete ring beam. The intermediate beam and partition wall along with its moderate opening for windows and doors are capable of resisting lateral load from hurricane force winds. However, some general maintenance is needed. (See Retrofitting)

## **Roof:**

The roof is gable design with a pitch of thirty (30) degrees. The rafters are 2" x 6" anchored in an 8" x 2' reinforced concrete beam, secured at the foot by a ½" steel through the center of the rafter foot, decked with T-111 plywood. These features make the roof capable of resisting vertical load of hurricane force wind.

## **Windows:**

The windows are a combination of wooden shutters and decorative blocks, making the building vulnerable to flooding from storm force winds and rain. It is recommended that the decorative blocks be removed and the those areas fitted with wooden shutters to conform to the rest of the buildings. The doors are constructed of 1" x 6" v-joints and are in fairly good condition.

## **Shelter:**

A designated portion of this facility is used as a hurricane shelter. The selected buildings are an excellent choice for a shelter. These buildings are fitted with wooden shutters and solid wooden panel doors, thus making the building less vulnerable to storm force winds and rain. Lack of some basic amenities are some of the factors which inhibit the building's effectiveness as shelter.

There are no showers, kitchen and water pump.

## **Retrofitting:**

To remove decorative blocks and add shutters.

**Cost:**            \$12,500.00

## **Maintenance:**

Install rain-water guttering, repair roof and fascia board

**Cost:**            \$10,500.00

<b>Name of Facility</b>	<b>PARES CLINIC</b>
<b>Address:</b>	PARES VILLAGE
<b>Facility ID Number</b>	155
<b>GIS ID Number</b>	81
<b>Survey Date</b>	17 <sup>th</sup> February, 2001
<b>Date Constructed</b>	1961
<b>Year of Major Additions or Changes</b>	NONE
<b>Was Facility formally engineered?</b>	NOT KNOWN
<b>Wind code</b>	NOT KNOWN
<b>Number of Buildings</b>	ONE (1)
<b>Total Square Footage</b>	592
<b>Facility Damage History</b>	NOT KNOWN

**Introduction:**

This building is showing signs of aging in its frame and dry rot in the external roof components. The building lacks adequate space, which renders it limited to serve the public effectively. The facility is only fitted with two toilets, one for the staff, and the other to be used by the public. Based on the number of people using this facility on a regular basis, there should be a minimum of four toilets.

**Space requirement: 100 sq ft. at a total cost of \$175,000.00**

The view is held that this building is not suited for a clinic, and that a suitable replacement needs to be found to facilitate such an operation. Until such time, it is recommended that the missing glass be replaced, and that shutters be installed to protect the glass windows from wind-borne missiles and flying debris. It is also recommended that the corroded galvanized sheets on the roof be changed.

**Environment:**

The area around this Facility has many buildings within a 300'- radius which could impact the facility negatively in the event of a hurricane.

The facility is located in a residential area on relatively flat land.

**Foundation/floor:**

The building has a suspended wooden floor which is supported by reinforced concrete 8" block footings. The footings are about thirty inches (30") above grade, eliminating any possibility of flooding.

**Frame/ walls:**

The building's frame is constructed of 2" x 4" wooden studs. The external wall cladding is 1" x 6" lap siding, covered with a wire mesh and plaster finish. The walls and frame are exhibiting significant sign of aging and dry rot to its frame, making the building vulnerable to hurricane force winds.

**Roof:**

The roof is a 30-degree gable design. The frame is constructed of 2" x 4" rafters which are showing signs of dry rot. The roof covering is of corrugated galvanized sheets which are corroded and some sheets are loose, making the roof vulnerable to storm force winds. It is recommended that a new roof be constructed to replace the existing one.

**Windows/Doors:**

The windows are fitted with four-inch (4") louver-glass windows. A number of these glasses have fallen out leaving the building vulnerable to wind and rain. The building has two doors. One solid wood panel in the front and one metal in the rear, all of which are in good condition.

**Retrofitting:**

Shutters - Cost \$2,500.00  
Roof - Cost \$13,320.00

**Maintenance:**

- Replace Louver glass and corroded galvanized sheets
- Replace defected timber
- Paint the building

**Cost:                    \$ 10,695.00**

<b>Name of Facility</b>	<b>PARES PRIMARY SCHOOL</b>
<b>Address</b>	Pares Village
<b>Facility ID Number</b>	133
<b>GIS ID Number</b>	80
<b>Survey Date</b>	24 <sup>th</sup> February, 2001
<b>Date Constructed</b>	1990
<b>Year of Major Additions or Changes</b>	NONE
<b>Was Facility formally engineered?</b>	YES
<b>Wind code</b>	B.N.S. CP28 - Code of Practice for Wind Loads for Structural Design.
<b>Number of Buildings</b>	Two (2)
<b>Total Square Footage</b>	4,598
<b>Facility Damage History</b>	
•	NONE

**Introduction:**

This building was constructed in 1990. Its vulnerability to flooding is due to the fact that there are vent blocks on the leeward side of the building. The windward side is fitted with fixed wooden shutters, giving this side good protection from storm force winds. The exterior lights under the covered walkway are broken and need to be replaced.

A recommendation is therefore being made to remove the vent blocks and replace them with wooden shutters to conform with the other sections of the building.

**Environment:**

The facility is located in an open field on a gentle slope, which minimizes the possibility of flooding.

**Foundation/ Floor:**

The foundation is constructed of reinforced concrete 8" masonry blocks with reinforced concrete stiffeners 14' on a center.

The floor is a 5" thick reinforced concrete slab, which is in fairly good condition, however there are some minor cracks in the floor slab. It is recommended that these be fixed by cleaning of the cracks and fixing with a cement and sand mortar.

#### **Frame/Wall:**

This building was built in 1990 and is well sited. The frame is constructed of 8" x 10" reinforced concrete columns and 10 " x 20" reinforced concrete beams. The external cladding is of 6 " masonry blocks. Except for a few superficial cracks in the plastering, due to weathering, the building is in an excellent structural condition. There are no signs of defect in its beams and columns. It is capable of resisting lateral load from hurricane force winds.

#### **Windows/ Doors:**

The doors and windows are all made from 1' x 6' V- joint timber. Some of the catches on the windows and doors have become loose and have fallen off. These mechanisms need to be replaced in order to secure them in their position when opened.

#### **Roof:**

The roof is a 30-degree gable pitch. The roof's frame is constructed of 2" x 6" rafters fixed in place by ½" steel through the foot, anchored in reinforced concrete beam and decked with T-111 plywood. The roof covering is of metal corrugated sheets fastened to 1" x 4" purlin. In cases where internal walls are absent, wooden trusses are used in the roof to break the long span. This further assists in resisting the vertical load of hurricane force winds. The building is in excellent condition, but should be checked to make sure that all metal sheets are properly secured.

#### **Shelter:**

This facility can be used as a hurricane shelter, but has some deficiencies that inhibit its effectiveness. There are no showers and there is no kitchen. The vent blocks would have to be removed and fitted with shutters or storm panels that will protect the building from flying debris and storm force winds.

There is therefore need to:

- Install external lights.
- Replace catches to windows and doors.
- Build new shutters to replace vent blocks.

**Retrofitting:**

Remove vent blocks and install wooden shutters

**Cost:           \$45,943.00**

**Maintenance:**

Fix cracks in plaster and check roof sheeting.

**Cost:           \$1,934.00**

<b>Name of Facility</b>	<b>PARES SECONDARY SCHOOL</b>
<b>Address</b>	<b>PARES VILLAGE</b>
<b>Facility ID Number</b>	18
<b>GIS ID Number</b>	82
<b>Survey Date</b>	28 <sup>th</sup> April, 2001
<b>Date Constructed</b>	1970
<b>Year of Major Additions or Changes</b>	1995
<b>Was Facility Formally Engineered?</b>	YES
<b>Wind code</b>	NOT KNOWN
<b>Number of Buildings</b>	SIX (6)
<b>Total Square Footage</b>	31,600
<b>Facility Damage History</b>	
	<ul style="list-style-type: none"> <li>• NONE</li> </ul>

**Introduction:**

These buildings were constructed of structural steel in 1970. The building has excellent structural characteristics. However, there are signs of corrosion in many of the steel components. This is due to lack of maintenance to the frame for over thirty years. It is recommended that the components be chipped free of rust, and that two coats of anti-corrosive paint be applied to them. It should also be noted that some these components would need to be replaced, since they have corroded beyond repair.

The fiberglass insulation that forms the ceiling has fallen out, leaving the roof sheeting exposed. This has contributed to the excessive heat in the classrooms on the first floor. The other aspect of the roof which is of concern is the roof covering. The outside of the roof appears to be in good condition, but there are signs of oxidation between the aluminum sheets and metal purlins. It is recommended that a ceiling of plywood be installed to dissipate the heat.

The awning glass windows on both ends of the buildings are severely damaged. Much of the glass in these windows are broken, leaving the building vulnerable to hurricane force winds and rain.

The building is fitted with all of its amenities, however the toilet facility is in need of repair.

The entire leeward side of the buildings is fitted with vent blocks, thus making the building vulnerable to storm force winds and rain. (See recommendation)

### **Environment:**

The area around this facility has other buildings within a 300-ft radius which could impact the facility negatively in the event of a hurricane.

The facility is located in a lair, but was constructed with drainage around the building to take away any excess water. The land slopes gently to the west, following the natural contour of the land, draining excess surface water into the drainage.

### **Foundation:**

The foundations of the buildings are constructed of reinforced masonry blocks. The floors are of 5" reinforced concrete slabs.

### **Frame/Walls:**

The lateral load resistance systems are of a steel frame. The columns are 8" x 16" at 20' centers. The 8" x 24" beam acts as a frame for the vent blocks on the front.

### **Roofs:**

The roof is a gable design with pitches of 25 degrees. The rafters are steel frame bolted to the columns with purlin 4-foot center timber bolted to steel purlin at 3 feet on center. T-111 plywood is used as decking. The roof is covered with aluminum sheets which are all fixed in place by screws into metal purlin in every corrugation through the roofs.

### **Windows/Doors:**

The buildings are fitted with vent blocks and Miami shutters which are on the windward side of the building. These windows are in fairly good condition for light and ventilation. The doors are also in good condition and offer excellent protection to the building.

### **Shelter:**

This facility is not suited to be used as a transitory shelter.

**Retrofit:**

Replace awning windows.

**Cost:           \$3,500.00**

**Maintenance:**

Repair steel frame and roof. Replace toilet and face basins.

**Cost:                 \$ 250,500.00**

<b>Name of facility</b>	<b>PARHAM PRIMARY SCHOOL</b>
<b>Address</b>	Parham Town
<b>Facility ID Number</b>	134
<b>GIS ID Number</b>	85
<b>Survey Date</b>	23 <sup>rd</sup> February, 2001
<b>Date Constructed</b>	1969
<b>Year of major addition or change</b>	1994
<b>Was facility formally engineered?</b>	YES
<b>Are Plans Available?</b>	NO
<b>Wind Code</b>	BNS CP28 - Code of Practice for Wind Load for Structural Design
<b>Number of buildings</b>	SIX (6)
<b>Total Square Footage</b>	8,642
<b>Facility Damage History</b>	
•	NONE

**Introduction:**

This facility was constructed in 1969. It has good structural characteristics and hurricane-resistant features.

The existing roof covering was changed from asbestos sheets to 24-gauge galvanized sheets, secured in place by nailing. A new reinforced concrete ring-beam was added around the external walls, and the rafters are anchored in the beam by placing ½" steel through the foot to secure it in place.

The building is fitted with vent blocks on one side and wooden shutters on the other. It is recommended that the vent blocks be changed to conform with the rest of the building, giving the shelter better protection from storm force winds and flying debris.

The outside platform roof was damaged during a previous hurricane, and is still in a state of disrepair. The floors of the buildings are showing signs of cracking.

To eliminate the cracks and further strengthen the floor, it is recommended that a 2" reinforced concrete cap be placed over the entire/affected floors.

### **Environment:**

The area around this facility has many houses within the 300-ft radius that could impact the building negatively in a hurricane.

The facility is located in a residential area on a gentle North to South slope. This eliminates any possibility of flooding during heavy rains or hurricane.

### **Floor:**

The floors are of 5" thick reinforced concrete slabs, which have cracks in several areas of some of the floors.

### **Frame/Walls:**

The building's frame consists of reinforced concrete columns 8" x 12' x 9' 6" and the ring-beam 8' x 20" and reinforced concrete.

The external cladding is of 6" reinforced masonry blocks. This, along with the intermediate beams are capable of resisting lateral load from hurricane and earthquake.

### **Windows /doors:**

The buildings are fitted with solid wooden doors. The locks to most of the doors are missing. The windows are a combination of wooden shutters and vent blocks, which are on the leeward side of the buildings. The location of vent blocks does not eliminate the building's vulnerability to flooding from storm force winds and rain.

### **Shelter facility:**

The facility is equipped with kitchen, toilet and cistern, but there is no electric pump or showers. The windows of the designated building have wooden shutters and vent blocks. It is recommended that the vent blocks be changed to conform with the rest of the building, giving the shelter better protection from storm-force winds, rain and flying debris.

**Retrofit:**

Install wooden shutters

**Cost:            \$18,000.00**

Pour 2" concrete cap on all affected floors.

**Cost:            \$65,000.00**

**Maintenance:**

Replace locks and repair doors.

**Cost:            \$1,500.00**

<b>Name of Facility</b>	<b>POLICE HEADQUARTERS</b>
<b>Address</b>	AMERICAN ROAD
<b>Facility ID Number</b>	185
<b>GIS ID Number</b>	90
<b>Survey Date</b>	6 <sup>th</sup> June, 2001
<b>Date Constructed</b>	1972
<b>Year of Major Additions or Changes</b>	
<b>Was Facility Formally Engineered?</b>	YES
<b>Wind code</b>	NOT KNOWN
<b>Number of Buildings</b>	FOUR (4)
<b>Total Square Footage</b>	19,456
<b>Facility Damage History</b>	
	<ul style="list-style-type: none"> <li>• NONE</li> </ul>

**Introduction:**

The facility has excellent structural characteristics, and good hurricane-resistant features. There is one aspect of the structure that is of concern. On the southern end of the main building there are severe cracks in the face beam. This is due to corrosion of the reinforcement in the concrete beam.

It is therefore recommended that the defective concrete be removed and the steel chipped free of the rust. Two coats of anti-corrosive should be applied, and a sand and cement mix should be used to effect the repairs.

The building is further fitted with awning windows which are not protected on the outside, but are equipped with internal roll-up metal panels, which give protection to the building in the event of a hurricane. This protects from airborne missiles and flying debris. However, some of the windows have lost panes of glass, while others have lost blades. It is recommended that all the windows be checked and the damaged ones be repaired or replaced.

The barracks housing the male officers have suffered the same fate with its windows and the same action as above is recommended to correct these weaknesses. It should be further noted that these windows are unprotected and are vulnerable to airborne missiles and flying debris during a hurricane.

It is recommended that hurricane shutters be installed on the barracks and on the kitchen.

**Environment:**

The area around this facility has other buildings within a 300-ft radius which could impact the facility negatively in the event of a hurricane.

The facility's surrounding terrain is of a town setting. It is located on the top of a gentle rise. The land slopes towards the west.

There are many old cars stored on the compound. Debris from these cars can become airborne during a hurricane and impact the buildings negatively.

**Foundation:**

The foundation of buildings is constructed of 8" reinforced concrete blocks and reinforced concrete footing at 20 feet centers. The floor slabs are five inches (5") thick.

**Frame/Walls:**

The main building and main barrack are constructed of reinforced concrete columns and beams. The columns are 10" x 12" at twenty feet (20') centers. The beams are 10" x 24" with the intermediate beams being 10" x 20". The external cladding is 6" reinforced concrete blocks. The kitchen and canteen are constructed of reinforced concrete blocks. These structures show no signs of structural defect in the walls, columns or beams, making them capable of resisting lateral forces from hurricane and earthquake.

**Roof:**

The main building has a reinforced concrete flat roof. The roofs of the barracks, kitchen and canteen are constructed of 3" x 6" rafters with a 30-degree pitch design. The roof covering is galvanized sheets fixed in place by nailing into 2" x 4" purlins. General maintenance on the roof covering is needed.

**Windows/Doors:**

The windows are a combination of awning and louver glass. The dominant windows are awning, which require remedial work. The entrance door is a hinged glass panel door, while the other doors are of solid wood construction, and are in excellent condition.

**Operational Vulnerability:**

The facility is equipped with all of its amenities to include a cistern and standby power which allows for smooth operation during a hurricane or other emergencies. However, the unprotected and damaged windows make the buildings vulnerable to airborne missiles and flooding.

**Retrofit:**

Replace and repair windows.

**Cost:            \$4, 340.00**

Install shutters.

**Cost:            \$15, 685.00**

**Maintenance:**

Paint roof sheets and check fasteners.

**Cost:            \$ 25,400.00**

<b>Name of facility</b>	<b>POTTERS PRIMARY SCHOOL</b>
<b>Address</b>	POTTERS VILLAGE
<b>Facility ID Number</b>	135
<b>GIS ID Number</b>	92
<b>Survey Date</b>	28 <sup>th</sup> April, 2001
<b>Date Constructed</b>	1965
<b>Year of major addition or change</b>	1995
<b>Was facility formally engineered?</b>	NOT KNOWN
<b>Wind Code</b>	NOT KNOWN
<b>Number of buildings</b>	FIVE (5)
<b>Total Square Footage</b>	7,973
<b>Facility Damage History</b>	
	• <b>HURRICANE LUIS</b>

**Introduction:**

This facility is comprised of five (5) buildings, one (1) wooden building and four (4) masonry/concrete buildings. The facility received damage to its roof from hurricane Luis. The roofs were subsequently repaired. The entire roof was removed along with its existing beam. A new roof was reconstructed of 2" x 6" rafters and new ring beam with no overhang at the eave. These added features make the roof capable of resisting vertical load from hurricane force winds. The structural system of these buildings have excellent structural characteristics and show no signs of defect on its members. These attributes along with its moderate opening for windows are capable of resisting vertical and lateral load from hurricane and earthquake.

The wooden building is connected to pillars constructed from concrete blocks by the use of bolts which offer adequate holding protection to secure the building from hurricane winds.

## **Environment:**

The area around this facility has other buildings within a 300-ft radius and other debris that could impact the facility negatively in a hurricane. The facility's surrounding terrain is of a town setting. The facility is located on a gentle undulating slope from east to west.

## **Foundation:**

The foundations of the buildings are constructed of reinforced masonry blocks. The floor is a 5-in thick reinforced concrete slab, which has little or no defect in the surface.

## **Frame/ walls:**

The masonry building frames are constructed of reinforced concrete columns and beams, and the wooden building's frame is of 2" x 4" wood studs. The columns are 8" x 12" x 10'- high spacing at 20' on center. The beams are 10" x 24" with a span of 20 feet. The intermediate beams are 6" x 16". The exterior walls are 6"- thick masonry blocks which are load bearing.

## **Roofs:**

The roofs are gable frame with 2" x 6" rafters, and has a pitch of thirty degrees (30°). The rafters are connected in reinforced concrete beams at their base. The roof covering is plywood decking, 2" x 4" purlins and galvanized metal profile sheet. The sheets are secured in place by clout nails placed in every other corrugation, fastened into 2" x 4" purlins. The roof's components along with its connections of the rafters are all capable of resisting vertical load from hurricanes.

## **Windows/Doors:**

The windows are a combination of wooden shutters and vent blocks. This type of combination does not offer adequate protection to the facility from hurricane force winds and flying debris. It is therefore recommended that if this combination has to be used, that it is not used throughout the facility. However, there is one building which is equipped with all wooden shutters. This will give protection to its contents and provide an area for additional storage or shelter. Some doors are constructed of wood, while others are of metal. They are in excellent condition, and offer good protection to the buildings.

## **Shelter**

The building is a designated shelter, and is an excellent choice. It is fitted with metal doors and the windows are fitted with wooden shutters which offer adequate protection from hurricane force winds and air-borne missiles that might become active during a hurricane.

There a few problems that inhibit the overall effectiveness of the shelter. The sanitary facility is not accessible during a hurricane and the building is located on a hill, making it vulnerable to storm force winds coming from the east. It is recommended that one of the buildings at the lower elevation be fitted with wooden shutters, and is used as a shelter.

### **MAINTENANCE:**

Replace nuts and loose hinges to windows.

**Cost: \$350.00**

<b>Name of Facility</b>	<b>SCHOOL - BARBUDA</b>
<b>Address</b>	CODRINGTON, Barbuda
<b>Facility ID Number</b>	8
<b>GIS ID Number</b>	8
<b>Survey Date</b>	28 <sup>th</sup> April, 2001
<b>Date Constructed</b>	1900
<b>Year of Major Additions or Changes</b>	1970
<b>Was Facility Formally Engineered?</b>	Not known
<b>Wind code</b>	Not known
<b>Number of Buildings</b>	TWELVE (12)
<b>Total Square Footage</b>	16,811
<b>Facility Damage History</b>	
	<ul style="list-style-type: none"> <li>• Hurricanes Luis and Georges</li> </ul>

**Introduction:**

The earlier building was constructed in 1743, while the other buildings were added in the 1970's. These buildings have excellent hurricane-resistant features. However, their location, close to the coastline makes the buildings vulnerable to flooding and storm surge. The toilet facilities are not accessible during a storm.

**Environment:**

The areas around this facility have other buildings within a 300-ft radius which could impact the facility negatively in the event of a hurricane.

The facility is located on flat land approximately 100 meters from the coastline. The land slopes gently to the west draining into the sea.

**Foundation:**

The foundation for most part is constructed of reinforced masonry blocks. The existing structure which was constructed in 1743 is built of masonry stone.

### **Frame/Walls:**

The frames are constructed of a combination of masonry stone, 8" blocks, wooden 2" x 4" studs and reinforced concrete columns - 9" x 9' x 10' with spacing of 20' on center, and reinforced concrete beams 9" x 2'. The external cladding are of plywood, 18" stone wall and 8" masonry blocks. These components all have good structural characteristics. They are all capable of resisting lateral and vertical loads of hurricanes and earthquakes.

### **Roof:**

The roof is a twenty-five degree (25-) gable roof constructed of 3" x 4" rafters. The roof covering is of corrugated galvanized sheets affixed to 2' x 4' purlin. The suspended ceiling is of 3/8" plywood. There are no signs of defect in the roof components.

### **Windows/Doors:**

The buildings are fitted with an assortment of windows, namely, louver glass windows, Miami shutters, wooden shutters and vent blocks. These windows for the most part provide good protection for the buildings from hurricane force winds and flying debris. However, the buildings are fitted with vent blocks which make this area vulnerable to hurricane force winds and rain, and can cause severe flooding

### **Operational Vulnerability:**

The building is equipped with many of its amenities, however there is one weakness that could inhibit effective operations of this facility, that is, the absence of a water pump for the cistern in emergency situations.

### **Shelter:**

The designated shelter area is structurally sound, and offers good protection during hurricane. However, because of the close proximity of the building to the coastline, it is even more vulnerable to these natural hazards. As a result of this, it is recommended that the entire facility should **not** be used as a shelter.

### **Retrofit:**

There is need for the vent blocks to be replaced with wooden shutters.

**Cost:**           **\$8,785.00**

### **Maintenance:**

Secure loose galvanized sheets with screws.

**Cost:**           **\$600.00**

<b>Name of Facility</b>	<b>SEA VIEW FARM SCHOOL</b>
<b>Address</b>	Sea View Farm Village
<b>Facility ID Number</b>	137
<b>GIS ID Number</b>	158
<b>Survey Date</b>	23 <sup>rd</sup> February, 2001
<b>Date Constructed</b>	1987
<b>Year of Major Additions or Changes</b>	NONE
<b>Was Facility formally engineered?</b>	Yes
<b>Wind code</b>	BNS CP28- Code of Practice for wind Loads for Structural Design.
<b>Number of Buildings</b>	FIVE (5)
<b>Total Square Footage</b>	6,448
<b>Facility Damage History</b>	<ul style="list-style-type: none"> <li>• NONE</li> </ul>

**Introduction:**

This facility was constructed in 1987, and is comprised of five single-storey buildings which are connected by covered walkways. The buildings have excellent hurricane resistance features and structural characteristics. However, the buildings are showing signs of weakness in the floors. The floors have superficial cracks, and the mortar finish had become dislodged, leaving an unsightly appearance. It is recommended that a 2" concrete cap be placed over the floors to correct this defect.

**Environment:**

The Facility is located in a residential area on a gentle east to west slope.

There is natural drainage for surface water eliminating any possibility of flooding.

The area around this Facility has other buildings within a 300-ft radius which could impact it negatively in the event of a Hurricane.

**Foundation:**

The foundation is constructed of reinforced concrete and 8" reinforced masonry blocks, with column pads at 12' on center. The floor is constructed of 5" thick reinforced concrete slabs, laid on a compact fill. The floors of the buildings have superficial cracks and the mortar finish has become dislodged, leaving an unsightly appearance. A recommendation is therefore being made for a 2-in concrete cap to be placed over the floors to correct this defect.

**Frame/Wall:**

The building's frame is constructed of 8" x 12" reinforced concrete columns and 8" x 2" reinforced concrete beams. The external cladding is of 6" reinforced masonry blocks. The facility is capable of resisting lateral load of hurricane winds and earthquake.

**Windows/Doors:**

The buildings are fitted with wooden shutters and wooden doors, which provide excellent protection from storm force winds, rain and flying debris. However, some general maintenance is needed to the windows and doors. Some windows have loose nuts, bolts and hinges, while some doors are without locks.

**Shelter:**

This facility is also used as a shelter during a hurricane and is an excellent choice for such a purpose. It however lacks a few of the basic amenities such as kitchen facilities, showers and cistern with water pump to supply maintain an adequate supply of water, in the event the Government's supply is turned off. There are two metal tanks with a capacity of approximately 800 gallons that need to be properly connected to the guttering to collect rain water.

**Retrofitting:**

Pour a 2-in concrete cap.  
Build a cistern and secure a pump

**Cost:            \$105,200.00**

**Maintenance:**

Replace two face basins, one urinal and the rain-water guttering

**Cost:            \$ 4,500.00**

<b>Name of facility</b>	ST JOHN'S HEALTH CENTER
<b>Address</b>	St. John's
<b>Facility ID Number</b>	68
<b>GIS ID Number</b>	42
<b>Survey Date</b>	23 <sup>rd</sup> March, 2001
<b>Date Constructed</b>	1955
<b>Year of major addition or change</b>	1995
<b>Was facility formally engineered?</b>	Not known
<b>Wind Code</b>	Not known
<b>Number of buildings</b>	ONE (1)
<b>Total Square Footage</b>	7,973
<b>Facility Damage History</b>	
	<ul style="list-style-type: none"> <li>• Hurricane Luis</li> </ul>

### **Introduction:**

This building has excellent structural characteristics. The roof was damaged by Luis in 1995. A new roof was constructed of 2" x 6" rafters and a new reinforced concrete ring-beam added. The rafters were connected into the concrete beam at the base. The roof is fitted with galvanized sheets, secured in place by nailing into every other corrugation.

There is one problem that inhibits the effectiveness of the building. There are two cisterns, but there is no water pump to supply the building with water when the public supply is off.

The building needs to be painted, and its fascia boards need to be changed.

### **Environment:**

The areas around this facility have other buildings and debris within a 300-ft radius that could impact the buildings negatively in the event of a hurricane.

The facility is situated in a town setting, located on a gentle flat land slope from east to west, draining into the sea.

It is located approximately 1,000 feet from the coastline. Its vulnerability to flooding by storm surge is minimal because it is protected by the surrounding buildings.

**Foundation:**

The foundations of the building are constructed of reinforced masonry blocks. The ground floor is a 5" thick reinforced concrete slab and part timber.

**Frame/walls:**

The structural system of this building is comprised of 8" masonry walls which are load-bearing and 8" x 2' reinforced concrete ring beam. The internal walls are part masonry blocks and part timber. The building has good structural components and characteristics, and shows no sign of defect in the walls or beams. These attributes, along with its moderate window openings, make this facility capable of resisting lateral loads from hurricane force winds and earthquakes. However, the building is in need of general maintenance to enhance its overall image.

**Roof:**

The roofs are a combination of gable frame with 2" x 6" rafters, and has a pitch of 30 degrees and shed roof. The rafters are connected in reinforced concrete beams at their base. The roof covering is plywood decking set on 2" x 4" purlins and galvanized metal profile sheet fastened in place by nailing. The roofs are approximately fifteen years old and are in good condition. The roof components, along with its connections to the rafters, are all capable of resisting vertical load from hurricanes.

**Windows/Doors:**

The windows are a combination of louver glass and casement windows. These types of windows do offer some protection to the facility in normal conditions, but are quite vulnerable to air-borne missiles and flying debris during a hurricane.

It is recommended that wooden shutters or storm panels be installed to protect these windows in the event of a hurricane.

The building is fitted with metal doors and wood panels, which are in excellent condition, and offer good protection to the buildings.

**Retrofitting:**

Install wooden shutters and water pump.

**Cost:**                   **\$ 6,898.00**

**Maintenance:**

Install water pump and wooden shutters.

**Cost:**                   **\$28,050.00**

<b>Name of Facility</b>	<b>TREASURY - BARBUDA</b>
<b>Address</b>	CODRINGTON, BARBUDA
<b>Facility ID Number</b>	10
<b>GIS ID Number</b>	10
<b>Survey Date</b>	28 <sup>th</sup> APRIL, 2001
<b>Date Constructed</b>	1743
<b>Year of Major Additions or Changes</b>	1998
<b>Was Facility formally engineered</b>	Not known
<b>Wind code</b>	Not known.
<b>Number of Buildings</b>	ONE ( 1 )
<b>Total Square Footage</b>	1548
<b>Facility Damage History</b>	
	<ul style="list-style-type: none"> <li>• NONE</li> </ul>

**Introduction:**

This single-storey building was constructed in 1743. It has excellent hurricane resistance features and is well suited to function in the aftermath of hurricanes. However, its location being less than 500 feet from the coastline could be problematic during a high category storm.

The building lacks storage space. This can be provided as an addition to the existing building.

**Environment:**

The areas around this facility have other buildings within a 300-ft radius that could impact the facility negatively during a hurricane. It is located on flat land approximately 300 meters from the coastline. The land slopes gently to the west, draining into the sea.

**Foundation:**

The foundation is constructed of masonry stone. The floor is of the same type of stone with a three-inch (3") concrete cap finish. There are no defects.

**Frame/walls:**

The walls are of 20-inch thick stone. In 1998, 430 sq ft was added to the existing building. This construction is of 8" masonry blocks. The ring beam is 20" thick and the intermediate columns and beams are 9" x 9i" x 8' and 9" x 14", respectively.

The structural characteristics of this building make it capable of resisting lateral and vertical loads of hurricanes and earthquakes.

**Roof:**

The roof is constructed of 3" x 4" rafters with a 25-degree pitch. The roof covering is of corrugated galvanized sheets fastened in place by nailing to 2" x 4" purlins. The suspended ceiling is of 3/8" plywood. There are no signs of defects in the roof components.

**Windows/Doors:**

The building is fitted with louver glass windows but the majority are protected with burglar bars, while the others are suited for storm panels, which are readily available to be installed in the event of a hurricane. In addition, the building is fitted with two wooden doors in the front and two metal doors in the rear. These doors give good protection to the building during hurricanes.

**Operational vulnerability:**

The building is equipped with many of its amenities. However, there is one weakness that could inhibit the effectiveness of its operation. That is the absence of a water pump for the cistern in the case of emergency.

**Retrofitting :**

Install water pump.

**Cost:** \$1,850.00

**Maintenance:**

- None

<b>Name of Facility</b>	<b>TREASURY BUILDING</b>
<b>Address</b>	<b>ST JOHN'S CITY</b>
<b>Facility ID Number</b>	56
<b>GIS ID Number</b>	107
<b>Survey Date</b>	17 <sup>th</sup> February, 2001
<b>Date Constructed</b>	1932
<b>Year of Major Additions or Changes</b>	1991
<b>Was Facility formally engineered?</b>	Yes
<b>Wind code</b>	BNS CP28- Code of Practice for wind Loads for Structural Design.
<b>Number of Buildings</b>	One (1)
<b>Total Square Footage</b>	7,392
<b>Facility Damage History</b>	

- Damage by Hurricane HUGO

### **Introduction:**

The thick masonry stone walls of the ground floor of this offer good lateral resistance against hurricane force winds and earthquake loads. The car port adjacent to the building is showing signs of dry rot in its rafters, and the galvanized sheets are corroded and loose. These could become missiles during a hurricane and cause damage to the building.

### **Environment:**

The area around this facility has other buildings within a 300-ft radius which could impact the facility negatively in the event of a hurricane.

The building, located on a very gentle east to west slope, is vulnerable to flying debris from an old parking garage.

### **Frame/ walls:**

The building frame, being 20" thick, is capable of resisting lateral load since the large beams and columns transfer the load to the footings.

The first floor, which is constructed of timber, was severely damaged during the passage of hurricane Hugo. The entire first floor was replaced with a 5"-thick reinforced concrete floor. The walls are reconstructed of 6" reinforced masonry blocks. This further strengthens the structure, along with its 20" walls, which make the building capable of resisting lateral loads from hurricanes and earthquakes.

### **Roof:**

The roof is a gable pitch of 25 degrees. The rafters are constructed of 3" x 6" with 1"x 6" V Joint timber as its ceiling. The covering is of corrugated metal sheeting. The roof members are in excellent condition. The rafter connections at the its base makes the roof capable of resisting vertical loads from hurricane force winds.

### **Windows/Doors:**

The building is fitted with sliding glass windows and swinging double-glass doors.

### **Operational vulnerability:**

The building is equipped with all of its amenities. The only concern is that the windows and doors are of glass panel and have no shutters to give protection during a hurricane. This makes the building vulnerable to wind-borne missiles and flying debris.

Recommendations are therefore being made as follows:

- (1). That storm panels be made available to be installed in the event of a hurricane.
- (2). That the carport be demolished and rebuilt. At present, it is more of a hazard than an asset.

**Retrofitting:**

- Install storm panel for windows and doors.

**Cost:            \$7, 500.00**

- Rebuild the carport.

**Cost:            \$57, 500.00**

<b>Name of facility</b>	<b>URLINGS PRIMARY SCHOOL</b>
<b>Address</b>	URLINGS VILLAGE
<b>Facility ID Number</b>	138
<b>GIS ID Number</b>	162
<b>Survey Date</b>	28 <sup>th</sup> April, 2001
<b>Date Constructed</b>	1984
<b>Year of major addition or change</b>	NONE
<b>Was facility formally engineered?</b>	YES
<b>Wind Code:</b>	UNKNOWN
<b>Number of buildings</b>	SIX (6)
<b>Total Square Footage</b>	15,298
<b>Facility Damage History</b>	
	• LUIS

### **Introduction:**

This facility, comprised of six (6) buildings, was constructed in 1983. These buildings are all symmetrically shaped, making them less vulnerable to hurricane force winds. The roof covering is of concern, since there are signs of corrosion around the head nails and fasteners, and many of the sheets are corroded, making the covering vulnerable to hurricane force winds.

Because of the building's close proximity to the coastline, it is recommended that the metal sheets be changed to a pre-coated sheet and secured by screwing with pre-coated roof screws.

The building is fitted with Miami shutters. Many of those windows have lost their blades, while others are bent out of shape, thus preventing them from closing. The doors are in need of new locks.

The building has no shower facility.

### **Environment:**

The facility is located in on open field on a slope raising from north to south about 60' above mean sea level and about one thousand feet (1000') from the coastline. This eliminates any possibility of flooding. The facility is vulnerable to hurricane force winds coming in from the north due to its openness to the sea.

There is no "as built" plan for this facility. There have not been any changes to the existing buildings.

### **Foundation:**

The foundation is constructed of reinforced concrete and 8" masonry blocks, and the floor is a 5" reinforced concrete slab.

### **Frame/Walls:**

The frame consists of 10" x 10" reinforced concrete columns spacing at 12' on center and 10" x 2' reinforced concrete beams and intermediate beams 6" x 16" and 6" reinforced masonry blocks as its cladding. These members show no sign of structural defects and are capable of resisting lateral loads from hurricane and earthquake.

### **Roof:**

The roof is a 28 degree gable-pitched with 2" x 6" rafters are anchored in reinforced concrete beams at the foot. The partition walls also support the roofs internally. This makes for positive anchorage against vertical loads from hurricane. The decking is T-111 plywood which is covered with corrugated metal sheets fastened by nailing to 1" x 4" purlin.

### **Windows/ Doors:**

The building's windows are fitted with Miami shutters, which, for most part are in fairly good condition. The doors are of a solid wood panel construction and are in good condition.

### **Shelter**

This facility, in addition to housing the school, has two buildings which are designated as a hurricane shelter. These sections are also used for community activities. The facility has a kitchen and toilets, but no showers. The toilet facility is not accessible during a hurricane. (See floor plan). It is recommended that these two buildings be fitted with fixed wooden shutters to give better protection from storm force rains.

**Retrofitting:**

Replace six (6) lights (2ft fluorescent). Replace damaged windows.

**Cost**            **\$4578.00**

**Maintenance:**

Replace corroded metal sheeting

**Cost:**            **\$98,560.00**

<b>Name of facility</b>	<b>WILLIKIES PRIMARY SCHOOL</b>
<b>Address</b>	WILLIKIES VILLAGE
<b>Facility ID Number</b>	139
<b>GIS ID Number</b>	113
<b>Survey Date</b>	23 <sup>rd</sup> March, 2001
<b>Date Constructed</b>	1964
<b>Year of major addition or change</b>	1996
<b>Was facility formally engineered?</b>	YES
<b>Wind Code</b>	Not Known
<b>Number of buildings</b>	FOUR (4)
<b>Total Square Footage</b>	6,638

**Facility Damage History**

- LUIS

**Introduction:**

This facility, constructed in 1984, consists of four (4) single-storey buildings. The building has good hurricane-resistant features and excellent structural characteristics. The building's proximity to the coastline will cause the salt air to impact the roof's galvanized sheets negatively, causing corrosion to sheets and the connection.

It is recommended that in the future these sheets are changed to pre-coated sheets and pre-coated fasteners.

There is evidence of cracking in several areas of the floor slabs.

It is recommended that a 2" concrete cap, reinforced with #120 wire mesh be used to correct these defects. The building located on the western side has some minor cracks in the foundation wall. These should be cleaned and fixed with a sand and cement paste.

This facility received damage to portions of its roof covering from hurricane Luis. This was subsequently repaired. At present, some roof, some roof sheets are loose and need to properly secured. It is recommended that pre-coated screws be used.

The windows are made of timber and are in good condition. However, some of them have lost the catches which help to keep them in place, and, when open, some

hinges are loose and corroded. Most of the doors are without locks, and the areas around the locks are damaged, making these doors useless.

It is recommended that all the damaged doors be replaced, along with the hinges and catches on the windows.

The toilet block is not connected to the other buildings by the standard covered walkway, making this facility inaccessible during a rainstorm or hurricane. There is need for plumbing work to be carried out to replace urinals and face basins.

It is recommended that a covered walkway be built to connect the toilet block to the other buildings.

**Space requirement:           40ft x 50ft covered concrete walkway at an estimated cost of \$18, 000.00**

**Environment:**

The area around this facility has no houses within a 300-ft radius that could impact the buildings negatively in a hurricane.

The facility is located in an open field on a gentle west to east slope, which eliminates any possibility of flooding.

It is vulnerable to storm force winds coming in from the southeast.

**Foundation:**

The foundation is constructed of reinforced concrete and 8" concrete blocks with reinforced stiffer spacing at 14 feet on center. The floor is a 5"-thick reinforced concrete slab. It is recommended that a 2" concrete cap, reinforced with #120 wire mesh be used to correct these defects. The building located on the western side has some minor cracks in the foundation wall.

**Frame/ walls:**

The structural frame of the buildings is constructed of 10" x 12" reinforced concrete columns, spacing at fourteen feet (14') on center and ring-beam 10" x 12" reinforced concrete. The intermediate beams are 6" x 16". The internal and external walls are of 6" reinforced concrete blocks. These members show signs of structural defects, and are capable of resisting lateral loads from earthquakes and hurricane force winds.

## Roof:

The roofs are gable pitched of 25-degrees, constructed of 2" x 6" rafters, which are anchored at the foot in the concrete beam with ½" steel strapped over the rafters for positive anchorage and is decked with T-111 plywood. The roof's covering is of galvanized sheets secured by nailing in every other corrugation into 2" x 4" purlins spacing at 4 feet on center.

At present, some roof, some roof sheets are loose and need to properly secured. It is recommended that pre-coated screws be used.

## Windows/Doors:

The windows and doors are made of 1" x 6" timber. These types of windows and doors have good wind-resistant characteristics that will give good protection to the buildings from hurricane force winds, wind-borne missiles and rain.

Some of the windows have lost the catches and some hinges are loose and corroded. Most of the doors are without locks, and the areas around the locks are damaged.

## Shelter

This facility is used as a transitory shelter. It has all of its amenities. This facility can be an excellent shelter after the repairs are done to the roof, windows and doors.

### RETROFITTING:

Install urinals, face basins. Build covered walk. Replace doors and locks.  
Pour a 3" concrete cap.

**Cost:           \$ 36,386.00**

### MAINTENANCE:

**Fix cracks, replace catches, corroded hinges and lights**

**Cost:           \$6,500.00**

## 4.0

## RECOMMENDATIONS

After looking at the weaknesses and strengths of these facilities, I am of the view that the following should be implemented, urgently, or as soon as is practicable.

- Permanent “purpose-built” shelters should be constructed at strategic locations on the island in accordance with guidelines set out in the National Shelter Policy. These facilities should be constructed with all the necessary amenities with internal access. An examination of the present situation indicates that it is imperative that permanent shelters should be constructed. This will remove the additional burden placed on the school facilities used as transitory shelters.
- All critical Government facilities should be fitted with hurricane shutters or storm panels.
- Water storage facilities and, where applicable, cisterns with water pumps and standby power should be built/acquired.
- There should be on-going inspection of all Government buildings, followed by regular maintenance to prevent defects.
- Where mitigation intervention is needed, retrofitting should be implemented.
- Serious consideration should be given to enhancing the security of the school facilities, since most of the damage to these facilities are caused by vandalism.
- All roofs covered with corrugated metal sheets should be fastened in place with the appropriate screws and washers and 2" x 4" be used as purlin.
- All School buildings identified as shelters should be fitted with fixed wooden shutters and solid wooden or metal doors.
- Roofs that are fixed to wooden plates should have hurricane metal straps as an additional support for safe anchorage.
- Where galvanize is used as roofing cover on buildings close to coastline, the sheets should be pre-coated with an anti-corrosive agent and the appropriate screws and washers used to secure them.

TABLE 1- LIST OF BUILDINGS ASSESSED

6/18/01

FAC ID	GIS ID	BUILDING/SCHOOL	LOCATION	# FLOORS	YEAR BUILT
2	5	Antigua Girls High School	St. John's	2	1886
110	98	Bendals Primary School	Bendals Village	1	1970
143	212	Bishopgate Street Clinic	St. John's	1	1994
114	122	Clare Hall Secondary School	Clare Hall	1	1969
181	220	Fiennes Institute	St. John's	1	1929
36	102	Fire Station - St. John's	St. John's	2	1956
264	134	Freemans Village Primary School	Freemans Village	1	1962
48	34	General Post Office	St. John's	2	1967
119	196	Golden Grove Primary School	Golden Grove	1	1961
148	39	Grays Farm Health Center	Grays Farm	1	1955
11	11	Hanna Thomas Hospital - BARBUDA	Barbuda	1	1970
123	163	Irene B. Williams	Swetes Village	2	1993
149	202	Jennings Clinic	Jennings	1	1996
125	142	Jennings Primary School	Jennings	2	1998
266	145	John Hughes Primary School	John Hughes Village	1	1965
128	147	Liberta Primary School	Liberta Village	1	1960
129	155	Mary E. Pigott School	St. John's	2	1980
180	221	Mental Hospital	Sutherlands Development	1	1929
49	77	Ministry of Finance	St. John's	3	1968
184	214	Ministry of Public Works	St. John's	2	1965
297	247	National Archives	St. John's	2	1985
161	76	National Office of Disaster Services	St. John's	2	1975

TABLE 1- LIST OF BUILDINGS ASSESSED

6/18/01

FAC ID	GIS ID	BUILDING/SCHOOL	LOCATION	# FLOORS	YEAR BUILT
104	75	New Winthropes Primary School	New Winthropes Village	1	1946
131	153	Old Road Primary School	Old Road Village	1	1952
155	81	Pares Clinic	Pares Village	1	1969
133	80	Pares Primary School	Pares Village	1	1991
18	82	Pares Secondary School	Pares Village	2	1970
134	85	Parham Primary School	Parham Town	1	1970
185	90	Police Headquarters	St. John's	2	1971
135	92	Potters Primary School	Potters Village	1	1946
8	8	School - BARBUDA	Barbuda	1	1743
137	158	Sea View Farm Primary School	Sea View Farm Village	1	1988
68	42	St. John's Health Center	St. John's	2	1955
10	10	Treasury - BARBUDA	Barbuda	1	1743
56	107	Treasury Department - ANTIGUA	St. John's	2	1932
138	162	Urlings Primary School	Urlings Village	1	1984
139	113	Willikies Primary School	Willikies Village	1	1964

TABLE 2 - LIST OF BUILDINGS TO BE RETIRED AS SHELTERS

6/18/01

FAC ID	GIS ID	NAME OF SHELTER	REASON FOR RETIRING
266	145	JOHN HUGHES SCHOOL	Has all vent blocks, weak walls and no concrete headers. Highly vulnerable to hurricane and earthquake.
155	81	PARES CLINIC	Inadequate space for operation.
18	82	PARES SECONDARY SCHOOL	Too open on the leeward side. Difficult to protect. Extremely vulnerable to flooding.
8	8	SCHOOL IN BARBUDA (HOLY TRINITY)	Too close to the coastline. Vulnerable to flooding and tidal wave.

TABLE 3 - SUMMARY OF SHELTER PROVISIONS

6/18/01

FAC ID	GIS ID	FACILITY	AREA sq ft	STORAGE sq ft	KITCHEN	TOILET	CIST gals	PUMP	GEN
2	5	Antigua Girls High School	20640	180	1	6	20000	✓	☐
110	98	Bendals Primary School	12953	120	1	9	40000	✓	☐
143	212	Bishopgate Street Clinic	800	0	1	2	400	☐	☐
114	122	Clare Hall Secondary School	29248	200	1	13	30000	✓	☐
181	220	Fiennes Institute	20808	650	1	28	0	☐	✓
36	102	Fire Station - St. John's	5685	210	1	6	20000	✓	✓
264	134	Freemans Village Primary School	3100	0	0	0	0	☐	☐
48	34	General Post Office	14871	240	1	10	0	☐	✓
119	196	Golden Grove Primary School	11537	0	1	8	10000	✓	☐
148	39	Grays Farm Health Center	2635	80	1	5	0	☐	☐
11	11	Hanna Thomas Hospital - BARBUDA	7433	250	1	7	20000	✓	✓
123	163	Irene B. Williams	20800	120	1	14	35000	✓	☐
149	202	Jennings Clinic	2264	90	1	3	10000	☐	☐
125	142	Jennings Primary School	12983	120	1	14	16000	✓	☐
266	145	John Hughes Primary School	5152	90	0	11	20000	☐	☐
128	147	Liberta Primary School	9681	0	1	13	15000	☐	☐
129	155	Mary E. Pigott Primary School	16324	90	1	16	15000	✓	☐
180	221	Mental Hospital	30250	330	2	16	10000	☐	✓
49	77	Ministry of Finance	14871	500	1	12	0	☐	✓
184	214	Ministry of Public Works	13800	220	1	12	12000	✓	✓
297	247	National Archives	8741	1000	1	6	30000	✓	✓
161	76	National Office of Disaster Services	4540	3000	1	4	0	☐	✓

TABLE 3 - SUMMARY OF SHELTER PROVISIONS

6/18/01

FAC ID	GIS ID	FACILITY	AREA sq ft	STORAGE sq ft	KITCHEN	TOILET	CIST gals	PUMP	GEN
104	75	New Winthropes Primary School	5090	1	0	4	8000		
131	153	Old Road Primary School	8840	0	1	16	8000		
155	81	Pares Clinic	592	0	0	0	800		
133	80	Pares Primary School	4598	80	1	7	10000	✓	
18	82	Pares Secondary School	31600	192	1	14	30000		
134	85	Parham Primary School	8642	80	1	9	30000		
185	90	Police Headquarters	19456	650	1	20	45000	✓	✓
135	92	Potters Primary School	7973	80	0	10	0		
8	8	School - BARBUDA	16811	180	1	6	8000		
137	158	Sea View Farm Primary School	6448	90	1	7	1600		
68	42	St. John's Health Centre	7973	200	1	7	8000		
10	10	Treasury - BARBUDA	1548	80	0	4	0		✓
56	107	Treasury Department - ANTIGUA	7392	350	1	8	800	✓	✓
138	162	Urlings Primary School	15298	120	1	14	30000	✓	
139	113	Willikies Primary School	6638	80	0	7	15000	✓	

TABLE 4 - SUMMARY COST OF MAINTENANCE AND RETROFIT WORK

6/18/01

FAC ID	GIS ID	FACILITY	MAINTENANCE	SHUTTERS	FACILITIES	RETROFIT
2	5	Antigua Girls High School	\$850.00	\$5,250.00		\$0.00
110	98	Bendals Primary School	\$6,587.00	\$0.00		\$0.00
143	212	Bishopgate Street Clinic	\$4,300.00	\$375.00	\$1,675.00	\$14,500.00
114	122	Clare Hall Secondary School	\$51,000.00	\$28,600.00		\$1,500.00
181	220	Fiennes Institute	\$4,850.00	\$3,500.00	\$0.00	\$450.00
36	102	Fire Station - St. John's	\$35,000.00	\$15,000.00	\$250.00	\$5,500.00
264	134	Freemans Village Primary School	\$0.00	\$6,500.00	\$0.00	\$100,000.00
48	34	General Post Office	\$125,000.00	\$19,500.00	\$650.00	\$1,500.00
119	196	Golden Grove Primary School	\$17,460.00	\$4,785.00	\$450.00	\$0.00
148	39	Grays Farm Health Center	\$3,854.00	\$1,413.00	\$0.00	\$4,575.00
11	11	Hanna Thomas Hospital - BARBUDA	\$850.00	\$0.00	\$0.00	\$0.00
123	163	Irene B. Williams	\$25,675.00	\$0.00	\$0.00	\$10,500.00
149	202	Jennings Clinic	\$10,875.00	\$5,000.00	\$0.00	\$0.00
125	142	Jennings Primary School	\$4,500.00	\$35,000.00	\$0.00	\$0.00
266	145	John Hughes Primary School	\$6,589.00	\$20,050.00	\$850.00	\$210,000.00
128	147	Liberta Primary School	\$850.00	\$4,350.00	\$650.00	\$5,250.00
129	155	Mary E. Pigott Primary School	\$16,500.00	\$1,629.00	\$850.00	\$625.00
180	221	Mental Hospital	\$500,000.00	\$5,000.00	\$0.00	\$30,000.00
49	77	Ministry of Finance	\$0.00	\$15,875.00	\$30,000.00	\$250,000.00
184	214	Ministry of Public Works	\$35,000.00	\$12,450.00	\$0.00	\$0.00
297	247	National Archives	\$18,450.00	\$5,450.00		\$650.00
161	76	National Office of Disaster Services	\$4,589.00	\$2,575.00	\$0.00	\$0.00

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TABLE 4 - SUMMARY COST OF MAINTENANCE AND RETROFIT WORK

6/18/01

FAC ID	GIS ID	FACILITY	MAINTENANCE	SHUTTERS	FACILITIES	RETROFIT
104	75	New Winthropes Primary School	\$3,567.00	\$15,460.00	\$0.00	\$49,340.00
131	153	Old Road Primary School	\$10,500.00	\$9,481.00	\$0.00	\$1,600.00
155	81	Pares Clinic	\$10,695.00	\$2,500.00	\$650.00	\$65,000.00
133	80	Pares Primary School	\$1,934.00	\$45,943.00	\$850.00	\$0.00
18	82	Pares Secondary School	\$250,000.00	\$500.00	\$1,200.00	\$3,506.00
134	85	Parham Primary School	\$1,500.00	\$18,000.00	\$0.00	\$65,000.00
185	90	Police Headquarters	\$25,400.00	\$15,685.00	\$0.00	\$0.00
135	92	Potters Primary School	\$35,000.00	\$0.00	\$0.00	\$0.00
8	8	School - BARBUDA	\$8,785.00	\$0.00	\$0.00	\$0.00
137	158	Sea View Farm Primary School	\$1,950.00	\$0.00	\$2,600.00	\$105,200.00
68	42	St. John's Health Centre	\$28,050.00	\$6,898.00	\$0.00	\$1,680.00
10	10	Treasury - BARBUDA	\$0.00	\$0.00	\$0.00	\$1,850.00
56	107	Treasury Departemnt - ANTIGUA	\$0.00	\$7,500.00	\$57,500.00	\$0.00
138	162	Urlings Primary School	\$98,560.00	\$4,328.00	\$0.00	\$250.00
139	113	Willikies Primary School	\$6,500.00	\$0.00	\$1,500.00	\$36,386.00

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## EXPLANATION TO TABLE - 5

This section gives an assessment of the facilities and their vulnerability to natural hazards, which hazards may impact them from time to time- namely, hurricanes, earthquakes, storm surge, flooding and drought.

For example, buildings that are in close proximity to the coastline would be considered most vulnerable to storm surge and hurricanes. Facilities in this location would receive a score of two (2) which signifies that significant damage would take place, or three (3) which signifies that the hazard is life-threatening.

It is the view that all structures are vulnerable to earthquakes, and a score of one (1) should be given, except in cases where the structural integrity of the building is questionable. The score is changed from a minimum of one (1) to a maximum of three (3).

TABLE 5 - SUMMARY OF VULNERABILITY TO NATURAL HAZARDS

6/18/01

FAC ID	GIS ID	BUILDING	DROUGHT	FLOOD	EARTHQUAKE	HURRICANE	STORM SURGE	TOTAL
2	5	Antigua Girls High School	1	0	1	2	0	4
110	98	Bendals Primary School	0	1	1	2	0	4
143	212	Bishopgate Street Clinic	2	1	2	1	0	6
114	122	Clare Hall Secondary School	0	0	1	2	0	3
181	220	Fiennes Institute	1	0	2	1	0	4
36	102	Fire Station - St. John's	0	0	1	2	0	3
264	134	Freemans Village Primary School	0	1	1	1	0	3
48	34	General Post Office	0	1	2	2	2	7
119	196	Golden Grove Primary School	0	0	1	2	0	3
148	39	Grays Farm Health Center	1	0	1	2	0	3
11	11	Hanna Thomas Hospital - BARBUDA	2	2	1	2	2	7
123	163	Irene B. Williams	0	0	1	1	0	2
149	202	Jennings Clinic	0	1	1	2	0	4
125	142	Jennings Primary School	0	1	1	2	0	4
266	145	John Hughes Primary School	0	1	1	2	0	4
128	147	Liberta Primary School	0	1	2	2	0	5
129	155	Mary E. Pigott School	0	0	1	1	0	2
180	221	Mental Hospital	1	0	1	1	0	3
49	77	Ministry of Finance	0	2	1	2	3	8
184	214	Ministry of Public Works	1	0	1	1	0	3
297	247	National Archives	1	0	1	2	0	4
161	76	National Office of Disaster Services	0	0	1	1	0	2

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TABLE 5 - SUMMARY OF VULNERABILITY TO NATURAL HAZARDS

6/18/01

FAC ID	GIS ID	BUILDING	DROUGHT	FLOOD	EARTHQUAKE	HURRICANE	STORM SURGE	TOTAL
104	75	New Winthropes Primary School	0	1	2	2	0	5
131	153	Old Road Primary School	0	0	2	3	1	6
155	81	Pares Clinic	2	0	1	2	0	5
133	80	Pares Primary School	0	0	1	1	0	2
18	82	Pares Secondary School	1	1	1	2	0	5
134	85	Parham Primary School	0	0	1	2	0	3
185	90	Police Headquarters	0	0	1	0	0	1
135	92	Potters Primary School	1	0	1	1	0	3
8	8	School - BARBUDA	1	3	1	3	3	11
137	158	Sea View Farm Primary School	1	0	1	1	0	3
68	42	St. John's Health Center	0	1	1	2	1	5
10	10	Treasury - BARBUDA	1	2	1	2	2	8
56	107	Treasury Department - ANTIGUA	1	1	1	1	0	4
138	162	Urlings Primary School	0	0	1	3	0	4
139	113	Willikies Primary School	0	0	1	2	1	4

TABLE 6 - SHELTER ACCOMMODATION BY DISTRICT

6/18/01

FAC ID	GIS ID	DISTRICT	NAME OF FACILITY	SQ FT	NO OF PERS
2	5	City West	Antigua Girls High School	1900	80
110	98	St. Mary's North	Bendals Primary School	5963	144
114	122	Rural East	Clare Hall Secondary School	3200	133
264	134	All Saints West	Freemans Village Primary School	3069	128
119	196	Rural South	Golden Grove Primary School	11537	200
123	163	All Saints East & St. Luke	Irene B. Williams	17025	800
125	142	St. Mary's	Jennings Primary School	12983	300
266	145	All Saints East & St. Luke	John Hughes Primary School	5152	60
128	147	St. Paul	Liberta Primary School	3201	133
129	155	Rural South	Mary E. Pigott School	6050	254
104	75	St. George	New Winthropes Primary School	5090	212
131	153	All Saints East & St. Luke	Old Road Primary School	8840	69
133	80	St. Peter	Pares Primary School	4943	77
134	85	St. Peter	Parham Primary School	8642	260
135	92	St. George	Potters Primary School	4006	166
137	158	All Saints West	Sea View Farm Primary School	2100	87
138	162	St. Mary's South	Urlings Primary School	3472	145
139	113	St. Phillip North	Willikies Primary School	5922	130

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## EXPLANATION TO TABLE - 7

Table - 7 gives an assessment of the buildings by describing in terms familiar to use in British Codes. The siting characteristics of each building site, the effect of the topography, surrounding ground roughness and effect of size and height of each building.

The calculation of wind loads on structures is made based on the determination of the basic wind speed,  $V$  appropriate to the particular geographic location.

The basic wind speed  $V$  is multiplied by the factors  $S_1$ ,  $S_2$  and  $S_3$  which modify the basic wind speed and give the design wind speed  $V_s$ .

The design wind speed is then converted to a dynamic pressure which is then used in the design of parts and portions of the structure.

$S_1, S_2$  and  $S_3$  which are used to modify the basic wind speeds are modification factors where  $S_1$  is the **topography factor**,  $S_2$  is the **ground roughness, building size and height above ground factor**, and  $S_3$  is a factor which takes account of **the degree of security required and the period of time in years during which there will be exposure to the wind**.

The significance of the Topography factors is given in the following table:

	TOPOGRAPHY	VALUE OF $S_1$
a	All cases except those in b and c below.	1.00
b	Very exposed hill slopes and crests where acceleration of the wind is known to occur.  Valleys shaped to produce funneling of the wind.  Sites that are known to be abnormally windy due to some local influence.	1.1
c	Steep-sided, enclosed valleys with a reputation for being sheltered from all winds.	0.9

The factor  $S_2$  takes account of the combined effect of ground roughness, the variation of wind speed with height above ground and the size of the building or component part under consideration.

**For code purposes, the ground roughness is divided into four categories and buildings and their elements into three classes as follows:**

Ground roughness 1 - Long fetches of open, level or nearly open country with no shelter.

Ground roughness 2 - Flat or undulating country with obstructions such as hedges around fields, scattered windbreaks of trees and occasional buildings.

Ground roughness 3 - Surfaces covered by large numerous obstructions.  
Examples are well-wooded or forest areas and towns and their suburbs.

Ground roughness 4 - Surfaces covered by large numerous obstructions with a general roof height of about 82 feet or more.

The wind speed fluctuates from moment to moment and can be averaged over any chosen period of time. The shortest period over which wind speed is normally measured is about three (3)seconds and it has been found that a 3-second gust is of such a size that it may envelop obstacles up to 65 feet across. The longer the averaging time for the gust, the larger is the obstacle that may be enveloped. For this reason, three classes have been selected.

Class A - All units of cladding, glazing and roofing and their immediate fixings, and individual members of unclad structures.

Class B - All buildings and structures where neither the greatest horizontal nor the greatest vertical dimension exceeds 165 feet.

Class C - All buildings and structures whose greatest horizontal or greatest vertical dimension exceeds 165 feet.

In addition, as assessment of the flood risk potential, damage by hurricane-blown missiles and the effect of storm surge is given in (table 5)????

The last table in this section describes the structural characteristics of each building. The roof structure, roof connection details, structural frame and wall construction are described.

TABLE 7 - TOPOGRAPHY

6/18/01

FAC ID	GIS ID	NAME OF FACILITY	TOPOG FAC	SIT/LOC	GROUND FACTOR	SIZE/HEIGHT
2	5	Antigua Girls High School	Conforms with standard condition S1=1.0	Crest of hillside range	Ground roughness factor 2. Less vulnerable	Class B/ 5 meters or less
110	98	Bendals Primary School	Conforms with standard condition S1=1.0	Inland. Flat, open area.	Ground Roughness Factor 2 - less vulnerable	Class B/ 5 meters or less
143	212	Bishopgate Street Clinic	Conforms with standard condition S1=1.0	Inland. Sheltered, developed area.	Ground Roughness Factor 2 - less vulnerable	Class B/ 5 meters or less
114	122	Clare Hall Secondary School	Conforms with standard condition S1=1.0	Inland. Developed area. Gentle slope.	Ground Roughness Factor 2 - less vulnerable	Class B/ 5 meters or less
181	220	Fiennes Institute	Conforms with standard condition S1=1.0	Hillside. Developed area.	Ground Roughness Factor 2 - less vulnerable	Class B/ 5 meters or less
36	102	Fire Station - St. John's	Conforms with standard condition S1=1.0	Coastal. Gentle slope. Town setting	Ground Roughness Factor 1 - most vulnerable	Class B/ 8 meters or less
264	134	Freemans Village Primary School	Conforms with standard condition S1=1.0	Inland. Flat open plain. Developed area.	Ground Roughness Factor 2 - less vulnerable.	Class B/ 5 meters or less.
48	34	General Post Office	Greater exposure. Increased winds due to topography. S1 = 1.1	Coastal. Flat. Town setting.	Ground Roughness Factor 1 - most vulnerable	Class B/ 8 meters or less
119	196	Golden Grove Primary School	Conforms with standard condition S1=1.0	Gentle slope. Developed area.	Ground Roughness Factor 2 - less vulnerable.	Class B/ 5 meters or less.

TABLE 7 - TOPOGRAPHY

6/18/01

FAC ID	GIS ID	NAME OF FACILITY	TOPOG FAC	SIT/LOC	GROUND FACTOR	SIZE/HEIGHT
148	39	Grays Farm Health Center	Conforms with standard condition S1=1.0	Developed area. Coastal. Sheltered.	Ground Roughness Factor 2 - less vulnerable.	Class B/5 meters or less.
11	11	Hanna Thomas Hospital - BARBUDA	Greater exposure. Increased winds due to topography. S1 = 1.1	Coastal. Flat. Open plain.	Ground Roughness Factor 1 - most vulnerable	Class B/5 meters or less.
123	163	Irene B. Williams	Conforms with standard condition S1=0.9	Sheltered. Gentle slope. Developed area.	Ground Roughness Factor 2 - less vulnerable	Class B/6 meters or less
149	202	Jennings Clinic	Conforms with standard condition S1= 1.0	Flat. Developed area. Sheltered.	Ground Roughness Factor 2 - less vulnerable	Class B/ 5 meters or less
125	142	Jennings Primary School	Conforms with standard condition S1= 1.0	Coastal. Flat. Open field.	Ground Roughness Factor 2 - less vulnerable	Class B/8 meters or less
266	145	John Hughes Primary School	Greater exposure. S1 = 1.1	Crest of hill (sheltered)	Ground roughness factor 2. Less vulnerable.	Class B/ 5 meters or less
128	147	Liberta Primary School	Conforms with standard condition S1=1.0	Hillside. Sheltered. Developed area.	Ground roughness factor 2. Less vulnerable.	Class B/ 5 meters or less
129	155	Mary E. Pigott School	Conforms with standard condition S1=1.0	Gentle slope. Open field.	Ground roughness factor 2. Less vulnerable.	Class B/ 6 meters or less
180	221	Mental Hospital	Conforms with standard condition S1=1.0	Inland. Developed area. Gentle slope.	Ground roughness factor 2. Less vulnerable	Class B/ 6 meters or less

TABLE 7 - TOPOGRAPHY

6/18/01

FAC ID	GIS ID	NAME OF FACILITY	TOPOG FAC	SIT/LOC	GROUND FACTOR	SIZE/HEIGHT
49	77	Ministry of Finance	Greater exposure. Increased wind speed due to topography factor. S1 = 1.1	Coastal, flat developed area.	Ground roughness factor 2. Most vulnerable	Class B/ 9 meters or less
184	214	Ministry of Public Works	Conforms with standard condition S1=1.0	Inland. Flat developed area.	Ground roughness factor 2. Less vulnerable	Class B/ 6 meters or less
297	247	National Archives	Greater exposure S1 = 1.1	Crest of hill. Open field.	Ground roughness factor 1 - most vulnerable.	Class B/8 meters or less
161	76	National Office of Disaster Services	Greater exposure S1 = 1.0	Crest of hillside range	Ground roughness factor 1 - most vulnerable	Class B/9 meters or less
104	75	New Winthropes Primary School	Greater exposure S1 = 1.0	Inland. Hillside range developed area.	Ground roughness factor 2 - Less vulnerable.	Class B/6 meters or less.
131	153	Old Road Primary School	Greater exposure S1 = 1.0	Coastal side of hill range	Ground roughness factor 2 - Most vulnerable.	Class B/5 meters or less.
155	81	Pares Clinic	Conforms with standard condition S1=1.0	Inland. Flat developed area.	Ground roughness factor 2 - Less vulnerable.	Class B/4 meters or less.
133	80	Pares Primary School	Conforms with standard condition S1=1.0	Inland developed area. Gentle slope.	Ground roughness factor 2 - Less vulnerable.	Class B/5 meters or less.
18	82	Pares Secondary School	Conforms with standard condition S1=1.0	Inland. Gentle slope. Flat.	Ground roughness factor 2 - Less vulnerable.	Class B/8 meters or less.

TABLE 7 - TOPOGRAPHY

6/18/01

FAC ID	GIS ID	NAME OF FACILITY	TOPOG FAC	SIT/LOC	GROUND FACTOR	SIZE/HEIGHT
134	85	Parham Primary School	Conforms with standard condition S1=1.0	Developed area. Gentle slope.	Ground roughness factor 2 - Less vulnerable.	Class B/5 meters or less.
185	90	Police Headquarters	Conforms with standard condition S1=0.9	Gentle slope, sheltered area.	Ground roughness factor 2 - Less vulnerable.	Class B/8 meters or less.
135	92	Potters Primary School	Greater exposure. S1 = 1.0	Open field. Hill crest.	Ground roughness factor 1 - Most vulnerable.	Class B/5 meters or less.
8	8	School - BARBUDA	Greater exposure. Increased winds due to topography. S1 = 1.1	Coastal. Flat. Developed area.	Ground roughness factor 1 - Less vulnerable.	
137	158	Sea View Farm Primary School	Conforms with standard condition S1=1.0	Gentle slope. Developed area	Ground roughness factor 2 - Less vulnerable.	Class B/5 meters or less.
68	42	St. John's Health Center	Greater exposure. S1 = 1.0	Coastal. Flat. Developed area.	Ground roughness factor 1. Most vulnerable.	Class B/8 meters or less.
10	10	Treasury - BARBUDA	Greater exposure. Increased winds due to topography. S1 = 1.1	Coastal. Flat. Developed area.	Ground roughness factor 1. Most vulnerable.	Class B/5 meters or less.
56	107	Treasury Department - ANTIGUA	Greater exposure. Gentle slope. S1 = 1.0	Coastal. Town setting.	Ground roughness factor 1. Most vulnerable.	Class B/8 meters or less.
138	162	Urlings Primary School	Greater exposure. Increased winds due to topography. S1 = 1.1	Hillside range. Coastal	Ground roughness factor 1. Most vulnerable.	Class B/5 meters or less.

TABLE 7 - TOPOGRAPHY

6/18/01

FAC ID	GIS ID	NAME OF FACILITY	TOPOG FAC	SIT/LOC	GROUND FACTOR	SIZE/HEIGHT
139	113	Willikies Primary School	Greater exposure. S1 = 1.1	Gentle slope. Coastal, open field.	Ground roughness factor 1. Most vulnerable.	Class B/5 meters or less.

TABLE 8 - STRUCTURAL ASSESSMENT

6/18/01

FAC ID	GIS ID	NAME OF FACILITY	SHELTER	ROOF STRUCTURE	ROOF DETAILS	FRAME	WALLS	WINDOWS	DOORS
2	5	Antigua Girls High School	✓	2" x 6" rafters. Galvanize gable with 12" overhang - aniled.	Rafters connected to reinforced concrete beam 2 feet.	Part steel frame, part wood frame, and part masonry blocks.	Timber and 6" masonry blocks.	Louvers and wooden shutters.	Solid wood panel.
110	98	Bendals Primary School	✓	2" x 6" rafters. Gable roof. Galvanize secured by nails.	Rafters connected to reinforced concrete beam.	Steel frame.	6" masonry blocks.	Wooden shutters.	Solid wood panel.
143	212	Bishopgate Street Clinic	✓	2" x 6" rafters. Gable roof. Galvanize secured by nails.	Rafters connected to wooden beam with metal straps.	Wooden frame.	High rib plywood plaster.	Miami shutters and fixed wooden shutters.	Solid wood panel and metal.
114	122	Clare Hall Secondary School	✓	Steel rafters. 10 feet o.c. 2" x 6" rafters. Galvanize covering. 12" overhang.	Steel rafters reinforced with concrete at base.	Steel frame reinforced with concrete.	6" masonry blocks	Awning. Miami. Wooden.	Wooden. Metal.
181	220	Fiennes Institute	✓	Rafters 3" x 4" and 2" x 6". Plywood ceiling. Galvanize cover.	Rafters anchored at base in reinforced concrete nad metal straps.	Reinforced concrete masonry blocks.	6" and 8" masonry blocks	Awning. Wooden and Miami.	Solid wood and metal.
36	102	Fire Station - St. John's	✓	2" x 6" rafters and plywood ceiling, covered with galvanize.	Rafters anchored at base in reinforced concrete beam	Reinforced concrete columns and beams.	Reinforced concrete and 6" masonry blocks	Miami. Glass Panel.	Solid wood.

TABLE 8 - STRUCTURAL ASSESSMENT

6/18/01

FAC ID	GIS ID	NAME OF FACILITY	SHELTER	ROOF STRUCTURE	ROOF DETAILS	FRAME	WALLS	WINDOWS	DOORS
264	134	Freemans Village Primary School	✓	2" x 6" rafters. Plywood ceiling. Galvanize sheets nailed.	Rafters anchored at base in reinforced concrete.	Reinforced concrete and 6" masonry blocks.	6" masonry blocks	Miami and wooden.	Metal
48	34	General Post Office		3" x 6" rafter. Plywood ceiling. Galvanized sheets nailed.	Rafters anchored at base in reinforced concrete.	Reinforced concrete columns and beams.	6" masonry blocks	Metal	Metal
119	196	Golden Grove Primary School	✓	2" x 6" rafters - 32 on center. Gable 25 deg pitch.	Rafters anchored in poured reinforced concrete beam. Galvanize sheets nailed.	8" x 10" reinforced concrete columns - 8 feet on center.	Poured reinforced concrete and timber.	Wooden shutters.	Solid wooden and metal.
148	39	Grays Farm Health Center		Gable roof - 25 deg. 2" x 6" rafters 32 o.c. plywood ceiling.	Rafters anchored in poured reinforced concrete beam. Galvanize sheets.	NA	6" masonry blocks	Louver glass and wooden shutters	Solid wooden panels
11	11	Hanna Thomas Hospital - BARBUDA		Gable and hip - 20 deg. 2" x 6" rafters.	Galvanized sheets nailed. Rafters anchored in poured concrete beam.	8" x 8" columns spaced at 14 feet and 8" x 24" rign beam	6" masonry blocks	Louver glass and Miami shutters	Metal and solid wood panel.
123	163	Irene B. Williams	✓	Galvanize shed roof with 12" overhang.	Rafters connected to concrete ring beam 2" x 6".	Reinforced concrete columns and beams.	6" masonry blocks	50% awning and 50% vent blocks.	Steel.

TABLE 8 - STRUCTURAL ASSESSMENT

6/18/01

FAC ID	GIS ID	NAME OF FACILITY	SHELTER	ROOF STRUCTURE	ROOF DETAILS	FRAME	WALLS	WINDOWS	DOORS
149	202	Jennings Clinic		Gable roof - 30 deg. 2" x 6" rafters. Suspended ceiling of plywood.	Rafters anchored in reinforced concrete beam. Galvanized sheets - nailed.	8" x 8" column 14 feet center and 8" x 24" ring beam reinforced concrete.	6" masonry blocks	Awning	Solid flush.
125	142	Jennings Primary School	✓	Gable and octagonal roof. 30 deg. 3" x 6" rafters 32 o.c. plywood ceiling.	Rafters anchored at base in concrete beam.	8" x 12" reinforced concrete columns and 8" x 24" beams.	6" masonry blocks	Vent blocks and awning.	Steel
266	145	John Hughes Primary School	✓	Gable roof. 35 deg. 2" x 6" rafters. 42" o.c. plywood ceiling.	Rafters connected in poured concrete ring beam.	Portal steel frame. Reinforced concrete.	6" masonry blocks.	Vent blocks and wooden shutters.	Steel and wood panel.
128	147	Liberta Primary School	✓	Gable roof 25 deg. 2" x 6" rafters. 32 o.c. plywood ceiling	Rafters anchored at base in concrete ring beam.	8" x 8" reinforced concrete columns and 8" x 16' beams.	6" masonry blocks.	Vent blocks and wooden shutters.	Wooden panel.
129	155	Mary E. Pigott School	✓	Gable roof. 25 deg. 2" x 6" rafters. 32" o.c. Plywood ceiling.	Rafters anchored in concrete ring beam.	8" x 10" reinforced concrete columns and 8" x 24" beams.	6" masonry blocks.	Wooden shutters and Miami shutters	Wooden panel.
180	221	Mental Hospital		Gable and hip roofs. 30 deg. Roof 3" x 4" and 2' x 6" rafters o.c.	Rafters bolted to plate and in reinforced concrete beam.	20" stone wall and 6" blocks and wood studs.	20" stone wall. 6" blocks and wood studs	Wooden shutters and awning.	Solid wood and metal panel.

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TABLE 8 - STRUCTURAL ASSESSMENT

6/18/01

FAC ID	GIS ID	NAME OF FACILITY	SHELTER	ROOF STRUCTURE	ROOF DETAILS	FRAME	WALLS	WINDOWS	DOORS
49	77	Ministry of Finance	✓	Galvanize hip roof. 25 deg. Suspended ceiling.	Rafters connected to concrete ring beam 2" x 6".	Reinforced concrete columns and beams.	6" masonry blocks.	Glass awning.	Solid wood panel.
184	214	Ministry of Public Works	✓	Hip and gable. 25 and 30 deg. Roof 2" x 6". Rafters 32" o.c. suspended ceiling.	Rafters connected in poured concrete ring beam.	Reinforced concrete columns and beams.	8" blocks - Reinforced concrete walls	Sliding glass and awning	Solid wood and metal.
297	247	National Archives	✓	Hip roof. 35 deg. Suspended ceiling. Galvanize sheets.	Structural steel rafters bolted to steel columns.	Structural steel frame in concrete columns and beams.	8" masonry blocks	Awning	Steel frame. Tamper glass.
161	76	National Office of Disaster Services	✓	Reinforced concrete.	Reinforced concrete	Reinforced concrete columns and beams.	8" masonry blocks.	Louver glass, glass, wooden shutters.	Aluminum frame. Glass panel.
104	75	New Winthropes Primary School	✓	Flat concrete and gable. 30 deg. 2" x 6" rafters. 32 o.c.	Rafters strapped to wood plate and nailed to galvanize sheets.	Reinforced columns and beams	8" masonry blocks	Fixed wooden louvers and vent blocks.	Solid wood and metal
131	153	Old Road Primary School	✓	2" x 6" rafters. Gable 25 deg Pitch. 16-inch overhang.	Rafters connected to concrete beam. 2" x 6" trusses 12 feet on center	Reinforced concrete columns and beams. Pipe columns. Reinforced concrete beams 8" x 24".	6" masonry blocks.	50% wooden shutters and 50% vent blocks	Solid wood and metal

141

TABLE 8 - STRUCTURAL ASSESSMENT

6/18/01

FAC ID	GIS ID	NAME OF FACILITY	SHELTER	ROOF STRUCTURE	ROOF DETAILS	FRAME	WALLS	WINDOWS	DOORS
155	81	Pares Clinic		Gable roof - 30 deg. 2" x 4" rafters.	Rafters toe-nailed to wooden plate.	NA	2" x 4" Wooden studs.	Louver glass.	Solid wood panel and metal.
133	80	Pares Primary School	✓	Gable roof - 25 deg. Pitch. 2" x 6" rafters. 32" o.c.	Rafters connected in poured reinforced concrete beams.	8" x 12" columns. 20 feet centers. 8" x 20" ring beam.	6" masonry blocks	Wooden shutters and vent blocks.	Solid wood 1" x 6" G & T
18	82	Pares Secondary School		Structural steel. 20 feet on center	Rafters connected by bolts to steel column.	Structured steel columns. 20 feet centers. Steel beam bolted to columns	8" masonry blocks and vent blocks.	Awning, Miami shutters and louver glass.	Solid wood panels.
134	85	Parham Primary School	✓	25 deg. gable. 2" x 6" rafters 32" on center	Rafters connected in poured reinforced concrete beams.	8" x 12" reinforced concrete columns 15 feet on center. 8" x 24" ring beam.	6" masonry blocks	Wooden shutters and vent blocks.	Solid wooden door - 1" x 6" G&T.
185	90	Police Headquarters		Reinforced concrete. Flat and 28 deg gable- pitched 3" x 6". 32" on center.	Rafters connected in poured reinforced concrete beams.	10" x 16" reinforced concrete columns 20 feet on center. 10" x 32" ring beam.	8" masonry blocks	Awning	Aluminum frame glass panel and solid flush louver doors.
135	92	Potters Primary School	✓	2" x 6' rafters - 32" on center. Gable roof 25 - 30 deg.	Rafters connected in poured reinforced concrete beams.	NA	6" masonry and timber.	Wooden shutters	Metal and wood.

TABLE 8 - STRUCTURAL ASSESSMENT

6/18/01

FAC ID	GIS ID	NAME OF FACILITY	SHELTER	ROOF STRUCTURE	ROOF DETAILS	FRAME	WALLS	WINDOWS	DOORS
8	8	School - BARBUDA		25 deg. 3" x 12" rafters. Hardboard ceiling.	Galvanized sheets - nailed. Rafters fixed in poured reinforced concrete.	8" x 10" reinforced concrete columns 20 feet on center. 8" x 32" ring beam.	6" masonry blocks	Louver glass, wooden shutters and vent blocks.	Solid flush and wooden plywood.
137	158	Sea View Farm Primary School	✓	Gable roof. 25 deg. 2" x 6" rafters. 32" o.c. Plywood ceiling.	Rafters connected in concrete ring beam.	Reinforced concrete columns and beams.	6" masonry blocks.	Wooden shutters.	Wooden panels.
68	42	St. John's Health Center		Hip roof - 25 deg. 2" x 6" rafters spaced 2 feet on center.	Rafters anchored in poured reinforced concrete beam. Galvanize sheets - nailed.	NA	6" masonry blocks	Glass in steel frame.	Metal and wooden panel.
10	10	Treasury - BARBUDA		Gable - 25 deg. 3" x 4" rafters - 2 feet on center.	Galvanized sheets nailed. Rafters anchored in poured reinforced concrete beam.	NA	Stone and 6" masonry blocks	Louver glass.	Metal and solid wood panel.
56	107	Treasury Department - ANTIGUA		Hip roof. 25deg. 3" x 6" rafters.	Rafters anchored in reinforced concrete beam. Galvanize sheets - screwed.	Masonry stone nad concrete blocks.	20" masonry stone and 6" masonry blocks.	Sliding glass.	Aluminum frame with glass panel.
138	162	Urlings Primary School	✓	Gable roof. 28 deg. 2" x 6" rafters in 2' x 6" o.c.	Rafters anchored at ring beam 1" x 4" purlins. Galvanize sheet nails	Reinforced concrete columns and beams.	6" masonry blocks	Miami shutters.	Solid wood panel

TABLE 8 - STRUCTURAL ASSESSMENT

6/18/01

FAC ID	GIS ID	NAME OF FACILITY	SHELTER	ROOF STRUCTURE	ROOF DETAILS	FRAME	WALLS	WINDOWS	DOORS
139	113	Willikies Primary School	✓	Gable roof. 25 deg. 2" x 6" rafters in 2' x 6" o.c.	Rafters anchored in reinforced concrete beam. 2" x 4" purlin. galvanize sheets - nailed.	Reinforced concrete columns and beams.	6" masonry blocks	Woden shutters	Solid wood of 1" x 6" timber.



**Structural Vulnerability Assessment of Selected  
Government Facilities:  
Antigua and Barbuda**

**Floor Plans**

**Post-Georges Disaster Mitigation Project  
in Antigua & Barbuda and St. Kitts & Nevis**

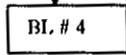
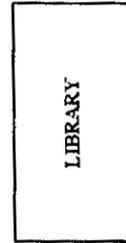
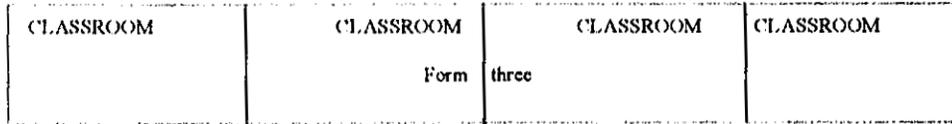
**July 2001**

**Post-Georges Disaster Mitigation in Antigua & Barbuda and St. Kitts & Nevis is implemented by the Organization of American States, Unit for Sustainable Development and Environment for USAID-Jamaica/Caribbean Regional Program**

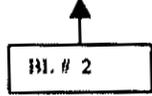
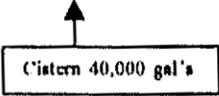
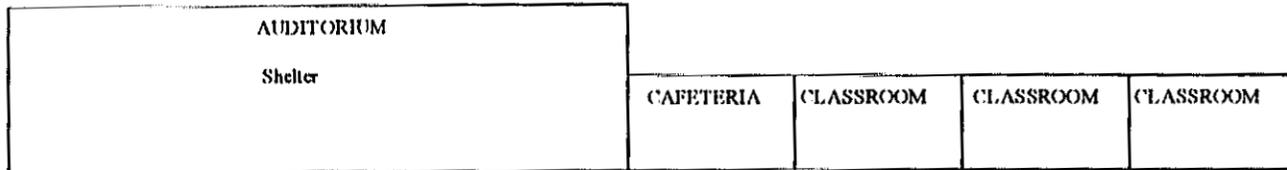
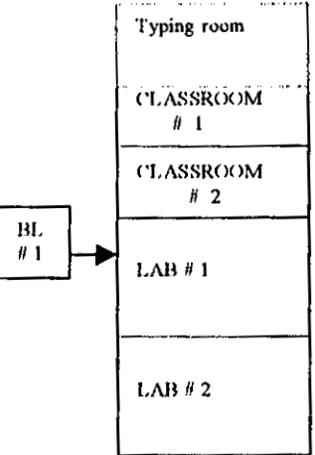
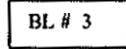
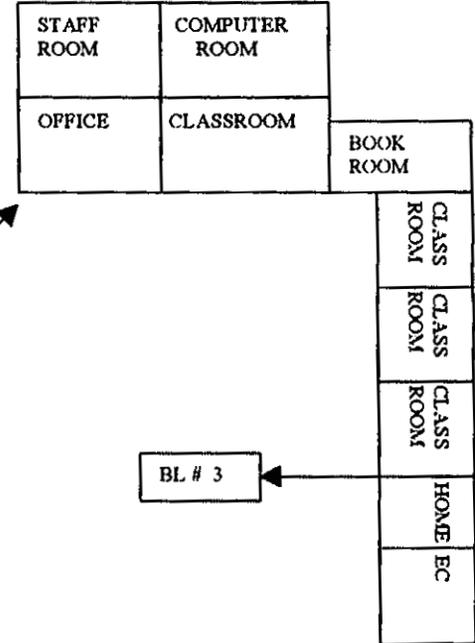
Organization of American States  
Unit of Sustainable Development and Environment  
1889 F Street NW Washington DC 20006  
<http://www.oas.org/pgdm>

This report was prepared under contract with the OAS by Everton Cornelius of VEC Consulting, with review assistance by the Antigua/Barbuda National Office of Disaster Services and Public Works Department.

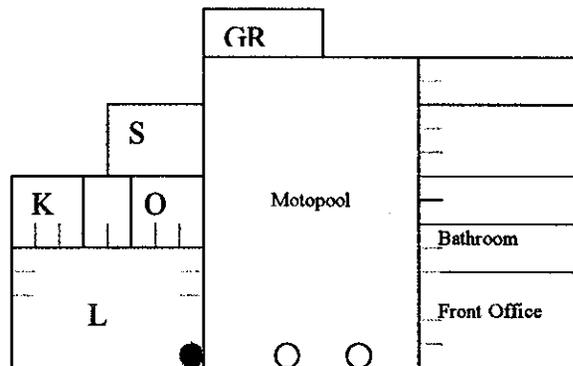
# CLARE HALL SECONDARY SCHOOL



1. Built in 1969
2. Total # of Buildings 8
3. Block 2 is the area designated as shelter, with a total area of 4,860 sqf. Shelter capacity 200
4. The total square footage = 23,788 (- 2,560 which is wood)
5. This building is a two-story Building and is the only Building with a Hip roof, all the other buildings have Gable roof.
6. Block 4 and the Typing room are the only two wooden Structures as part of this Facility.
7. Block 4, which is of Plywood, will require major repairs shortly.
8. Geographical location GR 253938



## St. Johns Fire Station



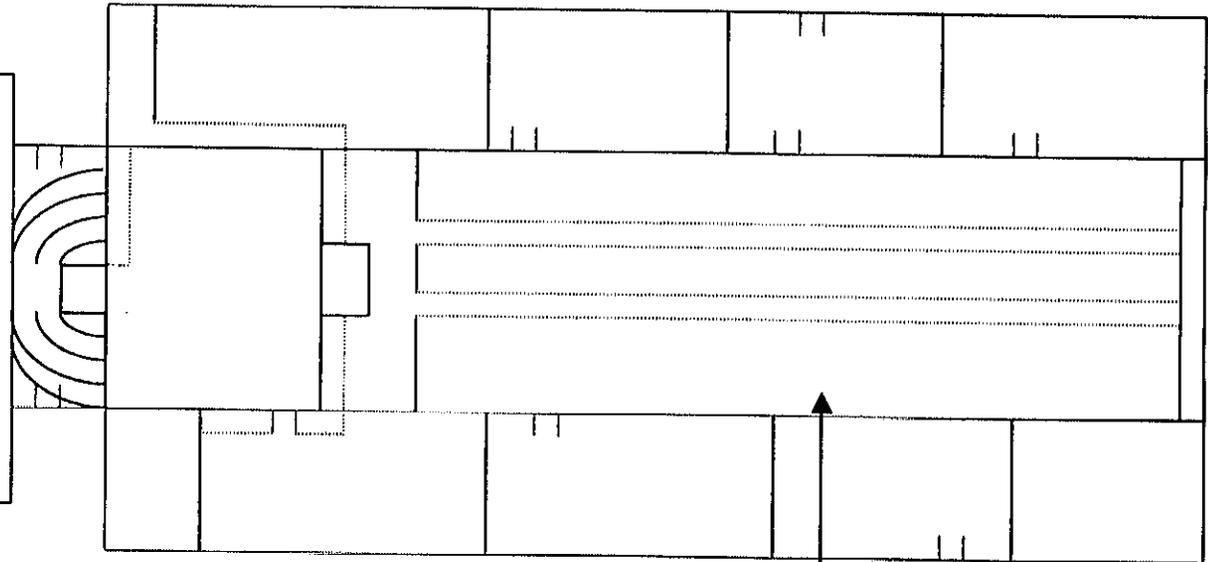
1. Built in 1956
1. The Total Square Footage of This Facility is 5,685.
2. The yellow area represents two-story block. The top Floor is sleeping quarters.
3. The additions to this Facility Was added at different Intervolves over time.
4. The area is well drained and Don't have a history of Flooding.
6. The Building has no Shutters
7. Geographical Location GR240931

# General Post Office

Mail Boxes

Mail Boxes

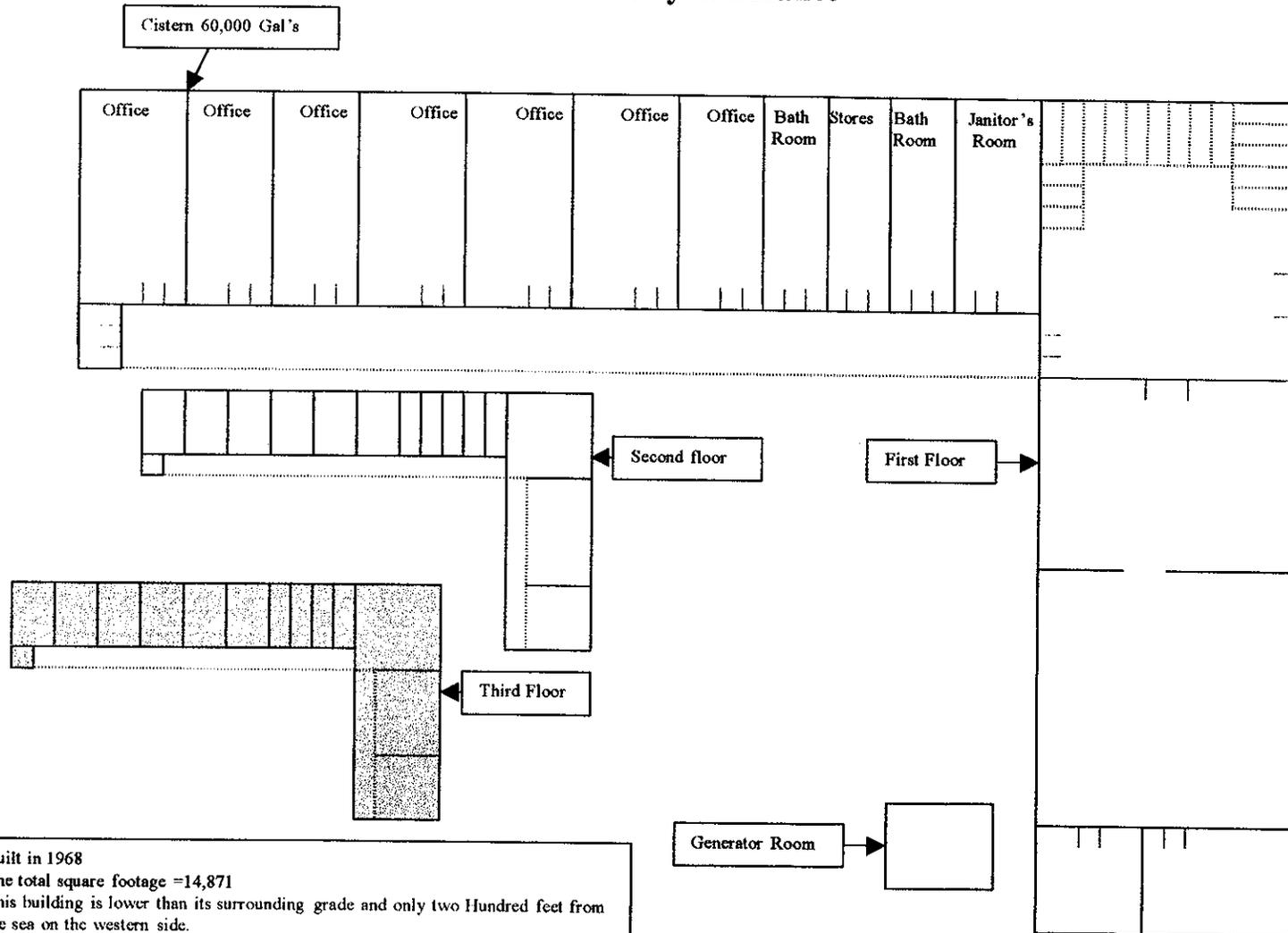
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Coat yard

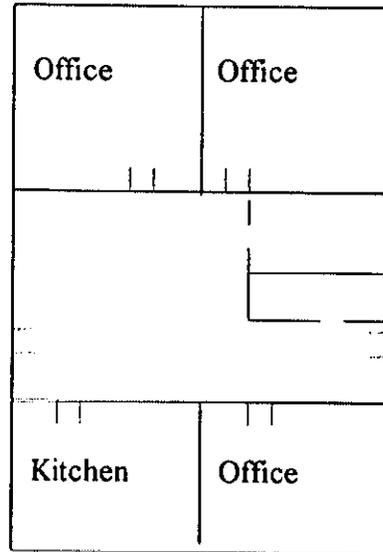
1. Built in 1967
2. One Building Facility
3. Total square Footage = 17,600
4. Flat shed roof
5. This is a two story Building
6. Geographical Location GR222938
7. Yellow represents two story
8. This building has no shutters

# Ministry of Finance



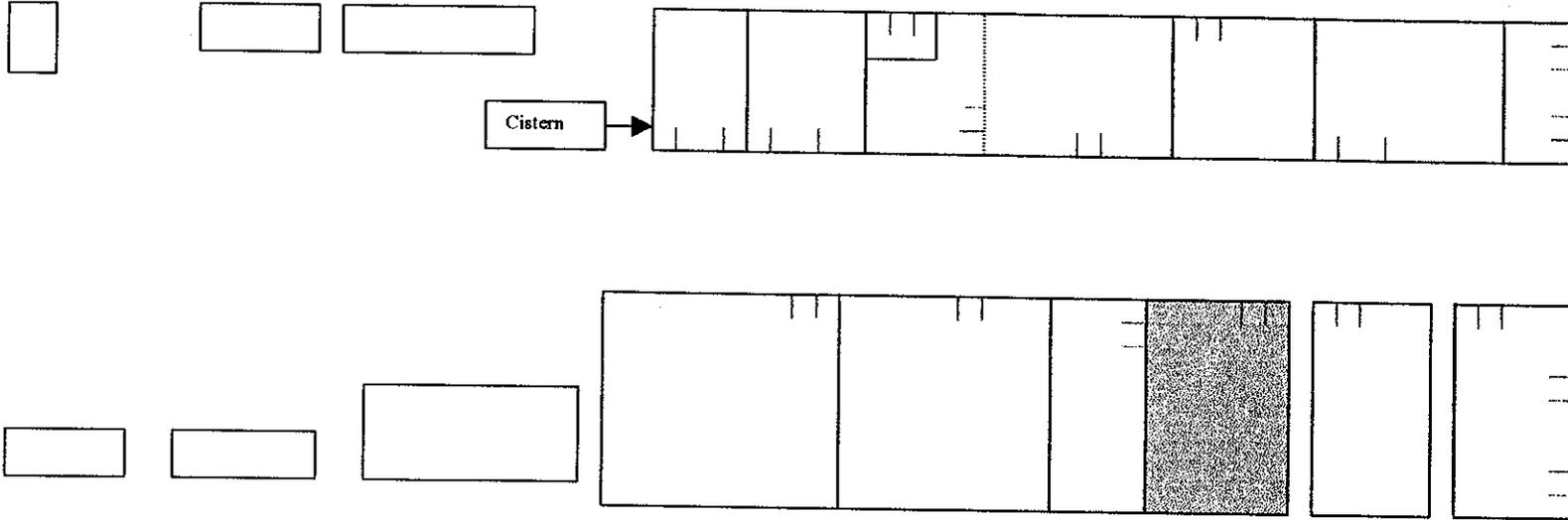
1. Built in 1968
2. The total square footage =14,871
3. This building is lower than its surrounding grade and only two Hundred feet from the sea on the western side.
4. Wooden Doors, Building has no shutters
5. Single Building Facility, three story
6. Geographical Location GR 222938
7. The yellow represents the two story area
8. Pink area represents the three story area

## Bishop Gate street Clinic



- 1. Built in 1994
- 2. Single building facility
- 3. Total square footage 800
- 4. Geographical location GR 233933

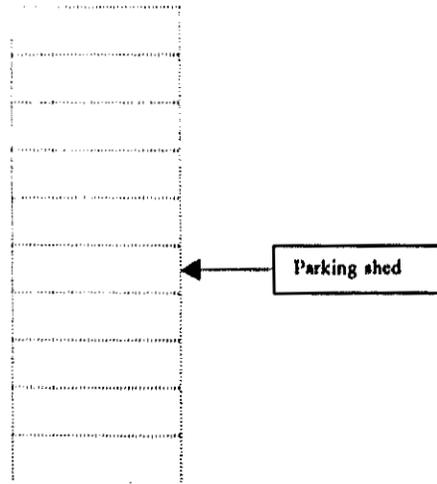
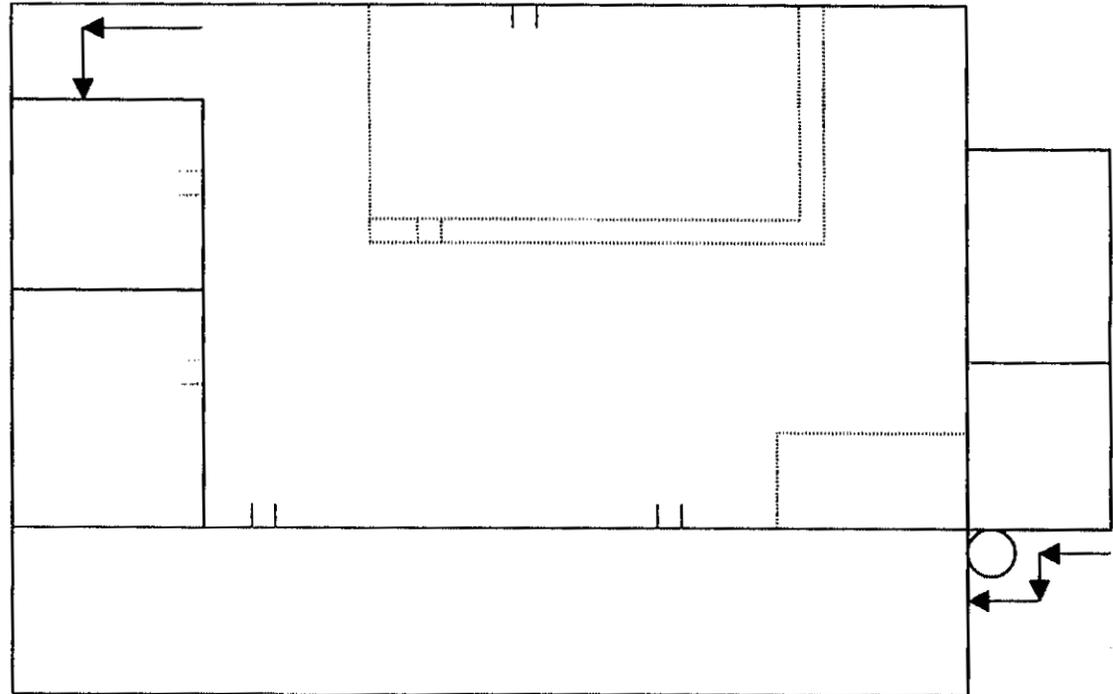
# Ministry of Public Works



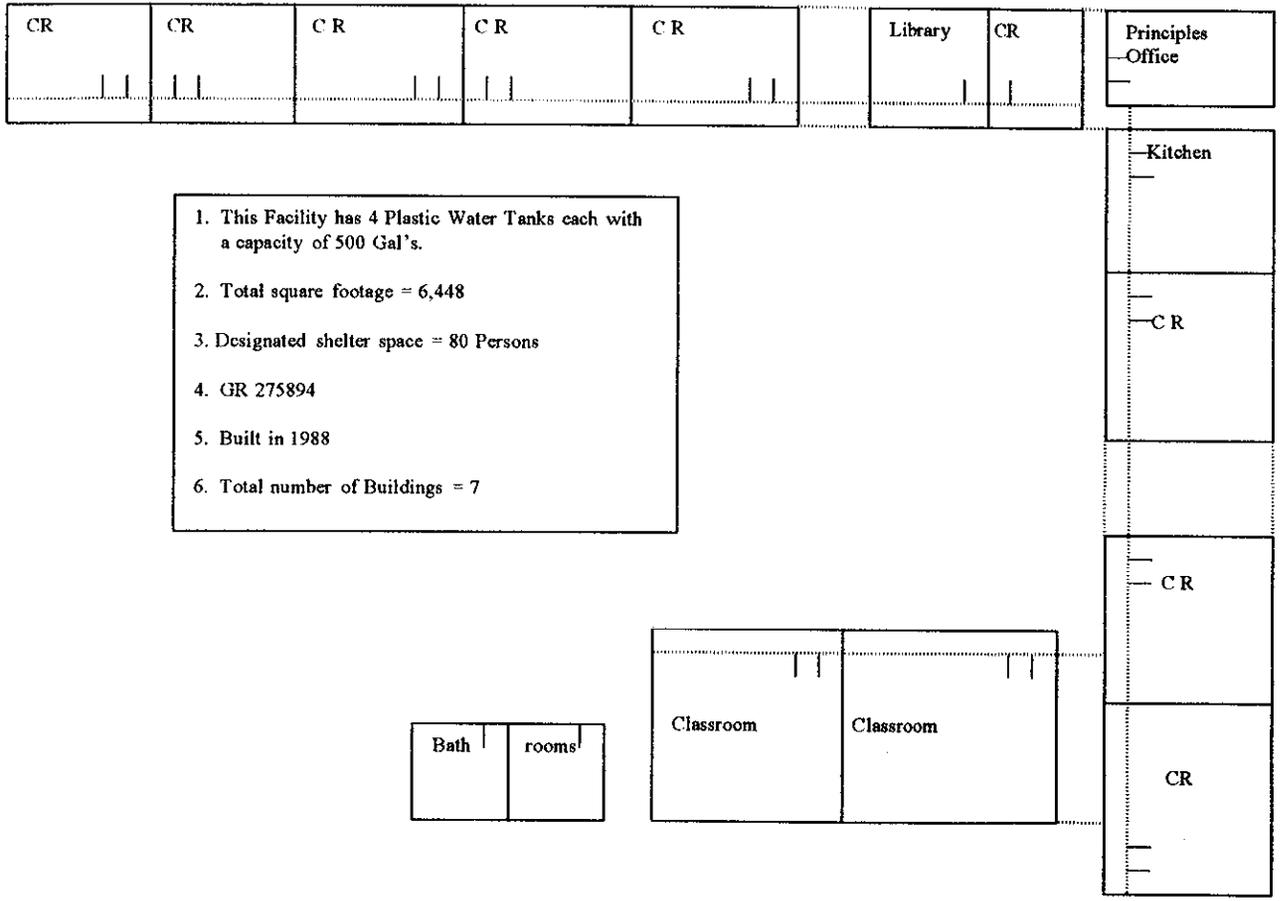
- 1. Total square footage = 13,800
- 2. Built in 1965
- 3. Location GR 229937

# Treasury

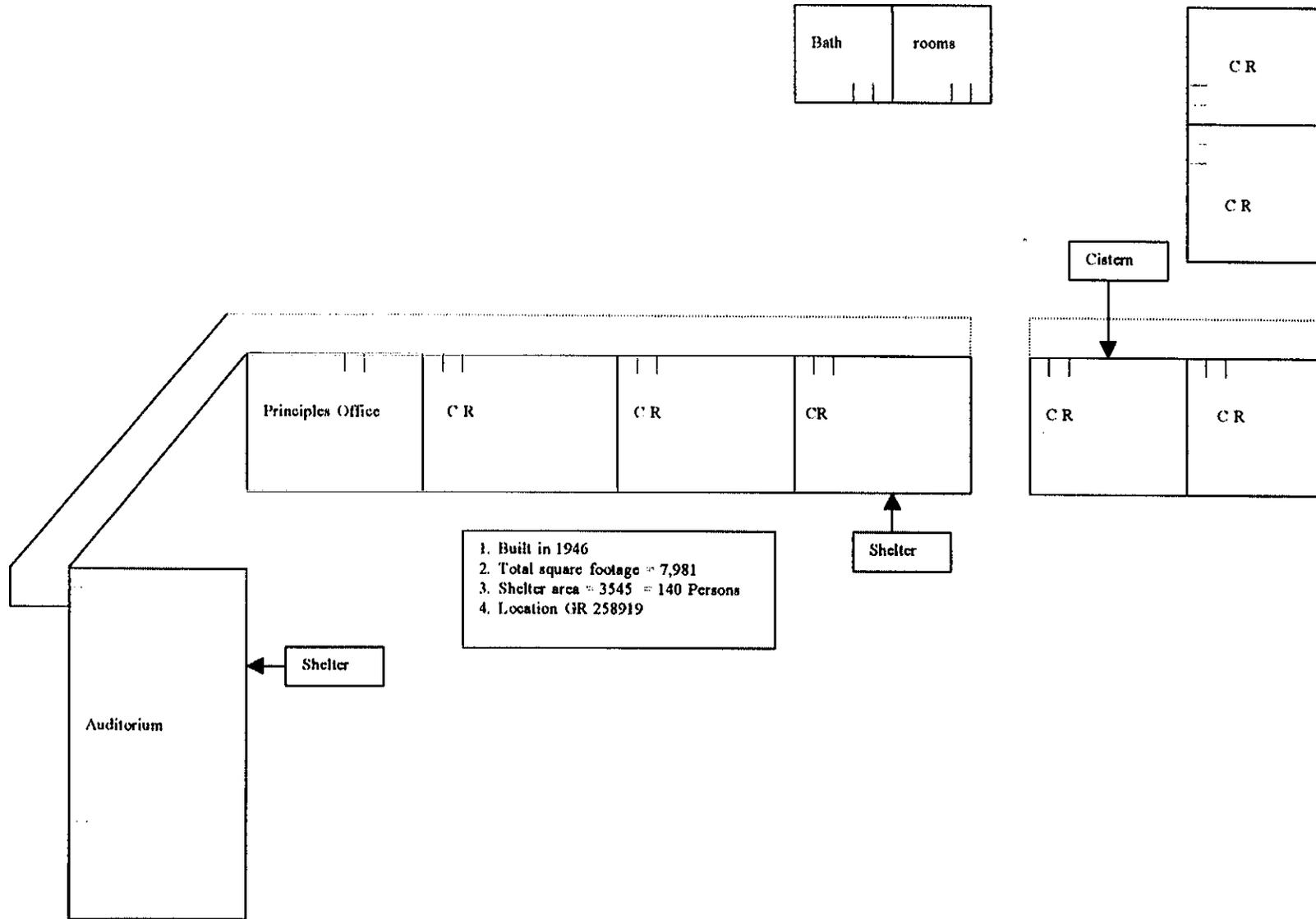
1. Total square footage 7,392
2. The Building has no shutters
3. Major repairs were carried out in 1991.
4. The building is Vulnerable to debris from its old parking garage
5. Single building facility
6. Geographical location GR233932
7. Built in 1837



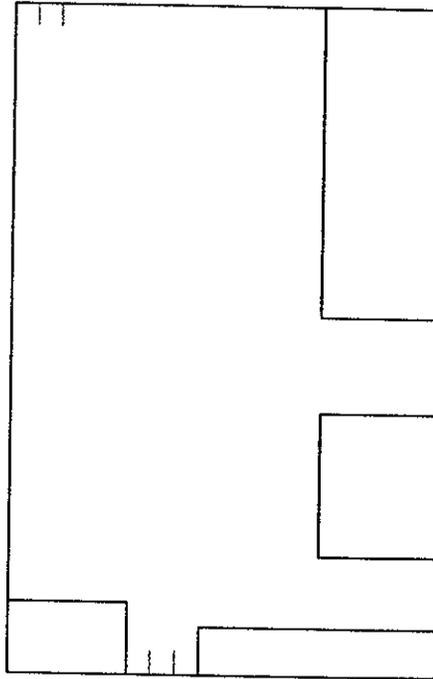
# Sea view Farm Primary School



# Potters Primary School



# Freemans Village Primary School



- 1. Built in 1962
- 2. Total square footage = 3,069
- 3. Geographical location GR292887
- 4. # Of persons to this shelter = 110
- 5. Two building facility

Bath	rooms	
------	-------	--

# Mental Hospital

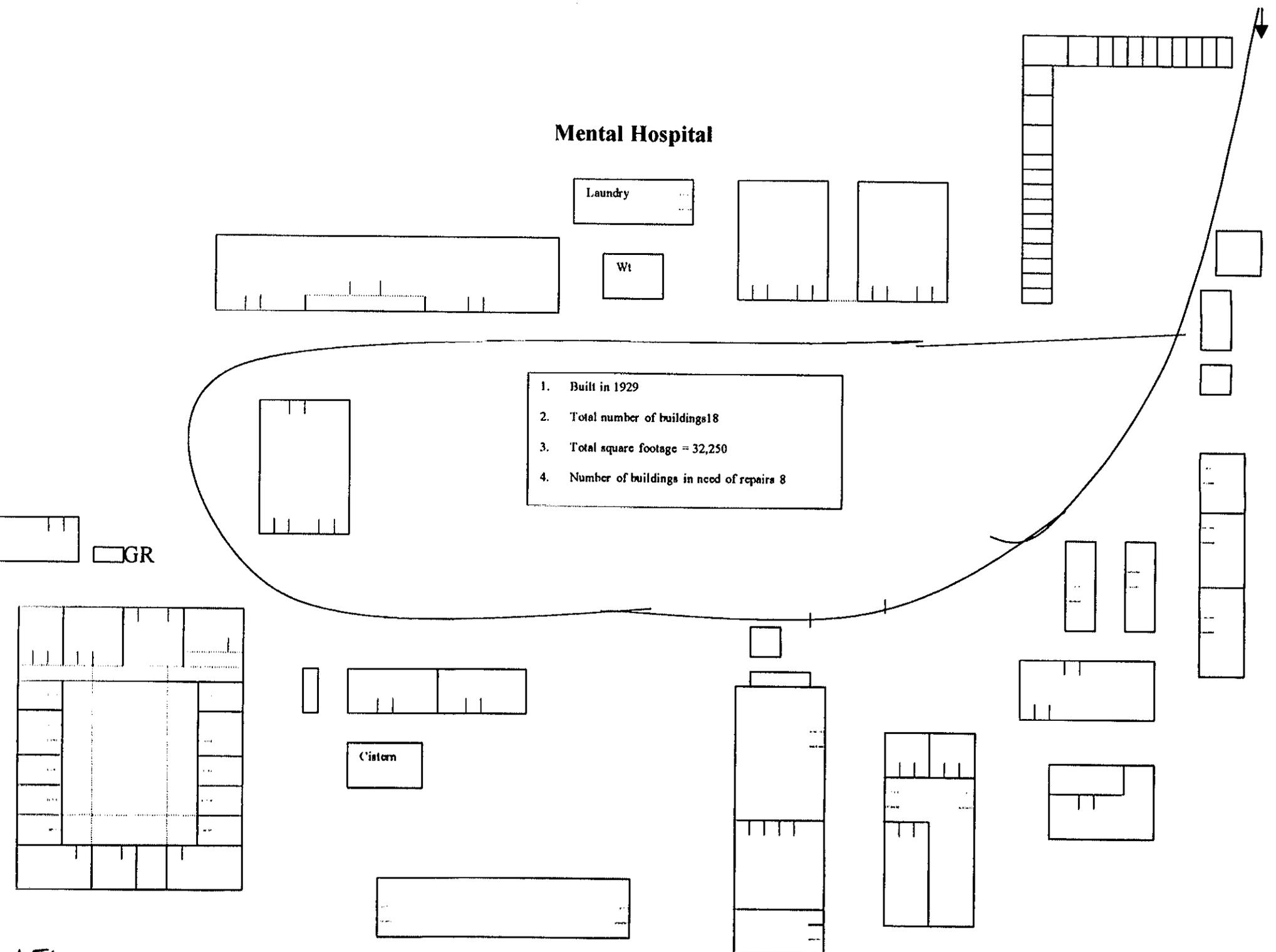
Laundry

Wt

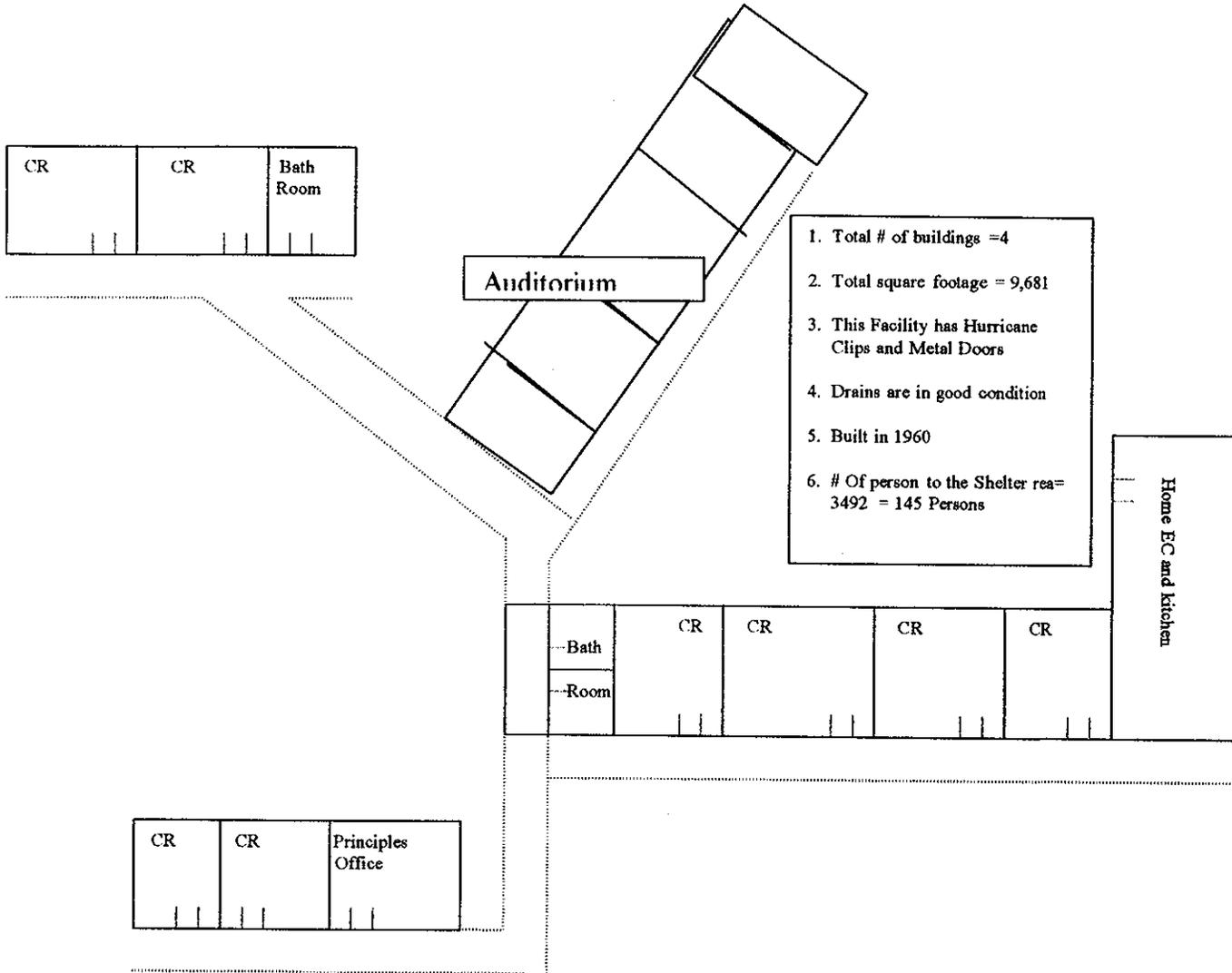
- 1. Built in 1929
- 2. Total number of buildings 18
- 3. Total square footage = 32,250
- 4. Number of buildings in need of repairs 8

Cistern

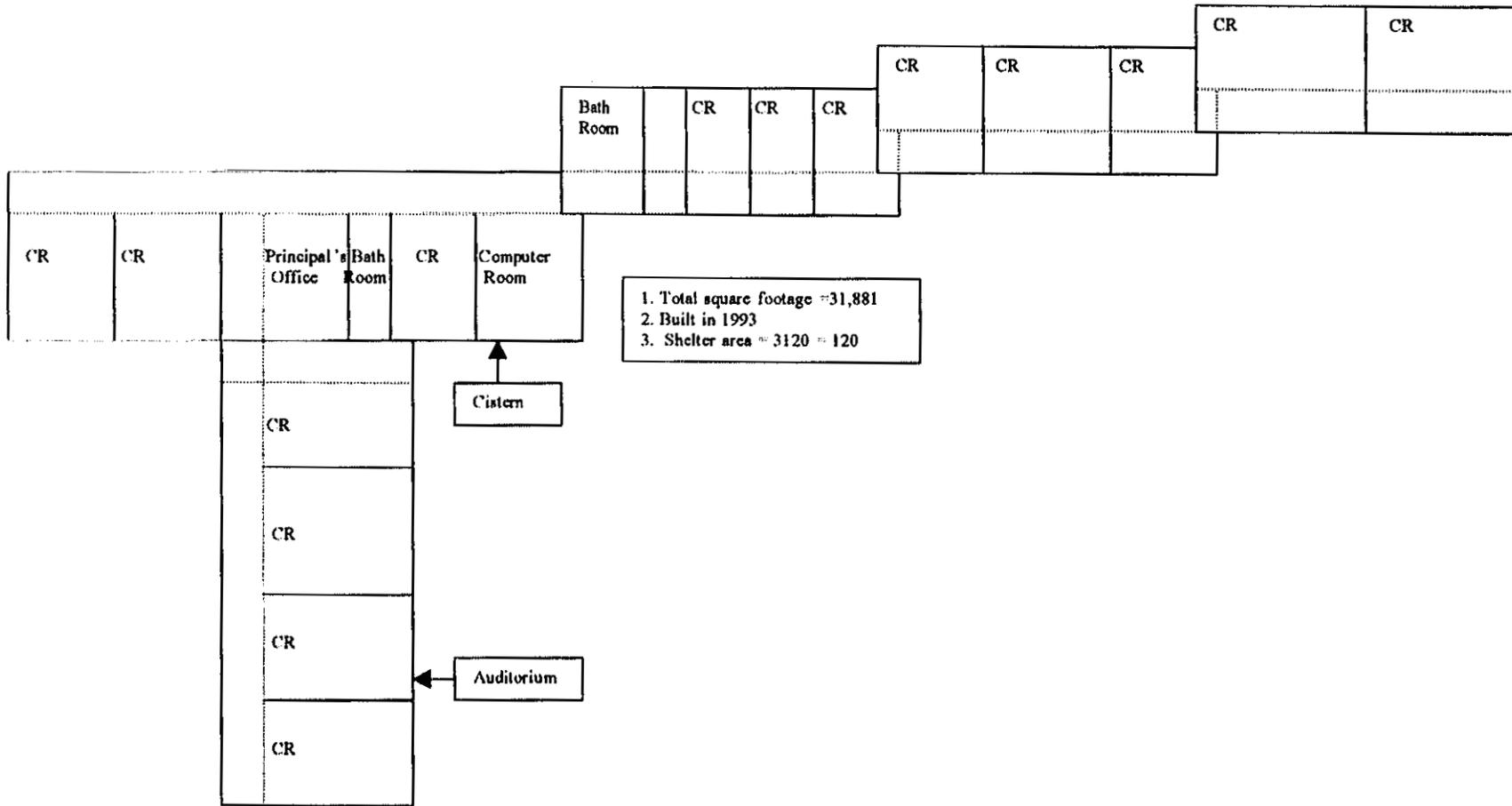
GR



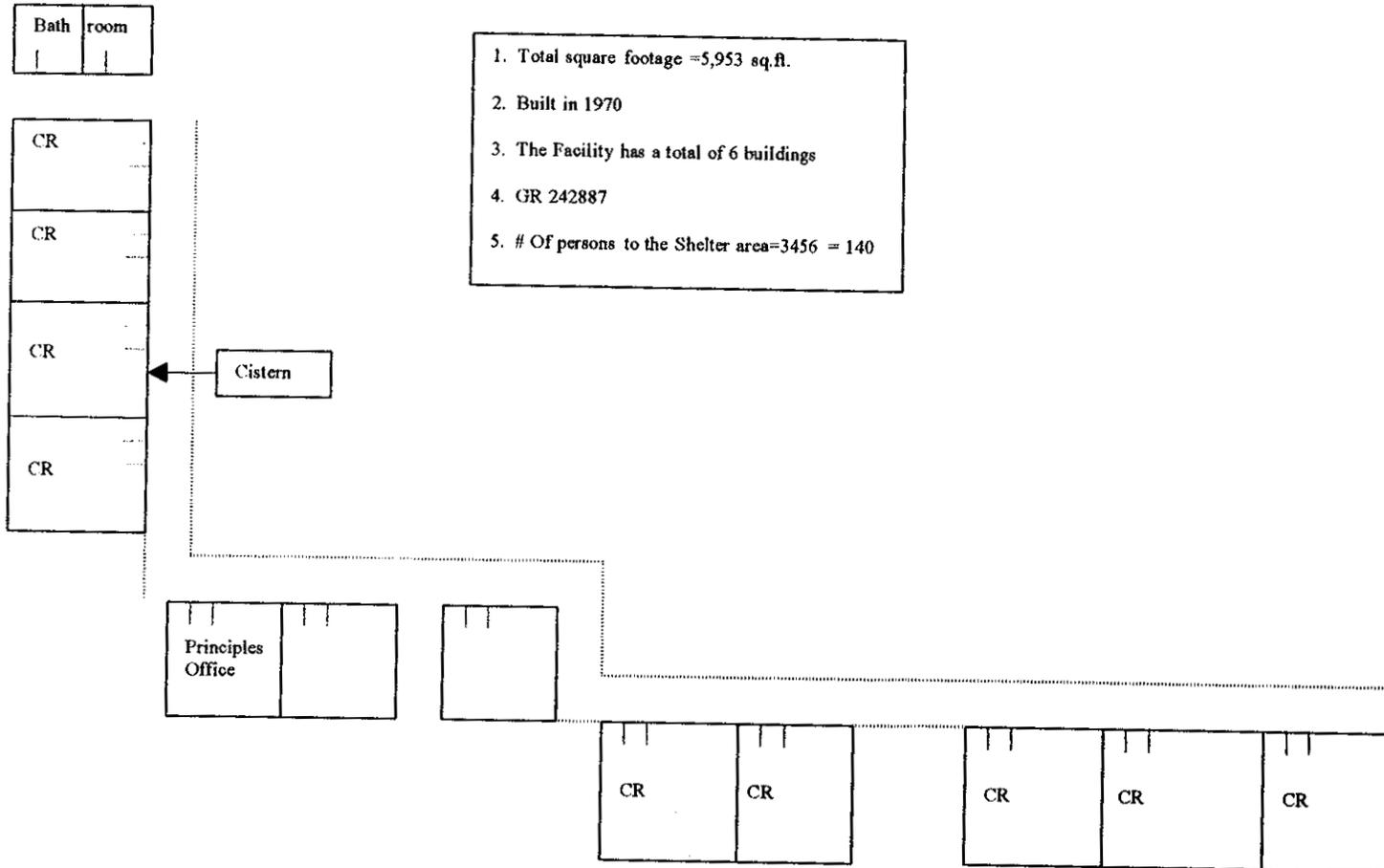
# Liberta Primary School



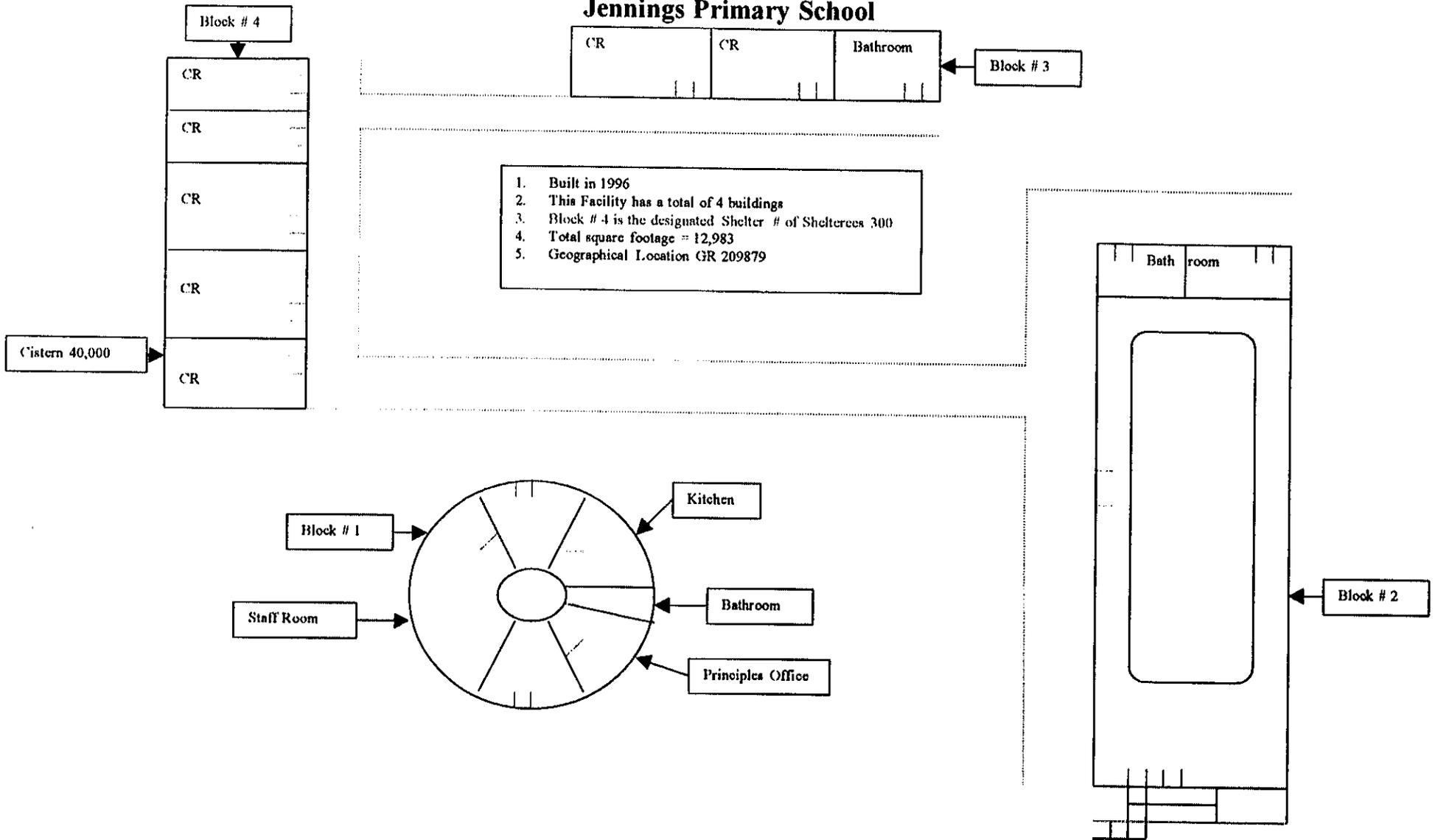
# SWEETS PRIMARY SCHOOL



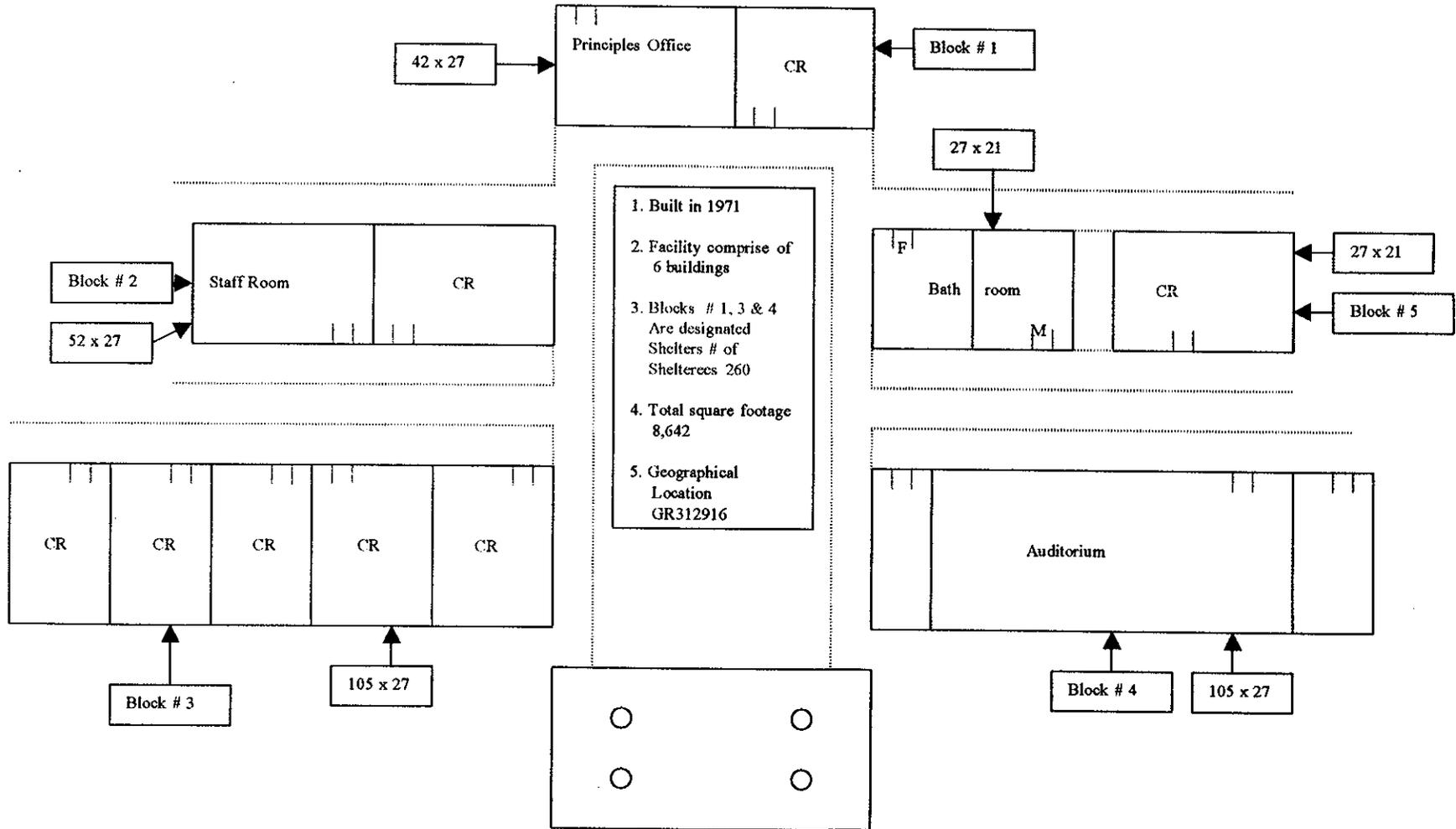
# BENDALS PRIMARY SCHOOL



# Jennings Primary School

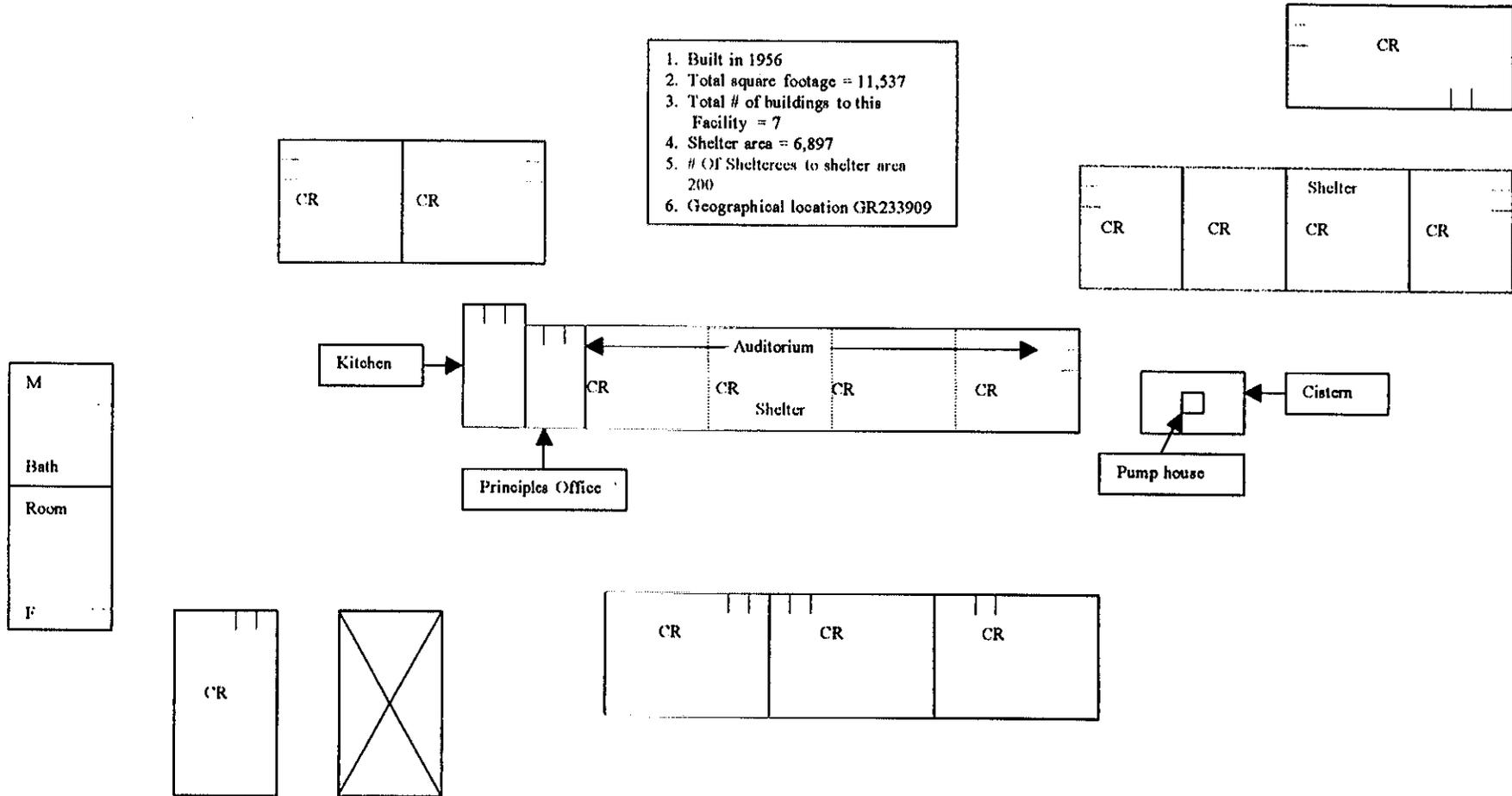


# PARHAM PRIMARY SCHOOL

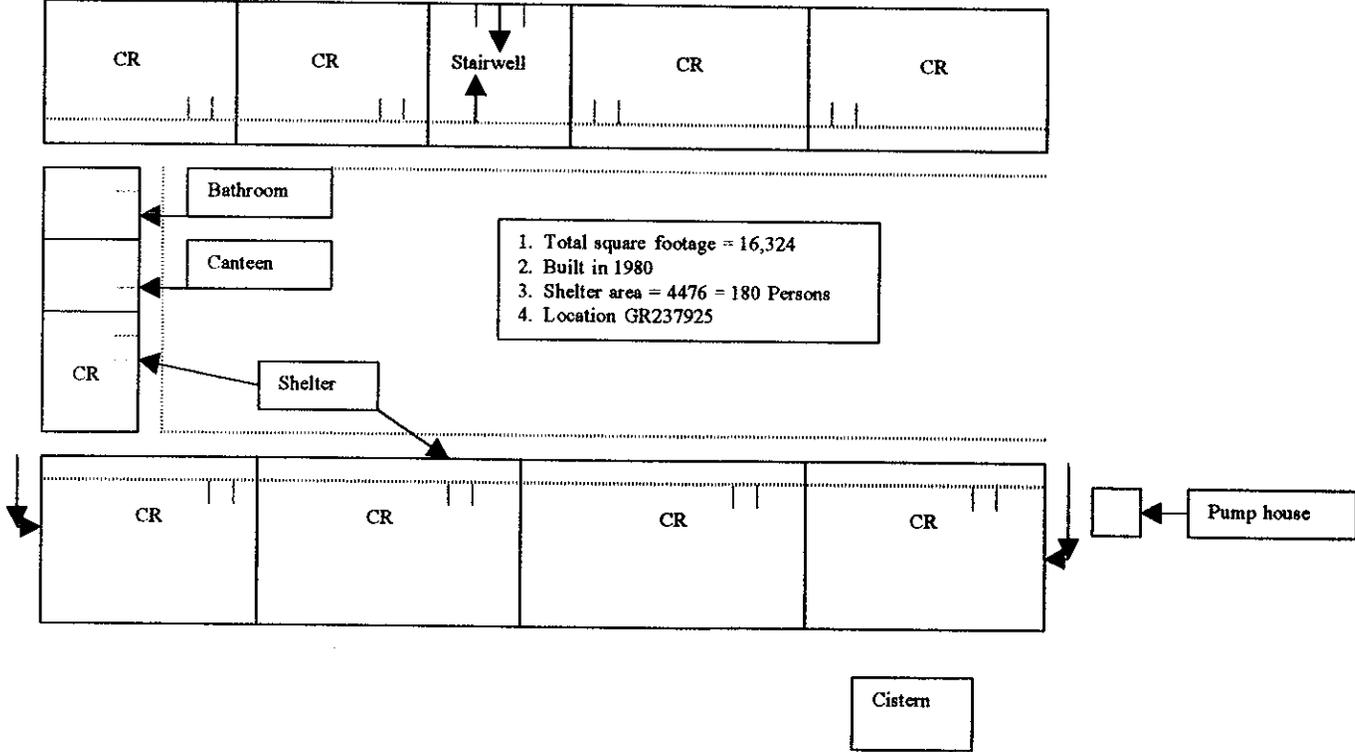
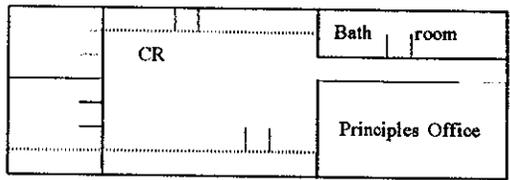


↓  
**GOLDEN GROVE PRIMARY SCHOOL**

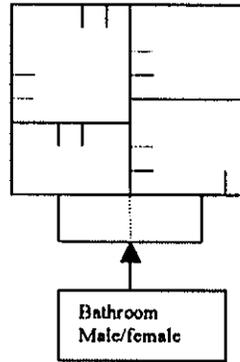
1. Built in 1956
2. Total square footage = 11,537
3. Total # of buildings to this Facility = 7
4. Shelter area = 6,897
5. # Of Shelterees to shelter area 200
6. Geographical location GR233909



# Mary E Pigott Primary School



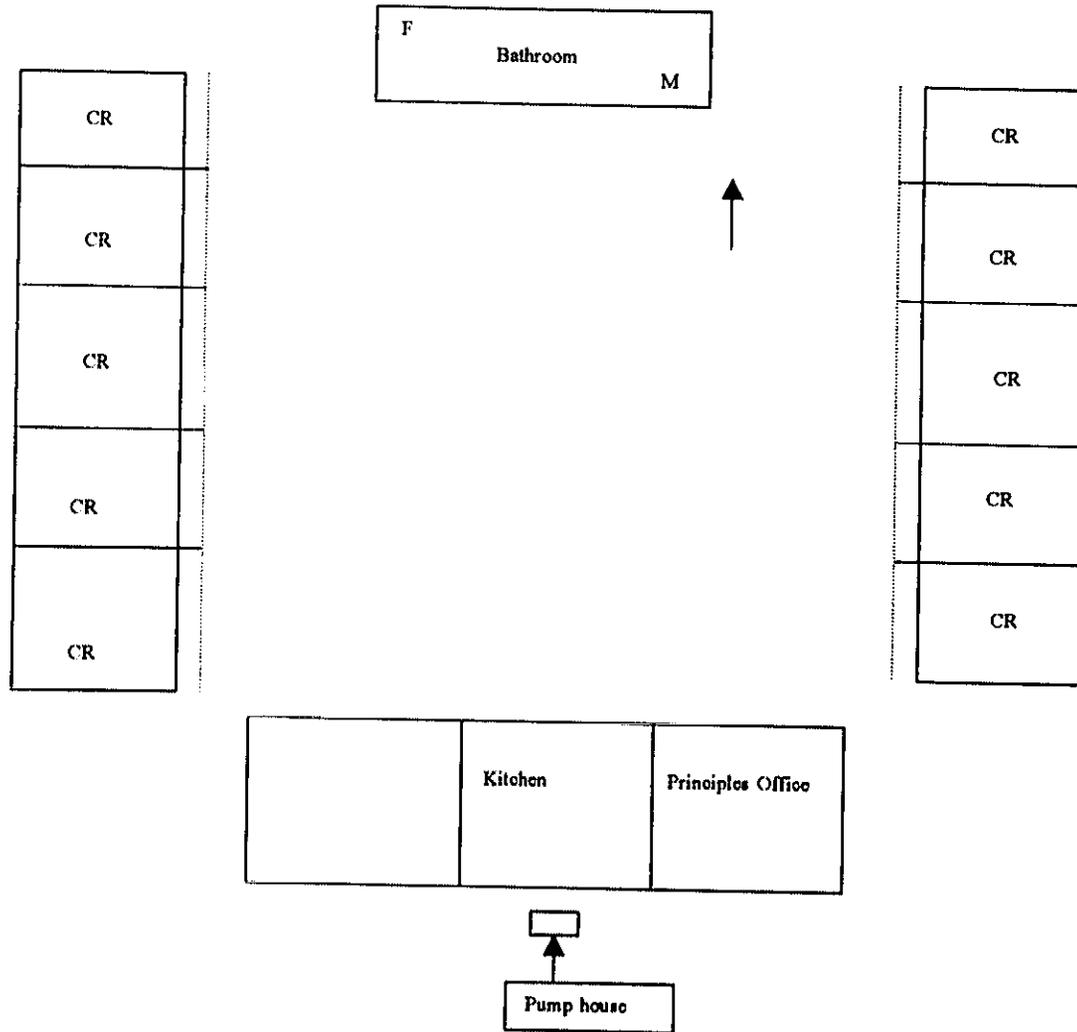
## Pares Clinic



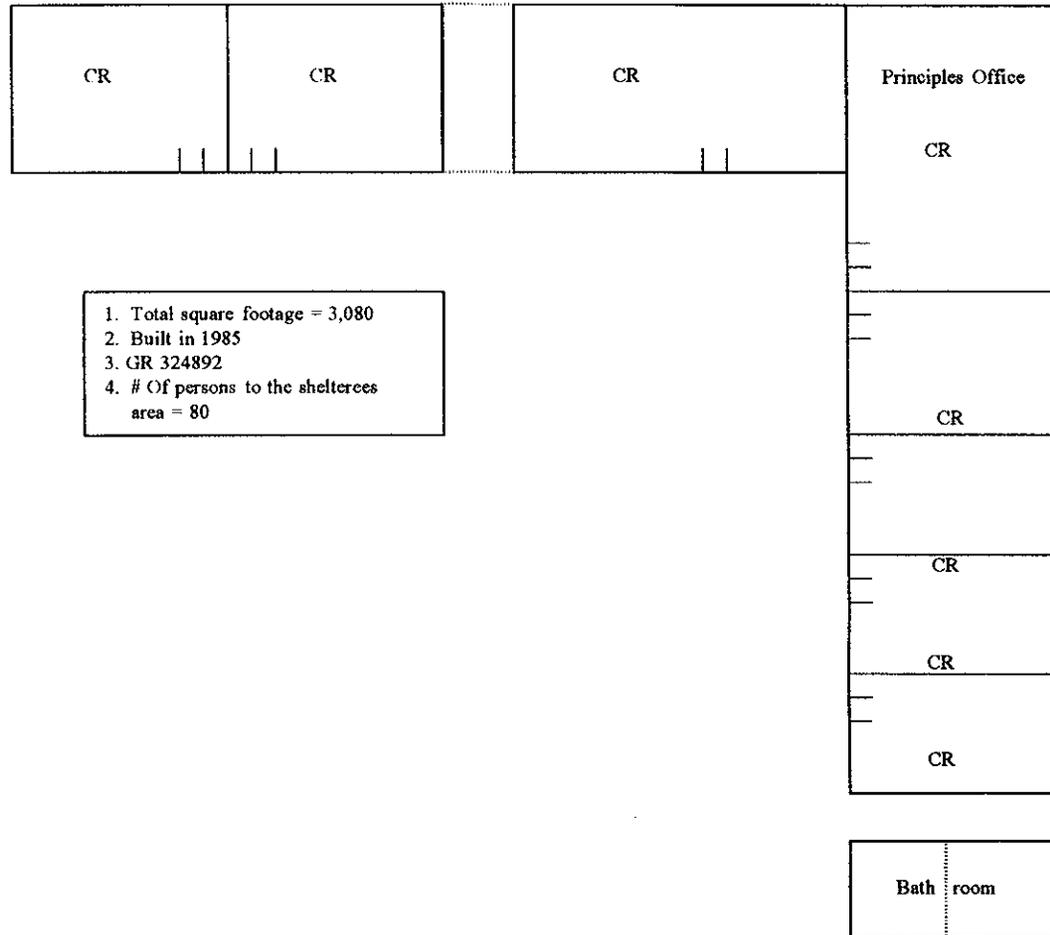
1. Total square footage = 592
2. Built in 1965
3. Location GR 524893



# Glenville Primary School

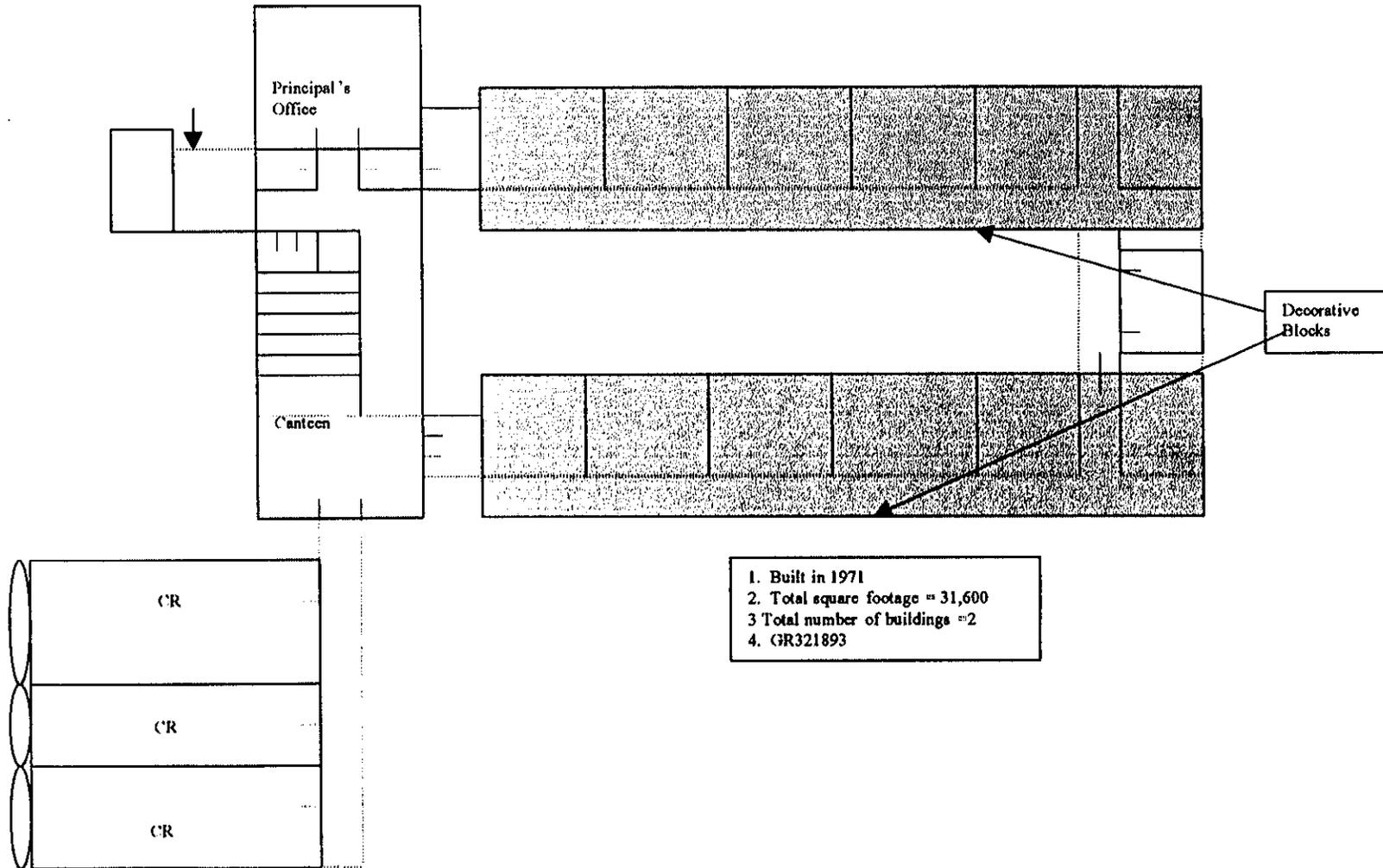


## Pares Primary School

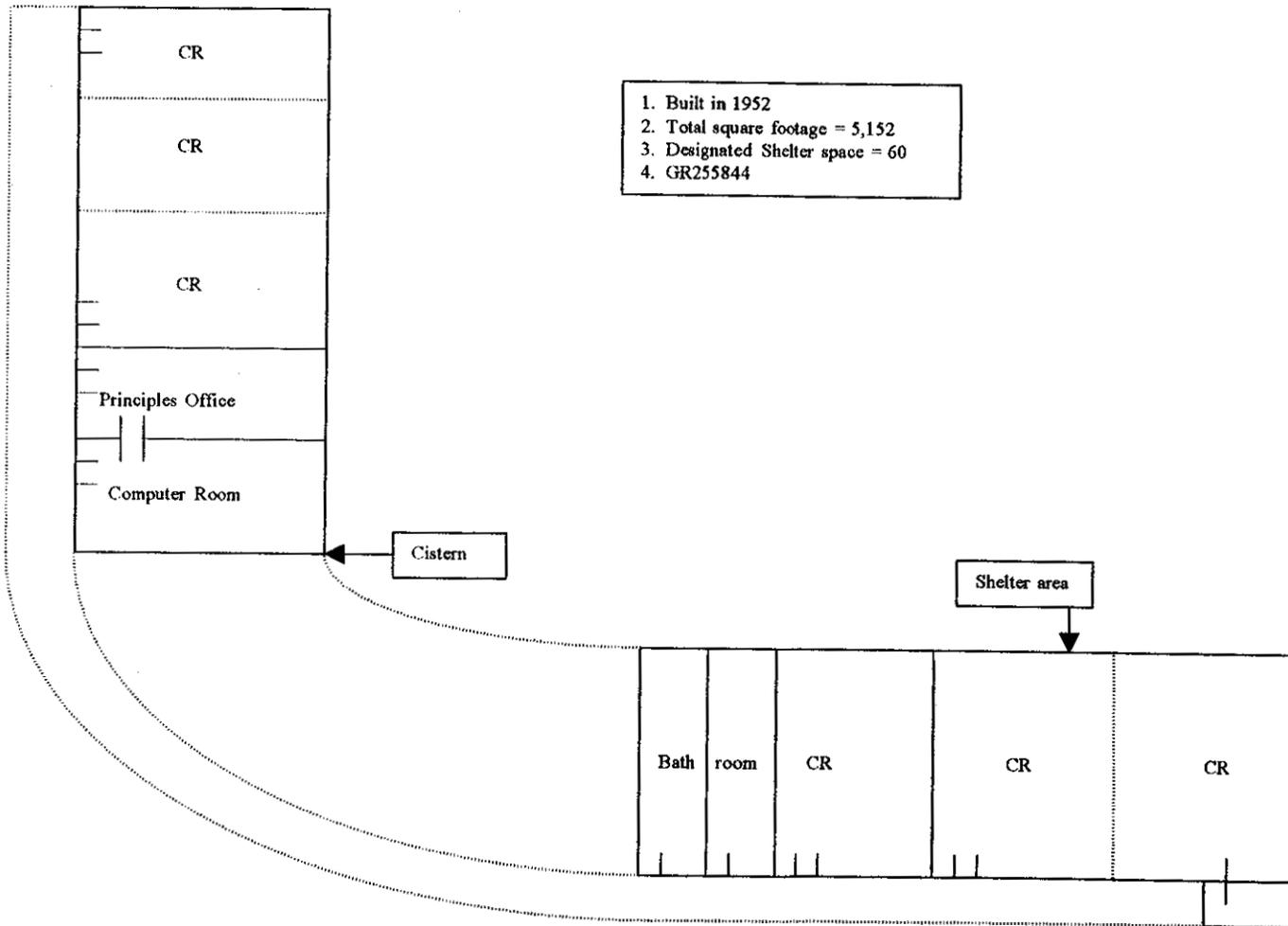


- |  |
|--|
| <ol style="list-style-type: none"> <li>1. Total square footage = 3,080</li> <li>2. Built in 1985</li> <li>3. GR 324892</li> <li>4. # Of persons to the shelterees area = 80</li> </ol> |
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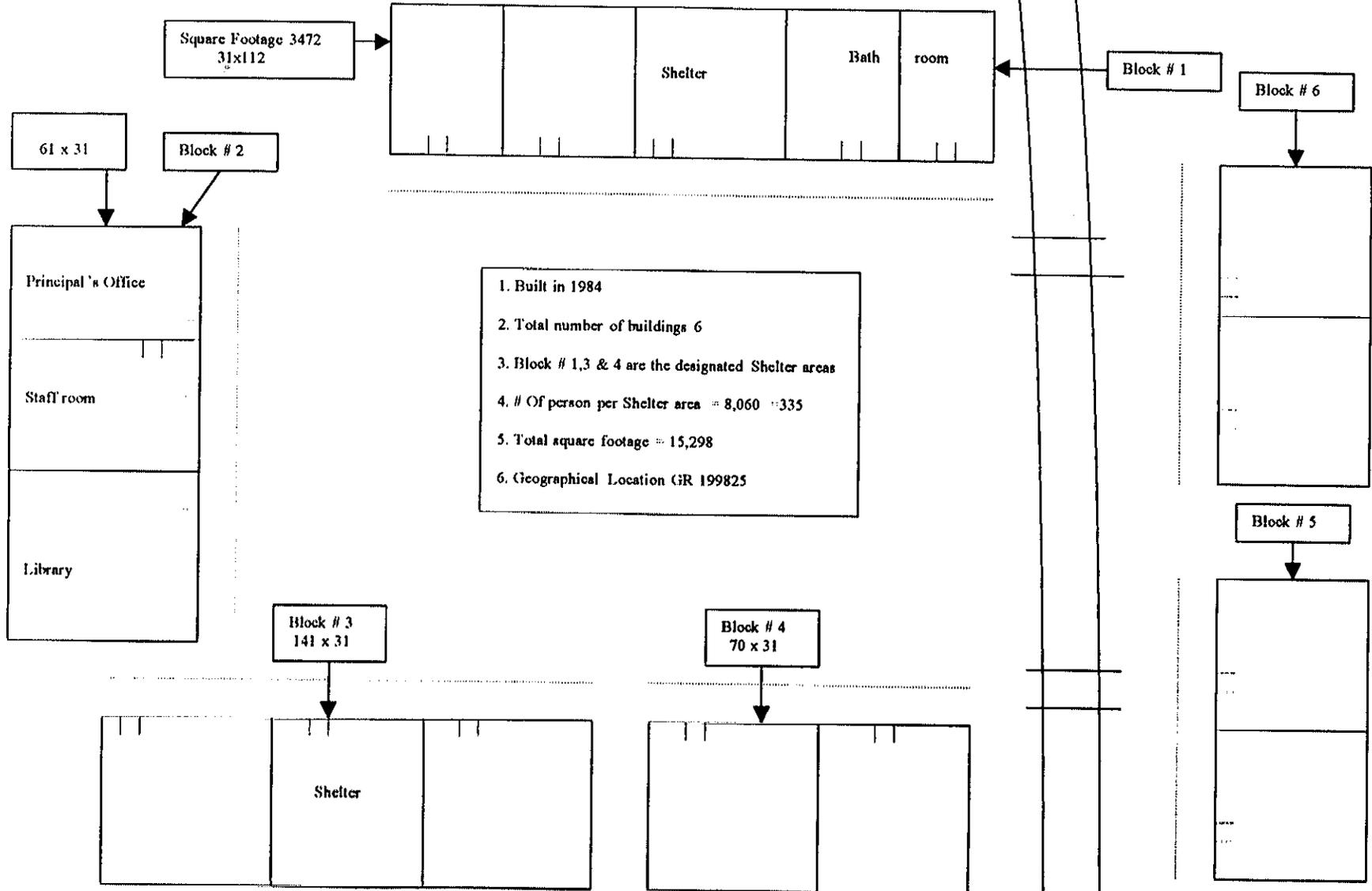
# Pares Secondary School



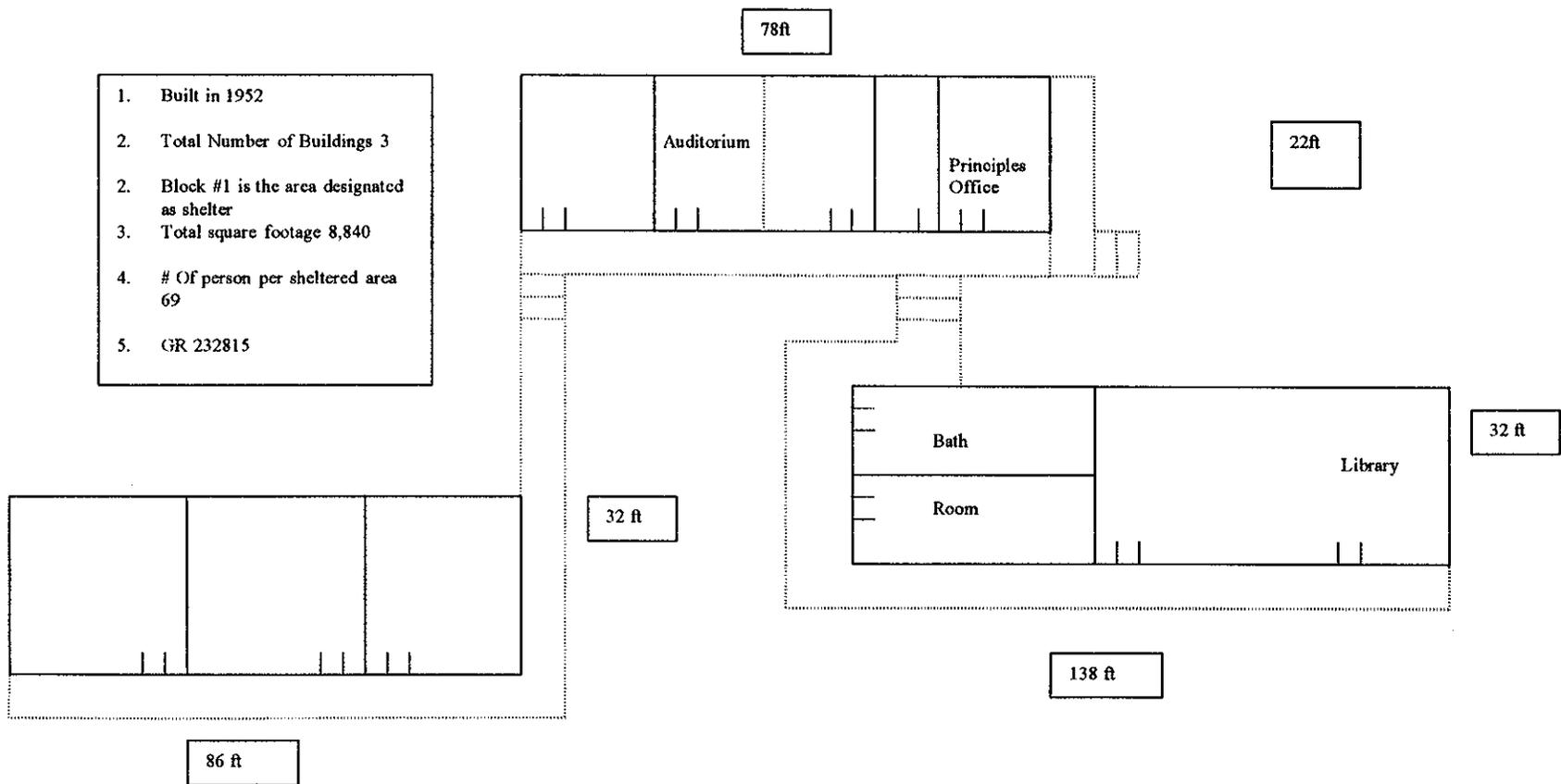
# John Hughes Primary School



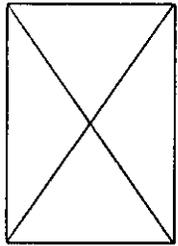
# URLINGS PRIMARY SCHOOL



# Old Road Primary School

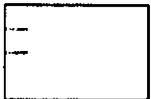
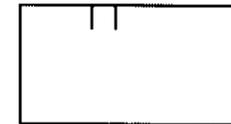
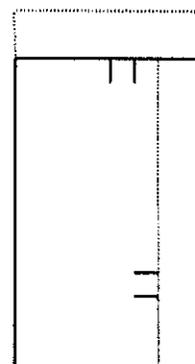
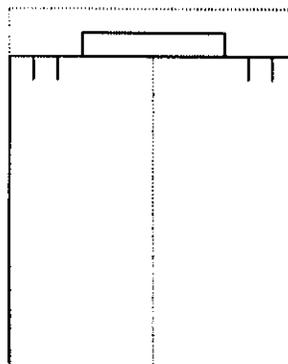
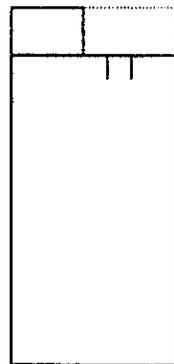
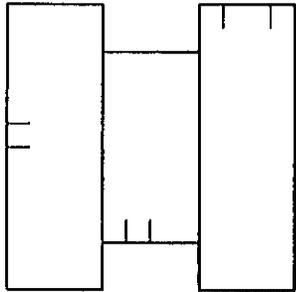
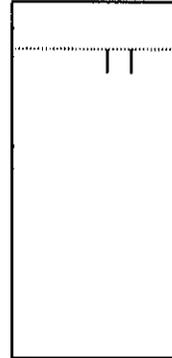
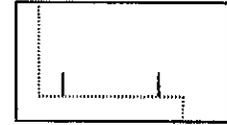


1. Built in 1952
2. Total Number of Buildings 3
2. Block #1 is the area designated as shelter
3. Total square footage 8,840
4. # Of person per sheltered area 69
5. GR 232815



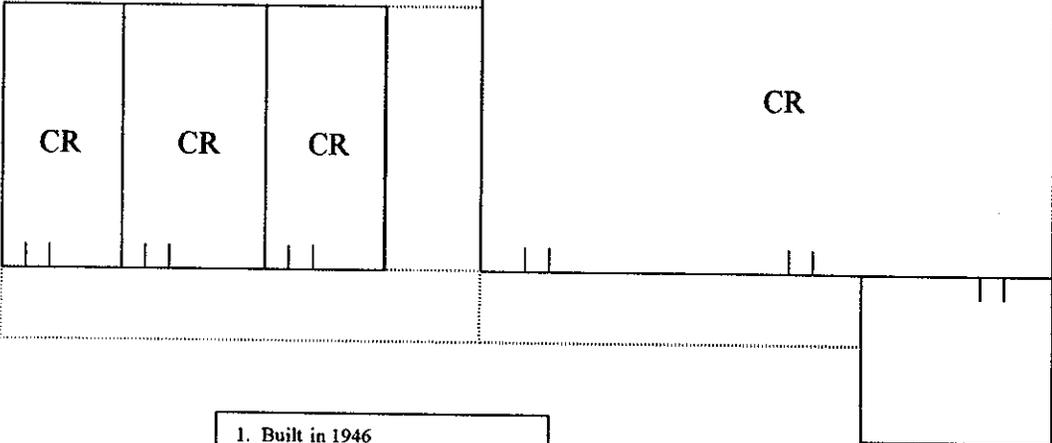
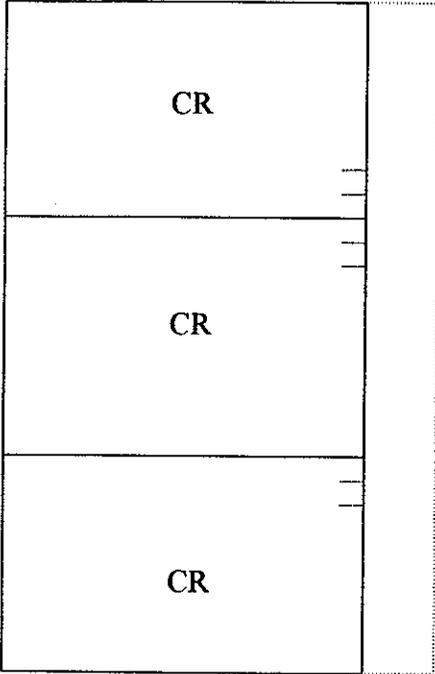
# FINNES

- 1. Built in 1929
- 2. Total square footage 22,808
- 3. Total # of building 17



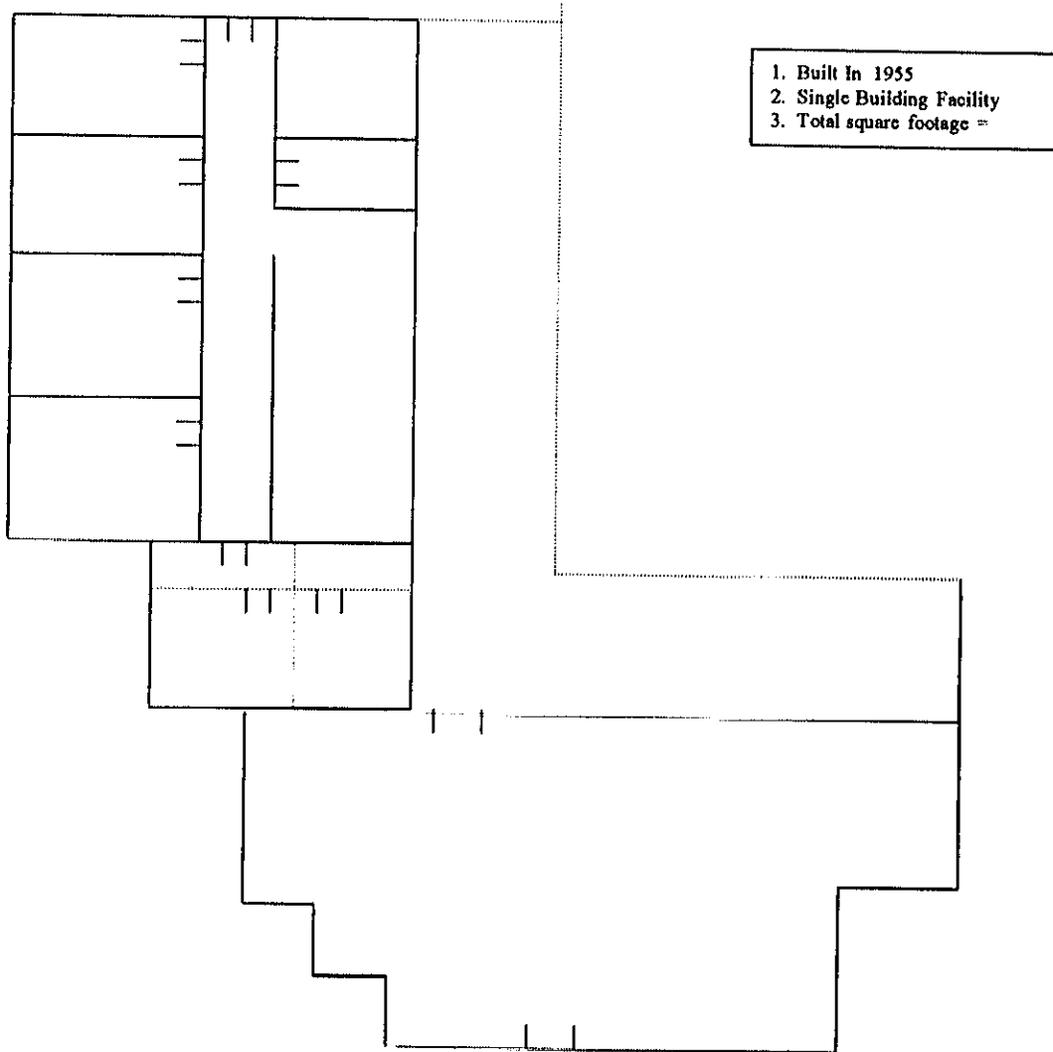


### New Winthrope Primary School

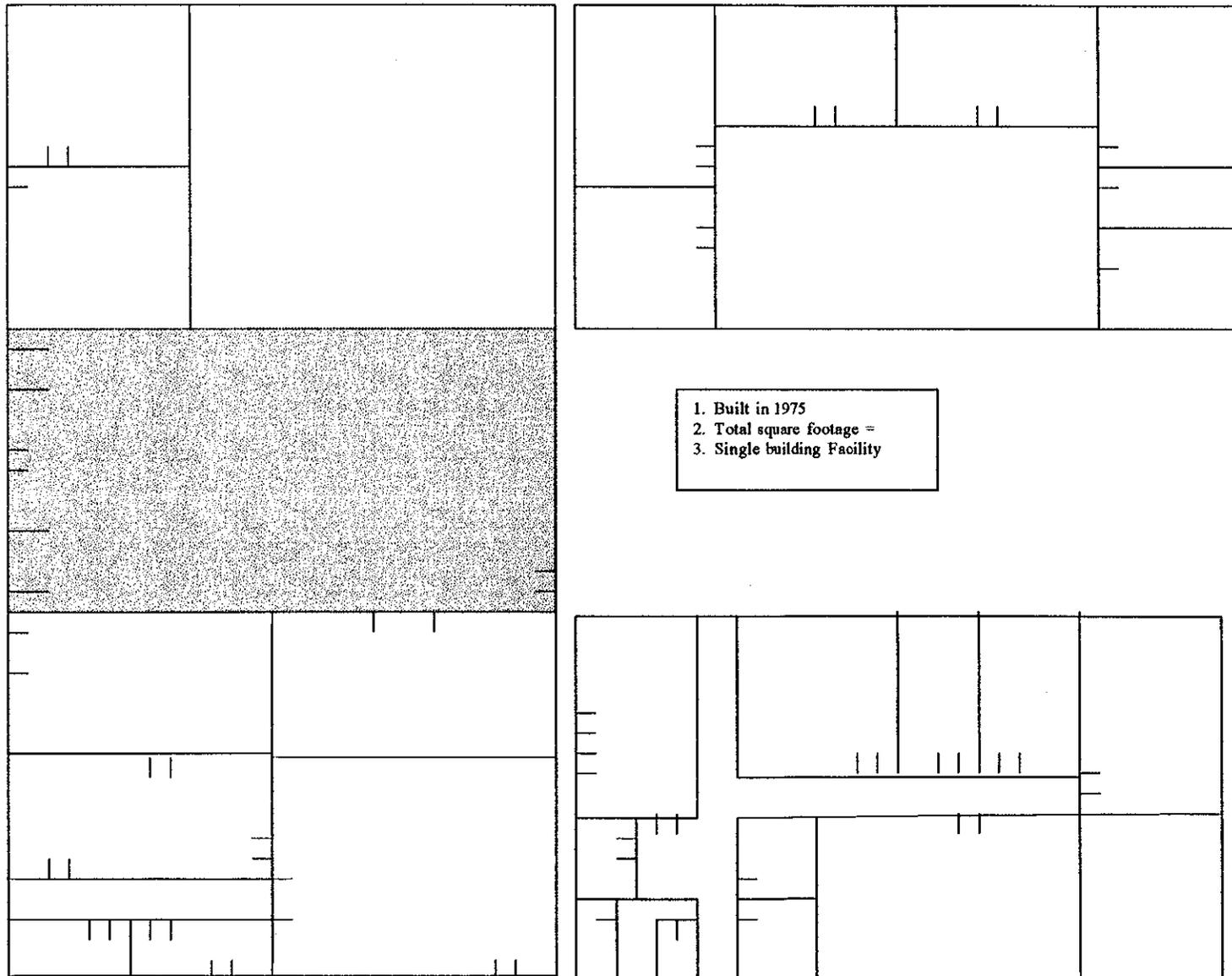


- 1. Built in 1946
- 2. Total square footage 1512
- 3. Total # of Building 2

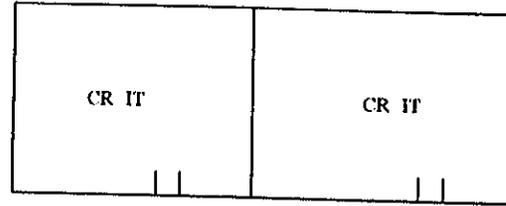
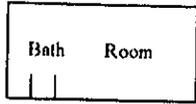
# GREEN BAY CLINIC



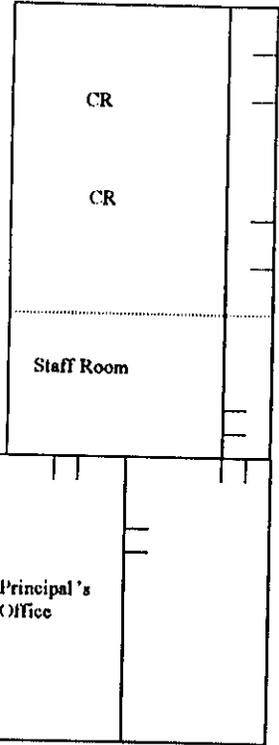
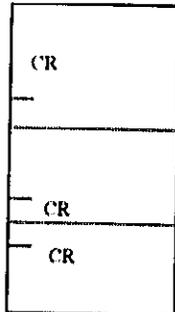
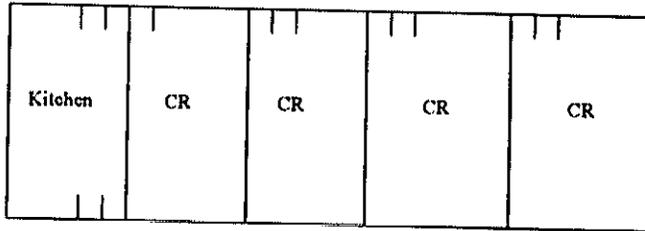
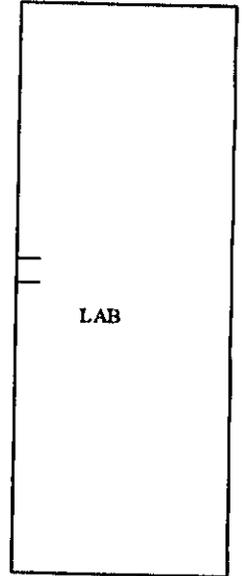
# NATIONAL OFFICE OF DISASTER SERVICES



# Antigua Girls High School

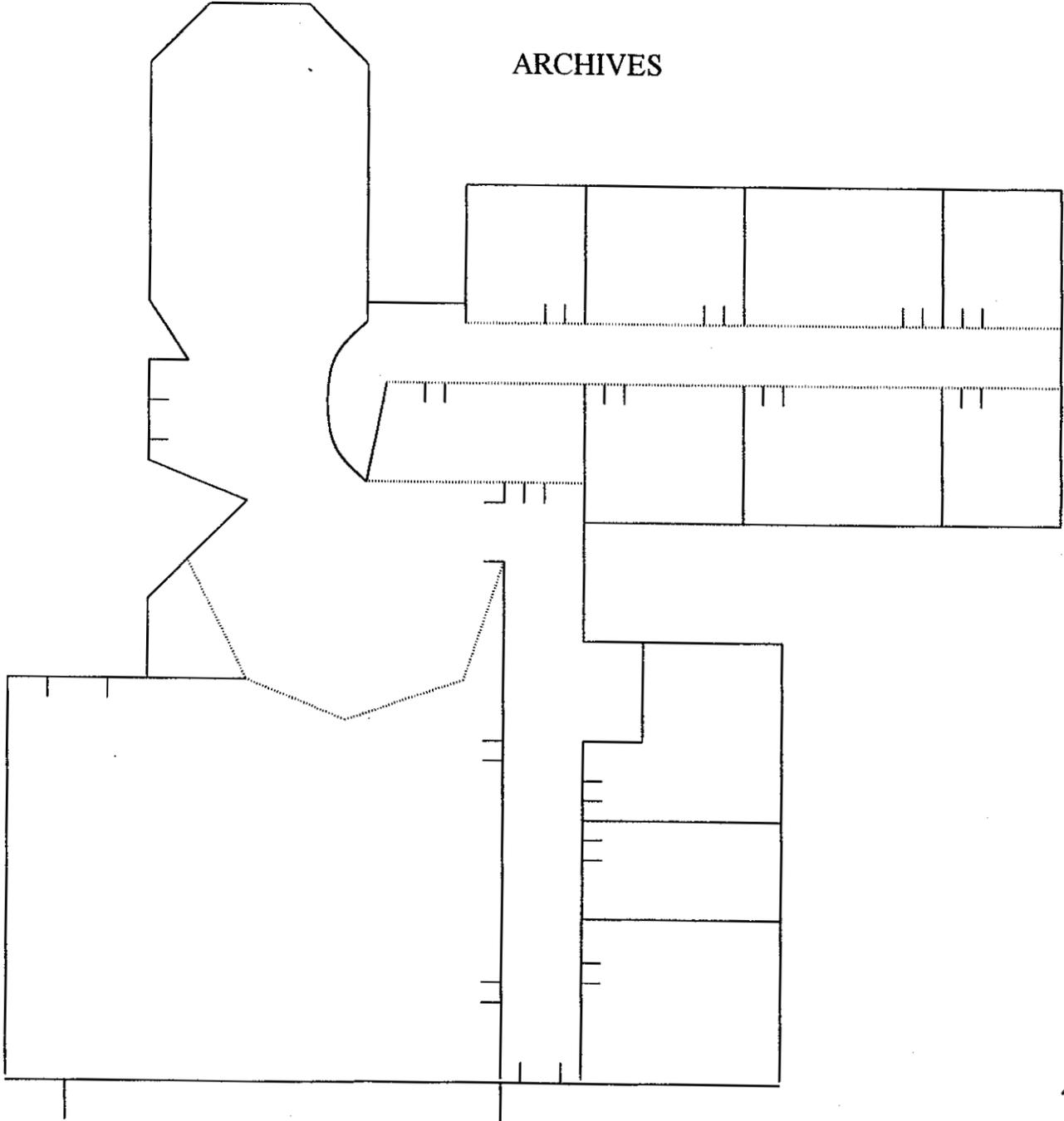


- 1. Built in 1886
- 2. Total square footage =
- 3. Total # of buildings = 6

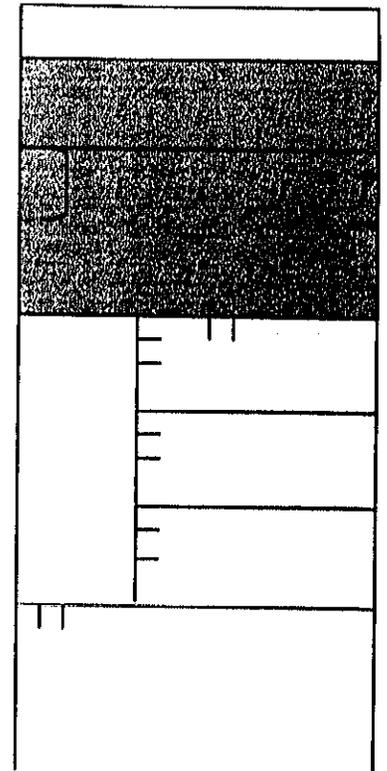
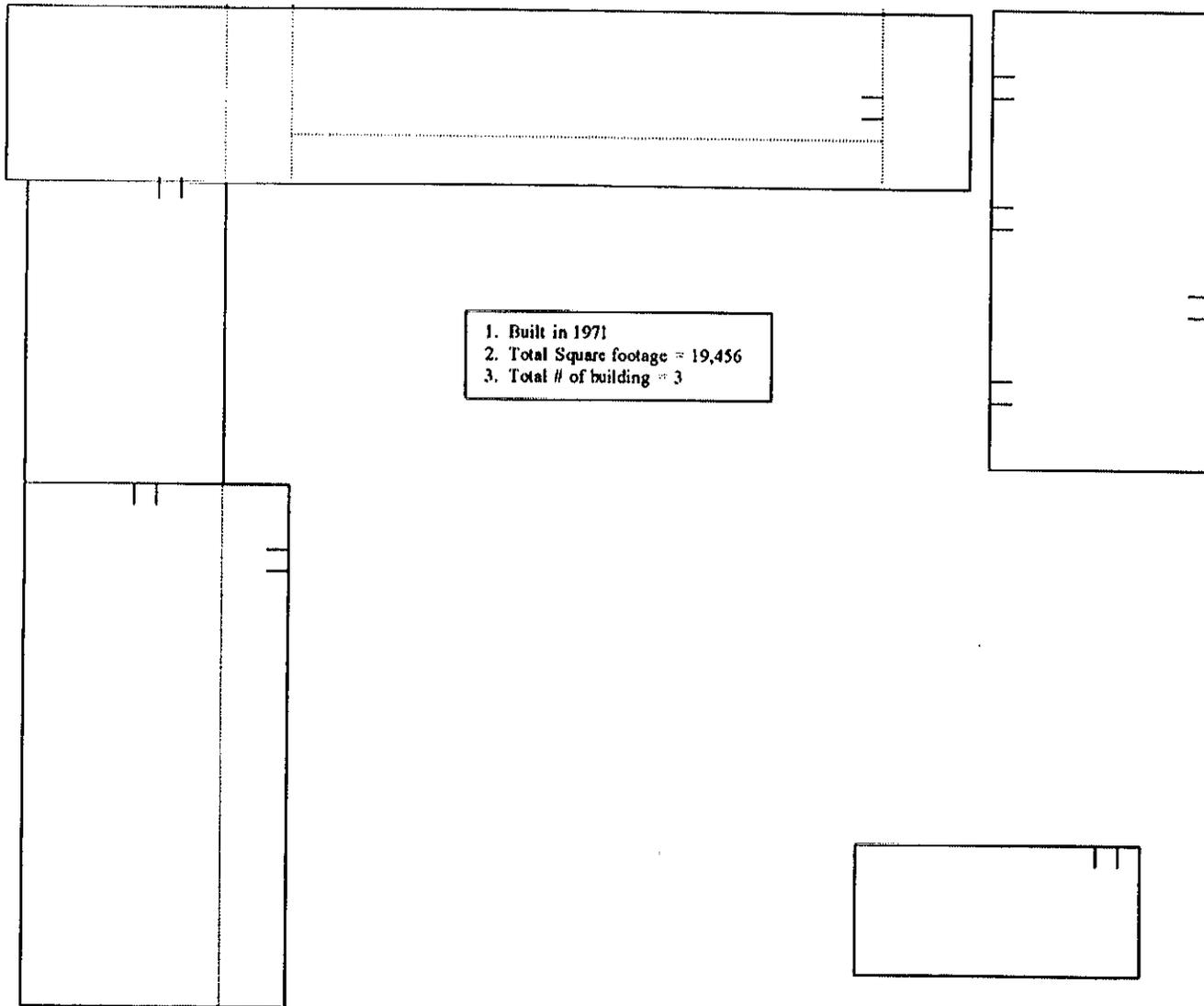


- 1. Built in 1985
- 2. Total square footage = 8,741
- 3. Single building facility

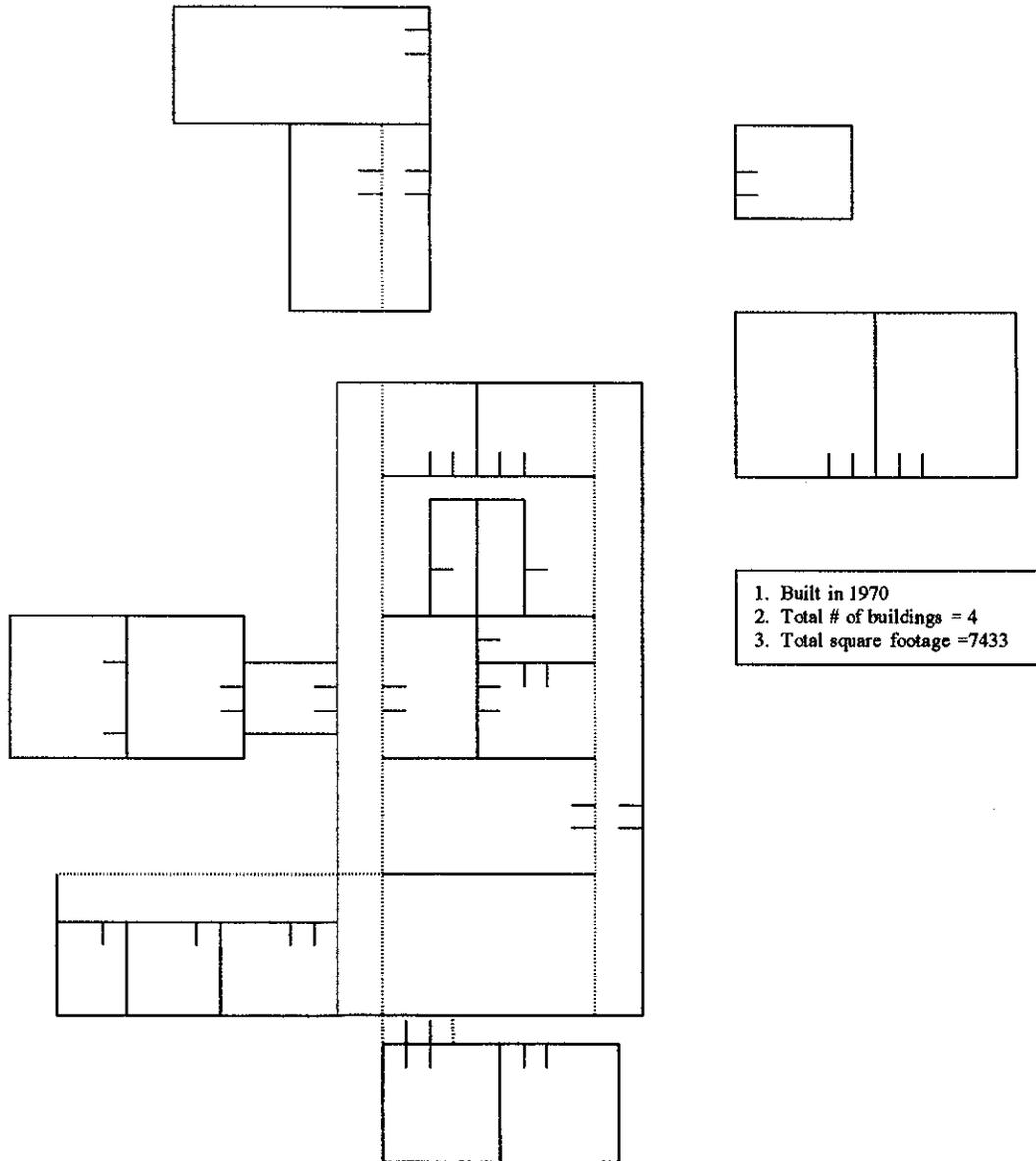
ARCHIVES



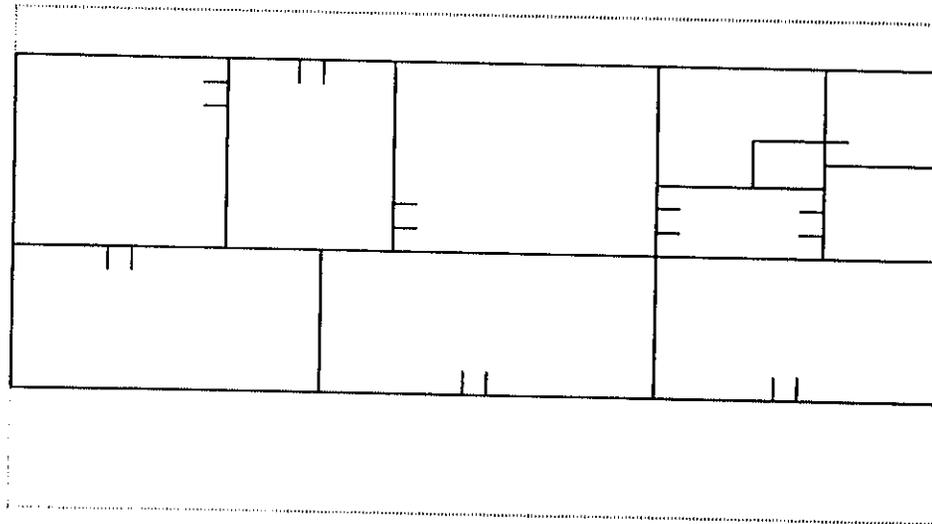
# POLICE HQ AMERICAN ROAD



# HANNA THOMAS HOSPITAL BARBUDA

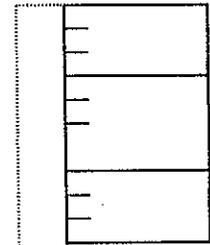
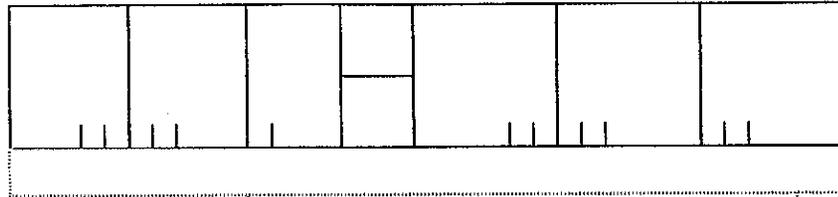
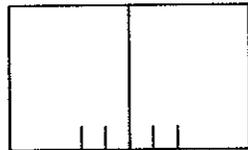


TREASURY AND POST OFFICE  
BARBUDA

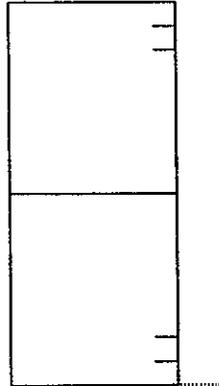


- 1. Built in = 1743
- 2. Total square footage = 1548
- 3. Single building facility

Barbuda's Secondary/Primary  
School

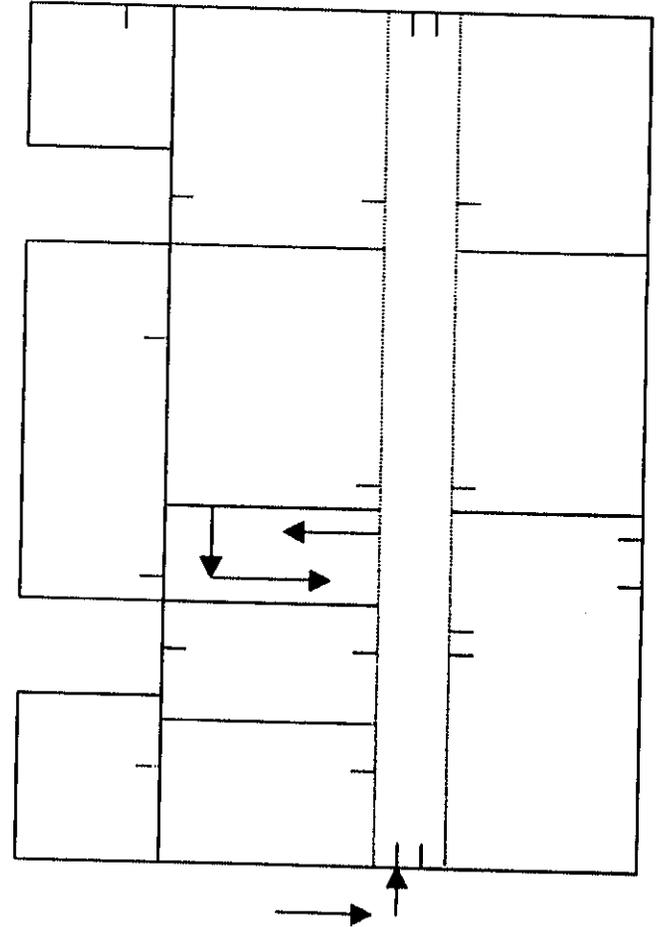
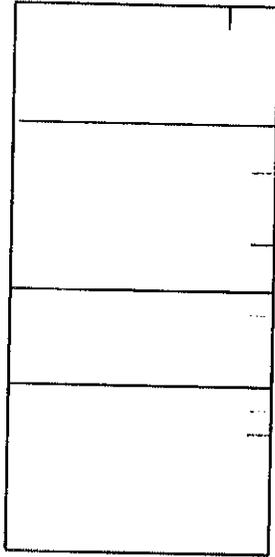


1. Built in 19 1743  
2. Total Square footage = 16,811  
3. Total # of buildings 13





St. Johns Health Centre



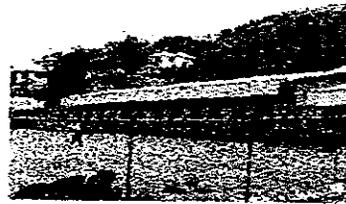
Generator room

# Antigua/Barbuda Structural Vulnerability Assessment Photos

**Antigua Girls High School**



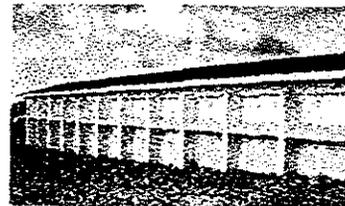
**Bendals Primary School**



**Clare Hall Secondary School**



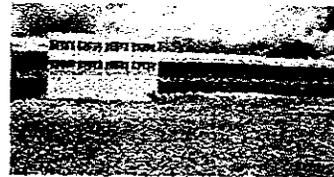
**Freemans Village Primary School**



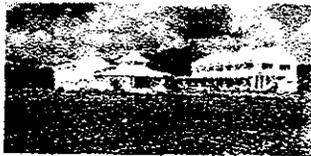
**Golden Grove Primary School**



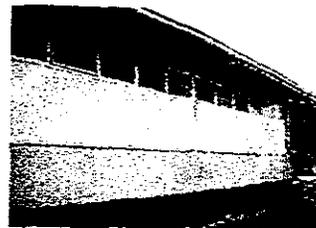
**Irene B. Williams School**



**Jennings Primary School**



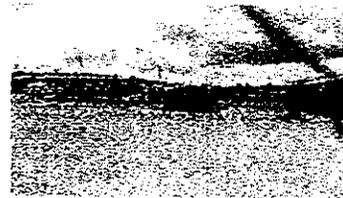
**John Hughes Primary School**



**Liberta Primary School**



**Mary E. Pigott School**



**New Winthropes Primary School**



**Old Road Primary School**



**Pares Primary School**



**Pares Secondary School**



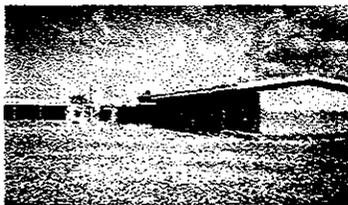
**Parham Primary School**



**Potters Primary School**



**School - Barbuda**



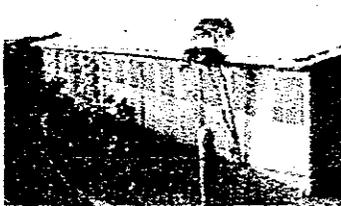
**Sea View Farm Primary School**



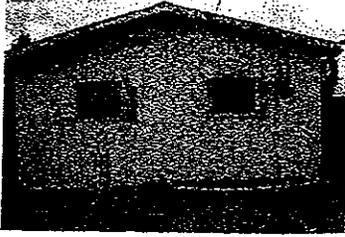
**Urlings Primary School**



**Willikies Primary School**



**Bishopgate Street Clinic**



**Fiennes Institute**



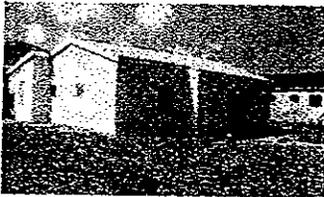
**Fire Station - St. John's**



**General Post Office**



**Grays Farm Health Center**



**Hanna Thomas Hospital - Barbuda**



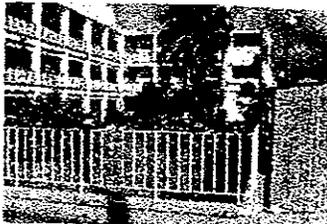
**Jennings Clinic**



**Mental Hospital**



**Ministry of Finance**



**Ministry of Public Works**



**National Archives**

**National Office of Disaster Services**



**Pares Clinic**

**St. John's Health Center**



**Treasury - Barbuda**

**Treasury Department - Antigua**

