3 INVESTIGATION PROCEDURE

3.1 General

The hospital facility comprises 22 separate buildings. The main hub of the facility can be further separated into several distinct units and, for the purposes of this report, these units will be treated as individual entities where applicable. While performing the hurricane evaluation, the main hub was considered to consist of 5 such entities, while for the seismic evaluation it was considered to consist of 7 entities.

The following is a list of the identifiable units The numbering system used hereunder is the same as shown on the site layout.

Code	Building
01	Storage Shed for the Incinerators
02	Large Incinerator (#1)
03	Linen Supply Store
04	Inflammable Store
05	Workshop #1
06	Workshop #2
07	Physiotherapy Department & Hospital Chapel
08	Laundry House
09	Boiler House (this building holds the generators)
10	Maintenance Store
11	Orderlies' Dormitories
12	Lion's Eye-Care Centre/Accident and Emergency Ward
13	Small Incinerator (#2)
14	Delivery/Storage Annex
15	Kitchen
16a	Main Building - North Block
16b	Main Building - South Block
16c	Main Building - Central Block
16d	Main Building - Head Orderlies Department & Cobalt Store
17	Main Entrance Hall
18	Extension Block
19	Housekeeping/Security Annex

Drawings for the original QEH were not available for reference during the investigation. Most of the information gathered about the main buildings was obtained through on-site observations and discussions with hospital personnel.

The Engineering Department was able to provide drawings for many of the newer buildings on the compound. Engineering drawings were provided for buildings 04, 07, 10, 12, and 18, each of which was constructed at various times from the mid-1980's to the present. Archi[illegible]al drawings were available for buildings 12 and 18 only, and electrical drawings were available for building 12.

3.2 Preliminary Meetings

On 30 March 1998 Mr Tony Gibbs of CEP visited the Hospital and met with the acting Hospital Director, Mr Andrew Watson, in order to determine the availability of resources for the assessment. Subsequent meetings were held with Mr Mark Gittens, Senior Technical Officer (acting), on 15 April and 20 May.

3.3 Document Search

On 26 June 1998, Mr Gibbs, along with Mr Andy Atherley and Mr Andrew Mayo of CEP, met with Mr Les Ethelridge, who worked on the construction of the original QEH project and headed the technical department of the hospital from 1964 until his retirement. Mr Len Walcott, Superintendent of Works (acting), was also present at that meeting. The purpose of the meeting was to locate any plans of the original building still extant, and to obtain further insight on the design and construction of the facility.

It was established that all such plans kept at the QEH had been destroyed. Mr Gibbs was advised to consult Architect Tony Hoad, who had inherited drawings from DM Simpson/Central Foundry, the erectors of the structural steelwork used in the main building. Contact was also made with Mr Ken Tucker of Atwell Dalgleish, the local representative for the steelwork suppliers Dorman Long. Neither of these individuals was able to locate any of the structural steel drawings for the hospital. Further research suggested that the plans could not be found in England either.

It should be realised that the establishment of a secure and orderly system of archiving of construction drawings depicting the as-built condition of the final structure is an essential ingredient of the long-term maintenance schedule of any constructed facility. Because the archive will serve its purpose over the lifetime of the facility, the protection of its contents against the effects of time cannot be overlooked.

3.4 Site Inspections and Meetings

On 17 June 1998 Mr Gibbs, Mr Atherley and Mr Mayo visited the site and met with Mr Gittens and Mr Walcott. A brief familiarisation tour of the compound was made to identify the individual parts of the overall facility. Subsequent detailed visits were made on 18, 19, 22, 23, 24, 25, 26, 29, 30 June; and 1, 2, 3 July by Mr Atherley and Mr Mayo. On these visits, where necessary, Mr Atherley and Mr Mayo were accompanied by Mr Walcott in order to gain easy entry into otherwise restricted areas. Further visits were made on 22 July and

20 August to clarify certain information gathered on previous visits.

Inspections consisted of obtaining qualitative data necessary for the hurricane analysis, measuring ground floor walls and columns for the earthquake analysis, and checking everywhere for signs of deterioration. No examination of foundations was attempted and, in the absence of structural plans for the majority of the facility, reasonable assumptions regarding the current condition of the existing building structures were necessarily made. It should be realised, however, that the type and condition of the foundations and the characteristics of the underlying soils will have a significant influence on the effects of earthquakes on the various buildings.

3.5 Desk Studies

To assist with the determination of vulnerability to hurricanes, the software package WIND-RITE was utilised. WIND-RITE is a software system developed by the Wind Engineering Research Centre at Texas Tech University, Lubbock, Texas, in the USA, in conjunction with the Insurance Institute for Property Loss Reduction.

This program is used to establish a relative grade for the wind resistance of buildings. A relative grade between 1 and 10 is assigned to a building during the evaluation process. A relative grade of 1 indicates that the building is highly resistant to wind-induced damage (less damage), whereas a building that receives a relative grade of 10 is highly susceptible to wind-induced damage (extensive damage).

To assist with the determination of vulnerability to earthquakes, the methodology of Ahmed F Hassan[5] was used. This methodology relies mainly on readily accessible data for an existing building such as the dimensions and arrangement of its structural elements and the floor area. Masonry walls, concrete columns and steel columns are given progressively higher weightings in determining their contributions to seismic resistance. The end result is a comparative assessment of seismic vulnerability.

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[5] Paper, "Seismic Vulnerability Assessment of Low-Rise Buildings in Regions with Infrequent Earthquakes". Ahmed F Hassan and Mete A Sozen, ACI Structural Journal, Jan-Feb 1997, pages 31 *et seq*

3.4 Buildings

Comments on the individual buildings are contained in the following sub-sections. As indicated in the introduction to this report, a number of the building entities comprising the facility are connected and form a central core of the hospital compound. For the purposes of this report, buildings 16a to 16d will be grouped as one and discussed under the heading "Main Building (All Sections)".

3.4.1 Storage Shed for the Incinerators

This is a small, rectangular, one-storey building made of unreinforced masonry, with a cast-in-place concrete roof. The building is in fair condition, with only light damage to the lintel over the main door being observed (see photo 2).

3.4.2 Large Incinerator

This is a one-storey building (though with sufficient height to be two-storey), rectangular in plan, with a reinforced concrete frame and a cast-in-place concrete roof. The access doors on the north elevation are supported by a steel portal frame. A large, free-standing chimney penetrates the roof at its centre in plan. This building is generally in fair condition (see photo 3).

3.4.3 Linen Supply Store

This is a rectangular, one-storey building with a regular steel portal frame structure clad with concrete blockwork walls (see photo 4). The roof envelope is made up of corrugated metal sheets supported by metal purlins spanning onto the structural portal frames. On the gable elevations, cracks delineating the interface of wall and portal frame columns have been observed. Reports indicate that during heavy rainfall the roof (see photo 20) is subject to leaking, and the building to flooding.

3.4.4 Inflammable Store

This is a small, single-storey building, irregular in plan, and constructed of reinforced masonry. Its roof is a cast-in-place concrete slab. This building is in fair condition (see photo 5).

3.4.5 Workshop #1

This single-storey, unreinforced masonry structure (see photo 6) has a gable roof made of timber rafters clad with corrugated metal sheets, and is irregularly shaped in plan. The wall is in ill repair at a few locations, with cracked and broken blocks in evidence (see photo 7). Light damage has been seen on the soffit of the internal ring beam. Some damage to roof timbers has been observed (see photo 8). Under rainy conditions, reportedly, flooding is experienced in the vicinity of the Workshop, with water typically being brought downslope from the region of the Boiler House.

3.4.6 Workshop #2

This is a single-storey, unreinforced masonry building, rectangular in plan, with a roof made up of timber rafters and metal sheets (see photo 9). The southern half was a later addition to the building. This building is generally in better condition than Workshop #1. The defects observed were a number of fine junction cracks at the interface of the original walls and the later-added walls.

3.4.7 Physiotherapy Department & Hospital Chapel

This is a two-storey reinforced masonry building (see photo 10), rectangular in plan, with walls made of concrete blocks and a cast-in-place reinforced concrete roof. A hipped timber roof structure is present over the Chapel (see photo 11). Cracks were observed in the walls in various areas on the north elevation and north-east and north-west corners (see photo 12). There is evidence of termite infestation in the timber flashing to the roof.

3.4.8 Laundry House

This is a rectangular, single-storey building (see photo 17), though the gable roof makes its overall height roughly equivalent to a two-storey building. Circular hollow section structural steel columns support steel trusses, which in turn support circular hollow section steel purlins to which metal sheeting is fixed. The walls of the building are made up of concrete blockwork. A small extension made of reinforced concrete columns, concrete blockwork walls, and corrugated metal sheets on the roof, is set on the north end.

This building is in a general state of disrepair. Broken blocks and numerous cracks have been observed in the walls (see photo 18). The roof sheeting is fixed to the circular roof purlins by hooked bolts, which are quite vulnerable to the uplift forces generated by high winds (see photo 16).

3.4.9 Boiler House

This building is a single-storey, steel framed structure, clad with concrete blockwork walls and metal sheeting on the roof. It is largely rectangular in plan, although it has two reinforced concrete extensions which make its shape somewhat irregular. Four slender, cylindrical chimneys, stabilised by three guy cables each, rise through the roof. The building is generally in poor condition, with cracked columns, cracked ceiling slabs and leaks in the metal roof (see photos 13 to 15). In similar fashion to the Laundry House, the roof sheeting is fixed to the circular roof purlins by hooked bolts.

3.4.10 Maintenance Store

This is a rectangular, single-storey, steel framed building, with concrete blockwork cladding for the walls and metal sheeting for the roof. On the west elevation, there is a small extension, made of concrete blockwork and a metal deck roof supported by timber rafters and purlins. The Maintenance Store is painted only on the exterior surfaces, and is in fair condition. It is linked to the Linen Supply Store by a metal deck roof, with the area bridged by the roof sealed at both ends by gates (see photos 19 and 20).

3.4.11 Orderlies' Dormitories

This is a single-storey, rectangular building (see photo 21) with a structural steel frame made up of concrete-encased steel columns supporting steel trusses. The building envelope consists of concrete blockwork walls and a corrugated sheet metal roof. There have been reports of roof leakage and some cracking was observed on internal partitions.

3.4.12 Lions Eye-Care Centre / Accident & Emergency Ward

The original building housing the Accident & Emergency Ward was a two-storey reinforced concrete structure, occupying the Lower Ground Floor and Ground Floor levels of the QEH. A three-storey reinforced concrete frame was constructed on top of this building, creating the spaces for the currently unoccupied Lions Eye-Care Centre (see photo 22). The entire structure is clad in concrete blockwork and glazed panels, with a cast-in-place concrete roof slab. Internal works are yet to be completed on the First Floor level. Some deterioration of the finishes and equipment in the Eye-Care Centre has occurred as a result of its prolonged disuse.

3.4.13 Small Incinerator

This single-storey building, constructed of unreinforced masonry and roofed with sheet metal, is in a general state of disrepair (see photo 23). A free-standing chimney penetrates the roof envelope. Both the timber roof trim and the roof sheeting, reported to have been replaced within the past year, are deteriorating. This may be due to the state of the immediate environment, ie the regular presence of refuse and the high operating temperatures of the incinerator. It is believed that damage to blockwork observed near the base of the north wall was caused by a fork-lift.

3.4.14 Delivery / Storage Annex

This is a two-storey, L-shaped building, made up of a structural steel frame with concrete-encased columns, clad with concrete blockwork and concrete breeze blocks, with a reinforced concrete roof slab. The short leg of the 'L' spans across the delivery access road, which leads into the courtyard enclosed by this building, the Kitchen and the Extension Block (see photo 24). The building is generally in fair condition.

3.4.15 Kitchen

This is a single-storey, steel-framed building (see photo 25) with walls made of concrete blocks and a gable roof clad with asbestos sheets. It is connected to the Storage section and to the Central Block. The building is generally in fair condition.

3.4.16 Main Building (All Sections)

The overall height of the main building is five storeys. However, a change in the ground surface profile across the site in the East-West direction results in only four storeys being visible from the South and East (see photo 27). The building is framed with structural steel beams and columns encased in concrete, with infill walls typically made up of a mix of concrete and clay blockwork.

The concrete floor slabs and flat concrete roof slab employ the SB system of floor slab construction. In this method, the concrete floor slab is poured onto a system of non-structural hollow clay blocks spanning between structural clay and mortar ribs reinforced with steel bars. In turn, these ribs span between the main beams of the building's frame, thus transferring the load of the floor slab to the main structure. This method of construction, relatively quick in comparison with conventional concrete solid slab construction, was commonly used at the time of construction of the hospital, and was used in many buildings in Barbados in the 1960s and 1970s.

Throughout the North, Central and South Blocks there have been many reported cases of fragments of hollow clay blocks falling from the soffit of the slabs. This problem has been experienced in many of the buildings using this flooring system. It is probably due to the brittle nature of fired clay, particularly when formed in thin sections, such as the cell walls of the clay blocks have been. There is also a possibility that there are locked-in stresses in the clay blocks due to the manufacturing process. Although this problem can prove to be an unsettling event for witnesses (and anecdotal evidence reveals that indeed it has!), it is not detrimental to the floor structure in its ability to carry gravity loads. Nevertheless, there is a possible hazard to persons and equipment under the slabs. Because of the historically unpredictable nature of the blocks under normal conditions, there is even greater cause for concern with respect to their behaviour during a moderate seismic event. Instances of damage to blocks due to this phenomenon have been observed on the unplastered soffit of the upper ground floor slab (see photo 36).

Random cracks of varied size have been observed in a number of perimeter walls in all blocks (see photo 35). There are examples of wall cracks in the range of $^1/_8$" to ¼" in width in the Mortuary and the Laboratories in the Central Block.

Finer cracks were observed at many of the junctions of structural elements (eg beams and columns) and non-structural elements (eg concrete block or clay block infill wall panels) throughout the building (see photo 35). These generally occur at the interface of two different materials, with different material properties under load, temperature and other environmental effects, and over the passage of time.

It has been reported that the original wall plastering used was not suitable for the Barbadian climate and has a tendency to chip off when any stress is applied. Some of the cracking observed might be localised to the plaster only.

3.4.17 Main Entrance Hall

This single-storey building, the entrance proper to the hospital (see photos 29 and 30), lies parallel to the North Block and is connected to the North Block, the Central Block and the Accident and Emergency Ward. Its structure is arranged in the form of a rectangular grid of concrete-encased steel columns supporting a gable roof made of steel elements and clad with metal sheets. The building is generally in fair condition.

3.4.18 Extension Block

This five-storey reinforced concrete building is rectangular in plan, clad with concrete and insulating glass panels (see photos 24 and 25) and has a flat cast-in-place concrete roof slab. It houses the Engineer's Office, the Doctor's Lounge, the Auditorium, the Neo-Natal Intensive Care Unit, the Delivery

Suite, and the Surgical Intensive Care Unit. This is one of the more recent additions to the Hospital, and has not developed any defects of note. It is noted, however, that some re-arrangement of the internal partitions in the Engineer's Office (on the Lower Ground Floor) took place shortly after completion to better accommodate internal activities. These changes have not been documented.

3.4.19 Housekeeping/Security Annex

This is a two-storey building (see photo 31), similar in structure and appearance to the Extension block, although smaller in plan. This building is also a very recent addition to the Hospital and is generally in fair condition, with only one damaged glazing panel observed. There is no documentation for this building, which was constructed empirically using elements extracted from the design of the Extension Block.

3.5 Building Assessments

This section contains tables listing the buildings and their grades for both the seismic and hurricane assessments.

3.5.1 Seismic Vulnerability Assessment

The following table presents the results of the seismic vulnerability assessment. A higher value for the Seismic Relative Vulnerability Number indicates a lower vulnerability to earthquake damage, and vice versa.

Individual Building	Code Number	Seismic Relative Vulnerability Number	Damage Potential	Comments
Storage Shed for the Incinerators	01	5.8	Mild	
Large Incinerator (#1)	02	0.3	Severe	Single-storey building, with a height of approximately two storeys, and a reinforced concrete roof
Linen Supply Store	03	2.3	Mild	
Inflammable Store	04	0.5	Moderate	Reinforced concrete roof
Workshop #1	05	2.7	Mild	
Workshop #2	06	1.8	Moderate	

Individual Building	Code Number	Seismic Relative Vulnerability Number	Damage Potential	Comments
Physiotherapy Department & Hospital Chapel	07	0.1	Severe	Two-storey building with a reinforced concrete roof
Laundry House	08	0.9	Moderate	
Boiler House	09	7.2	Mild	
Maintenance Store	10	1.6	Moderate	
Orderlies' Dormitories	11	2.1	Mild	
Lions Eye-Care Centre/Accident and Emergency Ward	12	0.1	Severe	Five-storey annex to the main building with a reinforced concrete roof
Small Incinerator (#2)	13	3.4	Mild	
Delivery/Storage Annex	14	0.6	Moderate	An annex to the main building
Kitchen	15	5.9	Mild	
Main Building - North Block	16a	0.1	Severe	Five-storey building with a reinforced concrete roof
Main Building - Central Block	16c	0.1	Severe	Five-storey building with a reinforced concrete roof
Main Building - South Block	16b	0.1	Severe	Five-storey building with a reinforced concrete roof
Main Building - Head Orderlies Dept. & Cobalt Store	16d	1.7	Moderate	Part of the main building
Main Entrance Hall	17	10.7	Mild	
Extension Block	18	0.2	Severe	Five-storey building with a reinforced concrete roof
Housekeeping/ Security Annex	19	0.2	Severe	Two-storey building with a reinforced concrete roof

These preliminary results suggest that all of the buildings in which the primary activities of the hospital are carried out are highly likely to be severely damaged in an earthquake. Further analytical assessments of these structures are warranted in order to confirm or contradict these preliminary results. Many of the smaller buildings providing ancillary services appear likely to suffer least damage.

3.5.2 Hurricane Vulnerability Assessment

The table on the following pages presents the results of the hurricane assessment, as generated by the WIND-RITE software package.

The 'Building Class' refers to the category of construction type used by WIND-RITE.

The 'Range' indicates the expected spread of values of the WIND-RITE Rating to be found for the building type, and is directly comparable with the actual value shown in the 'Rating' column. For the particular building class range, a higher value of rating indicates a higher vulnerability to hurricane damage, and vice versa.

The 'Rating' values for 'engineered' and 'non-engineered' buildings are also related to one another. For example, there is a relatively higher accepted risk involved with a non-engineered building (for which the structural behaviour is not necessarily inferior, but not readily assessable) when compared to an engineered reinforced concrete structure (with better documented structural properties and hence a more readily understood behaviour). Hence the higher values for non-engineered buildings.

The 'Comments' column makes note of assumptions made in classifying the buildings during the stages of data input.

The 'Recommendations' were initially generated by WIND-RITE itself. They are here presented after having been considered and tempered for reasonableness and relevance to the situation in Barbados.

Building and Code Number	WIND-RITE Building Class and Range	WIND-RITE Rating	Comments	Recommendations (modified from the suggestions provided by the WIND-RITE program)
Storage shed for the Incinerators 01	Non-engineered 4.5 - 10	7.0		Perform wall maintenance.
Large Incinerator (#1) 02	Non-engineered 4.5 - 10	7.3	It was decided to classify the chimney as an 'external appurtenance'. However, WIND-RITE might not recognise the chimney as such.	Provide engineered tie-downs for external appurtenances.
Linen Supply Store 03	Heavy Steel 1.5 - 5.5	3.6		Provide engineered shutters or use laminated glass for the windows
Inflammable Store 04	Reinforced Masonry 1.5 - 5.5	3.3		Provide engineered shutters for the windows
Workshop #1 05	Non-engineered 4.5 - 10	8.8		Provide engineered anchorage for the roof Provide engineered shutters for the windows.
Workshop #2 06	Non-engineered 4.5 - 10	8.6		Provide engineered tie-downs for external appurtenances.
Physiotherapy Dept. & Hospital Chapel 07	Reinforced Masonry 1.5 - 5.5	3.9		Provide engineered shutters or use laminated glass for the windows.
Laundry House 08	Heavy Steel 1.5 - 5.5	3.8		Provide engineered shutters or use laminated glass for the windows. Provide engineered anchorage for the roof Perform roof maintenance.

Building and Code Number	WIND-RITE Building Class and Range	WIND-RITE Rating	Comments	Recommendations (modified from the suggestions provided by the WIND-RITE program)
Boiler House 09	Heavy Steel 1.5 - 5.5	3.9		Provide engineered shutters or use laminated glass for the windows. Provide engineered anchorage for the roof.
Maintenance Store 10	Heavy Steel 1.5 -5.5	3.3		Provide engineered shutters for the windows.
Orderlies' Dormitories 11	Heavy Steel 1.5 - 5.5	3.6		Provide engineered shutters or use laminated glass for the windows.
Lions Eye-Care Centre/ Accident & Emergency Ward 12	Reinforced Concrete 1.5 - 5.5	4.2		Provide engineered shutters or use laminated glass for the windows. Provide engineered tie-downs for mechanical equipment.
Small Incinerator (#2) 13	Non-engineered 4.5 - 10	7.6	It was decided to classify the chimney as an 'external appurtenance'. However, WIND-RITE might not recognise the chimney as such.	Provide engineered tie-downs for external appurtenances.
Delivery/Storage Annex 14	Heavy Steel 1.5 - 5.5	3.2		Use laminated or insulating glass for the windows. Perform wall maintenance.
Kitchen 15	Heavy Steel 1.5 - 5.5	3.7		Provide engineered shutters or use laminated glass for the windows.
Main Building (All Sections) 16	Heavy Steel 1.5 - 5.5	3.6	In the WIND-RITE questionnaire, the question on wall maintenance asks if cracks have been seen in the mortar. To answer in a negative fashion is to say only that cracks were observed, not that the hospital authorities neglect any repairs.	Provide engineered shutters or use laminated glass for the windows. Provide engineered tie-downs for mechanical equipment. Perform wall maintenance.

Building and Code Number	WIND-RITE Building Class and Range	WIND-RITE Rating	Comments	Recommendations (modified from the suggestions provided by the WIND-RITE program)
Main Entrance Hall 17	Heavy Steel 1.5 - 5.5	4.1		Provide engineered shutters for the windows. Perform wall maintenance.
Extension Block **18**	Reinforced Concrete 1.5 - 5.5	4.3		Provide engineered shutters or use laminated glass for the windows. Provide engineered tie-downs for mechanical equipment.
Housekeeping/Security Annex **19**	Reinforced Concrete 1.5 - 5.5	3.8		Provide engineered shutters or use laminated glass for the windows.

The vast majority of buildings on the compound are inadequately protected against the effects of hurricane force winds and will require mitigative actions.

The buildings containing the primary functions of the QEH typically require protection for windows and mechanical equipment. However, a number of the small buildings will need to have mitigative actions performed on structural elements.

3.6 Services & Utilities

3.6.1 Electrical Power

Electrical power produced by the generators in the Boiler House is distributed to the various buildings on the compound via buried cable. This state of affairs is desirable because overhead cables are very susceptible to hurricane damage. It is reported that the standby generators are adequately sized to handle the current power requirements of the Hospital.

3.6.2 Water

Three water storage tanks are kept on the compound, all located in the Main Building. A 10,000 gallon tank is located in the penthouse of the North block, and another tank of similar capacity is kept in the penthouse of the South block. The third tank, which has a storage capacity of 9,000 gallons, is kept in the penthouse of the Central Block.

It is reported that these tanks do not adequately serve the requirements of the hospital. At the time of writing, a study commissioned by the QEH to determine the feasibility of installing a 50,000 gallon tank was in progress.

3.6.3 Sewerage and Solid Waste Disposal

All sewage and grey water are passed first into the community pit. from which it passes into the Bridgetown sewerage system. Solid waste, particularly medical waste, is disposed of in the hospital's on-compound incinerators. Both systems are reported to be currently operating in a satisfactory manner.

3.7 Communications

The maintenance of effective communication links during and after a disaster is most important if the hospital is to make the most effective use of its resources. This not only refers to telecommunications, but to the physical links between the buildings comprising the hospital facility. The areas where patients are treated are linked; however, during a hurricane, these areas might be cut off (or difficult to access) from various storage facilities, eg the Inflammable Store and Linen Supply Store.

Telecommunication systems using underground cables for distribution are protected from the effects of hurricane force winds, unlike overhead cable systems. Risk of damage still exists for both systems during seismic events. There is a risk of flooding involved with underground systems, and it has in fact been reported that the QEH switched from underground cables to overhead wires for their external communications due to problems experienced with water ingress into buried cables.

The QEH maintains an internal network using telephone and paging intercom systems. The telephone and paging systems serve the main hospital building and the ancillary buildings in close proximity, while the peripheral ancillary buildings are reached by the telephone system only. Both of these networks are managed by the PBX, located in the Housekeeping/Security Annex, and are distributed by internal building wiring and underground cables. There is also an inter-department intercom system using push-button units, serving the Operating Theatre and X-Ray Theatre, and distributed by internal wiring.

Additionally, a wireless communications link exists between the hospital PBX and the Central Emergency Relief Organisation (CERO). It is reported to be functioning adequately.

3.7 External Works

John Beckles Drive, the thoroughfare bordering the hospital compound to its west, provides the main vehicular access to the hospital from the area of the city centre of Bridgetown via its junction with River Road. This road, as well as River Road, has a history of severe flooding during heavy showers (see photo 37). This flooding does not directly affect the compound. However, it does significantly affect the ease of flow of traffic into and out of the hospital by effectively removing one of the two designated vehicular entrances to the compound.

A number of buildings on the hospital compound (including the Linen Supply Store and both Workshops) have been reported to be subject to flooding during periods of moderate to heavy rainfall. There are stormwater drains in the vicinity of the Workshops (see photo 38), which carry surface water into a culvert which drains into the Constitution River (see photo 39). These drains have been reported as being inadequate for their purpose during heavy showers (see photo 40).

A number of stormwater drain grilles have been observed on the one-way avenue parallel to Martindale's Road. Similar grilles are present on the eastern border of the car park adjacent to the South Block. These grilles are placed on top of a fine wire mesh which collects silt (see photo 41). Continued maintenance of these grille/mesh systems should be performed in order to prevent blockage (see photos 42 and 43).