CHAPTER 11 HAZARD MITIGATION STRATEGIES

11.1 INTRODUCTION

In the disaster management cycle three discreet phases are recognised; pre-disaster preparedness, disaster response and pos-disaster recovery. A crucial component of pre-disaster preparedness is hazard mitigation which seeks to reduce the potential impacts of hazardous processes. The ODP has implemented a Hazard Mitigation Programme as part of their preparedness efforts to augment the ongoing public education, awareness and disaster management programmes. The Hazard and Risk Assessment Project was implemented to provide crucial information for the formulation of measures, policies, and programmes as part of the BVI=s Hazard Mitigation Programme.

The preceding chapters of this report established the types of hazards, their magnitude, geographical distribution, frequency of occurrence and their likely impacts. This chapter presents strategies which might be employed in the BVI to reduce the potential impact of specific hazards. The strategies which are recommended have been largely determined from the findings of the Hazard and Risk Assessment Project described in the preceding chapters of this report.

The strategies presented here emphasizes the need to strengthen the physical development planning function, and to include hazard mitigation measures as a discreet but integral part of that function. The recommendations are presented with the recognition that significant mitigation activity takes place during the course of present development activities. However the most effective approach to hazard mitigation requires a systematic, sustained program for long term results. While specific measures and policies are presented, an effort has been made to outline a general approach and framework within which to develop appropriate mitigation measures.

11.2 GENERAL MITIGATION MEASURES

The results of the previous chapters allows us to establish priorities that facilitates the efficient and effective use of the limited resources available for hazard mitigation. The results indicate that natural hazards are potentially more damaging than technological hazards. Of the natural hazards that pose a threat to the BVI, high velocity winds produced by hurricanes, and ground shaking from earthquakes are the two most serious threats. These are followed by hurricane storm surge, land borne flooding, earthquake tsunamis and landslides. **As a general recommendation therefore it is suggested that reducing the potential impacts of high velocity winds and earthquake ground shaking. mitigation efforts be given priority.**

The mitigation strategies are separated into structural and non-structural measures. Specific mitigation measures are recommended within each group as they relate to different hazards. It should be borne in mind that while some measures seek to reduce potential loss of human life and reduce human suffering specifically, all hazard mitigation efforts ultimately seeks to accomplish this as its primary objective. Priority is also given to measures which reduce the potential impact on critical facilities, and these measure are given special attention.

11.3 STRUCTURAL MEASURES

Structural measures include all measures that allow elements in the built and natural environment to physically withstand the forces produced by specific hazardous phenomenon. This can be achieved by actively not placing the structure in harms way, protecting the structure from the hazard forces or by passively strengthening or modifying the structure or natural element to make it more hazard resistant. Structural measures involve measures that relate to the existing natural and built environments or which address future developments.

Measures that apply to the existing built and natural environments include:

X Relocation of structures

X Protection

X Retrofitting

Measures that apply to future development include:

X Appropriate location of structures

X Protection

X Hazard resistant design

11.3.1 SPECIFIC STRUCTURAL HAZARD MITIGATION RECOMMENDATIONS

HIGH VELOCITY WIND

1) Future critical facilities should not be located in areas of accelerated winds.

2) The most significant aspect of structural damage to buildings by high velocity wind results from roof damage. The roofs of existing buildings should be inspected and if necessary retrofitted to adequate standards.

3) The roofs of existing critical facilities should be retrofitted to a higher standard to ensure wind resistance.

4) The roof of future critical facilities should ideally be constructed with concrete or to a higher standard to ensure wind resistance.

5) Building openings such as windows and doors also suffer damage from high velocity winds. These openings if not constructed of wood or metal should be protected with shutters or temporary covers of adequate design.

6) Critical facilities should build storm shutters into the design of the building.

7) Government, commercial and institutional buildings constructed of metal sheeting should be inspected to ensure wind resistance.

8) An ongoing programme to inspect utility poles should be implemented to ensure that they meet relevant specifications.

9) In areas of accelerated winds, higher strength utility poles should be used and additional guy wires installed.

10) Adequate boat shelters should be developed to protect highly vulnerable boat stock.

EARTHQUAKE GROUND SHAKING

1) Existing critical facilities built on reclaimed land should be inspected and retrofitted if necessary to ensure earthquake resistance.

2) Future critical facilities should not be located on reclaimed land because of the high potential for liquefaction.

3) Older unreinforced masonry buildings should be inspected and retrofitted if necessary to increase earthquake resistance.

4) Older unreinforced masonry buildings should not be used for critical functions.

STORM SURGE

1) Critical facilities located on the shoreline in areas of high storm surge susceptibility should be protected by sea walls or other appropriate structures. Where possible their critical

function should be performed elsewhere.

2) Future critical facilities should not be located on the shoreline in areas of high storm surge susceptibility.

3) Buildings located on the shoreline in areas of high storm surge susceptibility should be designed to withstand storm surge forces.

4) The shoreline in areas of high storm surge susceptibility should be protected by sea defense structures such as sea walls.

INLAND FLOODING

1) Watercourses which pass through significant settlement areas should be properly configured and lined with concrete.

2) Existing bridges should be inspected to determine which ones are too low or which have support pillars within the watercourse channel. Where possible these should be replaced as these features restrict water flow and cause the channels to be easily blocked with debris.

3) Future bridges should not be built with these undesirable features.

4) Buildings constructed adjacent to watercourses should be elevated by at least one meter to prevent potential flood inundation.

5) Critical facilities should not be located adjacent to watercourses.

LANDSLIDES

1) Detailed slope analysis should be carried out where significant natural slope modification is

contemplated for development purposes.

2) In this respect the construction of buildings on steep hill slopes should involve a detailed slope analysis to ensure appropriate cut slope design.

3) Locations which are found to be especially prone to recurrent slope failures should be examined with the view to stabilizing the slope with structural support.

11.4 NON-STRUCTURAL MEASURES

These measures consist of all efforts not involving direct implementation of structural activity, that have the effect of reducing the impacts of hazards. They include governmental and non-governmental policies, and programs which promote hazard conscious development.

11.4.1 PHYSICAL PLANNING GUIDELINES AND REGULATIONS

The most effective way to ensure systematic and sustainable hazard mitigation is to integrate hazard mitigation issues into the physical planning process. In this way hazard mitigation issues become part of the whole range of development planning issues considered in the decision making process. It is therefore necessary to implement specific physical planning regulations and development guidelines to ensure consistent appropriate development practices.

The impact of natural hazards on structures is the most significant and therefore the implementation of an appropriate building code can go a far way towards reducing hazard vulnerability. Such a building code should include the following provisions:-

1) Building specifications for roof design to ensure resistance to high velocity winds. Separate specifications should be provided for critical facilities to achieve greater levels of resistance.

2) Guidelines for the proper construction of window shutters.

3) Regulation or guidelines to encourage the inclusion of window shutters into the design of critical facilities.

4) Regulations or guidelines should be developed to ensure the proper design of utility pole installations to ensure wind resistance.

5) Building specifications for building reinforcement to ensure earthquake resistance. Separate specifications should be provided for critical facilities to achieve greater levels of resistance.

6) Efforts should also be made to limit the construction of critical facilities on reclaimed land because of the high risk of earthquake induced liquefaction.

7) Specifications should be provided for the proper design of structures located on reclaimed land because of the high risk of earthquake induced liquefaction.

8) Building guidelines to encourage appropriate design of structures in areas of high storm surge susceptibility.

9) Regulations to limit the placement of critical facilities in areas of high storm surge susceptibility or at locations adjacent to watercourses.

10) Guidelines should be developed for bridge design so as not to increase the risk of localised flooding due to channel blockage.

11) Guidelines should be developed for building on steep slopes and designing road cuts to ensure slope stability of modified slopes and therefore prevent landslides.

11.4.2 DISASTER MANAGEMENT

The most important nonstructural measures that can be implemented by the ODP is the development of evacuation plans to protect human lives. This applies to areas susceptible to

high storm surge and also to the boating community. The ODP also provides a significant mitigation function by developing hazard warning systems. In the BVI this primarily requires the ability to monitor and track weather systems and seismic activity.

While the ODP currently has the ability to monitor, track and receive predictions about extreeme weather systems, there is no capacity to monitor seismic activity. **It is recommended that at least one seismic monitoring/recording station be installed in the BVI.**

11.4.3 GOVERNMENT PROGRAMMES

Government programs that encourage hazard mitigation can take the form of assistance programmes or development programmes. Financial assistance programmes to encourage the inspection of roofs and retrofitting to meet building code specifications of high velocity wind resistance is one example. This could be carried out at first on critical facilities. Such a programme could also be applied to development of boat shelters.

Specific development programmes can have a significant impact on hazard mitigation. In some cases these projects can only be undertaken by the government. In addition these projects add infrastructure and if properly designed can also have economic spinoffs for the community. These projects can also generate opportunities for employment. Examples of projects that could be undertaken are the redesign of water courses in Road Town and the building of a promenade around Road Harbour which would act as a sea defense structure.

11.4.4 PRIVATE SECTOR PROGRAMMES

The private sector can also play a significant role in hazard mitigation. Financial institutions

and materials suppliers could for example make financing available for roof retrofitting. Insurance companies can have a powerful impact on building design by offering premium incentives for building design and location that meets building code specifications.

11.4.5 INSTITUTIONAL CAPACITY

In order to achieve hazard mitigation objectives requires sustained effort by informed personnel within functional institutions. The development planning agencies and the disaster management agency therefore have to be strengthened to carry out theses tasks.