

## RISK ASSESSMENT REPORT

### **8.0 Need for Disaster Management**

Data on disaster occurrence, its effect upon people and its cost to countries, are primary inputs for analysis of the temporal and geographical trends in disaster impact. Disaster losses, provide the basis for identifying where, and to what extent, the potentially negative outcomes embedded in the concept of risk is realized. They help to understand where, and to whom, disaster risk becomes impact. They also provide the basis for risk assessment processes, a departing point for the application of disaster reduction measures.

Development cannot be sustainable unless disaster mitigation is built into development process. Investments in mitigation are more cost effective than expenditure on relief and rehabilitation. Prevention and mitigation contribute to lasting improvement in safety and are essential to integrated disaster management. Disaster response alone is not sufficient as it yields only temporary results at very high cost. So emphasis must be on Disaster prevention, mitigation and preparedness, which help in achieving objectivity of vulnerability reduction.

Disaster response is a multi-layered activity which starts from awareness about them at an individual and household level and goes up to community and civil administration level. Organizations with formal assemblage of people, either for residential or non-residential also need to identify and widely make known the natural hazards likely in their premise and ways of mitigating them in at the time of crisis.

The term Disaster, Hazard and Vulnerability have been defined as follows:

- a. “A Disaster is a sudden, calamitous event that causes serious disruption of the functioning of a community or a society involving widespread human material

economic or environmental losses and impacts which exceeds the ability of the affected community or society to cope using its own resources." - UN International Strategy for Disaster Reduction, (UNISDR)

- b. A Disaster is a "Situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering". - Centre for Research of Epidemiology of Disaster (CRED), Belgium
- c. Hazard is a natural physical event which has a potential to convert into a disaster, causing widespread injury or deaths and damage to public or private property or the environment.
- d. "Vulnerability means inability to resist a hazard or respond when a disaster has occurred. It depends on several factors such as people's age and state of health, local environmental and sanitary conditions, as well as on the quality and state of local buildings and their location with respect to any hazards." – UNISDR.

Disasters are often classified according to their cause i.e. natural or manmade.

**A. Natural disasters:-**

Flood, Earthquake, Tsunami, Cyclone, Landslide, etc.

**B. Manmade disasters:-**

Air crash, Railway accident, Industrial accident, Bomb blast, etc.

The Indian subcontinent is highly vulnerable to floods, cyclones, droughts, earthquakes, tsunamis, etc. Twenty five states in the country are disaster prone. Although Karnataka has not experienced any major natural or manmade disaster, it is always prudent to be prepared to face any disaster. The coastal zone of Karnataka is potentially prone to cyclones and destructive sea waves. Similarly, being a well known tourist destination it can also be targeted by terrorists who want to disrupt peace in the country.

A Disaster Management Plan (DMP) is prepared by considering all the factors required for management and mitigation of adverse effects of any small or big disaster. Some man-made disasters can be avoided by proper design, adequate maintenance and good house-keeping.

### **8.1 Objectives of Disaster Management Plan (DMP)**

The mandate of a DMP is to make use of the combined resources created or available at the site and/or off-site services to achieve the following:

- To minimize the detrimental effects of a disaster on people and property;
- Provide rescue services and medical treatment to affected people within and outside the periphery of the resort.
- Inform and collaborate with local/state emergency relief authorities;
- Initially contain and ultimately bring the disaster under control;
- Preserve relevant records and equipment for subsequent enquiry into the causes and circumstances leading to the disastrous happenings;
- Investigate and take steps to prevent recurrence of similar incidents.

The DMP therefore needs to be related to the identification of sources from which hazards can arise and the maximum loss scenario that can take place in the concerned area. The project proponent should adhere to all the laws regulating the construction of the proposed resort.

### **8.2 Specific Focus of the DMP**

Based on the vulnerability profile of the proposed Resort, the DMP focuses on the two natural events, namely Cyclone and Tunami which should be kept in mind for design of building structures and event preparedness. An analysis of the events is given in the

**Table 8.1.** Analysis of the historical records leads to believe that both events will have low probability of occurrence and low to moderate severity. However, preparedness for any event is of paramount importance to the Resort and Golf course project.

**Table 8.1 Natural events of relevance to the proposed Resort**

Sr.	Natural Event	Early warning lead time	Damage caused by	Disaster Response
1.	Cyclone	24 to 48 hours from IMD through radio broadcast, local news channels, mass public address by the local administration	High winds, blow-away or collapse of building structures, flood in the river leading to bank-breach and rapid inundation	Evacuation to mainland through the Tannir Bhavi, Mangalore post site forecast time of land hit of the cyclone.
2.	Tsunami	3-5 hours from the district administration by local news channels, mass public address	High waves from the sea side, the wave from the Gurpur river side.	Rapid evacuation towards main land, preferably on foot after tsunami warning immediately

### **8.3 Specific Nature of Vulnerability for the Resort**

Specific vulnerability of the site is compounded by two factors, one pertaining to location and another to the specific nature of the activity.

- a. Proposed location of the Resort is on a barrier beach between Gurpur River and the sea. In event of high torrential rain caused by a cyclone, there could be bank-breach on the river causing short circuiting of flow of water through over the barrier beach subjecting the Resort site to voluminous inundation.
- b. Route of evacuation to mainland town runs parallel to the seashore thus the evacuation route is partially exposed to effect of tsunamigenic waves.
- c. Some occupants of the Resort may be foreign tourists who might not have appropriate local threat perception and may be from non-english speaking countries, therefore appropriate mode of communication may be critical in effective evacuation.

#### **8.4 Disaster Management Plan – Measures taken in Planning and Construction of Resort Buildings**

The Resort will adhere to the following codes of construction in the buildings proposed as part of the Resort.

- a. IS code - IS 15498:2004 ‘Guidelines for improving the cyclonic resistance of low rise houses and other buildings/structures’ for wind resistance.
- b. IS code – IS 2309:1989 ‘Protection of Buildings and Allied Structures against Lightening –Code of Practice’.
- c. IS code – IS 1893 ‘Criteria for Earthquake Resistant Design of Structures’

In addition following general planning measures are proposed to reduce and/or mitigate the risk from natural events.

- i. All buildings in the resort will be built over a plinth 1 m high from the finished floor level
- ii. No basement I proposed in the Resort. No residential or human-access activity below grade is proposed in the Resort.
- iii. The Resort will be boundary walled from all sides with cemented laterite blocks of minimum 1.7 m high with Y frame or cyclone barb wiring on top. Shelter vegetation will be grown on the seaward side of the boundary wall all long the seacoast.
- iv. All electrical transformers and outdoor equipment will be kept on pedestals of minimum 1.5 m. All outdoor electrical fittings will be of IP 55 grade.
- v. Access to the beach from inside the Resort will be controlled, documented and will be under surveillance of CCTV. A beach volunteer will be on guard during daytime when beach sport or beach excursion is planned for resort occupants.

- vi. The buildings will not have any overhang not supported from the roof structure/truss/purling through structural tie-ins. No gravity-resting canopy, *pargolas*, etc. will be constructed in the buildings.
- vii. Branches of trees will be cropped so as not to interfere with the window openings or form canopy above the buildings.
- viii. All weak trees which may cause fall hazards during high wind conditions will be uprooted or sawed at breast height. No trees with spreading canopy or branches will be maintained at the two pole structure or near outdoor power incomer structures.
- ix. Internal roads and parking will be designed in annular manner so that vehicles may not need to reverse for going out of the Resort.
- x. A high power paging system will be installed in the Resort covering all the building foyers, corridors, amenities and outdoor areas for mass communications.
- xi. Residual current circuit breakers will be installed on all electrical fittings to eliminate risk of electrocution during any event of inundation.
- xii. Personnel and occupant movements in the Resort will be documented at the gate for rapid head count.
- xiii. 5 kg DCP type fire extinguishers will be installed within 30 m travel span in all the buildings. 5 kg CO<sub>2</sub> type extinguishers will be placed near electrical board room, near outdoor power incomer structure and in the kitchen.

## **8.5 Disaster Management Plan – Measures taken in Operations of the Resort.**

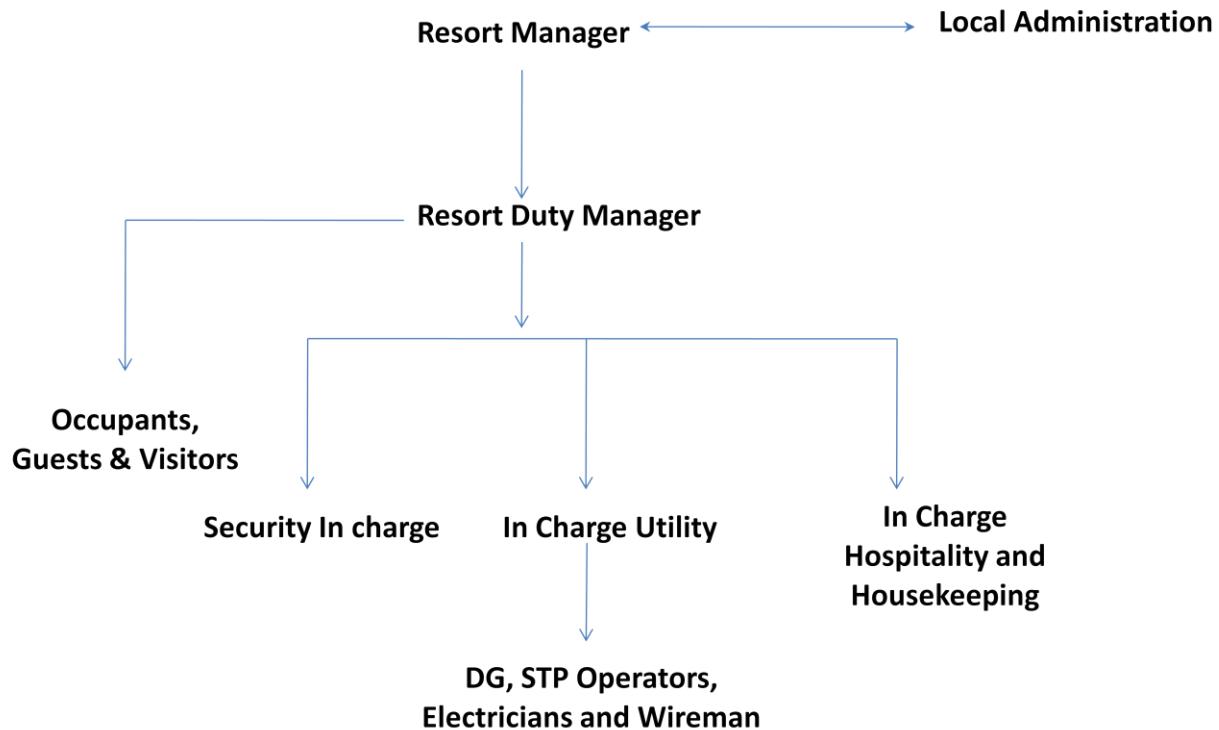
Following good practices will be followed in operations of the Resort.

- i. The Resort will conduct a spatial orientation of all the occupants immediately after they are enrolled. The orientation program will brief them about the following:

- a. Layout of the Resort
  - b. Safety features and firefighting equipment installed in the buildings
  - c. Attentiveness towards paging system installed in the Resort
  - d. Method of documentation of occupancy while an occupant comes in or goes out of the Resort.
  - e. Key personnel who the occupant is expected bring to notice any non-routine incident or incident involving safety of personnel
  - f. General evacuation procedures when instructed over pager system (including what to carry when evacuation, and what to shut, lock or tie back)
- ii. All occupants will be given a printed leaflet about does and don's inside the resort. These necessary conditions will be made part of the occupancy agreement. A suitable insurance policy may be bought for the occupants if they chose so.
  - iii. A layout of the Resort will be placed in all the mass gathering places of the resort buildings. Fire and emergency exits will be marked in all the foyers/common corridors of the buildings.
  - iv. Gate of the Resort will be designated as assembly point for collecting and head count during any evacuation procedure.
  - v. A well stocked first aid box will be places in the Gate Complex of the Resort. An emergency toolbox will also be placed in the Gate Complex. Contents of the first aid box and emergency toolbox are given in the following sections.

## **8.6 Disaster Management Plan – Preparedness of the Resort Management**

The Resort management will follow organization structure as shown in Figure 8.1. Responsibilities of the individual team member are described as follows.



**Fig.8.1: Organizational Structure**

### 8.6.1. General Responsibility and Preparedness

- Resort management will be vigilant towards weather warnings and status reports being broadcast from local radio station or telecast from local channel.
- Resort management will act swiftly and decisively in event of any emergency measures suggested by the local administration. They will not let their judgement be effected by panic or be guided by rumours or hearsay.
- Occupancy register with occupant details will be placed in a water proof bag and will be carried along by the Resort Duty Officer (Administration) or any further reference. A hard copy of all documents will always be maintained as soft copies are not portable and are of limited value in absence of computer systems.

- d. The Resort will stock HSD fuel in 200 l MS drums for DG and vehicles so that they are no dependant on a filling station supply in time of crisis.
- e. All vehicles in the duty of the Resort will be kept monsoon worthy by end of May.
- f. One vehicle capable of carrying 6-8 people should be on duty with the Resort at all times.
- g. Security incharge will be responsible for maintaining a First Aid Box and an Emergency Tool Kit, as listed in **Table 3.2**.

#### **8.6.1.1. Resort Manager**

- a) Resort Manager will be the overall incharge of all Resort functions. He will be the link between District/local Administration and the Resort.
- b) Resort Manager will be empowered to take necessary commercial and personnel decisions in the event of any natural disaster.
- c) Resort Manager may or may not be resident in the resort. He will be available to assist the Resort Duty Officer during any emergency.
- d) He will be responsible for emergency medical aid agreement with a nearby hospital. He will keep updated about key persons in the Local Administration who may contact him during any emergency.
- e) He will be authorized to talk to media in case of any public declaration regarding the Resort to be made.
- f) He will be responsible for adherence of all structural safeguards and stocking of consumable pertaining to emergency management. He will be responsible periodic mock drills in the Resort.
- g) In event of his absence, all his responsibilities will be undertaken by the senior most Resort Duty Officer who is not on duty at the time of emergency.

#### **8.6.1.2 Resort Duty Officer**

- a) Resort Duty Officer will be the person incharge of the overall operations of the Resort corresponding to his shift of duty. Resort Duty Officers will be present in all shifts on relieving basis. Resort Duty Officer will act as On-Scene Commander for all emergency actions in the Resort.
- b) He will coordinate with the Security Incharge for effective message transmission to all occupants and mustering of all occupants at the assembly point near the Gate Complex of the Resort.
- c) All utilities and amenities such as DGs, emergency/backup power, communication will be operated under his instructions.
- d) He will take the decision for evacuation of occupants and employees of the Resort in consultation with the Resort Manager/ Acting Resort Manager.

#### **8.6.1.3 Security Incharge**

- a) Security Incharge will be responsible documentation of entries and exits of employees and occupants for tallying with the Resort Duty Officer and for head count at the Assembly Point.
- b) Security incharge will be responsible for evacuation of occupants and employees as prioritized by the Resort Duty Officer using vehicles available with the Resort. He will coordinate with the drivers and occupants at the point of refuge.
- c) He will instruct the security guard to carry out fire fighting activities when required.
- d) He will be the custodian of the First Aid Box and an Emergency Tool Kit.
- e) Final securing of the Resort and necessary inventorization will be carried out by him before pre-evacuation loak-up of the Resort.

#### **8.6.1.4 Incharge Utility and Services**

- a) Incharge Utility and Services will be responsible for keeping the emergency utilities such as DGs running at the time of emergency, in event of any power outage.
- b) He will ensure operation of all the communications and emergency illumination in the Resort.
- c) He shall be responsible for effective lockout of electrical and emergency power systems after evacuation in coordination with Security Incharge.
- d) He shall be responsible for stocking of fuel for DG and vehicles for emergency.
- e) All building related safety measures such as operation of CCTV cameras, fire extinguishers, emergency exit illuminations, structural stability of the buildings, securing of overhangs, etc. will be responsibility of the Incharge Utility and Services

#### **8.6.1.5 Incharge Hospitality and Housekeeping**

- a) Incharge Hospitality and Housekeeping will be responsible for housekeeping and fire prevention in the kitchen.
- b) He will insure that there are no structures, fitments and furniture in the building and villa rooms which may come loose during an emergency event any may cause harm to the occupants.
- c) He will be responsible for arrangement of necessary ration supplies and other household and daily needs material to the occupants before they are evacuated from the Resort.
- d) He will bring outdoor furniture and gardening equipment and bicycles, etc. inside or under cover
- e) He will ensure that all water taps are closed and water tanks are sealed for reuse after re-occupation.
- f) He will ensure that all windows shutters are closed and secured. All loose windows will be sealed by duct tape.

**Table 8.2 Contents of First Aid Box and Emergency Tool Kit**

First Aid	Emergency Tool Kit
<ul style="list-style-type: none"> <li>• 5 packets of waterproof band aid dressings</li> <li>• 5 rolls of non-allergenic tape</li> <li>• 20 sterile eye pads</li> <li>• 20 triangular bandages</li> <li>• 30 conforming gauze bandage</li> <li>• 30 sterile combine dressing</li> <li>• 3 stainless steel scissors</li> <li>• 10 square gauze swabs</li> <li>• 2 bottles antiseptic lotions</li> <li>• 3 wound closure steri-strip</li> <li>• 2 bottles antiseptic solution</li> <li>• 25 alcohol swabs</li> </ul>	<ul style="list-style-type: none"> <li>• 2 Portable radio sets with batteries</li> <li>• 5 high power LED torchs with batteries</li> <li>• 2 Magaphones with batteries</li> <li>• Non-perishable food sufficient for 40 people</li> <li>• 3 pairs of sturdy gloves</li> <li>• 10 large waterproof bags</li> <li>• 20 candles, matches in a sealed plastic bag</li> <li>• Essential medications</li> <li>• Copies of important documents</li> <li>• Two sets of mechanic grade multi tools</li> <li>• Two sets of hack saws, heavy duty crow bars</li> <li>• One firemen's axe</li> </ul>

## 8.7 Disaster Management Plan - Measures recommended for Cyclone Hazard

Cyclones are huge revolving storms caused by winds blowing around a central area of low atmospheric pressure. In the northern hemisphere, cyclones are called hurricanes or typhoons and their winds blow in an anti-clockwise circle. In the southern hemisphere, these tropical storms are known as cyclones, whose winds blow in a clockwise circle. Cyclones develop over warm seas near the Equator. Air heated by the sun rises very swiftly, which creates areas of very low pressure. As the warm air rises, it becomes loaded with moisture which condenses into massive thunderclouds. Cool air rushes in to fill the void that is left, but because of the constant turning of the Earth on its axis, the air is bent inwards and then spirals upwards with great force. The swirling winds rotate faster and faster, forming a huge circle which can be up to 2,000 km across.

At the centre of the storm is a calm, cloudless area called the eye, where there is no rain, and the winds are fairly light.

Following measures are recommended to the occupants before, during and after a cyclone:

#### **8.7.1. Recommended Actions before Cyclone**

- a) All occupants will keep their identification papers (photo IDs, passport, VISA and currency notes secure in a waterproof sling bag)
- b) Occupants will keep their cellular phones charged and in switched on mode
- c) Occupants will identify their next of kin and their contact numbers with the Resort at the time of registration
- d) Occupants will be vigilant towards any paging announcement and will follow the instructions swiftly and decisively.
- e) Occupants will not make long calls on their cellular phones as it may cause the airwave to be crowded and hinder necessary communications.

#### **8.7.2. Recommended Actions during Cyclone**

- a) Ensure that you and your family members are wearing strong shoes and suitable clothing.
- b) Take your Emergency Kit and your Evacuation Kit and commence your Evacuation Plan.
- c) Turn off all electricity, gas and water and unplug all appliances if inside the Resort or at any location functioning as cyclone shelter.
- d) Keep your Emergency Kit close at hand.
- e) Bring your family into the strongest part of the house. This may even be a bathroom covered from all sides.
- f) Keep listening to the radio for cyclone updates and remain indoors until advised.
- g) If the building begins to break up, immediately seek shelter under a strong table or bench or under a heavy mattress.

- h) Beware of the calm eye of the cyclone. Some people venture outdoors during the eye of the cyclone, mistakenly believing that the cyclone has passed. Stay inside until you have received official advice that it is safe to go outside.

#### **8.7.3. Recommended Actions after a Cyclone**

The time immediately after a cyclone is often just as dangerous as the initial event itself. Many injuries and deaths have occurred as a result of people failing to take proper precautions while exploring collapsed buildings and sightseeing through devastated streets. Once you have been advised that the cyclone has passed you must adhere to the following:

- a) Listen to your radio and remain indoors until advised or contacted by the Resort personnel.
- b) If you are told to return to the Resort, , do so using the recommended routes communicated by the Resort Duty Officer.
- c) Do not go sightseeing.
- d) Do not use electrical appliances which have been wet until they are checked for safety.
- e) Boil or purify your water until supplies are declared safe.
- f) Stay away from damaged powerlines, fallen trees and flood water. g. If your building has become uninhabitable due to cyclone damage, contact Resort Administration to prioritize a cleanup.

#### **8.8 Disaster Management Plan - Measures recommended for Tsunami Hazard**

A tsunami is a series of fast moving waves produced during large scale ocean disturbances. A tsunami can occur with very little warning; caused by a variety of natural or technological events, such as earthquakes, volcanic eruptions, explosions,

landslides, and meteorite impacts. Tsunami is different from regular ocean waves in several ways:

- A tsunami is a series of sea waves that are extremely long. As a tsunami crosses a deep ocean the length from crest to crest may be as much as 150 kilometres and these waves can travel at speeds of 1,000 km/h.
- As a tsunami leaves the deep water of the ocean and travels to the shallower water near the coast, the tsunami slows and the wave height increases. This process is called shoaling.
- A tsunami that is unnoticeable at sea, because of its long wave lengths, may reach several metres or more in height by the time that it reaches the coast.
- Regular ocean waves move in the water from the surface down to around 150m deep, but a tsunami moves in the water all the way to the seafloor. Therefore the volume of water that is moved by a tsunami is significantly more than the amount moved by regular ocean waves.
- As many tsunami are a series of waves, there is often more than one wave and the first wave may not be the largest.
- Depending on whether the first part of a tsunami to reach the shore is a crest or a trough, it may appear as a rapidly rising or falling tide.
- Even a small tsunami can be very dangerous to swimmers and mariners.

Because of the limited warning time for a tsunami, it is very important for the occupants to quickly follow the instructions given by the Resort Management.

Following measures are recommended to the occupants before, during and after a tsunami.

#### **8.8.1. Recommended actions before and during Tsunami**

- a) Listen attentively to instruction on the paging system of the Resort.

- b) Due to very short time of response, evacuation by vehicles is not recommended in case of a tsunami. When asked to evacuate from the Gate Complex of the Resort, immediately move inland or to higher ground at least 10 meters above sea level or, if possible, move at least 1 km away from the beaches, harbours and coastal estuaries/riverbank areas. For reference, it will be safe to move further west and south away from the sea and Gurpur River.
- c) It will be in your own interests to walk to safety as swiftly as possible to avoid traffic jams. There is no necessity of running, brisk walking is sufficient to go away from the sea side.
- d) If you are somehow unable to leave the area, take shelter in the upper level of a sturdy brick or concrete multi-storey building and stay there until advised that it is safe to leave (homes and small buildings are not designed to withstand tsunami forces).
- e) Take your emergency kit with you, as well as important papers, medical needs, and family photographs.
- f) If you are swimming in the sea, get out of the water and move away from the shore further landwards.
- g) If you are on a boat or water scooter close to shore and there is sufficient time, return to land, secure your vessel and move to higher ground.
- h) If you are on a ship or boat at sea, move to deep water (Open Ocean) well offshore and remain there until further advised.
- i) Do not go to the coast or headlands to watch the tsunami even after the major waves have subsided.
- j) Keep listening to your local radio station and media for further information and follow the advice from Resort Management who will contact you on your cellular phone.
- k) Tsunami move significantly faster than normal wind-driven waves and can move faster than people can run. Once you see the tsunami it may be too late to escape. The backwash of a tsunami is extremely dangerous. As the large volume

of water recedes back towards the ocean, it may carry debris and people back to sea with it. Hold on to a tall, strong structure if waves have reached you. Do not enter the water if you are at a dry or high place.

- l) Even a small tsunami may cause strong turbulence and very dangerous currents.  
DO not wade through water of unknown depth and current.
- m) Do not return to coastal areas/low lying areas until an all-clear is given by emergency services or public officials.

#### **8.8.2. Recommended actions after Tsunami**

- a) Wait for the Resort Management to contact you and ask you to come back to the Resort.
- b) Do not go near flooded and damaged areas until the emergency services or public officials advise that it is safe to return.
- c) Do not drink unboiled tap water until water supplies have been declared safe.
- d) Do not eat food which has been immersed in flood waters.
- e) Do not use gas or electrical appliances in the Resort which have been immersed in flood waters until they have been checked and declared safe.

#### **8.9 Disaster Management Plan – Updation of Plan**

The DMP has been prepared before the Resort has been constructed and has become operational. The DMP must be revised immediately after construction of the Resort is over and it is ready to accept occupancies so that relevant details of the Resort pertaining to emergency preparedness are re-documented and made suitable for actual implementation.

#### **8.10 Structure of the DMP**

The Disaster Management Plan provides risk analysis and precautionary measures with reference to likely disasters listed below:

- Fire
- Earthquake
- Flood
- Cyclone
- Terror strike/ blast
- Biological Disaster
- Power failure, water shortage, road congestion, communication failure, sea level rise, etc.

### **8.11 Type of Disasters and Risks**

The types of disasters that can affect the proposed development are as follows:

Since the proposed site is not located near any active industrial area, risks associated with industrial hazards are not likely.

#### **8.11.1 Fire:**

Occurrence of fire requires fuel, heat and oxidizer. Fire disasters are most common of the emergencies which can occur at a resort site. Sometimes they occur in circumstances that are unexpected or unpredictable. Fire incidences can be natural or human generated.

#### **Types of fires**

1. **Natural:** Natural fires are generated by volcanic eruption, lightning and the like. Earthquake and storms can cause devastating fires due to short circuits in damaged houses, fallen power cables, ignition of spilled fuels, gas leakages, etc. Proper insulation, meticulous wiring, leak proof storage etc. should form a part of disaster preparedness.
2. **Manmade:** Faulty electrical circuits, defective electrical wiring, poor maintenance of “boilers/electrical equipment”, cooking gas leakages, etc can

cause fires. Similarly, accidental leakage of flammable liquids and careless disposal of lighted cigarette buds can also cause devastating fires.

### **3. List of Major Fire Hazards:**

- Flammable chemicals: Paints, Aerosols, Fuels, etc.
- Flammable substances: Furniture, Upholstery, Dry Grass, etc.
- Processes involving open flame: Cooking, Smoking, etc.
- Heat producing devices: Dryers, Heaters, Hot Plates, etc.
- Electrical equipment: Short circuits and malfunctioning equipment.

#### **8.11.2 Seismic Environment & Precaution:**

As per the Seismic Zoning Map of India, Karnataka falls under Seismic Zone-3. During the last 15 years, the country has experienced 10 major earthquakes that have resulted in over 20,000 deaths. As per the current seismic zone map of the country (IS 1893: 2002), over 59% of India's land area is under threat of moderate to severe seismic hazard. Earthquake of magnitude 6.0 or more on the Richter scale usually results in a large number of casualties. 90% of casualties result directly from the collapse of buildings. Secondary events, such as landslides, floods, fires, and tsunamis, account for the remainder (10 per cent) of the casualties. Mortality increases with age, disability and degree of destruction of the structures. Many deaths can be prevented by early implementation of rescue services and medical aid.

#### **8.11.3 Floods**

Fortunately, Karnataka is not prone to severe flooding due to its hilly topography combined with excellent network of drainage provided by rivers and flood plains. In particular the project site is free from flooding hazards.

#### **8.11.4 Cyclones**

Cyclones are caused by atmospheric disturbances around a low-pressure area with swift and often destructive air circulation. They cause violent storms and heavy rains. The air circulates inward in an anticlockwise direction in the Northern hemisphere and

clockwise in the Southern hemisphere. As per the accepted classification of Cyclones, Karnataka falls in Category II of low vulnerability.

**Table 8.3 Wind speed categories and related events**

Type of Disturbances	Wind Speed in Km/h	Wind Speed in Knots
<b>Low Pressure</b>	Less than 31	Less than 17
<b>Depression</b>	31-50	17-27
<b>Deep Depression</b>	51-62	28-33
<b>Cyclonic Storm</b>	63-88	34-47
<b>Severe Cyclonic Storm</b>	89-117	48-63
<b>Very Severe Cyclonic Storm</b>	118-165	64-89
<b>Extremely Severe Cyclonic Storm</b>	166-220	90-119
<b>Super Cyclone</b>	More than 221	More than 120

Where: 1 knot – 1.85 km per hour

Cyclones are classified into five different levels on the basis of wind speed. They are further divided into the following categories according to their damage capacity.

**Table 8.4 Cyclone categories**

Cyclone Category	Wind Speed in Km/h	Damage Capacity
01	120-150	Minimal
02	150-180	Moderate

03	180-210	Extensive
04	210-250	Extreme
05	250 and above	Catastrophic

### 8.11.5 Tsunamis

The Indian coastal belt has not recorded many severe tsunamis in the past. Few tsunamis are known to have occurred in Indian Ocean. The multi hazard situation on the West coast of India is presented in the following table.

**Table 8.5 Multiple Hazard Data for West Coast of India**

Name of the Coastal State / UT	Seismic Zone	Design Cyclonic Wind [IS:875 (III)] (m/s)	Probable Maximum Storm Surge Heights (m)	Astronomical High Tide above Mean Sea Level (m)	Flood Proneness
Gujarat	V,IV,III	50 & 47	2.5-5.0	1.1-4.1	In 5 coastal districts
Dadra & Nagar Haveli	III	44	5.0	1.9	-
Daman & Diu	III	50 & 44	5.0	1.1	-
Maharashtra	IV & III	44 & 39	2.9-4.2	1.9	-
Goa	III & II	39	3.4	1.0	-
Karnataka	III & II	39	3.4-3.7	0.8	-
Kerala	III	39	2.3-3.5	0.8	In 9 coastal districts
Lakshadweep	III	39	**	0.5	-

*Source:* National Disaster Management Guidelines: Management of Tsunamis, 2010.

*This is a publication of the National Disaster Management Authority, Government of India.*

### 8.11.6 Terror Strikes and Blasts

Terrorist attacks may not be eliminated completely, but the effects of these attacks on buildings and structures can be mitigated to a large extent with precautions and pre-emptive strategies.

### **8.11.7 Explosion**

This refers to air-borne or grounded detonation of explosive devices on or near targets. The detonator can be carried by hand, delivered by vehicles, hurled as projectiles, or placed in the usual supplies to the Resort/Hotel building. The detonators can be non-nuclear type or nuclear type. Explosions almost instantaneously damage the built environment. If more devices than one are used in a chain, then the duration of the threat is enhanced and the extent of damage is greater. The extent of damage is determined by the type, quality and quantity of possibilities – from non-structural element loss, structural element damage, structural elements collapse, to progressive failure of part/ whole building.

### **8.11.8 Arson**

This refers to initiation of fire at or near targets. The fire can be initiated by direct contact or by a projectile carrying an accelerant. The threat can last from minutes to hours. The extent of damage is determined by the type and quality of device/accelerant used in arson, and by the type of materials present at or near targets. Again, damage can vary over the whole spectrum – from non-structural element loss, structural elements damage, structural element collapse, to progressive failure of “part/whole” resort.

### **8.11.9 Armed Attack**

This refers to tactical assault or sniper attacks from remote location. The attack can be by ballistics using small arms, or by stand-off weapons using rocket propelled grenades or mortars. The armed attack can last from minutes to days depending on how agile the

counter-attack is in wearing-off and over-powering the aggressors. The extent of damages is contingent on the intent and capabilities of the attacker.

#### **8.11.10 Biological/Chemical/Radioactive Attack**

This refers to contamination with or dispersion of a biological/chemical agent that leads to harmful effects on human and plant lives. The contaminants could be solid, liquid or gaseous, and generated instantaneously at the site of attack by biological, chemical, nuclear or radiological reactions. The reactions can directly affect the body parts or can lead indirectly to diseases as the contaminants enter the body, food and water chains. The duration for which the attack has an influence is dependent on the agent employed and the conditions under which the agents are released. Contamination can spread through wind and water, while biological infection can spread through human and/or animal vectors. On the other hand, chemical contamination can spread through human contact, vehicles, water and wind. Chemicals can have lasting effects, if not immediate.

Contamination duration, due to radiological agents, may range from immediate to several years. Similarly the “light/heat flash” and blast overpressure due to a nuclear explosion may last only for a few seconds, but the negative fallout of released radiation can persist for years.

#### **8.11.11 Epidemics**

Apart from the natural and transnational movement of pathogenic organisms, their potential use as weapons of biological warfare and bio-terrorism has becomes far more important now than ever before. Utilization of organisms causing smallpox and anthrax by terrorist group can cause great harm and panic. Biological agents are living organisms or their toxic products that can kill or incapacitate people, livestock, and plants.

#### **8.11.12 Bio-terrorism**

Bio-terrorism can be defined as the use of biological agents to cause deaths, disability or damage mainly to human beings. The three basic groups of biological agents, which could be used as weapons, are bacteria, viruses, and toxins. Most biological agents are difficult to grow and maintain. Many breakdown quickly when exposed to sunlight and other environmental factors, while others, such as anthrax spores, persist very long.

Biological agents can be dispersed by spraying them into the air, by infecting animals that carry the disease to humans and by contaminating food and water. Potentially, hundreds of human pathogens could be used as weapons; however, public health authorities have identified only a few as having the potential to cause mass casualties leading to civil disruptions.

There are a number of causes why biological weapons are potentially more powerful agents of mass casualties leading to civil disruption. Biological agents can be disseminated with readily available technology. Common agricultural spray can be adapted to disseminate biological pathogens of proper particle size to cause infection in human population over great distances.

The perpetrators can use natural weather conditions, such as wind and temperature inversions as well as existing building infrastructures (e.g. ventilation system) or air movement related to transportation (e.g. subway trains and cars passing through tunnels) to disseminate these agents. The expense of producing biological weapons is far less than that of creating other weapon systems.

The methods of biological agent dissemination and delivery techniques include:

- Aerosols – biological agents are dispersed into the air, forming a fine mist that may drift for miles. Inhaling the agent may cause epidemics in human beings and animals.

- Animals – some diseases are spread by insects and animals, such as fleas, mice, flies, mosquitoes, and livestock.
- Food and water contamination – some pathogenic organisms and toxins may persist in food and water supplies. Most microbes can be killed, and toxins deactivated, by cooking food and boiling water. Most microbes are killed by boiling water for one minute.

#### **8.11.12.1 Types of biological agents**

There are three categories of biological agents with potential to cause mass casualties. However, those in category A have the greatest potential for fear and disruption and most significant public health impacts.

The disease anthrax is caused by gram-positive, non-motile *Bacillus anthracis*. Anthrax has been a scourge of cattle and other herbivores for centuries. During the industrial revolution, the inhalation of this bacillus was first recognized as an occupational pulmonary disease in workers of the wool industry of Europe. Anthrax is an ideal biological weapon. The disease is highly lethal. The spores can maintain virulence for decades.

If used as a biological weapon, **smallpox** represents a serious threat to civilian population because of its fatality rate of 30% or more, among unvaccinated persons and the absence of specific therapy. Smallpox has long been considered as the most devastating of all infectious diseases.

The mere mention of the word **plague** conjures up deadly images because, historically it has already demonstrated a potential to kill millions of people across the globe. It is a disease that results from an infection by non-motile, gram-negative *Coccobacillus Yersinia pestis*. This is another weapon, besides smallpox, which can cause devastation. A vaccine for plague does exist, however, it is no longer being produced and it does not demonstrate efficacy against infection spread through aerosols. **Botulism or Botulinum**

**toxins** are a deadly toxic substance that can be produced in an animal, a plant, or a microbe. The toxins cause a serious disease in humans. Toxins are natural and non-volatile and generally do not penetrate intact skin, as in case of chemicals weapons. There are different types of toxins and they are immunologically distinct, meaning that antibodies developed against one do not cross-react against others.

**Tularemia** is caused by Francisella Tularensis, which is a gram-negative, non-motile coccobacillus. Tularemia is a disease acquired in a natural setting by humans through skin or mucous membrane contact with the body fluids or tissues of infected animals or from being bitten by infected deerflies, mosquitoes, or ticks. It can remain dormant for weeks in the environment or in animal carcasses and for years if frozen.

#### **8.11.13 Sea Level Rise**

The phenomenon of sea level rise is yet to be fully comprehended although some predictions have been made for time spans of hundred years. Considering the projected life of the proposed project, this eventuality is not of importance at the specific site in Karnataka.

#### **8.12 Preliminary Hazard Analysis (PHA)**

A preliminary hazard analysis has been carried out to identify major hazards associated with the functioning of the proposed project (**Table 8.4**).

**Table 8.6 Hazards, Risks and Vulnerability**

Hazard	Component	Potential Risk Vulnerability/ Probability
D.G. Sets	Mechanical hazards and fire hazards in: Lube oil system Cable galleries Short circuits	<b>Low:</b> The DG sets are used only in case of power failures, which are rare. The lubrication oil and diesel

		are stored in small quantities.
Power Transformers	Fire and explosion	<b>Low:</b> Transformers are always kept in the open, with proper fencing, and isolated from buildings.
Electrical Control room	Fire in cable galleries and switches. Static electricity due to improper earthing and bonding. Fire, in earthing and bonding may result in Power failure.	<b>Medium:</b> The risk may arise from low quality of insulation material bad maintenance or alterations by untrained manpower. It may also arise from voltage fluctuations.
LPG Cylinders storage	Fire and explosion due to leakage	<b>Low:</b> Probability of cylinder related fire and explosion is low.
Natural Disasters	Earthquake and cyclones may damage the electrical system, lifts, and water/sewerage lines. It may also damage the external envelop of structures.	<b>Low:</b> Karnataka falls in Seismic Zone III which is one of the least vulnerable zones. Karnataka does not have history of severe earthquakes. Karnataka lies on the West coast of India which is less prone to severe atmospheric changes resulting in cyclones, hurricanes, storms etc.
Topography and Drainage	Flooding/Water logging may curtail access to daily needs and transports facilities.	<b>Low:</b> The risk may arise only in rare event of choking of natural and manmade storm water drainage system coupled with high tide and storm surge. The site is securely located at a minimum height of 40 M above MSL.
Terrorist attack, blasts etc.	Forced acquisition of building and hostage situation may result from terrorist attacks.	<b>Low:</b> The project is not a high priority target. The location is in a rural setting and not in a prime area.
Mob attack	Agitated mob attack will result in life and property damage.	<b>Low:</b> The area is residential, rural and peaceful, hence no such disturbance is likely

Biological Disaster	Disease outbreak, Epidemics causing deaths.	<b>Medium:</b> Karnataka is well connected by all means of transportation to the entire country and the outside, so the risk of biological disaster is considerable. However the State has well equipped machinery to deal with such occurrences and thus the overall risk is medium
Others	Power failure, Water shortage,, traffic congestion, communication failure, etc.	<b>Low:</b> Such types of risks are rarely prevalent in the area where the project is proposed. As remedial response is very quick and services are immediate, no problems of difficult nature are likely. Power failure will not affect the project seriously as stand by DG sets are provided for all essential services.  With water recycling, rain harvesting and sufficient storage capacity the project will have sufficient buffer for any short term water shortage in PWD supply. In case of prolonged problem the project can avail of private water tanker supply.

### 8.13 Precautionary Measures

Precautionary measures for any disaster are to be taken by all the users/visitors of the proposed resort. Hence the measures mentioned below are to be meticulously followed by occupants of the Resort. To be well informed about such precautions a printed booklet will be kept in each resort villa/room.

### **8.13.1 Fire:**

The following basic precautions are recommended:

- Good house-keeping.
- Compulsory use of ashtrays while smoking.
- Prompt repair of faulty electrical appliances.
- High voltage points and instruments to be secured and labeled prominently.
- Switches and fuses to conform to correct rating of circuit.
- Welding /Cutting jobs to be carried out under strict supervision.
- Fire Rescue drills to be carried out at regular intervals.
- Elementary fire fighting training to occupants.

### **8.13.2 Earthquake:**

- BIS codes relevant to the project site shall be adopted for building standards
- Heavy items such as pictures and mirrors to be hanged away from beds, settees, and other sitting places.
- Overhead light and fixtures to be braced securely.
- Heavy/large objects to be stored on lower shelves.
- All breakable items such as bottled foods, "glasses/china ware", etc. shall be stored in lower level closed cabinets with latches.
- Repair defective electrical wiring and leaky gas connections. These are potential fire hazards.
- Water heaters, LPG cylinders, etc., to be secured by strapping these to wall studs and bolting to the floor.
- Weed killers, pesticides, and flammable products will be stored securely in closed cabinets with latches, in bottom shelves.
- Safe places to be identified, indoors and outdoors, for safe occupation of the occupiers during tremors. numbers (of doctors, hospitals, police, etc) to be displayed in each resort "villa/room' and also in other service areas of the resort.

- Emergency “telephone/cell”

### **8.13.3 Floods**

- Sewerage and storm water systems to be checked at regular intervals for their proper functioning.
- Provision will be made to harvest most of the rain water from the proposed site. This will reduce the water shortage as well as runoff water on the site.

### **8.13.4 Cyclones**

- Periodical checking of all resort buildings for structural faults, to secure loose tiles, and to carry out timely repairs, will be resorted to.
- Periodical removal of dead wood or dying trees close to the villas to be undertaken.
- Hurricane lanterns filled with kerosene, battery operated torches and enough dry cells will always be made available during emergencies.

### **8.13.5 Tsunamis**

- An earthquake that lasts 20 seconds or longer in a coastal area, may cause tsunamis.
- When the shaking stops, people will be moved quickly to higher ground away from the coast. A tsunami may be coming within minutes.

### **8.13.6 Terror attack/ bomb blast**

- The resort will be fully secured all around the periphery and there will be only one entry and one exit to the entire facility.
- The entry and exit points will be manned for 24 hours with specially trained security staff fully equipped with latest security gadgets including closed circuit electronic surveillance cameras/CCTVs monitoring all sensitive areas within the

Resort Complex. A log book will be maintained to record the identities of all “vehicles/residents/guests/visitors” entering and leaving the Resort.

- All “persons/vehicles” entering the resort will be fully checked for explosives and weapons.

#### **8.13.7 Biological Disaster**

Most of the precautions to prevent a biological disaster come under the domain of government authorities. However, at personal level, hygienic practices and proper sanitation are essential criteria to be followed to prevent the spread of both, induced or natural infections. The resort management will periodically be in touch with government health authorities to prevent any such eventuality.

#### **8.13.8 Other Disasters**

Other disasters are rare and have not occurred in the region or their occurrence can easily be mitigated with routine precautions. Nevertheless the following precautions will be taken:

- Sufficient water will be stored, in excess of actual requirement, as a buffer stock to tackle the eventuality of temporary water supply shortage.
- Multiple communication channels will be maintained to tide over the situation of failure of telephone link “and/or” malfunction of main server.
- “Alternate/renewable” energy sources will be used to illuminate “gardens/golf course”, lobbies and corridors to supplement conventional power, as also to serve as emergency power source during unexpected electricity supply failures. Such alternate power sources shall include solar power, biogas and small wind turbines.

### **8.14 Disaster Preparedness Onsite**

The plan will include installation of alarms and other security related communication gadgets. The resort will prepare a Disaster Management Plan and will constitute a

dedicated Disaster Management Committee/Team to implement the same when required.

#### **8.14.1 Fire Alarms/Other Measures**

Fire and smoke alarms will be installed in all covered places such as rooms, lobbies, halls, kitchens, offices, etc. The functioning of these fire alarms will be checked every week by the resort security staff.

- To meet the requirements, the following measures will be taken:
- Courtyard will be paved suitably to bear the load of fire engines.
- Electrical meter room will be sealed with non-combustible materials.
- The lighting in all fire escape routes will be based on independent circuits backed by DG sets.
- Underground and overhead water storage tanks having appropriate capacity will be provided for fire fighting.
- Automatic water sprinklers will be installed in all internal covered spaces.
- Fire Hydrants, Fire Hoses and Fire Extinguishers will be installed throughout the resort as mandated by the Fire Department.
- Portable fire extinguishers of dry chemical powder will be provided in the electric meter rooms and basements.

#### **8.15 Occupational Health and Safety**

The facility will have many activities such as construction, erection, testing, commissioning, operation and maintenance, where manpower, materials and machines are the basic inputs. Occupational health and safety of all the people concerned will be a major responsibility of the resort management. All statutory requirements in the above connection will be meticulously implemented. The security staff of the resort will maintain a close liaison with government authority in-charge of the Off-site Disaster Management Plan and give all collaborative support in emergency situations.

#### **8.16 Emergency Response in the Event of Disaster**

In case of emergency due to any type of disaster a quick and immediate response is essential. This response depends on the actions taken by individuals to avoid or mitigate the adverse effects of a disaster and to undertake search and rescue operations. Following are the actions which will be taken in various emergent situations.

#### **8.16.1 Action in the event of Fire**

Extinguishing fires: A small fire at the point of leakage will be extinguished by enveloping it with a water spray or a suitable smothering agent such as CO<sub>2</sub> or DCP (Dry Chemical Powder). Fire fighting personnel working close to un-ignited vapour clouds or close to fire, will be protected continuously by water sprays.

#### **8.16.2 Response Sequence during Event of Fire**

Any person noticing the fire will attempt to isolate and extinguish the fire with readily available equipment and inform or arrange to inform the Security Head in-charge regarding the:

- Location of fire
- Type of material burning
- Extent of fire
- Caller's name and phone number
- Security Personnel will:
  - Sound the siren as per the Siren Code.
  - Will cordon off the area and call the local fire fighting Department.
  - Will direct all occupiers/guests to evacuate and assemble in designated fire shelter spaces

#### **8.16.3 Actions in case of Flood/Tsunami**

As stated earlier, such eventualities are not expected considering the past weather records of the entire Konkan coast encompassing the state of Karnataka. However, the

resort management shall take all necessary precautions in consultation with the State weather and disaster management authorities.

#### **8.16.4 Biological attacks**

The resort management will take all necessary precautions as suggested by the state health and intelligence agencies, in the event of any such eventuality that comes to their notice.

#### **8.17 Relief and Rehabilitation**

- Relief authorities at the site will:
- Encourage self-help in every activity of their day-to-day living.
- Provide assistance for identification/assessment of human and material loss.
- Provide assistance in maintenance of law and order.
- Provide assistance in maintaining sanitation standards and in disposal of waste.
- Promote cultural and recreational activities for mental health.
- Measures during Earthquake
- Relief authorities will: Conduct a week-long survey to locate quake related hazards/damages in the resort.
- Work with local emergency services and officials to help affected people and those likely to be affected.
- Provide tips for conducting earthquake drills.
- Actions to be taken to prevent impact of Cyclone
- Residents/ visitors will be advised to stay tuned to weather advisories broadcast on radio or TV.
- Radios and TVs in Resort lobbies/restaurants etc. will also be activated for the benefit of residents/guests.
- All windows and external doors of the resort complex will be shut and appropriately secured to withstand high wind speeds.

- Extra food, which can be eaten without cooking, and surplus drinking water will be stocked for the benefit of residents/guests to tide over long power failures and damage to F&B infrastructure.
- Hurricane lanterns, torches and other emergency lights will be made available.
- All loose and unsecured materials which can fly and cause damage due to strong winds, will be removed to safe locations and/or securely fastened.
- Electrical mains will be switched off except for emergency utilities.
- The management will be continuously in touch with the State Disaster Management Authority and scrupulously follow its instructions with respect to the need for evacuation of the resort or any other eventuality.

### **8.18 Disaster Prevention**

Following measures will be undertaken for prevention of disasters:

- Maintaining data base of agencies responsible for handling emergencies like Hospitals, Trauma care, State Disaster Management Agency, Police, Ambulance etc.
- Maintaining constant liaison with agencies who can forewarn of likely disasters such as IMD (India Meteorological Department), National Tsunami Warning Centre etc.
- Train staff in handling firefighting equipment
- Defining a organ gram for handling emergency situations eg. Identification of a works main controller, incident controller etc. so as to have coordinated response to attend to emergencies. Conduct mock drills at regular intervals
- Identify an emergency control centre having maps, utility drawings such as electrical, fire fighting etc.