Disaster Management Report, Risk Assessment and Management Plan

Name of the Project	Proposed reconstruction of HOLIDAY HOME CUM GUEST HOUSE in CRZ-II area
Project Location	District/S.R.O.: Puri, Tahasil: Puri Sadar No. 605, P.S.: Puri Sadar No. 78, Mouza: Sipasurubuli, Khata No.: 30, Plot No.: 360/428 (Part), Sub-Plot Nos. 136, 137, 138, 139, 140, 141, 142, 143, 149 & 150
Name of the Proponent	M/s. Prabhukrupa Estates and Properties Plot No. 977/1418, Shree Krushna Nilay Jhunjhunwala Garden, Ashok Nagar Bhubaneswar – 751009, Odisha Mob: +91 – 9238331715 Email: jitendra.patra@gmail.com

1. History of Disasters in Odisha:

Odisha is one of the most disaster affected states in India along east coast. It has record of periodic occurrence of Flood, Cyclone and Tidal Ingression. In recent years Odisha also witnessed minor earthquakes particularly in coastal belts making it highly venerable to multi-hazard disasters.

The state of Odisha is having a geographical area of 1,55,707 Sq. km with population of 41,947,358 according to 2011 census. The state has tropical climate characterised by medium to high temperature, high humidity, short and mild winter. The mean annual rainfall is 1503 mm. The coastal part of the state is frequented by natural disaster like flood and cyclone almost every year.

The flood and cyclone in coastal Odisha are the regular features. The rivers in the coastal region have the characteristics of deltaic riverine nature. Occasionally, even little rainfall in uplands causes flood in lower deltaic regions. The problem becomes more acute when the flood arises due to cyclonic storm. Coastal Odisha falls in the path of severe cyclonic storm originating in the Bay of Bengal, so there is concentration of runoff due to heavy rainfall brought in by cyclonic storm in short duration.

1.1 Mapping Major Disasters in Odisha

In general, Odisha come across following disasters.

1.1.1 Cyclone

A Cyclone is a very large mass of air with low pressure surrounded by a high pressure air mass. The large whirling mass of air at the centre where pressure is low is known as Cyclone and acts like a chimney through which air gets lifted, expands, cools and finally gets condensed causing precipitation and Cyclonic gale. Odisha on the east coast along with West Bengal and Andhra Pradesh has the location disadvantage of being in the path of depression of severe cyclonic storms. Severe cyclonic storm occurs when the southwest monsoon recedes or just before the onset of monsoon in late April-May-June spell.

The Super cyclone (1999) and Phailin (2013) are two important cyclones of present time.

A conservative estimation of the effects of natural disaster reflects that from 1963 to 1999 Odisha has experienced 13 major disasters, which have killed 22,228 people, affected 7,02,97 people and made 3,421 thousand homeless.

1.1.2 Flood

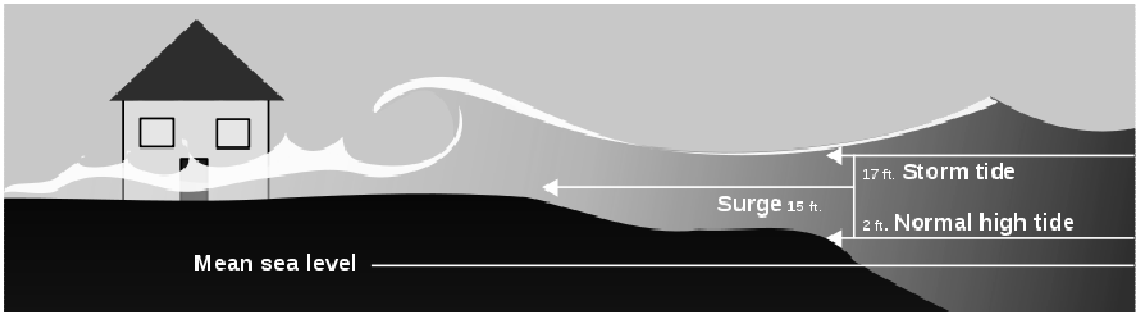
Before draining into the Bay of Bengal, all the major rivers of Odisha flow long distances; some of them originate beyond the state of Odisha. The intensity of floods inundating the rivers depend much on the topography of the State, the drainage system with low channel capacity, low flood slope, sand banked mouths, high concentration of rainfall in a small or limited number of days in the catchments basin etc.

The Flood prone area of the state is assessed at the level of 33.40 Lakh Hectares. Mahanadi, one of the major rivers flowing in the State and its tributaries has the potential to cause major floods. Out of a total geographical area of 15,571 lakh hectares, 1.40 lakh hectares are usually very flood prone. The State is also vulnerable to flash floods and landslides.

1.1.3 Tidal Ingress

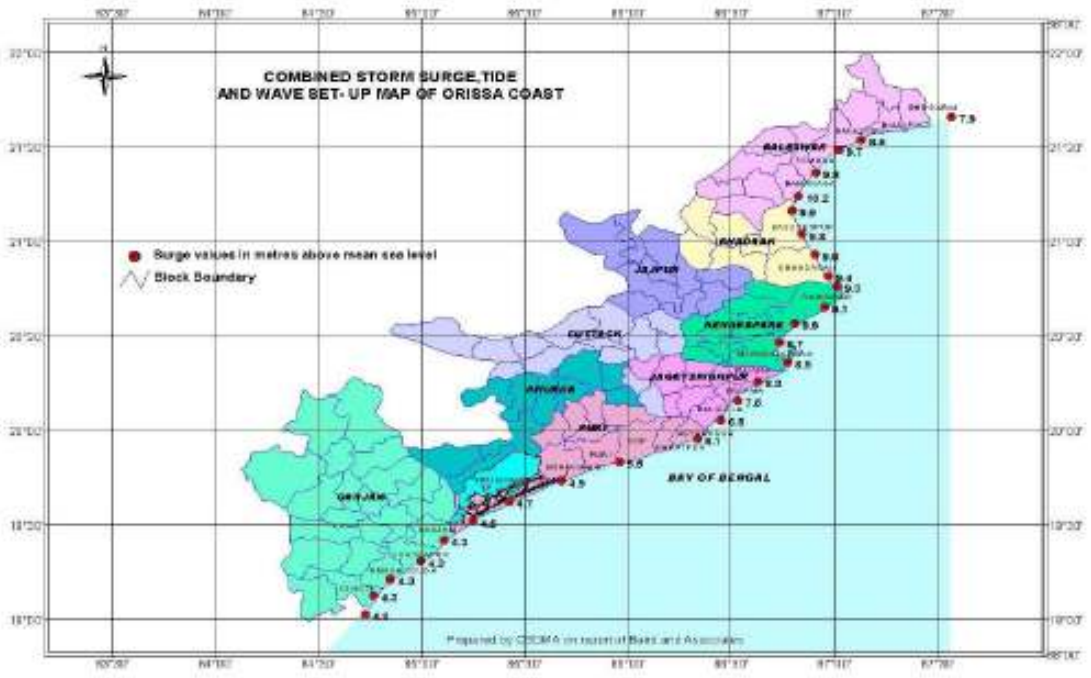
During Cyclone & sometimes due to heavy flood, tidal waves from the sea enter into the land with great force and store over the land for days together. This may cause devastation to structures, loss of life and Crop.

Tidal Ingress better known as storm surge is an offshore rise of water associated with a low pressure weather system, typically tropical cyclones and strong extra-tropical cyclones. Storm surges are caused primarily by high winds pushing on the ocean's surface.



Odisha Coast particularly area between Puri and Paradeep is very venerable to Tidal Ingress. Major damage due to Tidal Ingress was witnessed in 1971 Cyclone and 1999 Super Cyclone.

The Super Cyclone of 1999 witnessed a cyclonic gale of 300 km/hr. More than 10,000 people died and 2 million people are affected by this Cyclone. The tidal surge of 6 to 7 m arising out of wind speed of 300 km/hr swept across a 100 Km of coastal stretch in Jagatsinghpur and Kendrapara districts, submerging the entire area and destroying almost all kucha houses and infrastructures. Saline inundation of 2,00,000 ha of extremely fertile agricultural land caused wide spread devastation to standing crops of the entire coastal area. Ersama area near Paradeep was one of the most affected areas during Super Cyclone.

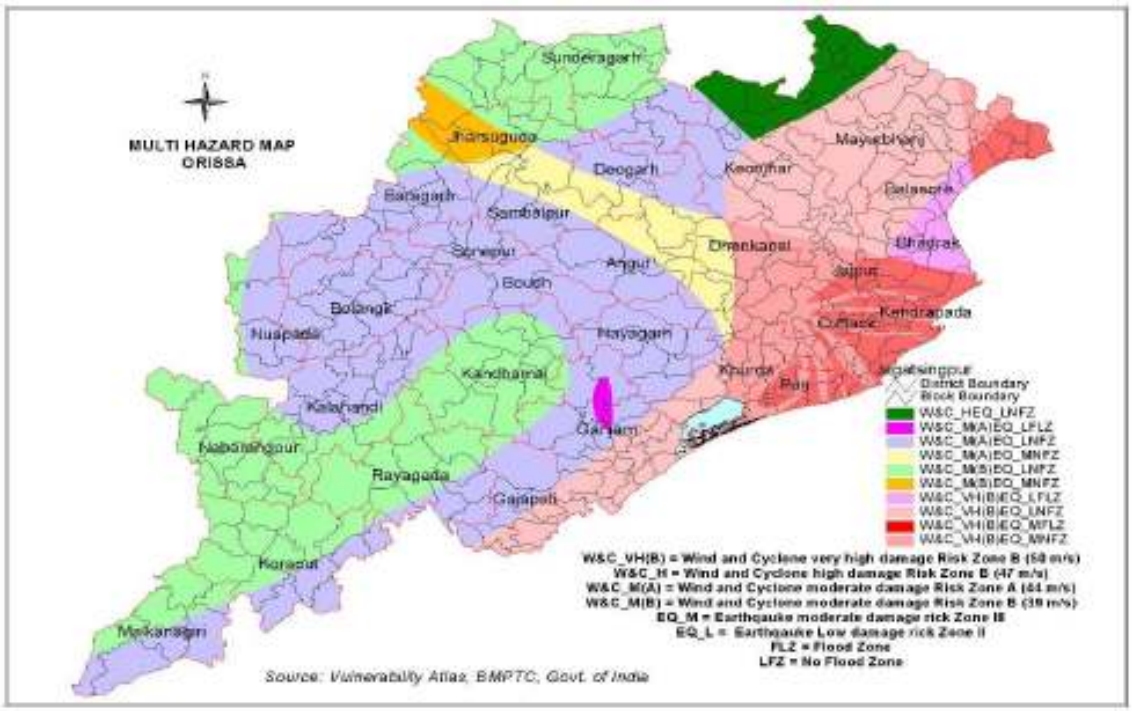


1.1.4 Earth Quake

Earthquakes are caused by natural tectonics activities and strike without warning and are thus unpredictable. The middle part of the coastal Odisha, including Puri comes under Seismic Zone III. Depending on the severity of tremor, degree of devastation varies in earthquake area. However, Odisha has not faced any such severe earthquake in recent past.

1.1.5 Area Affected by Multi Hazards

If one looks at the history of disasters in Odisha, one finds a series of various types of disasters that have struck the State over the years with devastating effects. Odisha is also one of the poorest states in India. Its poverty and backwardness, coupled with recurring natural disasters make the State and its people one of the most vulnerable in the country. Rivers such as the Mahanadi, Subarnarekha, Brahmani, Baitarani, Rusikulya and their many tributaries flowing through the state expose vast areas to floods. The 482 Kms coastline exposes the state to cyclones and storm surges. Droughts are also a regular feature and the western districts of the State are prone to repeated droughts. The state is also vulnerable to tornadoes, heat wave, fire, industrial hazards and human epidemics.



Multi Hazard Map of Odisha *Source: OSDMA, Odisha*

Details of areas vulnerable to floods, cyclones and earthquakes:

Type of Hazard	Particulars	% of Area vulnerable
Flood	Flood Prone	1.9%
	Flood Protected	2.4%
	Outside Flood Area	95.7%
Cyclone	198-180 Km/h	24.1%
	169.2 Km/h	3.3%
	158.9-140.9 Km/h	72.6%
Earthquake	Low damage risk Zone	84.2%
	Moderate damage risk zone	15.8%

2. Structural Risk Assessment

Major risk during any disaster is to Human Life, Infrastructure and Crops. Infrastructure being a major component which is exposed to the fury of disaster, it becomes imperative to evaluate and mitigate structural risks to safeguard human life. Different Parameters are considered while calculating Structural Risk Assessment: They are:

Nature of Hazard: As categorized in previous section, Hazard or Disaster is of many types. The magnitude of hazards varies from area to area depending on proximity to epicentre of disaster, its velocity and load. It is scientifically calculated depending in which hazard zone the structure falls.

Vulnerability: It is the extent to which the proposed structure is likely to be damaged or disrupted by the impact of particular disaster on account of their nature, construction and proximity to or disaster prone area. It is to be taken into consideration during planning of the area and identifying the site.

Carrying Capacity: It refers to the strength, coping strategies and resources that would be utilized to mitigate, prepare for damaging effects of disaster or quickly recover from disaster. Thus, estimation of Carrying Capacity of the structure, area and Management is to be planned considering the fact that Carrying Capacity and vulnerabilities are inversely related to each other.

Accessibility to the Area: The risk assessment of a structure also depends on the accessibility of the area during normal and during disaster. As many part of the ICZM Project operates in fragile coastal area, this factor has give due consideration in design, drawing and preparation of estimates for structures due to remote accessibility

Overall risk assessment is the measurement of the expected losses due to a hazard event of a particular magnitude occurring in a given area over a specific time period. This has to be ascertained for any infrastructural design, particularly in Coastal Odisha. The Risk is estimated as a function of the probability of particular occurrences and the losses each would cause. The level of Infrastructure Risk depends on:

- Nature of the hazard
- Vulnerability of the structure which are affected.
- Economic value of those elements.

Therefore, Risk is estimated as:

Risk= Hazard x Vulnerability / Carrying Capacity.

3. Design Parameters for Multi-Hazard Resistance Structures

Cyclones/Flood/ Tsunami are destructive because of their associated long duration high rotating winds, very heavy rainfall and storm surge. It is more so when they strike coasts of countries/states bordering the North Bay of Bengal. In the past, 21 out of 24 cyclones with large loss of lives (human deaths 10000 or more associated with cyclone disasters) in the globe took place in these areas. This was due to very serious storm surge problem of the region. In the past, some of the record storm tides (combined effect of surge and astronomical tides) of the world, up to 13 m have been observed in this region. Shallow bay, low flat zigzag terrain, high astronomical tides, high density of population, low socio economic conditions, lack of awareness, inadequate preparedness and absence of hedging mechanisms add to the problem.

Major Design Parameters to be considered while building the structure:

- Sustainable Use
- Accommodation Capacity
- Location and Orientation of structure
- Building Design and Structural Stability
- Building Components
- Structural Specifications
- Material Selection
- Other Considerations

3.1 Sustainable Use

The proposed holiday home cum guest house is planned for accommodation of vacationers and pilgrims visiting the golden triangle including Puri. Therefore it will be of use throughout the year, although more incumbencies are expected during the peak season. In such a case, all precautionary measures will be kept ready for the wellbeing of the individuals. Such a sustainable use should also generate required finances to supplement proper maintenance of the structure as well as to maintain safety measures in case of any causality.

Therefore, more a building is used in normal time, the better it is maintained, the more successfully it serves in emergencies. Regular use also provides economic justification for the investment and safety of the incumbency.

3.2 Accommodation Capacity

Generally, the capacity of accommodation during disaster for vulnerable populations consisting of incumbency and staffs. In such case, following points will be considered while taking safety measures for the concern vulnerable populations.

- Safety may be provided to the incumbents as well as local vulnerable people in need of shelter.
- Provisions for food, water supply and other emergency services need to be augmented to the incumbency.

3.3 Location and Orientation of structure

Proper location of any structure in multi hazard coastal belt is the first step towards making it to hazard proof. Emphasis in designing the structure is that it is located on the available high elevated land of the site. Guidance on the levels is taken from large scale maps and as much as practicable construction of the structure was made elevated. This will act as Disaster Risk Reduction (DRR) mechanism for better safety of the structure.

Similarly, Orientation Plan of the infrastructure for wind direction, light incidence etc also need to be considered to increase the carrying capacity of the structure and will reduce vulnerability. The front of the structure is to be designed in such a manner that it will offer least resistance to cyclone, tsunami and flood. Conversely being structurally strong and more the shorter side faces the wind more efficiently.

3.4 Building Design and Structural Stability

Shape of the building is very important to make it resistant to Multi hazards such as Flood, Cyclones, Tsunami, Wind and earthquake. In general, simple and compact structure shapes are better.

- The design of the structure allows high wind to go around them causing less injury to the structure during severe cyclone, tsunami and flood.
- To prevent cracks at the corner, the structure was strengthened at the corners and rounding the corners, which are considered a good option to avoid wind load.

3.5 Building components

Foundation: In view of general soft top soil in coastal areas, pile foundations may be preferable. However, raft foundations in the basement are considered based on local conditions and soil strata.

Column Structure: All coastal masonry structures must have (Column Structure) frame structure.

Plinth Band: Proper plinth band have been included in the design in order to provide extra reinforcement in this vulnerable area.

Wind Load: Sufficient structural design has been incorporated in the design of the proposed structure to reduce wind pressure.

BMTPC Guidelines: Structural design is planned keeping BMTPC in view to meet the vulnerability of disaster usually encountered along Odisha Coast.

RCC Masonry: RCC masonry building is designed considering with prevailing storm tide level of this vulnerable area. For the high winds in cyclone prone areas it is found necessary to reinforce the walls by means of reinforced concrete bands and vertical reinforcing bars as for earthquake resistance.

3.6 Structural Specifications

Following structural specification is considered for the proposed structure:

1. The structure is designed to withstand the wind velocity of 300 km/hr and roof live load of 500 kg/cu.m. as per IS: 875. It is also being designed as earthquake resistant.
2. Wind velocity for East Coast of India: Basic wind speed 65 m/sec with modification factors K1=1.08, K2=1.05, and K3=1.0 as per IS 875 - standards is considered.
3. Vents: Provide as per the norms for adequate ventilation.
4. Shelves: Provided at door-window level in line with seismic band at that level.

3.7 Material Selection

1. Corrosion resistant steel will be used to increase the service life of the structure.
2. Good concrete with proper cover is planned to reduce corrosion to corrosion resistant steel results in a durable structure.

3.8 Other Consideration

1. Provision should be kept for appropriate power back-up facilities such as generator.
2. Additional communication facilities may be provided during natural calamities.
3. Disaster Management Committees may be formed for effective management during disaster.

4. Structure Management Plan

4.1 Linkage with Administration

The smooth implementation of disaster mitigation plan is to be effective by proper institutional linkage arrangement. For infrastructural safety, proper linkage is to be identified with the departmental administration, Districts Disaster Management Committee, Local Multipurpose Cyclone Shelter Management Committee and rescue team for the infrastructural safety.

4.2 Creation of Management Unit

A realistic management unit is to be prepared for proper managements and maintenance of the structure during the disaster, necessary awareness is to be imparted to the staff.

4.3 Linkage with Disaster Management Unit (State /National)

Odisha has developed an efficient disaster mitigation agency, i.e. OSDMA. Simultaneously, District level, Block level & calamity committees are formed and trainees are developed for rescues and other operations. Therefore, proper linkage is to be established with these units through various media for a smart operation.

4.4 Safeguarding Management Plan

The management body of the project is to develop a management plan for various disasters usually encountered along the above specified coastal stretches such as cyclone, flood, saline ingression, earthquake etc. The management body is to plan properly through mock practices and vulnerability mapping for the safe guard of the Management Plan prepared for the purpose.