

Building Resilience to Tsunamis in the Indian Ocean
BASELINE STUDY REPORT
SHAVIYANI ATOLL
MALDIVES

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1. Executive Summary

- Over 80% of the land area of Maldives is less than 1 meter above sea level. The predicted sea level rise of 0.09 m to 0.88 m in the period 1990 to 2100 (IPCC), combined with increased extreme weather occurrences, makes the Maldives one of the most vulnerable countries to climate change and sea level rise.
- The National Disaster Risk Profile of Maldives shows that Maldives has moderate hazard levels except for the low probability and high consequential tsunami hazard in the near future, and high probability and high consequential Sea level rise hazard in the distant future. Overall, Shaviyani Atoll falls under Zone 5 for Tsunamis, Cyclones and Surge Hazards. Beach erosion, sea water inundation due sea swelling and flat topography of the islands, strong wind with heavy rain, change in the patterns of wave action which facilitates shore line change are some the major hazards observed by the local population.
- Prior to Tsunami, the Government of Maldives developed “Safe Island” Program which will be implemented in the next few years. Communities living on smaller, less inhabited and potentially more vulnerable islands, would be settled on larger islands, presumably with better natural protection and enhanced coastal defenses.
- In collaboration with the National Disaster management Center Authorities and the Ministry of Atoll Development, Shaviyani Atoll was selected for UN/ISRD – SEEDS Asia intervention activities on Disaster Risk Reduction. Field visits were conducted to collect primary and secondary data for vulnerability and risk assessments. The five identified islands of Shivayani Atoll, revealed that lack of awareness on the current risks and development programmes to encounter future disasters, limits the actual agenda of Island Officials, CBO’s and NGO’s.
- The complete dependency on Male and tourism industry for livelihood and food security have been identified as the main indicators of islands vulnerability. Overall, about 70 % of the male population’s livelihood comes form either fishing or resorts industry, leaving women, youth and elderly alone in the islands, representing 74% of the total population. Moreover, about 80% of food consumed in the islands is brought from Male putting islanders at a higher risk, in case of any emergency.

- Project Selamat will integrate Community Based Disaster Risk Reduction into Environmental Management in order to build communities resilience in the identified project area. The Three core objectives of Project Selamat in the region will be : To promote Environmental Management as part of Disaster Risk Reduction, To promote adaptation activities to climate change through Disaster Management Planning and Disaster Risk Reduction Activities and To build women and youth communities capacities towards self management.
- The designed Intervention activities will include: Development and Training of Disaster Management Plans at Atoll and Island level, implementation and hands on training on Model Home Kitchen gardens, capacity building and establishment of coastal protection measures (Coastal Bioshields), training and implementation of Model Waste Disposal Management and establishment of Community Resource Center.
- The “Bio Island concept for community resilience” is proposed under Project Selamat. The project will adopt a multidimensional approach through execution of intervention activities like implementation and hands on training of coastal protection measures, disaster management planning, home kitchen gardens and solid waste management.
- As a result of the project activities, the results of the study of the natural resources available in the island, utilization of the resources by the island community and experiences gained through the field interventions implemented during the project period will lead to develop and demonstrate the concept of ‘Bio Island for Communities Resilience’. The Bio Island concept could concurrently address the sustainable resource management and the food security of the island population and Disaster Management Planning for a safer Island.
- The project Activities will be implemented during the project period of 19 months. A team of multicultural expertise on coastal protection measures and Disaster Risk Reduction will take the lead on the implementation process along with the local communities. Ownership of all activities by local communities will be must in order to ensure the sustainability and the project’s overall goal: to build communities of Shivayani atoll resilience to natural Disasters
- Active involvement of local NGOs, youth groups and women community is essential to ensure the community to share the ownership of the processes. Empowering youth and women groups will improve the islands resilience and self management as they are usually left alone in the Island while men are working outside.
- The project Selamat in Shaviyani has been designed and will be implemented at island/atoll level in the lines of priorities three and priority four identified in the Hyogo Framework for Action 2005 – 2015.



2. Introduction

Project Selamat, a UNISDR¹ – ADRRN² initiative with SEEDS Asia as implementing agency, aims to Build Communities Resilience in Shaviyani Atoll, Maldives to natural disasters.

Project Selamat is part of a larger international initiative by the UNISDR-ADRRN, with the ultimate goal of building community level coping capacities towards long term resilience in four countries: India, Sri Lanka, Indonesia and Maldives.

In collaboration with the National Disaster management Center Authorities and the Ministry of Atoll Development, Shaviyani Atoll in Maldives was selected for the SEEDS Asia intervention activities on Disaster Risk Reduction.

This document provides a Base Line on which intervention activities in Shaviyani Atoll, have been designed. The document will also serve as overall framework of action and provides a baseline for monitoring and evaluation of the programme.

On 19th – 24th November 2007, an international team of expertise on Disaster Risk Reduction and two members of the ADRRN International Project Team conducted a field mission to the five selected Islands (Milandhoo, Funadhoo, Komandhoo, Foakaidhoo and Kandithem). Throughout the visit, community consultations were conducted with community representatives from the islands. Group discussions were also held with Government departments at National level, aid agencies and local NGOs. The team consulted previous baseline documentation, assessment reports and diverse Government reports on environmental and disaster management.

This document is intended to understand and analyze the vulnerabilities of the local communities living in Shaviyani Atoll, as well as to identify the Project Activities to be carried out under Project Selamat with the final objective of building resilient communities and reducing the local vulnerabilities. Following this introduction, chapter three presents an overview of Maldives, describing the hazard profile and presenting the current activities and agencies presently working on Disaster Risk Reduction. Chapter four describes the local vulnerabilities, the observations and findings of the field mission and the risk analysis of the five selected islands. Chapter five analyses the findings at the National and Atoll level and discuss the possible strategies to be followed. The Baseline concludes with chapter six, that presents the identified project activities, analyses its stakeholders and its overall contribution towards the Hyogo Framework for Action 2005-2015.

¹ United Nations International Strategy for Disaster Reduction
² Asian Disaster Reduction & Response Network





3. Maldives – Country Profile

3.1 Background & Context

The Republic of Maldives is an archipelago of islands stretching over 820 km north-south and 128 km east-west. Maldives comprises 1,190 small islands which are clustered into 26 natural atolls, which for administrative purposes are grouped into 20. Of the more than 1000 islands, only 199 islands are inhabited, and another 80 islands have been developed into tourist resorts. Over 80% of the land area is less than 1 meter above sea level. All of the human settlement, industry and vital infrastructure of the Maldives lie very close to the shoreline, within 0.8 to 2 m of mean sea level

The population of 298,968 (Census 2006) is scattered throughout the country, but Male', the capital island, houses a population of 103,000 in an area of only 2 sq km, making it one of the most densely populated cities in the world. The city also averages an annual growth rate of 5.59%, much greater than the growth rate of the country, at 1.69%.

Tourism is the main economic activity and contributes about one third to the GDP. Fisheries are the largest contributor to exports and contribute about 7% to the GDP. The construction industry is an important contributor to the Maldives economy, representing 3.6% of GDP in 2003. The sector has grown in recent years, largely as the result of a 19% increase in the number of households between 1999-2000, particularly in Male', and consequent demands for more housing.³

Of the country nearly 1.190 coralline island covering more than 100,000 sq km of the ocean, only 33 island have land area in excess of 1 sq km. Agriculture's contribution to Maldives gross domestic product(GDP) has declined steady, falling from 3.6 percent in 1995 to 2.7 percent in 2003. As underscored by the 6th National Development Plan(NDP), the agriculture sector's importance to the economy is greater than its contribution to GDP because of its role in generating employment and income opportunities in the atolls, improving food security, and providing greater self reliance from import substitution of certain agricultural produce.⁴ (Ministry of Agriculture, Maldives)

³ United Nation Environment Programme, 2005, Maldives *Post Tsunami Environmental Assessment*.

⁴ Ministry of Fisheries, Agriculture and Marine Resources, Republic of Maldives.
http://www.fishagri.gov.mv/agri/programs/planned/rpt/Planned_projects.pdf



The 7th National Plan of the Maldives identifies Environmental Management as one of the top priorities. The low lying islands of the Maldives are very sensitive to the impacts from predicted climate change and extremely vulnerable to natural disasters as demonstrated by the December 2004 tsunami. ⁵

The predicted sea level rise of 0.09 m to 0.88 m in the period 1990 to 2100 (IPCC), combined with increased extreme weather occurrences, makes the Maldives one of the most vulnerable countries to climate change and sea level rise.

The small sizes of the islands forces human settlements and vital infrastructure to be located near the coast and thus at high risk. The Government of Maldives identifies the urgent need to include the climate change predictions in future land use planning and community development plans.

The Maldives is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and is the first country to sign the Kyoto Protocol. Maldives has prepared a National Adaptation Programme of Action and the adaptation policies have been integrated in the relevant chapters of this plan.

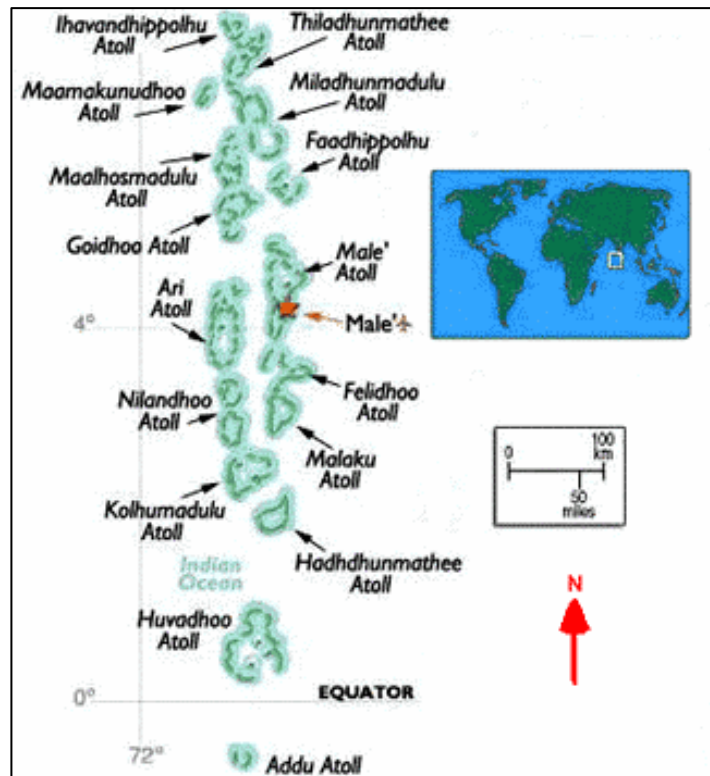


Figure 1: Map of Maldives

⁵ Ministry of Planning and National development, Maldives, 2007, *Seventh National Development Plan. Creating New Opportunities. 2006 – 2010.*

3.2 Hazard Profile

(Source: United Nations Development Programme, Maldives (www.mv.undp.org))

The disaster risk scenario for Maldives can be described as moderate in general. The natural hazards that have potential impact on Maldives in future are tsunami, storm, earthquake and sea level rise. Storm includes wind, rainfall and surge hazards.

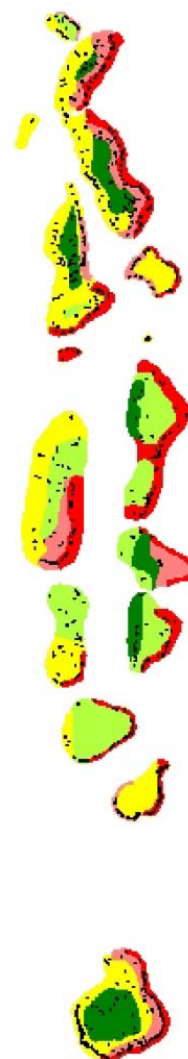
Tsunamis

Maldives has tsunami hazard largely from the east though relatively low hazard is from the north and south also. So, islands along the eastern fringe of eastern atolls are at greater hazard. Islands along the western fringe of western islands have relatively low tsunami risk. Historically, Maldives has been affected by three earthquake sources in the Indian Ocean. Of the total 85 tsunamis generated since 1816, 67 originated from the Sumatra subduction zone in east and the remaining 13 from the Makran coast zone in north and Carlsburg Transform fault zone in south. The probable maximum tsunami wave height is estimated as 4.5 m in zone 5. The return period of Dec.26th, 2004 tsunami is found to be 219 years (one of numerous probable events)!

Tsunami hazard zone and probable maximum wave height

Hazard Zone	Range of probable maximum wave height
1	<30 cm
2	30-80 cm
3	80-250 cm
4	250-320 cm
5	320-450 cm

In general, due to the presence of large coral reefs around the islands, most of the islands are protected from wave impact. The geographic locations of certain group of islands are such that they are protected from tsunami waves. The hazard zones of these island are classified as zones 1-2. The group of islands lying along the eastern side of Maldives, are most prone to tsunami waves (zone 4-5), as 95 % of tsunamis that affected Maldives generated from eastern source zone - three segments of Sumatra subduction zone.



Considering tsunami hazard from all three source zone, as well as local shoaling factor reflected from bathometry contours drawn at 50m intervals, tsunami hazard zones are created having five level hazard zones (Zone 1 to Zone5). Zone 5 is having highest hazards. In general, return period of tsunami waves from various source zones are plotted in figure 6, moreover, table gives the probable maximum wave height in each zone. Table 3 gives the probable maximum tsunami wave heights for various hazard zone.

Storms

Storm Surge Hazard

Cyclonic Wind hazard

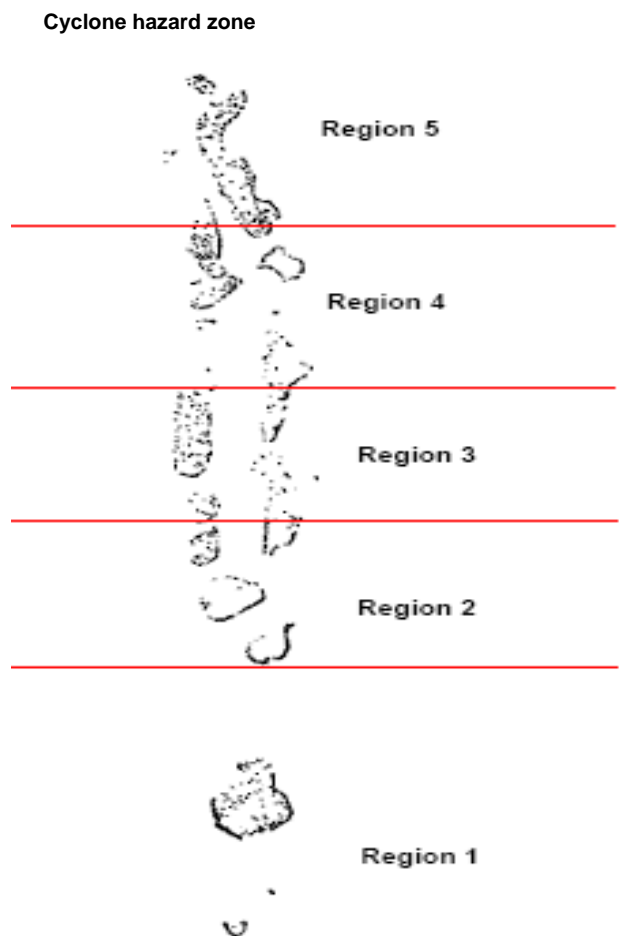
Past records indicate that during the period 1877-2004, eleven cyclones crossed Maldives. Their frequency decreases from north to south. Most of the cyclones crossed northern Maldives. The strongest cyclone that crossed northern part of Maldives had estimated wind speed of 65 knots.

The Northern atolls are at greater hazard from cyclonic winds and storm surge. This reduces gradually to very low hazard in southern atolls. The maximum probable wind speed in zone 5 is 96.8 knots (180 kmph) and the cyclonic storm category is a lower CAT 3 on Saffir-Simpson scale.

At this speed high damage is expected from wind, rain and storm surge hazards.

Cyclone hazard zone in Maldives and the probable maximum wind speed

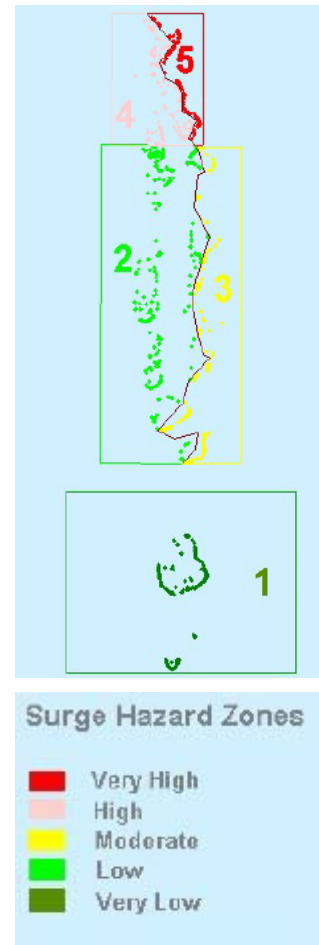
Hazard Zone	Probable Maximum Wind Speed (knots)	Saffir-Simpson Scale
1	0.0	0
2	55.9	0
3	69.6	1
4	84.2	2
5	96.8	3



Storm Tide hazard

Maldives is affected by severe local storms (thunder storms/thunder squalls). Sometimes, storms accompanied with rainfall and high waves affect the southern parts of islands during April and December, which is the interim period between the northeast and southwest monsoon seasons.

Hazard Zone	Pressure drop hPa	Storm Surge Height	Average Tide height (m)	Storm Tide (m)
1	-	-	-	-
2	15	0.45	0.93	1.38
3	15	0.60	0.93	1.53
4	30	0.99	0.98	1.97
5	30	1.32	0.98	2.30



Earthquake Hazard

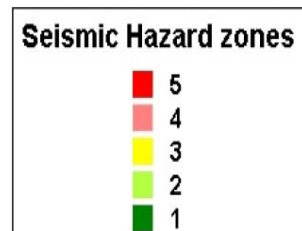
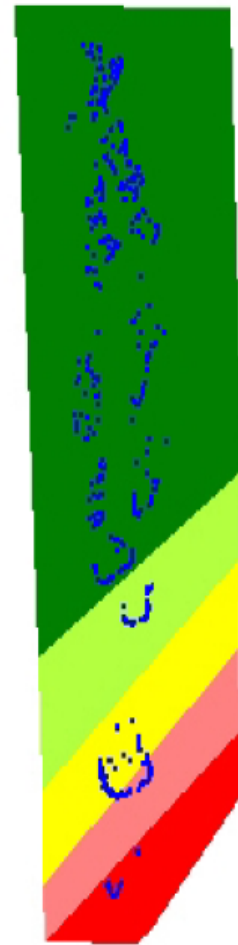
Except for Seenu, Gnaviyani and Gaafu atolls the earthquake hazard is low across the country. The probable maximum MMI is estimated as 7-8 in zone 5. This level of MMI can cause moderate-high damage.

Probable Maximum MMI values in each hazard zone

Seismic hazard zones	MMI value range for 475 years return period
1	Less than 4.5
2	4.5 to 5
3	5.0 to 5.5
4	5.5 to 7.0
5	7.0 to 8.0

Sea Level Rise Hazard

Sea level rise due to climate change has uniform hazard throughout the country. The IP CC in its Third Assessment Report 2001 estimates a projected sea level rise of 0.09 m to 0.88 m for 1990 to 2100. The impact on Maldives is directly proportional to the elevation of islands. With about three-quarters of the land area of Maldives less than a meter above mean sea level, the slightest rise in sea level will prove extremely threatening. Male is estimated to be inundated by 15% by 2025 and 50% by 2100 under conservative scenarios of climate change. Due to non-availability of high resolution topographic data impacts other islands could not be undertaken.



Summary

Overall, Maldives has moderate hazard levels except for the low probability and high consequential tsunami hazard in the near future, and high probability and high consequential Sea level rise hazard in the distant future.

Risk from physical vulnerability is more a function of exposure concentration. As such Male tops the list. The islands in risk zone 5 are given in the table below.

S. No	ISLAND	ATOLL	MULTI HAZARD PHYSICAL RISK
1	MALE	KAAFU	5
2	FOAMMULAH	GNAVIYANI	5
3	KULHUDUFFUSHI	HAA DHAALU	5
4	HULHUDHOO	SEENU	5
5	DHIDHDHOO	HAA ALIFU	5
6	DHIDHDHOO	ALIFU DHAALU	5
7	KELAA	HAA ALIFU	5
8	NOLHIVARAMU	HAA DHAALU	5
9	GADHDHOO	GAAFU DHAALU	5
10	NAIFARU	LHAVIYANI	5
11	THODDOO	ALIFU ALIFU	5
12	EYDHAFUSHI	BAA	5
13	KALHAIDHOO	LAAMU	5

Risk from social vulnerability has no significant trend except Male being in low risk. The risks are randomly spread across the country as several factors drive the vulnerability. The table below gives islands in risk zone 5.

S.NO.	ISLAND	ATOLL	MULTI HAZARD SOCIAL RISK
1	THURAAKUNU	HAA ALIFU	5
2	BERINMADHOO	HAA ALIFU	5
3	HATHIFUSHI	HAA ALIFU	5
4	NOLHIVARAMU	HAA DHAALU	5
5	ALIFUSHI	RAA	5
6	HULHUDHUFFA ARU	RAA	5
7	BURUNI	THAA	5
8	DHIYADHOO	GAAFU ALIFU	5
9	GADHDHOO	GAAFU DHAALU	5
10	MEEDHOO	SEENU	5
11	HITHADHOO	SEENU	5
12	FEYDHOO	SEENU	5

3.3 Disaster Events

There is no record of a major disaster in Maldives prior to the 2004 Indian Ocean Tsunami. However, over the past six years, 142 inhabited islands have experienced severe weather events, ranging from strong winds, rainfall related flooding, storm surges, tidal flooding or rough seas causing damage to coastal infrastructure.

Over the same period, 90 inhabited islands have experienced flooding. Amongst these 37 islands are known to have regular flooding incidences - flooding over six times or more during past 6 years. Out of all inhabited islands 97 percent reported significant erosion between 1998 and 2004, 64 percent reported severe erosion or erosion as a crisis, while 34 percent reported having moderate erosion or erosion as an area of concern.⁶

*The Tsunami*⁷

The Maldives was among the most severely affected countries hit by the Asian Tsunami at 9.20 am on 26th December 2004. Waves ranging from 1.2 to 4.2 m were reported from all the Atolls of the Maldives. Over 35 inhabited islands were badly damaged. 29,580 residents were displaced while around 12,000 were made homeless. In all, nearly a third of the country's 290,000 residents suffered from loss or damage of homes, livelihoods and local infrastructure.

An assessment undertaken jointly by the World Bank- ADB-UN System and the Government estimated total damages of \$470 million which is equal to 62 percent of Maldives GDP.

The tsunami had an enormous impact on the national economy, which depends largely on nature tourism, fishing and agriculture. Flooding wiped out electricity supplies on many islands, destroying communication links with most atolls. Communications were lost for ten hours or more on 182 islands. Four islands remain without direct communication. Twenty-five percent of the islands experienced major damage to essential infrastructure such as jetties and harbors, which provide crucial links between the islands and the outside world.

The tsunami of December 2004 exposed the true vulnerability of the Maldives and the difficulties it faces in providing disaster management and mitigation services to the population scattered across 198 islands and over 100 islands developed as tourist resorts or industrial islands. The country lacked coherent lands for disaster management and there were no tested frameworks for establishment of operation centres. Hence, it took several hours to establish the coordination mechanisms and operations on ground. When the 2004 tsunami struck, the roles and responsibilities of various Government agencies for disaster management had not been adequately defined and the concept of disaster risk management not institutionalized.

Therefore, from the lessons learned from the tsunami, there is a need for longer term planning and institutionalization of preparations and preparedness for future disasters.

⁶ Ministry of Environment Energy and Water Republic of Maldives, 2006, *National Adaptation Programme of Action (NAPA)*

⁷ United Nation Environment Programme, 2005, *Maldives Post Tsunami Environmental Assessment*

Because of the geographic dispersion of the country and the impossibility of placing central Government resources for disaster response on all Atolls, it is essential that island communities be closely involved in disaster planning, mitigation and preparedness measures so that they are adequately provided for their own first response.

3.4 Country Mandates for Disaster Management

Right after the Tsunami, The Government of Maldives (GOM) created a National Disaster Management Centre (NDMC), which continues in operation.

The Government of Maldives committed the implementation of The Hyogo Frame of Action by 2015 during the World Conference on Disaster Risk Reduction held in Kobe on 2005. The Maldives is now at the stage of setting its priorities for implementing the HFA.

The NDMC and UNDP have prepared the first draft of a National Legal Framework for the Maldives Disaster Management Act, which is going through the process of inviting inputs from other Government ministries to be refined and formulated into legislation and to be ratified by the parliament before it can become effective. The purpose of the act is to provide for disaster response, risk management, mitigation & preparation, relief and recovery through capacity building at all levels and establishing partnerships with communities and international organizations. The Act establishes a number of key bodies to coordinate and undertake several responsibilities with respect to Disaster Management.⁸

However, a key initiative from the Government is the 'Safe Island' Program, which was first developed prior to the tsunami. Under the 'Safe Island' Program communities living on smaller, less inhabited and potentially more vulnerable islands, would be settled on larger islands, presumably with better natural protection and enhanced coastal defenses.

To date, criteria for identifying 'Safe Islands', i.e., geophysical characteristics beyond size that would allow them to be considered 'safe' have not been fully elaborated. Mitigation of environmental impacts and reduction of disaster risks must be a priority during any plan to dramatically increase the land mass, population and infrastructure on islands as physically vulnerable and ecologically sensitive as those in Maldives⁹.

In the top priorities Identified by the GOM in its 7th National development Plan, policies and strategies for Environmental management & Disaster Risk Reduction have been stated¹⁰:

- Beach erosion coupled with inundation is one of the major environmental concerns of Maldives. Almost all islands experience varying degrees of erosion. Coastal developments need to be very carefully considered in order to avoid increasing vulnerability to flooding, high waves that could further aggravate the existing erosion problems.

⁸ National Consultation on developing Disaster Risk Reduction Framework for the Maldives, 2007

⁹ United Nation Environment Programme, 2005, *Maldives Post Tsunami Environmental Assessment*

¹⁰ Ministry of Planning and National development, Maldives, 2007, *Seventh National Development Plan. Creating New Opportunities. 2006 – 2010.*

- Management of solid waste is one of the most pressing environmental issues in the Maldives. It is estimated that 175 tonnes of solid waste was generated per day in 2000 in the Maldives, and it is predicted to increase to 381 tonnes by 2010 and to 666 tonnes by 2020. A national waste management strategy and development of national comprehensive policies on solid waste management are currently being prepared. Two regional waste management facilities were established in HDh. Kulhudhuffushi and S. Hithadhoo under the Regional Development
- Island waste management facilities were established in N. Velidhoo and N. Holhudhoo under UNDP assistance. The Australian & Canadian Red Cross Societies and UNDP will construct 96 Island Waste Management Centres by mid 2007. Additionally UNDP, World Bank, EU, Atoll Ecosystem Conservation Project and Government of Maldives support establishment of waste management centres in the inhabited islands.
- A sustainable waste management system needs to be developed based on construction of simple composting, recycling and waste incineration facilities at island level combined with integrated regional waste management facilities. This system should also be tailored to manage solid waste generated from resorts in those regions. Solid wastes generated in the Maldives include hazardous wastes such as asbestors, oil/fuel, fertilisers, pesticides and healthcare wastes. There are no regulations for the use and disposal of hazardous substances in the Maldives and there are no facilities to store hazardous waste. Safe disposal and management of hazardous waste, particularly healthcare waste is an issue that needs to be properly addressed. Maldives is a party to the Basel Convention and has annual reporting obligations. Since there is no system to monitor generation and movement of hazardous waste within Maldives, a hazardous waste communication system needs to be developed urgently.

In order to improve the quality of environmental services to the islands, capacity needs to be developed at Atoll and island levels to undertake environmental administration. Additional investment is required to enhance the capacity and skills through provision of training on environmental best practices and providing island offices with sufficient equipment, operating budgets and guidelines to initiate environmental monitoring, enforcement and conduct proactive environmental assessment and management.

3.5 Ongoing Initiatives for Disaster Risk Reduction

Pre-tsunami initiatives to reduce the vulnerability of the Maldivian population to flooding have focused on engineering coastal defenses that would protect against storm waves. The capital island, Male', is ringed by a huge seawall built from concrete tetrapods donated by Japan at a cost of \$60 million dollars. According to a study performed by Japan Society of Civil Engineers after the tsunami, the seawall reduced the tsunami's impact in Male'. Building sea defenses of this caliber around all inhabited islands, however, would not be economically feasible. Alternative strategies will be needed to reduce flooding impacts on people and their property.

To restore the island and to create a safer and larger island for the local population, a reconstruction plan has been developed by the National Disaster Management Centre.

Prior to the tsunami the focus of disaster management was on the impact of global warming and sea level rise. The islands' average elevation of 1.5 metres above sea level makes them extremely vulnerable to the impact of rising sea levels, tsunami and storm waves. Beach erosion is a perennial problem and is reported to occur on some 88 of the 198 inhabited islands. Coral reefs play a major role in protecting the islands from storm waves and the environmental assessment of the tsunami impact seems to indicate that greater damage was experienced where there was coral reef deterioration and loss of coastal vegetation. Environmental protection is therefore a key ingredient in risk reduction initiatives within the Maldives¹¹.

Government of Maldives, Ministry of Planning Safe Island Program

Even before the Tsunami struck, the Ministry of Planning and National Development had developed a plan to construct so-called safe islands in each of the 20 atolls under the "Safe Islands Program" also called the "Focus Island Program". These safe islands will have a much higher protection from natural and other disasters, through seawalls, vegetation enclosure surrounding the island, and drains to clear away floods should there be high waves.

The GOM is proposing to accelerate its Population Development and Consolidation 'Safe Island' Program. Under the 'Safe Island' Program communities living on smaller, less inhabited and potentially more vulnerable islands, would be settled on larger islands, presumably with better natural protection and enhanced coastal defences.

To date, criteria for identifying 'Safe Islands', i.e., geophysical characteristics beyond size that would allow them to be considered 'safe' have not been fully elaborated. Mitigation of environmental impacts and reduction of disaster risks must be a priority during any plan to dramatically increase the land mass, population and infrastructure on islands as physically vulnerable and ecologically sensitive as those in Maldives. The GOM has developed conceptual designs for enhanced mitigation features on the proposed host islands.

¹¹ Disaster Management Plan, Tourism Sector, Republic of the Maldives. August 2005. Eleonor B.Jones

Government of Maldives, Ministry of Tourism

In 2005, a Disaster Management Plan/Procedures manual for the Tourism Sector was commissioned by the Ministry of Tourism and supported by United Nations Development Programme (UNDP) Recovery Support programme. The plan presents the requirements of the Ministry of Tourism and the Hotel/Resort Sector for documented procedures to reduce risk and to facilitate effective response and recovery from any hazardous event, which may lead to a disaster or a crisis.

National Disaster Management Center

The NDMC is the lead organization mandated to coordinate and manage the activities in any disaster. Specifically, the organization is mandated to coordinate all recovery and rehabilitation activities, coordinate all risk reduction activities and create a prepared public through proper coordination among stakeholders and generating awareness among the government institutions as well as the public.

National Early Warning System¹²

Telecommunications Authority, Maldives (TAM) & Department of Meteorology

The Department of Meteorology has been appointed as the lead department to establish a national Early Warning System which it's expected to be completed by February 2008. However, main challenges faced are budgetary constrains; inter agency coordination and communication linkages from the early warning system.

A technical Committee on Early warning and Emergency telecommunications (TCEWET) was form under TAM in January 2006 with the mandate of studying technical solutions and formulating a Pland to implement early warning and emergency telecommunications. The telecom Policy 2006-2010 has been developed and the emergency telecommunications policy is already incorporated into the 7th national development Plan.

A TETRA Radio network Project financed by French Development Agency (AFD) (5 Million Euro) will be implemented in 2008. The project is expected to cover 80% of population. The result of these activities is expected to be a reliable early warning & emergency communication available anywhere in the country. (

Ministry of Education

The need of Disaster Management at school level is reflected in the 7th National Plan and in the National Education master Plan 2007 – 2011. As per government sources, sensitization programmes have been carried out for the Ministry of Education staff and the Ministry is planning to integrate Disaster Risk Reduction into primary education curriculum.

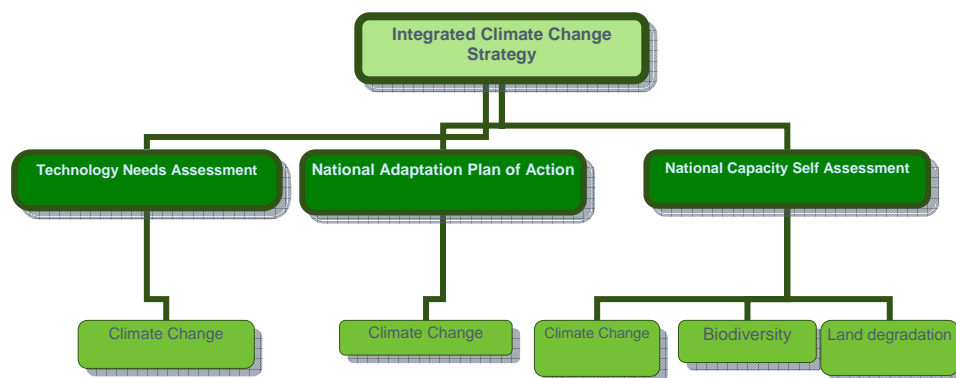
¹² National Consultation on developing Disaster Risk Reduction Framework for the Maldives, 2007, Male.

Ministry of Environment, Energy and Water, GEF (Global Environment Facility) & UNDP

The Government and UNDP signed (03/10/04) a Global Environment Facility (GEF) funded project that seeks to assist the nation take preventative measures against the impacts of global climate change. The project prepared a “National Adaptation Plan of Action” (NAPA) for climate change, through a country wide consultation process and further, provides the basis for implementation of adaptation activities in the country in the face of relevant development activities

The National Adaptation Plan of Action (NAPA) developed by this project will be distributed to atoll communities, Government Ministries, private sector and other stakeholders that are specifically impacted by adverse effects of climate change.

It will also be distributed to the United Nations Framework Convention on Climate Change,



United Nations Development Programme, private investors and various international, bilateral and multilateral donor agencies.

They will be encouraged to assist in implementing climate change adaptation projects, which are identified in the NAPA for the Maldives.

The Goal of the NAPA is to present a coherent framework to climate Change adaptation measures that enhances the resilience of the natural, human and social systems and ensures their sustainability in the face of predicted hazards.

The National Adaptation Plan of Action identifies the projects that are necessary for long-term adaptation of Maldives to the adverse effects of climate change.

Projects identified by the Government with the objective of improving the communities’ resilience are:

1. Strengthening coastal zone management in Maldives to enhance climate change resilience.
2. Increase the resilience of local food production through enhancing the capacity of farmers, local communities and institutions to address food security issues caused by climate change and climate variability
3. Improve resilience of Island communities to climate change and variability through sustainable building designs

SAARC, Coastal Zone Management Center

The SAARC Coastal Zone Management Centre (SCZMC) seeks to promote cooperation in planning, management and sustainable development of the coastal zones, including research, training and promotion of awareness in the region.

1. Identify the organizations in the region dealing with relevant coastal resources management issues and facilitate interaction amongst institutions (ministries, coastal authorities, intergovernmental organizations, international organizations, non-governmental organizations, funding agencies, etc.) and other stakeholders involved, and promote coordination and cooperation on ICZM issues.
2. Collect, compile and disseminate information through networking among the Member States;
3. Assess and standardize the planning methodologies for Integrated Coastal Zone Management (ICZM);
4. Provide support for the promotion and development of ICZM concepts, methodologies and planning tools;
5. Promote the exchange of experiences, information, data and expertise in ICZM;
6. Assist in institutional strengthening and human resources development for capacity building in ICZM; and
7. Conduct and coordinate research in the field of coastal zone management and facilitate technology transfer.

United Nations Development Programme (UNDP)

A national Disaster Risk profile has been developed by UNDP, Maldives.

The overall goal of the UNDP Maldives programme states that: “By 2010, communities enjoy improved access to environmental services and are more capable of protecting the environment and reducing vulnerability and disaster risks with enhanced disaster management capacity”.

Their work in Maldives has been focused on the 3rd priority of HFA on community based preparedness plans and 5th priority.

UNDP main process is CBDRM (Community Based Disaster Risk Management) which involves preparation of “island disaster management plans”.

Training on specific life-saving skills such as first aid, early warning response protocols and shelter management have been provided in Meenu & Vaavu Atoll. Island Disaster management plans, community volunteers training, first aid kit manuals, emergency response equipment, CBDRM manual and simulation exercises have been implemented in both Atolls.

UNDP country programme 2008-20120 focuses on¹³:

(a) facilitate access by vulnerable communities to environment management measures through national standards and guidelines on coastal modification, land use planning, solid waste management, water and sanitation, to guide island and atoll community practices;

(b) develop a strategy to devolve key environmental protection, monitoring and enforcement responsibilities to the island councils and communities, and address disparities in service delivery;

(c) build capacity for local bodies to manage and operate infrastructure restored or installed through the tsunami recovery programme, ensuring the participation of civil society and especially youth;

(d) undertake an economic assessment of the contribution of atoll ecosystem to the national economy, to guide policy decisions and resource allocation for natural resource management; and (e) pilot atoll ecosystem conservation practices.

UNDP also plans to provide Support identifying key measures for disaster preparedness and mitigation with particular focus on climate change adaptation initiatives. Drawing on the recent assessment of national and regional vulnerabilities to climate change and natural disasters – now incorporated in the draft National Action Plan for Adaptation – support will include:

(a) increasing island communities’ knowledge of climate change-related risks and vulnerabilities;

(b) informing them of appropriate options and mechanisms for climate change mitigation and adaptation

(c) formulating and implementing climate change adaptation and disaster management plans in pilot area

¹³ United Nations Development programme 2008-2010, Maldives. www.mv.undp.com

4. Current Status of the Project Area

In collaboration with the National Disaster management Center Authorities and the Atoll Ministry, Shaviyani Atoll was selected for UN/ISRD – SEEDS Asia intervention activities on Disaster Risk Reduction.

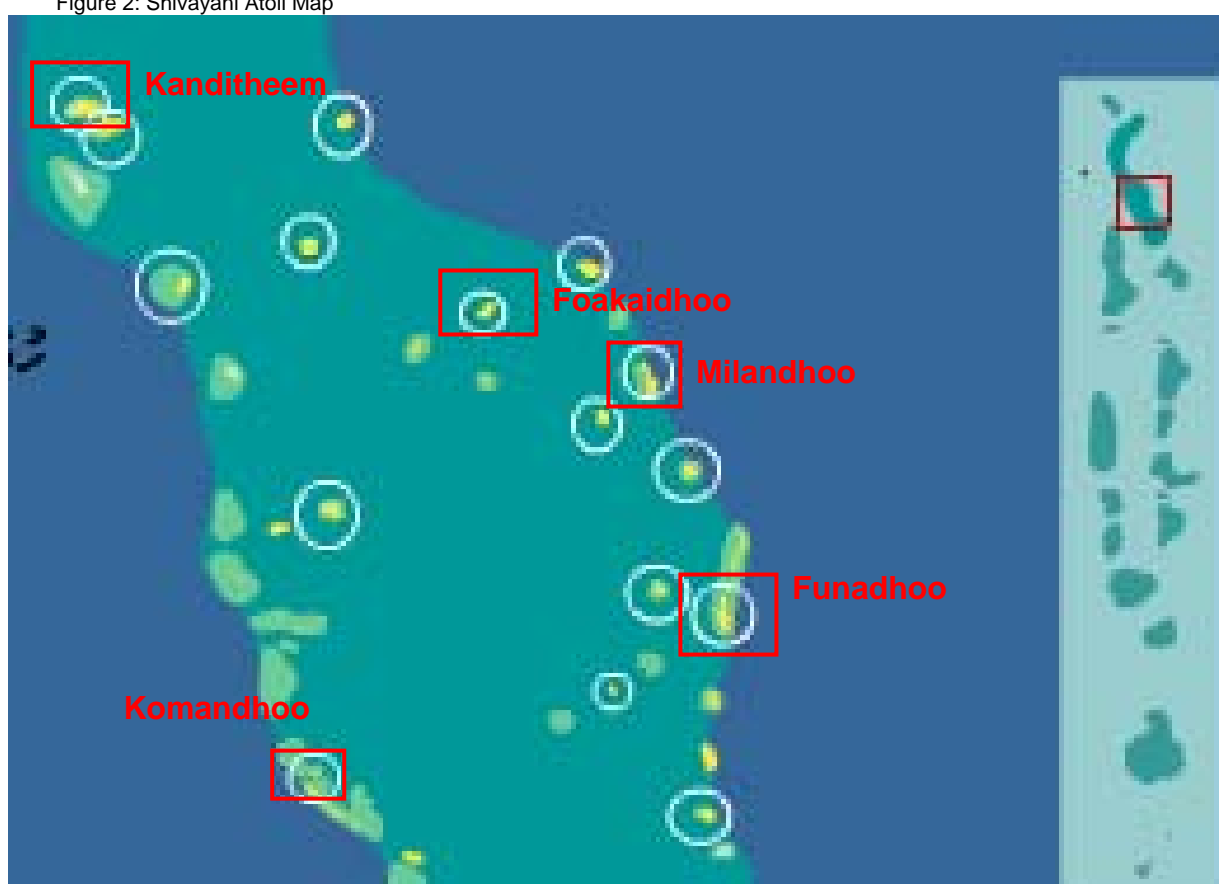
Five islands were visited in order to analyze risks and vulnerabilities the communities in those islands are exposed to. The five islands selected are:

1. Funadhoo (Atoll Capital)
2. Milandhoo
3. Komandoo
4. Foakaidhoo
5. Kanditheemu

Assessment was carried out in a collaborative approach with Key stakeholders in the 5 islands.

Sr. No	Name of Island	Distance from Male (km)	Distance from Atoll capital (miles)	Population			Size of the Island (hectare)	No House Holds
				TOTAL	Male	Female		
1	Funadhoo	218.39	0.0	1,801	887	914	78.82	337
2	Milandhoo	234.13		1,978	1057	921	126.23	400
3	Komandoo	213.75	32.6	1,643	850	793	6	300
4	Foakaidhoo	239.87	21.0	1,423	725	691	57.5	234
5	Kanditheem	258	21.7	1,249	627	622	89	249

Figure 2: Shivayani Atoll Map



4.1 Shaviyani Atoll – An Introduction¹⁴

History, Economy, Education & Hazard Profile

Shaviyani atoll is geographically located within the naturally occurring northern most atoll formation of Thiladhunmathi. A total of 52 islands comprising of 15 inhabited and 36 uninhabited islands form this atoll.

Shaviyani Atoll had been one of the atolls in the country with very slow development. Due to the confinement of the people in their localized small scale occupations and almost no development projects until the recent past, the atoll lacked developmental progress. However, within the last few years steady progress was seen in all areas. New innovations in the overall management of the atoll, various development strategies and programmes launched in the atoll by the government with strong community support, the situation in Shaviyani Atoll has changed considerably.

Now, all islands have made immense progress in terms of development. Economic status of the people has improved and higher standards in education are maintained and health facilities are enhanced. These developments created better employment opportunities. (Shivayani Atoll Office)

Shaviyani Atoll Islands

Inhabited Islands

- 1 Kanditheem
- 2 Noomara
- 3 Goidhoo
- 4 Feydhoo
- 5 Feevah
- 6 Bilehfahi
- 7 Foakaidhoo
- 8 Narudhoo
- 9 Maakandoodho
- 10 Maroshi
- 11 Lhaimagu
- 12 Komandoo
- 13 Maaungoodhoo
- 14 Funadhoo
- 15 Milandhoo

Uninhabited islands

- 1 Kakaeriyadhoo
- 2 Fushifaru
- 3 Neyo
- 4 Kudadhoo
- 5 Madidhoo
- 6 Kuredhoo
- 7 Ribudhoo
- 8 Nalandhoo
- 9 Migoodhoo
- 10 Hirumbadhoo
- 11 Farukolhu
- 12 Dhonvelihuraa
- 13 kanbaalifaru
- 14 Eriyadhoo
- 15 Ekasdhoo
- 16 Vangaru
- 17 Kudalhaimandhoc
- 18 Firunbaidhoo
- 19 Dholhiyadhoo
- 20 Dholhiyadhoo Kudarah
- 21 Dhekinanfaru
- 22 Gallaidhoo
- 23 Gallaidhoo Kudafaru
- 24 Keekeemini
- 25 Bolissafaru
- 26 Dhiguvelidhoo
- 27 Mathikomandoo
- 28 Muleehuraa
- 29 Kudafaru
- 30 Boduhuraa
- 31 Naalaahuraa
- 32 Hurasfaru
- 33 Naainfaru
- 34 Kunburudhoo
- 35 Koshinbi
- 36 Bishuraa

¹⁴ <http://www.shaviyani.gov.mv>

The islands in this atoll are small with half of the islands having less than 20 hectares of land area. There are 9 islands that are smaller than one hectare. These islands comprise 18% of the islands. The smallness of the atoll indicates to the islands' vulnerability to environmental impacts.

Economy

The main sources of income of the atoll population come from fishing. The islands of Feevah and Goidhoo perform relatively well in agricultural production. Fishing is carried out throughout the year, during both monsoons by most of the islands.

The island of Komandhoo performs well in fishing. Apart from Pole and Line fishing which is common in the country, the atoll is good for reef fishing including 'Faana and Huifi Landa' which are profitable fishery export products.

In addition, people bring income from their engagement in the tourism industry and other commercial work in the capital island, Male.

Health

Basic medical care was introduced for the first time in the atoll with the establishment of a health centre on 25 December 1970 in the island of Lhaimagu. This health centre was shifted to Farukolhu Funadhoo (now Funadhoo) in 1971 when the island was made the atoll capital. This health centre is now developed to Atoll Hospital which has a well equipped laboratory and operation theatre facilities and are manned by a gynecologist, anaesthetist and a general practitioner.

All five Islands visited have health centers providing health care by a medical doctor and trained nurses and basic laboratory services. All the islands have also basic health care services provided by family health workers.



Majority of the population of the atoll have access to safe drinking water. 40% of the households have been provided with water storage tanks on a soft loan basis under the Shaviyani Atoll development project and Atoll Development Committee. Most households have safe sanitation facilities.

Out of the 5 Islands, only Komandoo has a desalination plant which uses advanced modern technology. This desalination plant, which was the outcome of a community initiated project funded jointly by Ministry of Health and Atoll Development Committee has started supplying piped water to all households in Komandoo from the beginning of 2004. Rest of the Island used Rain water which is collected through water tanks.

A pilot programme to develop plans to reduce incidence of water and sanitation diseases and empower communities to develop sustainable plans has been initiated in collaboration with Maldives Water and Sanitation Authority and UNICEF. The programme, Community Planning for Water, Sanitation and Hygiene, aims to work initially with nine islands in the Atoll.

Education

Primary education is universal in all inhabited islands of Shaviyani Atoll. Every island has a school providing education at least up to primary level. These include 3 government schools, 1 private school and 12 community schools. A total of 8 schools which teach up to secondary level education are in the atoll. They are the Atoll Education Centre, Atoll School, Funadhoo School, Milandhoo School, Madharusathul Munawwara in Maroshi, Feevah School, Foakaidhoo School, Maaungoodhoo School and Lhaimagu School. Most of the secondary schools yet offer only commerce stream subjects. The schools which offer both the Science and Commerce stream subjects are the Shaviyani Atoll Education Centre in Komandoo and the 3 schools in Kanditheemu, Maakandoodhoo and Milandhoo. Most schools have computer labs funded jointly by parents, government and the Shaviyani Atoll Development Project.

Shaviyani Atoll Office¹⁵

The atoll office was established on 9 September 1958 by the state. Until 1st January 1968, the atoll office was located in Lhaimagu which was the capital of the atoll. The government declared that effective from 1st January 1968, the capital would be Farukolhu Funadhoo (Funadhoo) and hence, the atoll office was transferred to Funadhoo. The present atoll office was declared open on 14 March 1997.

Main functions of the Atoll Office:

The main functions of the Atoll Office are those mandated by the Ministry of Atolls Administration. In addition to that, the atoll office is also responsible for carrying out tasks assigned to the atoll office by other government offices. For easy administration, work at the atoll office is distributed among 6 divisions or sections.

¹⁵ <http://www.shaviyani.gov.mv/>

A. Section (Administrative section)

This section looks after the overall administration of the atoll office and strengthening the administration of the island offices and the atoll office and introducing modern management systems to the island offices.

B. Section (Budget section)

This section is responsible for drawing up the annual budget and looking after the budget expenditure. Also sees to the maintenance of buildings and property, and wages of the staff of the atoll office and island offices. The budget section is also responsible for hiring and firing of staff of atoll office and island offices and maintaining staff records.

C. Section (Human resources section)

This section is incharge of wages, allowances and wage increments of staff employed in other government sectors in the atoll. The section is also responsible for hiring and firing of staff in those sectors.

D. Section (Income and construction section)

The main function of this section is to collect revenue obtained from various sources, maintain bank accounts and income accounts. Moreover, this section also conducts and monitors construction activities run by various projects.

E. Section (Public Services section)

This section deals with the public services. The section looks into concerns, issues and grievances raised by the public, carry out investigations and send them for prosecution. The section is also responsible for dealing with land and property issues and formulating and implementing regulations.

F. Section (Project Planning, implementation and Monitoring Section)

The main task of this section is to plan, implement and monitor development projects and to collect statistics and analyze them. In addition, the section is also responsible for mobilizing island committees, clubs and organization and for implementing the Environmental Action Plan.

Community Based Organizations in Shaviyani Atoll

In each island there are various CBO's active, whose mandate is generally aimed at island development through various activities. In general each island has a Women's Development Committee (WDC) and an Island Development Committee (IDC).

Women's Development Committees

On January 1, 1983 committees working for the development of women were established in the atolls following the decision made in the second meeting of the women of the atolls held in Malé in 1981, to establish Women's Committees that function under the same regulations in all inhabited islands in the country,

Until April 1, 1993 the women's committees were selected by the Department of Women's Affairs. The members were selected from among those identified by the island and ward authorities as individuals noted for their community services in their respective islands. Health Assistants, midwives and teachers were encouraged to be included among these. Although all islands were using the same basic procedure to select members for the committees, in some islands women voted for their members. Men can also be part of the committees and may be assigned to all posts except that of the president and vice president of the committee.

The main objective of these committees is to plan, organize and conduct various programmes/activities to promote the development of the women in their ward/island and to support the Island Office for island activities.

As per the information provided by the atoll office, women's committee activities and responsibilities include:

- a. conduct programmes/activities to promote national and social unity among the women
- b. work for the protection of women's rights
- c. work for the improvement of the general status of women in the ward/island and conduct programmes/activities to increase the participation of women in the economic and political arenas
- d. increase the number of women going into tertiary education
- e. improve the health standards of women
- f. gather important data and information about the women of the ward/island
- g. create awareness of the importance of voluntary work for the development of the community
- h. participate as best as possible in all programmes/activities organized by the government and other bodies to promote the development of women

Island Development Committees

The IDC activities include planning, organizing and conducting various programmes/activities for the development of the island and offer cooperation to the island authorities.

As per the information provided by the Atoll officials, the IDC role and responsibilities are as follow:

- a. work in association with the Island Office to promote the spirit of religious, national and social unity in the community
- b. work with the people in carrying out various programmes/activities necessary for the development of the island
- c. provide full cooperation to the Island Office in conducting developmental programmes organized by either the government or government approved authorities
- d. work in association with the Island Office in providing all the necessary assistance to the Women's Committees and any other functioning associations for the development of the community.
- e. make efforts to increase the wealth of the island

The committee members comprise of the island authorities, people selected by the Atoll Chief, President of the Women's Committee, and personnel elected . Numbers of personnel to be selected into the committee according to the population of the community is as follows:

Population	Elected	Selected by the Atoll Chief
Less than 1000	5	2
Between 1000 - 3000	6	3
More than 3000	10	5

Group discussions were held with IDC members from the five islands. The activities carried out were very similar through out. The Island Development Committes manage the local infrastructures like power house, desalinization plants, community IT centres; island pharmacy etc. through contracting to the local CBOs and revenue generated is used for the island development activities. The Island Development Council are extending their support for managing local infrastructures and the execution of welfare activities.

The team could conclude that both IDC and women Committees and governing system lack awareness and well defined agenda to address the current risks and long term development programmes to encounter the future disasters and promote resilient island communities.

Atoll Developmental Activities ¹⁶

Relocation of People from Firubaidhoo to Funadhoo

Under the policy to integrate population and development, the first phase of the project to relocate people from Firubaidhoo to Funadhoo was launched on June 6, 1996. The 26 houses planned for this phase were completed and handed over to their owners on the December 1, 1997. Following that, the second and third phase has also now been completed and work on the fourth and final phase is now in progress. The construction of the 36 houses planned for this phase is scheduled to be completed and handed over on August 15, 2003. The end of work of the fourth phase would conclude the project to relocate people from Firubaidhoo to Funadhoo.

Relocation of People from Maakandoodhoo to Milandhoo and Funadhoo

The construction of houses in Milandhoo for this project was inaugurated by the Minister of Atolls Administration, Mr Abdulla Hameed on August 8, 1997. During the first phase of this project 30 households were transferred from Maakandoodhoo. Also, having completed the second phase, 50 of the houses from the 100 that were selected for the second phase of the project have now been finished and handed over to the owners. A total of 116 households have already been transferred to Milandhoo and the construction of another 21 are currently in progress.

The completion of these 21 would leave 152 households more to be relocated from Maakandoodhoo to Milandhoo. The government is presently organizing the relocation of these households.

Among the 23 households who had asked to be relocated to Funadhoo, all except 4 have already accepted the houses built on Funadhoo.

Construction of Harbors and the Reclamation of Land

Under the project to reclaim land and construct the harbors of the islands in the atoll, the harbours of 4 islands have already been completed. The first harbor to be constructed under this project was that of Komandoo, work on which started on May 2, 1992 and completed on June 25, 1994. The harbour of Kanditheemu was completed over the period from November 21, 1998 to February 14, 1999. Construction of the Maroshi harbor was launched on January 3, 1999 and concluded on November 1, 2002. Most recent of the harbors that have so far been completed in the atoll is the one in Funadhoo which started on July 20, 2000 and completed on April 6, 2001. The island of Foakaidhoo is to have its harbor constructed next.

¹⁶ <http://www.shaviyani.gov.mv/>

- Establishment of Health Post and Health Centres

Under the government project to provide health services to the people, 4 Health Centers and 3 Health Posts have been established and opened for service in the atoll. Those include the Health Centers in Bileiyfahi, Komandoo and Milandhoo in addition to the Atoll Health Centre plus the Health Posts in Kanditheemu, Goidhoo, and Maaungoodhoo. Also, the construction of Health Posts in Maroshi, Foakaidhoo and Feevah are now in progress. It is estimated that the construction of these would be completed this year and ready to open for service. An operation theatre is also currently being built at the Atoll Health Centre. Government Project to Develop the Atolls

Under the project to develop the atolls, undertaken by the Ministry of Atolls Administration, 14 Island Offices, 14 mosques and 3 Court Houses have been constructed in this atoll. The Atoll Office, Atolhuge and Mariyaadhuge - guesthouses for visiting official dignitaries - have also been built in the atoll under this project. Also, the renovation of the mosques in Foakaidhoo and Maaungoodho were also conducted under the same project.

- Project to Increase the Capacity of Schools

Additions have been made to both the government and public schools in the atoll in order to better cater for the increasing demands for education. In the year 2000, 1 additional classroom was built in the schools in Noomaraa and Maaungoodhoo. The same year, 2 new classrooms were constructed in the schools in Feevah, Foakaidhoo, Lhaimagu and the Atoll School. Renovation of the old school buildings in Funadhoo, Milandhoo, Maaungoodhoo were also carried out under this project. Also, the Ministry of Education built a new building with 4 classrooms in Maaungoodhoo School and has laid the foundation for a four storey building in the Atoll Education Centre, where preliminary work to start construction is now in progress.

Hazard Profile

According to the national Disaster Risk Profile of Maldives, developed by UNDP (refer to 1.1), Maldives has moderate hazard levels except for the low probability and high consequential tsunami hazard in the near future, and high probability and high consequential Sea level rise hazard in the distant future.

Overall, Shaviyani Atoll falls under Zone 5 for *Tsunamis, Cyclones and Surge Hazards*.

Sea level rise due to climate change has uniform hazard throughout the country. The IPCC in its Third Assessment Report 2001 estimates a projected sea level rise of 0.09 m to 0.88 m for 1990 to 2100. The impact on Shaviyani is directly proportional to the elevation of islands.

With about three-quarters of the land area of Maldives less than a meter above mean sea level, the slightest rise in sea level will prove extremely threatening.

Past Events

Although recorded data is not available, beach erosion (at different points in all islands the team visited observed this problem), sea water inundation due to sea swelling and flat topography of the islands, strong wind with heavy rain, change in the patterns of wave action which facilitates shore line change are some of the major hazards observed by the local population.

Since the islands are smaller in size they are prone to these risks and highly vulnerable to these kinds of natural disasters. In some cases the human activities like eradication of the coastal vegetation also attributes to the problem. It was reported by the local population the problem of beach erosion is severe during the recent past.

Some time the high wind speed also damages the houses and carries away the roof top in the islands. The tsunami waves of 2004 December had struck two of the five islands visited and destroyed houses in one island and sea water intrusion up to half a kilometre damaged the agricultural lands and crops in the other island.

Sand Mining

Construction is one of the major activities being carried out in the islands and sand mining has become a common practice, increasing islands vulnerability. Lack of space is a greater constraint in some of the islands for construction of new houses and to develop new infrastructure facilities in the islands.

Officially it is called land reclamation, which has been found a common denominator in all islands visited. By reclaiming the land to the atoll officials, islands are allowed to carry out sand mining in order to extend land area of the islands.



Being sea level rise and coastal erosion a hazard for the islands, sand mining increases the islands vulnerability to it.

In 2007, In Funadhoo the Island Official introduced a new regulation where 1,000 bags of sand are given as a quota to the existing families of the islands for new construction.

At the National level, Government of Maldives promotes safer island programme through which the households could be relocated in to a new island.



4.2 Field Survey

Field surveys were carried out in five islands to collect primary and secondary data for vulnerability assessments. The team conducted a participatory vulnerability assessment along with representatives of the local communities of the five islands, including islands officials, Island and Women Island Committee, youth Groups, police and Fire Department, and school teachers.



For purpose of this study and given the geographical situation of Maldives, social and physical vulnerability/capacity has been viewed as a composite of the following parameters: Food insecurity, Life loss potential, livelihood, morbidity, Bonding/Social Culture, Communications and Disaster preparedness.



The data collected from the five islands are given at Annex-A. Key Findings and brief description of the indicators is given below.

▪ Food Insecurity

Maldives imports almost all food items except fresh tuna and coconut. Heavy import dependency and limited food storage pose severe food security risk to the population.

The Islands are dependent on Male or other islands for food supply. According to the National Adaptation Programme of Action (NAPA) in 2003, 7% of the population experienced food crisis and for nearly half of this population it lasted for less than 10 days.

Food is distributed by boat from Male to all the islands, in the worse case scenario were frequency of climate change events; food security would be posed to a high risk.

Island food production is very limited (fish and coconut), increasing their dependency from Male supply. Few home Kitchen gardens were found during the field survey. The absence of small agricultural plots managed on the island itself acts as a factor contributing to a higher vulnerability. The lack of awareness and knowledge about home food production was the main reason for it.

The households in the islands have enough backyard space to develop a home garden. Generally the gardens are with a few fruit trees and few vegetable crops with out much crop diversity. The products are used to meet the domestic requirement. The gardens are managed with out any improved agronomic practices in terms of soil and water management. The good rainfall received in the island generally supports well both agriculture and home garden activities. The Government is keen on promoting the both agriculture and home gardening to enhance internal food and nutritional security.

The islands visited do not anticipate food crisis in worse case scenario, therefore food storage is not carried out by either the community or the government, increasing the population vulnerability in case of a disruption of food supply chain during an emergency.

A food storage system is not developed to meet if there is a crisis for food grains. The local population reported the local shops could support to meet if any such risk in the future. The island chief office on every week takes note of the existing stock in all shops in the island and shares with atoll office. Therefore given an island scenario lower number of shops, higher the vulnerability of the island is.

The presence of agricultural plots and horticulture on the islands can act as emergency food on the island. Moreover, based on the field reports, the team could conclude, presence of vulnerable population groups as factors enhancing pressure on food security. Whereas, presence of agriculture and horticulture as alternative food supply channels can make islands more self-sufficient for interim periods following possible major disasters.

In all islands visited rain water is the main and only source of water for local communities. A well functioning island level water storage method exists and linked with good rain water harvesting system. The stored water is used during the crisis time.



▪ **Morbidity**

The health facility plays a very important part in meeting the demands of health care services in times of emergencies. This is more so in case of island nations like Maldives. If there is inadequate staff or medical facilities and emergency plans are not in place, it increases the vulnerability.

All islands visited have a health center with the basic facilities available. However the main hospital is situated in the atoll capital, Funadhoo. When the patients need special treatment or facilities like X-Ray, needs to travel to the atoll capital. Islands have transportation facilities for Male and atoll capital. Yet, private speed boats for emergency situations were not seen. It was reported to the team that in case of an emergency, the doctor of the health care will request to Atoll hospital to sent the patient.

In terms of medical staff, it was found that the islands are very dependent on foreign staff, most of them from India, as the limited option for higher education in the country (only available abroad). All the island visited have one doctor available for meeting the needs of all population expect from Funadhoo (atoll capital) where 5 doctors are based. However, family and social health workers are available in all the islands.

On the other hand, garbage disposal by the households contributes to health hazard threats. The absence of solid waste management in the five islands was a major problem prioritized by the leaders and community members, which would lead to a higher level of injury in case of a disaster.

The community is well aware of the problem, but no system was developed. It was reported final disposal point is a major problem, different islands practice different methods for the final disposal, like burning, dumping at a specific point, disposing in the sea etc.



A few incidences of women committee members' efforts to solid waste management through segregation and disposal were not successfully adopted at the community level.

Funadhoo and Milandhoo islands have recently being resettled from their original islands, as the number of population was increasing water contamination and waste became a major problem and therefore the local community shifted to new islands.

The efforts by the INGOs in Komadhoo Island are not appreciated by the community. The structures developed by the INGOs are left unutilized.

Sanitation is another concern expressed in all islands; the local perception is that the soak pit method would pollute the shallow ground water table during the course of time.

▪ **Livelihoods**

In Maldives, most of the people are dependent on either fishery or tourism industry. In the Islands, livelihood options are few: a) fishery b) resorts industry c) construction d) government employment.

For livelihood most of men generate the main income for their families either traveling to tourist islands or for fishing.

In the five islands visited, fishing is the primary livelihood of the islanders. Tuna is the main species they catch other species like reef fish and white fish in small quantities. Motorized high speed boats (in one boat around 10 to 12 men form a team for fishing) and Dhonis (traditional boats) are used for fishing; the boats are equipped with the advance communication technologies. Apart from these boats small boats are used for fishing by some of the households.



No market facility is available in the islands; the main market source is the visiting vessels in the sea from Male. The Maldives Industry of Fisheries Company (MIFCO) is the only company involved in buying the fish, and hence some time the vessel may not be there in the sea when the fishermen come back with the catch.

The other problem is the capacity of the vessel; the maximum capacity is 30 tonnes some time if they get good catch they have to the extra fish to the island for processing. The price is fixed but changes according to the season. The processed fish in the islands is transported to Male and sold as dry fish in the market. Dry processing is done at the household level or in some islands in the commercial processing units owned by private individuals.

The increasing export market opportunities reduce the quantity of dry fish processing in the islands. The availability of the live bait fish is a major problem the island fishermen are facing now.

Some of the islanders who own dhonis and small boats are involved in lobster and prawn catch through diving method and the market for these items are the resort islands.

The other major economic activity which supports the island households is construction work in the new resort islands. They migrate to the islands as a team of 20 to 30 to do manual labor. They stay there for three to six months after a break of 20 days to a month at home again go back to the islands for work. The resort islands are located far away places hence it is difficult to make more trips to home islands. Since it is rewarding the islanders are attracted to take up the job.



In most of the cases women have taken up the commercial fish processing, making the family unit extremely dependent on Male (capital where all the fish is sent) and the tourism industry.

Agriculture in the island is women based activity; they manage the farm and carry out almost 95% of the activities. In the islands if land is available some of the households practice agriculture, the crops include a number of fruit bearing trees and vegetable crops. The islander make furrows as a mechanism of rain water harvesting and also irrigate the plants. If needed they also make small shallow water pits and use the water for irrigation. Government policy prevents owning individual agricultural plots, but encourages the interested households to clear a plot and cultivate different crops. Enough arable land and fresh water resources are the two major constrains for the promotion of intensive agricultural practice in the islands. The products are sold in the same island, rarely neighboring islands but mostly taken to Male markets.

The other important source of income to the islanders is government jobs available in the island. Some of the educated are appointed as staff in the office of the island chief, government hospitals, schools, court, police etc.

Dry processing units, ice plants are other facilities available in the islands which also provide job opportunities to the local people and migrants from other countries. The bank facility is available only in the atoll head quarters but a mobile unit visits all the island monthly once similarly a post man visit the islands twice a month to collect and dispatch the mails.

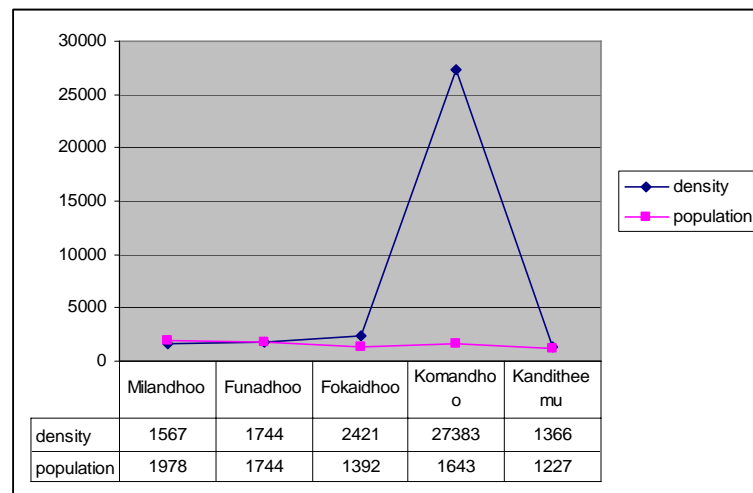


▪ **Life Loss Potential**

The greater the population exposed to hazard, the greater is the risk to life loss. In the Maldives, certain islands have problems related to population density. It was found that in some islands the increasing pressure on limited land put pressure on scarce resources and limited infrastructure.

It was observed that where there is increase in density, people have to resort to drinking water from ground water tank which are contaminated, it leads to health hazards in normal circumstances also.

Komandoo, had the highest level of density out of the five islands visited. With a total population of 1,636 and 6 hectares of land, different families have been forced to share a one family unit house due to the unavailability of land for new construction.



Density of Population in the 5 visited islands

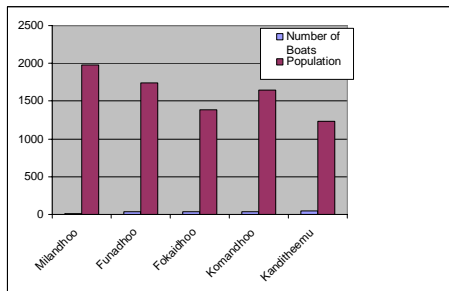
Apart from the area used for construction houses and the other common infrastructure facilities the remaining land area in the island is considered as Common Property Resource (CPR). The island population is allowed to have access and use the area but the ownership lies with the government. In the islands identified for relocation programmes large areas of land is already allotted to houses to new migrants and also have plans to allot area more area to the future migrants

With limited opportunities for livelihood there are numerous cases of a large number of women headed households and the elderly. The breaking up of families to fulfill needs of livelihood often results in large number of women and children living on the island all by themselves. Also, the elderly population is often left behind on the islands which contribute to the vulnerability of the island.



The women, children and the elderly stay alone on the islands, representing 74% of the five Island population), exposing their vulnerabilities in case of emergencies to a higher risk.

Accessibility to the island is an important indicator for life security of island communities. Availability of vessels for transportation acts as a resilience factor but the high cost of private speed boats in case of emergencies reduces it and increases the vulnerability.



On average, the islands visited have 2 boats available for 100 populations. In case of any emergency if the island would need to be evacuated, the communities would be exposed to a high risk due to the unavailability of transportation.

▪ Communications

An excellent hardware network is established at atoll level. Each island has a multipurpose community IT centre managed by the local group like Island Women's committee or Island Youth Movement. The centres are used by the islanders to make phone calls, access internet facility, make photocopies, send and receive fax messages etc. The two telecommunications companies of Maldives have their presence in all islands. The teledensity is around 99%. Innovative experiments like local area network and CB system to communicate fishermen in the sea with a range of 45 to 50 nautical miles are developed by the fishermen to reach fishers in the sea. A local cable television system (which carries the message from island council as flash news regularly) and local area telephone network are in place in one of the islands to increase the efficiency of the local area communication system.

Primarily the islanders depend on open sources like TV, Radio for their information needs and receive generic information. No arrangement is available to cater the local specific information needs of the island population. Some of the information needs identified during the discussion with islanders were

- Market information for both fish and agricultural products from the islands
- Scheduling of local ferry service, inter islands and also to Male
- Information on sources of improved technologies and agricultural/home garden inputs
- Government development schemes to the specific atoll and the island
- Visits/alerts of mobile banks and post man to the islands
- Educational facilities available in the different islands and Male
- Health information
- Job opportunities to the educated youths and other sections

A through information need analysis could help us to get the exhaustive list of the information needs pertaining to the different islands and also the different sections of the island communities.

Early warning system

The Department of meteorology from Male sends the information to office of the atoll chief from there to the office of the island chief and the staff in the island chief office makes the public announcement. The atoll office has a data base of mobile telephone numbers of the Island chief, leaders and other important persons of all islands in the atoll to reach out for any urgent message. Most of the islanders said mass media like TV and Radio are the two major sources of information about weather report or any other warning message.

▪ Bonding / Social Culture

In the Island visited a cohesive community structure was observed.

Overall, the islands have well structured governing system. The island chief is the head of the governing system at the island; atoll chief nominates the island chief. The island chiefs enjoy the position as long as they enjoy the confidence of the atoll chief. Some of the islands have senior island chief and assistant island chief as well. Island Development Council is the prime body which plans the island development in collaboration with the office of the island chief. Around 12 members form the council, the members are elected and the tenure is for four years. Island women committee leader finds a place in the council to ensure women's representation in the council. Island development council is in charge of all development activities; the council express the needs to the atoll office and gets the necessary fund support. Activities like harbour management, solid waste management also come under the control of the Island Development Council. Island office is the source of information about the local welfare activities.

At the island level the different sections of the communities are mobilized and formed as Community Based Organizations (CBOs) such as Island Women's Committee, Island Youth Movement, Fishermen Association etc. The CBOs are with huge memberships, most of the women and youth in the islands become members of these organizations. They organize periodical meeting for once in a month or some times twice to discuss and plan their activities. Atoll office acts like a hub, which facilitates the meeting of the leaders of the different islands.

Group discussions were held with the Women committees of the 5 selected Islands.

Summary of findings are given below:

Island	Number members	Activities carried out by committee (Base Line)	Remarks
Milandhoo	14 women 1 man	<ul style="list-style-type: none"> - Maintenance of pre-school. - Recently started agriculture activities in the backyard of woman's center. Chili, brinza, pumpkin, coco, flowers, etc. are planted. - Home garden are common in the island. They sell surplus vegetables to local shopkeepers or individual merchant in the island (to ship to Male) 	<p>This woman's committee has interaction with their counterpart in Foakaidhoo. Members from this island visits Foakaidhoo 3-4 times per year to update their activities and exchange ideas, etc.</p> <p>It was felt a low level of Disaster awareness and risks in the Islands.</p>
Funadhoo (Atoll capital)	15 women, 2 men	<ul style="list-style-type: none"> - Maintenance of pre-school (they get 2000 per month for this work from island office. - organized events for Woman's & Children's' Day 	<p>During the PRA exercise, committee members accepted that low level of motivation & lack of awareness are the main challenges of the committee as being a member does not generate any income.</p>
Fukaidhoo	19 women, 1 man	<ul style="list-style-type: none"> - Preschool maintenance: WC collect 50 per students from their parents and provide the amount to preschool teacher for their salary (money is managed in island office) - Organize sports game to women: (local sports such as bashi or volleyball). Each time 40-50 women participates. - Consultation and Information provision to women: 	<p>Most active committee out of the 5 Islands visited.</p> <p>During PRA exercise, some of the members stated that lack of education and awareness is a limitation in order to develop new activities.</p>

		<p>provides information such as on general health (sometimes work with health center), reproductive health, family planning to women. WC also provide divorce consultation service for women aged 25-35 mainly.</p> <ul style="list-style-type: none"> - Income generation program for WC: Cleaning (350/month) - Ministry of gender and family provide 15/person for WC meeting. WC report to the Ministry every month and receive money. - Waste separation was once conducted by woman's committee but was not successful because of the lack of support from local people. 	
Komandoo	12 women, 1 man	<ul style="list-style-type: none"> - Preschool maintenance - Organize course training for sewing. Instructors were invited from Male and provide both basic and advance training for 35 participants. - Small scale agriculture using vacant lot behind head master's office 	Members identify livelihood as their main concern, as they do not generate any income.
Kanditheemu	18 women, 2 men	<ul style="list-style-type: none"> - Preschool maintenance. WC collects 65 per student from parents for teacher's salary. There is only 1 class room for preschool and the new building has been planned long time ago but not materialized yet. - Course training of pottery drawing/paintings for women. The proposal was sent to Atoll Office and received 20,000 from the office. WC invites resource person from Male and also receives help from youth center from Funadhoo. The course is for 15 days. - WC also plans to organize sewing class for women in the future since embroidery and hand painting on women's cloths are becoming popular. - Waste Management (separation of organic waste, coco, cans/bins, sanitary wastes in vacant lot) is being done voluntarily by women. Knowledge of waste separation is from TV and from school. 	<p>Income generation for WC: Cleaning of preschool for 1,200 per months (from island office)</p> <p>WC has 4 meetings per month and report to the Ministry of Gender and Family.</p>



The inter island relationship is smooth, trips are made to visit the relatives and friends. Transportation is through special ferrys meant for travel and by fishing boats. The cost of travel is a major restricting factor of the movement of the islanders.

The NGOs present in the islands support the Island Development Council and CBOs to execute the development projects. They involve other activities like organizing functions to celebrate special days, sports events and cleaning the islands. They also engage in activities like schooling, career guidance of youths etc. Some of the NGOs have some limited experience in organizing training programmes like embroidery, tailoring, human rights etc.

▪ **Disaster Preparedness**

Promotion of selected number species as bio barrier in the coast is the local practice in the islands to protect the beach from the natural hazards. The islanders have a list of plant species which are good to withstand the shore erosion and block the strong wind coupled with heavy rain. The other method adopted was construction of break wall made of rocks/boulders and coral reefs from the sea. But the walls could not stand for longer time; they need good foundation to withstand the wave movement. Among the five islands visited in three islands it was observed that some effort has been made by the local population to plant banyan trees at a few points along the coast to prevent the beach erosion. The banyan cuttings planted are with stunted growth due to lack of proper soil management practices. April end to June middle is considered as the suitable season for planting saplings and cuttings.

Following are the suitable tree species identified by the local people 1. Banyan, 2. Coconut, 3. Dikka, 4. Funa (the timber is good to make boat), 5. Kurethi, 6. Kaandu (traditionally the unripe fruit is used as a vegetable), 7. Hinud, 8. Medili, 9. Mahu, 10. Bread fruit etc. (the names are local names need to collect the common name and botanical name of these species)

The cohesive community structure in the island is also helping to buttress the resilience of these islands to different type of shocks. Relocation due to rapid population would affect the community structures and reduce the resilience of these communities.



4.3 Risk Analysis

The two main components of risk assessment comprise hazard assessment and vulnerability assessment.

Risk in particular area can be described as multiplication of hazard and vulnerability, the methodology used under the present study is based on the same theory. The mathematical model has been prepared for different hazards prevailing in Shaviyani Atoll (Sea Level Rise, Floods, Cyclones, and Tsunamis).

Methodology

The methodology followed under the present report comprises the following steps:

1. Collection of data through PRA exercise conducted in the field.
2. Defining Indicators for physical and social vulnerabilities/capacities within the local communities and weightage assignment.
3. Identification of sub indicators for major indicators given, based on the availability of data.
4. Analysis of data and provided rating in scale of 1 to 5 based on the situation on the ground and priority in terms of disaster management.
5. Quantification of Risk for each Island as a result of multiplying hazard and vulnerability ratings.
6. Sum up different risk value for different hazards in order to collectively represent risk in each island.

Based on the mathematical methodology followed and the findings during the field surveys, the risk measured is given in the table below:

Hazards	Milandhoo	Funadhoo	Foakaidhoo	Komandhoo	Kanditheem
Sea level rise/ coastal erosion	10.7	11.1	10.6	12.3	9.3
Tsunami	7.3	7.3	6.3	9.7	7.1
Cyclone	9.6	9.7	9.8	11.5	9.4
Flood	9.17	8.3	8.3	9.46	7.79
TOTAL	36.77	36.4	35	42.96	33.59

Although common characteristics were found in all 5 islands, it can be observed from the table, Komandhoo Island is exposed to a higher risk from natural Disasters than the other Islands.



5. Results & Discussions

This chapter seeks to analyze the key findings at National, Atoll and Island level, from the data presented in the previous sections and to discuss the intervention strategies to be followed by SEEDS Asia under Project Selamat.

National level descriptive information was developed based on the secondary data such as government plans and strategies, assessment conducted by other agencies and activities at the national level. Vulnerabilities, capacities and risk assessments have been conducted in detail for the 5 selected areas based on the field surveys findings.

Over 80% of the land area of Maldives is less than 1 meter above sea level. The predicted sea level rise of 0.09 m to 0.88 m in the period 1990 to 2100 (IPCC), combined with increased extreme weather occurrences, makes the Maldives one of the most vulnerable countries to climate change and sea level rise.

The National Disaster Risk Profile of Maldives shows that Maldives has moderate hazard levels except for the low probability and high consequential tsunami hazard in the near future, and high probability and high consequential Sea level rise hazard in the distant future. Overall, Shaviyani Atoll falls under Zone 5 for Tsunamis, Cyclones and Surge Hazards. Beach erosion, sea water inundation due sea swelling and flat topography of the islands, strong wind with heavy rain, change in the patterns of wave action which facilitates shore line change are some the major hazards observed by the local population.

Maldives is a signatory of the Hyogo Frame of Action, the first draft of the National Disaster Management Plan has been prepared by the National Disaster Management Center with assistance from UNDP however, the final version is still in the offing.

Among its top priorities in the 7th National Plan, the Government of Maldives has included policies and strategies for environmental management and disaster risk reduction, focusing on coping mechanisms towards climate change and waste management. The “Safe Island Programme”, initiated by the government will identify host islands where the local communities will be shifted from the small islands which are under high risk. If the proposed designs of the host islands do not include issues like food security, waste management and carrying capacities of the islands, then the host islands may find it difficult to sustain increase in load.

It was observed that land shortage, solid waste, sewage disposal and declining freshwater quality are some of the serious problems identified in the project area, Shaviyani Atoll. Further, 2 out of 5 islands in the atoll were recently re-settled.

This fact is quite alarming because the local communities were shifted to the new island because of the same problems which plagued their islands. As the new resettled islands are again facing the same problems, long term solutions have to be figured out.

As a short cut solution to the problem of land shortage island officials have proposed the concept of land reclamation, creating new land but at the same time leading to an increase of the physical carrying capacity of the islands and causing ecological damage to the islands itself.

Furthermore, all the products consumed in the island, with the exception of fish, come from the capital, Male. This not only increases the vulnerability in terms of food insecurity of the islanders but also adds to the environmental problems. Products like plastic bags and cans are commonly used by the islanders. However, being non degradable items, they are just thrown to the beaches or sea, leading to an increase of diseases and water contamination. The community is well aware of the problem, but no system was developed. It was reported final disposal point is a major problem, different islands practice different methods for the final disposal, like burning, dumping at a specific point, disposing in the sea etc.

In the five islands visited, for livelihood most of men generate the main income for their families either traveling to tourist islands or for fishing and in most of the cases women have taken up the commercial fish processing, making the family unit extremely dependent on Male (capital where all the fish is sent) and the tourism industry.

Field surveys conducted at the ground level reveal that local communities do not perceive natural disasters as a pertinent risk neither their dependency on Male. However, they did perceived the environmental problems, as the effects of it are already affecting their lives: ground water contamination, increase of diseases, and shortage of land for new construction...

Given the geographical characteristics of Maldives, in the long term, lack environmental management could lead to a major man made disaster. Can communities keep shifting from island to island once they are contaminated?

Lack of educational institutions in the islands is one of the major bottlenecks. After schooling children have to travel to Male to attend college. Students need to travel abroad to pursue higher education. Most of them do not return back because of the limited job opportunities available back home. It was found that specialized jobs were taken up by foreigners.

At the island level the different sections of the communities are mobilized and formed as Community Based Organizations (CBOs) such as Island Women's Committee, Island Youth Movement, and Fishermen Association etc. The CBOs are with huge memberships, most of the women and youth in the islands become members of these organizations. They organize periodical meeting for once in a month or some times twice to discuss and plan their activities. Atoll office acts like a hub, which facilitates the meeting of the leaders of the different islands. However, it was observed that the low level of awareness limits the agenda of govt. officials and local CBOs to promote awareness programmes and disaster preparedness activities.

Presently, the island office and CBOs conduct general programmes such as celebrations, improvement of infrastructures, maintenance of the Island etc and without much emphasis on disaster risk reduction or community awareness raising.

The economy is predominantly dominated by tourism and fishing. As tradition men take up the role of the bread earners and venture out for livelihood leaving women on the island subjected to high risk. Women, children and the elderly account for nearly 74% of the population of Shaviyani atoll. In spite of such a large percentage women play a negligible role in the major decision making processes. It was found that some initiatives taken up by women committees for a better organized island were not followed by the men folk. Therefore, project activities targeting women as main stakeholders will need to take cultural issues into account. However, building women capacities and self resilience will be crucial in order to ensure a disaster resilient island.

The islands visited do not anticipate food crisis in a worst case scenario, therefore food storage is not carried out by either the community or the government, increasing the population vulnerability in case of a disruption of food supply chain during an emergency. The presence of agricultural plots and horticulture on the islands can act as emergency food on the island. Moreover, based on the field reports, the team could conclude, presence of vulnerable population groups as factors enhancing pressure on food security. Whereas, presence of agriculture and horticulture as alternative food supply channels can make islands more self-sufficient for interim periods following possible major disasters. The Government is keen on promoting both agriculture and home gardening to enhance internal food and nutritional security. The households in the islands visited had enough backyard space to develop a home garden. Generally the gardens are with a few fruit trees and few vegetable crops without much crop diversity. The products are used to meet the domestic requirement, however the gardens are managed without any improved agronomic practices in terms of soil and water management.

Considering the findings analyzed in the previous chapters, the “Bio Island concept for community resilience” is proposed under Project Selamat. The project will adopt a multidimensional approach through execution of intervention activities like implementation of coastal protection measures, disaster management planning, home kitchen gardens and solid waste management.

The project Area will be in Shaviyani Atoll. Although Komandhoo was identified as the island exposed to a higher risk to Natural Disasters (refer to 4.3 Risk Analysis), it was reported by Island and Atoll officials that the local communities from Komandhoo will be resettled to a new Island in the near future. For that reason, Milandhoo Island, identified as the second island under higher Risk, will be the main target for the demonstration of the “Bio Island concept for community resilience”.



6. Emerging Directions

The Emerging Directions and therefore the intervention activities have been design based on the findings described in section number five.

The land use, environmental conditions, demographic details, anthropogenic pressure etc varies from island to island hence it is appropriate to adopt island specific approach for developmental interventions and disaster mitigation plans.

6.1 Strategies

Integrating Community Based Disaster Risk Reduction and Environmental Management.

As a result of the field visits, ground analysis and Risk Identification, the following activities have been identified for Project Selamat in Maldives:

1. Island Disaster Management Plans

Shivayani Atoll does not have disaster management plans or emergency procedures in place. The limited accessibility to the islands and their dependency on the atoll offices and Male exposes the islanders to a higher risk in case of an emergency.

With the aim of making the island safe against disasters, Disaster Management Plans need to be developed. Moreover, the process of Island Disaster Management Plans will involve a greater emphasis on linkage with the overall Atoll DMP.

Training programmes will be conducted at atoll & island level to help prepare the island and atoll plans. In order to ensure ownership and long term impact, the plans will be developed by atoll and island officials in close collaboration with project Selamat expertise on Disaster Management.

2. Establishing Coastal Bioshield

In general the islands of Maldives are highly prone to natural disasters due to their small physical size, limited natural resources, relative isolation, extreme openness to external shocks etc. High density due to stable population growth, poor infrastructure facilities, limited livelihood options, human resources, and skills are some other factors which make the situation more vulnerable. These characteristics bring the islands under pressure to plan and develop mechanisms to mitigate the possible disasters and strengthen the resilience of the island communities and islands.

Open seashore of the islands are highly prone to natural disasters like beach erosion, sea water inundation, strong wind and possible tsunami waves in the future.

Promotion of selected tree species as bio barrier in the coast is the local practice in the islands to protect the beach from the natural hazards.

The islanders identify a list of plant species which are good to withstand the shore erosion and block the strong wind coupled with heavy rain. They are 1. Banyan, 2. Coconut, 3. Dikka, 4. Funa (the timber is good to make boat), 5. Kurethi, 6. Kaandu (traditionally the unripe fruit is used as a vegetable), 7. Hinud, 8. Medili, 9. Mahu, 10. Bread fruit etc. The other method adopted by the islanders was construction of break walls in the sea near the shore with rocks/boulders and coral reefs from the sea. But the walls could not stay for longer time; they need good foundation to with stand the wave movement.

Promoting a multilayered and multispecies bioshield could be an appropriate mitigating mechanism. This would also include shrubs which would act as soil binders and prevent sand erosion. This could promote the natural resilience of the coastal areas.

The species selected for bioshields development should be suitable to coastal conditions and economically beneficial trees preferred by the local men and women.

For establishing the bioshield the scientific soil management is vital for healthy growth of the plants. Since watering could a problem the planting should be done during the rainy season. The bioshields would support water and soil conservation which would improve the environmental condition of the islands. The species in the bioshields can support some of the local economic needs (like coconut, timber etc) of the island communities. Selection and mix of the species should be based on the space and height of the bioshield required to the selected coastal line. Active involvement of the island development council, youth groups and the local NGOs is essential to ensure the community to share the ownership of the processes.

3. Model Home Kitchen Gardens

Home gardens are crucial to brining resilience in vulnerable regions apart from meeting island nutritional security. Experiences from south Asian countries clearly show that eco agriculture approaches, agronomic and livelihood diversity and community networks were found to strengthen the capacity of the households to withstand and recover from disaster (Melissa Harvey, 2007). In Maldives, on average home gardens occuppies 100 m² to 500 m² area adjacent to home. Apart from this, it ensures ecological biodiversity and more numbers of economically important plant species provide income to the household.

The major crops cultivated are vegetables like chillies, beans, eggplant, few greens, maize, cucumbers, water melon etc, tubers like tapioca, taro, spices, other trees like curry leaf, drumstick, coconut, arecanut, and a few fruit trees like banana, papaya, bread fruit, *Muntingia calabura (jeymu)*, guava, mango etc. Survey studies indicate that a home garden has around ten to twelve different species with different varieties of the same. It is essential to produce plant based vitamin and fibre from fruits and vegetables to supplement rice and fish based diet.

The FAO Resilience Analytical Framework could be adopted which recommends four principles to improve resilience such as strengthening diversity; rebuilding local institutions and support networks; reinforcing local knowledge; and building on farmers' ability to adapt and reorganize.

The approach covers both technical and social issues to bring sustainability. Using this framework as an overall guiding principle, attempt is initiated to develop a plan to promote and strengthen the homestead garden ins a particular island to bring resilience. A modest attempt would be made to develop a replicable model during the project period. Participatory multi-stakeholder approach would be adopted to implement the following activities.

The proposed activities, time taken to each of the activity as well as an estimated budget is to cover around 250 households. Apart from, strengthening traditional home gardens, efforts would be continued to study and experiment hydroponics through demystification of technology as well as process at decentralized manner. Based on the results and feasibility efforts would be taken to upscale it to the other islands in the atoll with support of atoll office.

4. Community Resource Centre

The excellent hardware telecommunication facilities and good human resource available in the islands are providing a very good opportunity for the promotion of community IT centres functioning in the islands to Community recourse centers.

This centre could cater the local specific information needs of the community. To achieve this, the local centre should develop linkages with different information sources and a system to ensure regular flow of information from these sources. The list information needs identified by the local community is already discussed.

These centers in the islands could cater the island specific, need driven information of the local communities. To achieve this, the local centre should develop linkages with different sources (which could provide the information as per the local needs), a system to ensure regular flow of information from these sources and converting the generic information to local specific information. The centre can also provided the information as per the changing needs of the different subsections of the community. Periodical need assessment by the centre managers would help to update the new and dynamic needs of the community. Forums like Island council meetings and other community meeting could be also utilized to collect information needs and demands. Capacity building and training of the centre managers on need assessment, content development etc., are crucial to achieve these aims.

This would enhance the information access of women whose movements are restricted due to cultural reasons. Women are exposed to these IT based communication and in one of the islands visited the local women committee managing the island community IT centre.

The growing number of mobile users' and their interests to access data services over their mobiles phones could provide an opportunity to develop of mobile data networks. These centers would pave the way to achieve digitally empowered development of the island communities.

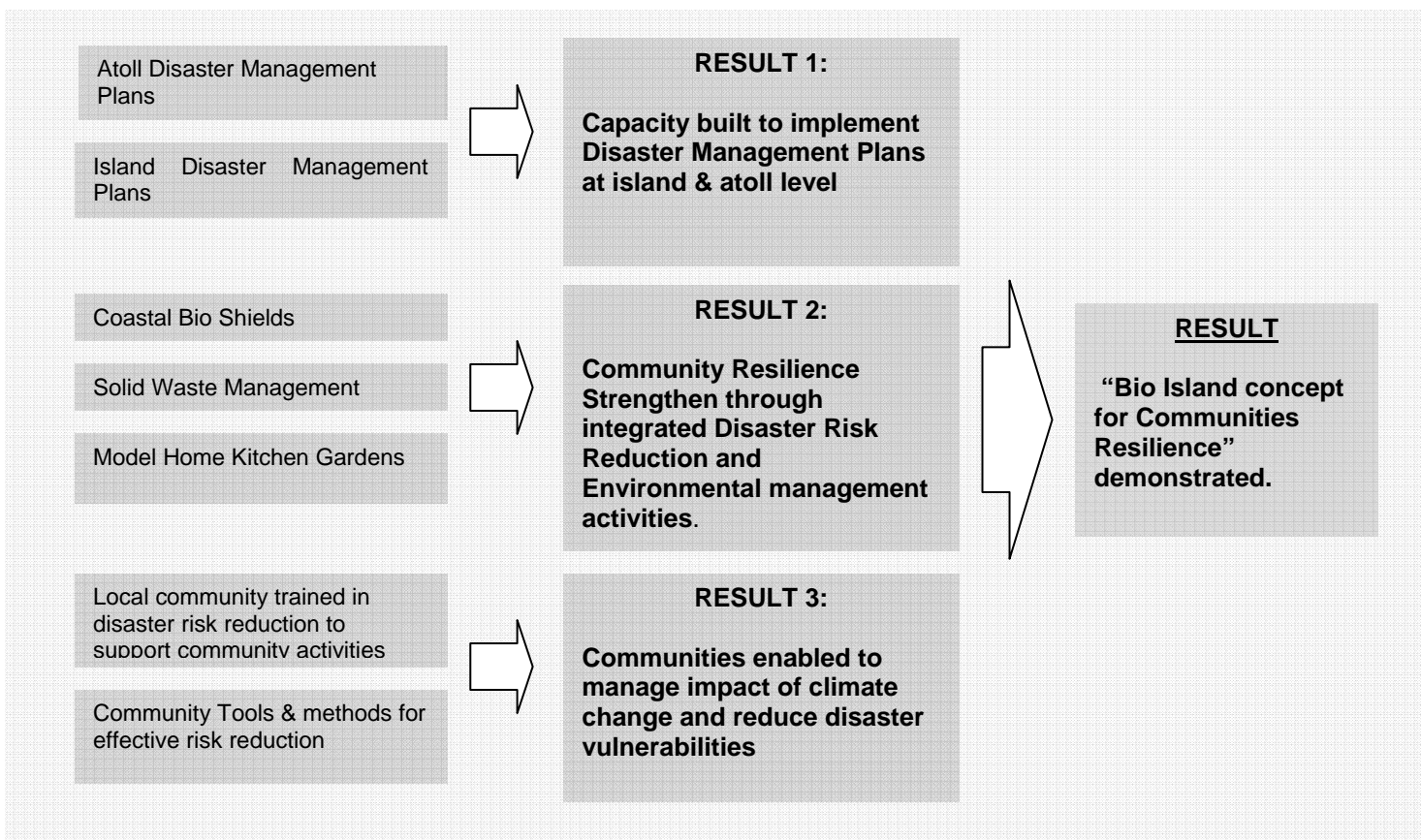
Based on the results gained in one island and feasibility efforts would be taken to upscale the model to the other islands in the atoll with support of atoll office.

5. Waste Disposal Management, promoting Environmental Management as part of Disaster Risk Reduction.

Proper waste management is one of most environmentally challenging issues for the project sites in Maldives. In all five islands in Shaviyani Atoll where the project team visited, no proper solid waste management system was in place, and no regular or controlled collection were being carried, even at the Atoll level. Households either carried wastes to a designated waste disposal site or simply dumped them in the periphery of the islands or into the sea itself. Moreover, the risk of such problems will further increase especially during the time of a disaster. Unmanaged and mixed wastes dumped around coastal area and nearby peripheral lands can easily be washed away during tidal waves, tsunamis, and tropical storms, which also cause soil contamination and other environmental problems.

Proper waste and debris management has been identified as one of the most important elements for disaster risk reduction, especially in small islands such as Maldives.

Operations’ Framework



The project Activities will be implemented during the project period of 19 months. A team of multicultural expertise on coastal protection measures and Disaster Risk Reduction will take the lead on the implementation process along with the local communities. Ownership of all activities by local communities will be must in order to ensure the sustainability and the project's overall goal: to build communities of Shivayani atoll resilience to natural Disasters.

The methodology adopted will be implementation of developmental interventions coupled with high quality training programmes to promote human resource development. The training programmes will be supported with simple training materials both in print and multimedia CD forms. The prevailing good working relationship among CBOs and NGOs at the ground level could provide favorable environment for conducting the training programmes successfully.

The results of the study of the natural resources available in the island, utilization of the resources by the island community and experiences gained through the field interventions implemented during the project period would help to develop the concept 'bio island for communities resilience'. The bio island concept could concurrently address the twin issues the sustainable resource management, food security of the island population and disaster Management planning.

6.2 Stakeholder Analysis

With the objective of identifying key Stakeholders for Project Selamat, Group discussions with community members of the 5 Islands, NGOs', CBOS', and Government Agencies were conducted.

The Stakeholders have been classified in two sections: Primary and Final stakeholders. The Primary stakeholders will be involved through out the project activities and will be the targeted beneficiaries. Final Stakeholders, will play a major role in decision making at policy and advocacy level, and activities' replecability.

Project Selamat Primary and Final Stakeholders

- National Disaster Management Center:

The NDMC is the main Government Department responsible for Disaster Management & Risk Reduction activities in the country of Maldives. The shortage of highly qualify employees on Disaster Risk Reduction makes them highly dependent on international agencies in order to build their own capacities and implement DRR activities in the islands. The NDMC will be the focal point for the project implementation in order to ensure replicability of the project activities to other islands and linking the community based activities with implementation of Hyogo Frame of Action at the National Level.

Project Selamat will be implemented in collaboration with the National Disaster Management Center.

- Ministry of Atoll Development

As the overall authority of all the atolls in the country, the ministry of Atoll Development is responsible for activities and plans to be implemented at atoll level. In case of any emergency, the NDMC will coordinate with the Ministry relief operations & disaster Management activities. The Ministry administers island & atoll management and therefore has direct input in integrating island risk reduction into developmental activities. The organization is the main information link between island & atoll authorities.

Along with the NDMC , the Ministry of Atoll development will be a crucial stakeholder in order to dissemination and sustainability of the project as project not only in Shaviyani Atoll but also its replicability in other atolls.

- Ministry of Fisheries & Agriculture and Marine Resource (MOFAMR)

The MOFAMR has the overall mandate for the sustainable management and development of fisheries, agriculture and marine resources of the nation. The Department has already conducted training programmes in several Atoll for a better improvement of the existing agricultural plots. The MOFAMR will be a crucial Stakeholder for the dissemination of the agricultural activities to be conducted (Model Home Kitchen Garden) and its replicability to other Atolls.

- UNDP

UNDP is main agency in the country working along the GOM on Disaster Management and DRR at policy and implementation level. Different activities have been carried out by UNDP after Tsunami December 2004.

A commonly agreed framework of action and sharing of good practice and to avoid overlap of activities of both agencies.

- Care Society, NGO

Care Society is the most active local NGO working in Maldives. However, low level of knowledge on DRR activities limits their number of interventions under this subject. Building their own capacity on DRR with primarily focused on School Safety is their major requirement from the project

- Shaviyani Atoll officials

The Atoll offices play a key role in effectively responding to island level disasters and providing guidance and training to Island Officials in strengthening environmental management and disaster preparedness capabilities. In case of an emergency, the Atoll officials will also be responsible of the coordination among Shivayani Atoll islands.

- Island Chief/ Island govt. employees

The island chief is the person assigned as head of the Island. He is in charge of planning, organizing and conducting the various developmental programmes/activities in accordance with the guidance of the Atoll chief.

His involvement will be crucial in order to ensure Implementation of project activities and its sustainability at the island level

- CBO's based on Islands

Island Development Committee

The IDC responsibilities in the island include planning, organizing and conducting various programmes/activities for the development of the ward/island and offer sincere cooperation to the island authorities

Enhancing the IDC members skills & capabilities will be crucial for the sustainability of project programmes & replicability in other Islands as the members could shared the knowledge and activities carried out with other IDC members from different islands.

Women Development committee

The main responsibilities of these committees are to plan, organize and conduct various programmes/activities to promote the development of the women in their ward/island. As highlighted in the risk assessment women and children are exposed to a higher risk as they remain through out the year in the island while the husbands/ fathers work outside the island.

Women Committees become a main stakeholder in order to conduct awareness campaigns & training programmes with the women communities in the islands with the final objective to reduce their vulnerabilities.

- NGO's & Youth Movement in the Islands

Presence of NGO was found in all islands visited. However their lack awareness on the current risks and development programmes to encounter future disasters, limits their actual agenda to organizing cultural events, music bands and providing support to CBO's. Involvement of NGO's in all project implementation activities will be main focus on stake holder's strategy plan of project Selamat.

- School & Hospital employees

During times of emergencies, school & hospital buildings are usually used as community shelter. Hospital and school community will become a crucial stakeholder in order to develop Disaster management Plans for the islands

Primary Stakeholders, to be directly involved in the project implementation

Stakeholders		Reason chosen/ relation with the project
Sector	Sub sector	
Government	NDMC	As the National Disaster Management Center of Maldives, Main Govt. Department responsible for Disaster management & Risk Reduction activities in the country of Maldives, Their cooperation is crucial for the implementation, dissemination and sustainability of the project as project not only in Shaviyani Atoll but also its replicability in other atolls.
	Atoll officials	The Atoll offices play a key role in effectively responding to island level disasters and providing guidance to Island communities in strengthening disaster preparedness capabilities. As the overall authority of the atoll, without their support and approval it will be difficult to organize events & activities at the island level as Island Chief depend on Atoll Chief decision making. As during the project duration 5 Islands of the Atoll will be covered, will depend on the Atoll Chief its implementation in the rest of the islands.
	Islands officials	At the local level, support & interest from Island Chief & officials will be crucial for the success of the project.
	CBO's Women Committee Island Development Committee	Women in the islands are exposed to a higher risk as they remain alone with the children & elderly alone while the men go for fishing or to the resorts in order to generate the family income. Increasing awareness among women community & enhancing their capacities on DRR activities will increase their resilience and safety. Women Committee can be the channel to reach out larger number of women as they conduct exchange programmes with committees from different islands. The IDC responsibilities in the island include planning, organizing and conducting various programmes/activities for the development of the ward/island and offer sincere cooperation to the island authorities Enhancing the IDC members skills & capabilities will be crucial for the sustainability of project programmes & replicability in other Islands as the members could shared the knowledge and activities carried out with other IDC members from different islands.
Local Community	Local NGO's based the island	Active involvement of local NGOs, youth groups and the is essential to ensure the community to share the ownership of the processes. Empowering youth and women groups will improve the islands resilience and self management as they are usually left alone in the Island while men are working outside.
	Women	
	Youth	

Project strategies to be followed towards Stakeholders

Identification of Key Stakeholders at Government Level

Government Stakeholders Identified above, have been mapped out on a Power/Awareness matrix with the aim of designing strategies to be followed to ensure the project’s success.

Definitions

Level of Awareness

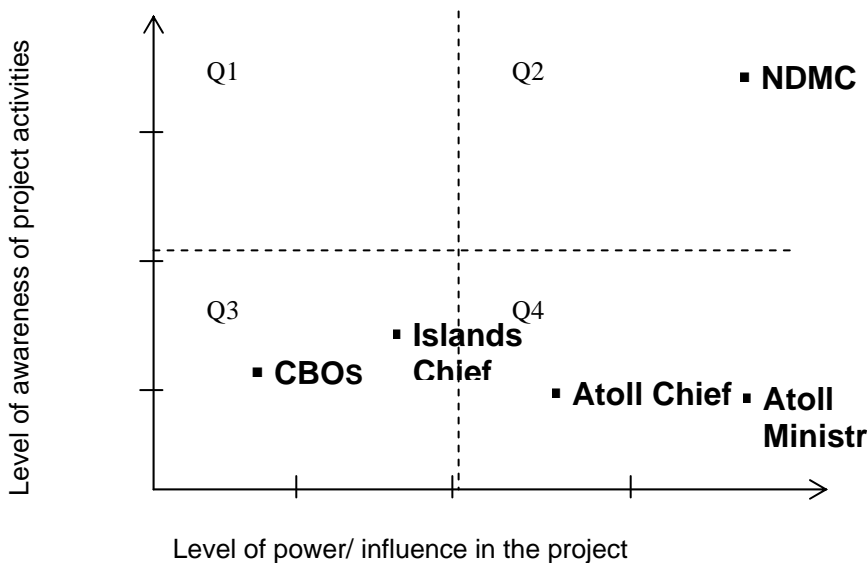
Amount of information and knowledge about the project activities and Disaster Risk Reduction.

Level of Power/influence in the project

People and groups that influence opinion and make decisions. These stakeholders include the people whose support will be needed in order to implement project activities & to convince elected officials to adopt & support the activities: e.g. community leaders, political leaders. These influences and decision makers are the ultimate targets in order to ensure project sustainability & replecability.

- 0 – 1: Influence on community mobilization
- 1 – 2: influence on community + decision making at local level
- 2 – 3: Decision making at regional level
- 3 – 4: Decision making at national level + policy makers

Government Stakeholders Matrix



Project Strategy in relation to Government Stakeholders

Q2

NDMC

The National Disaster Management Center involvement is vital in every step of the project implementation. So far, it has been informed and involved in project activities and design. As main agency responsible of implementation of the Hyogo Framework of Action and Coordination of Disaster Risk Reduction Activities at the national level, their involvement will be crucial for the success and sustainability of the project.

It is essential to keep their attention and interest by involving them in the decision making process.

Q3

Island Chiefs & Island Office

At the community level, the Island Chief is the main responsible for the implementation of all development programmes. Although his/her power of influence it's limited at the national level, he/she will play a major role at the island level.

The Island Chief and his/her office have a potential to contribute to the project and therefore enhance the quality of the programme by involving them in the project implementation and consulting their local knowledge and expertise on the Island.

Project Strategy should also focused on enhancing their capacities and skills on DRR and Environment Management activities. Leading to a higher awareness, the stakeholder is empowered to take his/her own initiatives on disaster risk reduction .

By doing so, Island official could become master trainers and share their knowledge and skills with other Islands.

CBOs

Women Committee & Island Development Committee

Island Development Council is the prime body which plans the island development in collaboration with the office of he island chief. On the other hand, Women Committee is the prime body to implement development programmes for women. Therefore, there is a need of enhancing their capacities and skills on Environment Management programmes and DRR activities. Leading to a higher awareness, the stakeholders will be empowered to take their own initiatives, and therefore to ensure project impact & sustainability.

Involving Islands CBOs is crucial in order to ensure the community to share the ownership of the processes.

Q4

Ministry of Atolls Development

The MoAD administers island and atoll management and therefore has direct input in integrating island risk reduction developmental activities.

Due to their level of influence and decision making at the national level lines of communication need to be open up through the NDMC and keep them inform of all activities implemented at the Atoll & Island level.

Atoll Chief & Atoll Office

The Atoll Chief & Atoll Office, play a key role in effectively responding to island level disasters and providing guidance to island communities in strengthening disaster preparedness capabilities.

There is a need of increasing their level of awareness about all project activities and involving them during its implementation. It needs to make clear that their involvement will be great benefit for Shaviyani Atoll.

Project strategy should also focus on increasing the level of influence of Shaviyani Atoll Office by building their capacities and skills on Disaster risk Reduction. By doing so, Shivayani Atoll could at the same time conduct their own training programmes to the rest of the islands of the atoll which will not be covered under Project Selamat and share their lessons learnt and best practices with other Atolls of the Country.

Summary of Findings : Stakeholders, Base Line & Targets

1. Government Stake Holders

Women committee Stakeholder	Activities & Strategies to be followed	Q3 Base Line	Q1 Expected position in matrix (outcome)
NDMC	To keep their attention and interest by involving them in the decision making process through out the project duration.	Q2	Q2
Ministry of Atoll Development	To open up lines of communications through the NDMC and keep them inform of all activities implemented at the Atoll & Island level.	Q3	Q2
Atoll chief & officials	To increasing their level of awareness about all project activities and to involve them during its implementation. To build their capacities and skills on Disaster risk Reduction & disaster management planning	Q3	Q2
Island Chief & officials	To involve them in the project implementation (island level) and consulting their local knowledge and expertise on the Island. To enhance their capacities and skills on DRR	Q3	Q4
Island development Committee	To ensure the community to share the ownership of the processes	Q3	Q1

2. Community Stakeholders

Active involvement of local NGOs, youth groups and women community is essential to ensure the community to share the ownership of the processes. Empowering youth and women groups will improve the islands resilience and self management as they are usually left alone in the Island while men are working outside.

Stake holder	Activities or strategy to follow	Expected change / Indicator	Base Line
NGO's	Presence of NGO was found in all islands visited. However their lack awareness on the current risks and development programmes to encounter future disasters, limits their actual agenda to organizing cultural events, music bands and providing support to CBO's. Involvement of NGO's in all project implementation activities will be main focus on stake holder's strategy plan of project Selamat.	Increased level of awareness and knowledge of NGO members. Capacity increased in order to developed their our programmes	<i>Initiatives/Programmes:</i> At present, NGO's are not implementing/conducting awareness programme/ activities on DRR and Environmental management.
Youth community	Youth and women community will participate and be involved in all training and capacity building programmes in order to increase their self resilience in the islands.	Self resilience improved by capacity built on agricultural programmes	<i>Own initiatives</i> Number of own initiatives (home kitchen gardens, coastal protection) very less about the youth & women community.
Women community			

6.3 Impact Indicators

As mentioned in the first Chapter of the report, this Base Line will be used for the monitoring an evaluation of the project. Outcome and Impact Indicators have been defined on the basis of findings at the ground level as activities design.

Activities	Impact Indicators
<p>1.1 Disaster Management Plans developed at Island & atoll level</p> <p>1.2 Atoll and island Officials trained on Disaster Management Planning</p>	<p>Target: Disaster Management Plans Developed at Milandhoo, Funadhoo, Fokaidhoo, Komandhoo Kanditheemu. Disaster Management Plans developed at atoll level.</p> <p>Indicator: Number of Islands with DMP developed, number of officials trained on DMP.</p> <p>Base Line: DMP or Emergency plans not in place in any of the targeted areas. Number of Officials</p> <p>Stakeholders: Island & Atoll officials</p>
<p>2.1 Detailed baseline report on one Model island to implement Coastal Bio-Shield, Home Kitchen Gardens and Waste Management.</p> <p>2.2 Community training on coastal protection measures (Bio Shields), Model Home Kitchen gardens and Community Based waste Management.</p> <p>2.3 Guidelines on Home Kitchen Gardens & waste management for local communities</p>	<p>Target: 1 Island (Milandhoo). Study to be replicated by respective officials from Shivayani Atoll.</p> <p>Indicator: Initiatives undertaken by island officials based on the findings and recommendations of the assessment. Atoll and Island Officials conduct their own assessment in their respective islands. CBOs & NGOs include in their agenda DRR activities. Improved practical knowledge of local communities. Science based improved agronomic practices with balanced biodiversity in home gardens.</p> <p>Stakeholders: women, youth, Island development committee, island & atoll officials.</p>
<p>3.1 Implementation of Coastal Bio shields & Model Home Kitchen Gardens & solid waste Management</p> <p>3.2 Establishment of Community Resource Center</p> <p>3.3 Implementation of Model Waste Management System</p>	<p>Target: 1 Island (Milandhoo) with climate change adaptation measures and community resilience strengthen through BioShields & Model Home Kitchen Gardens. Women and youth communities in Milandhoo island trained on model home kitchen garden, bioshield & waste management.</p> <p>Indicator: Number of households which improved their productivity on agriculture. KAP pre/post survey. Community participation rate. Number of users of Community Resource Center. System in place to address the local information needs, availability of ICT based resources material & training manuals. Waste Management System used by community.</p> <p>Base Line: 69% of Milandhoo Population women & youth male. No formal training given, low level of awareness. Few numbers of MHKG, with very limited production.</p> <p>Stakeholders: CBOS, youth and women community.</p>
<p>4.1 National Workshop, best practices and lessons learnt.</p>	<p>Target: Local NGOs, Government and international agencies to participate in the Workshop</p> <p>Base Line:</p> <p>Stakeholders: Field practitioners, govt. officials and local community involved in decision making and implementation of DRR activities.</p>

6.4 Overall Framework – Contribution to the Hyogo Framework for Action 2005 - 2015

As already underline in the present report, Maldives is among the most vulnerable to predicted climate change.

The project Selamat in Shaviyani has been designed and will be implemented at island/atoll level in the lines of priorities three and priority four identified in the Hyogo Framework for Action 2005 – 2015.

Under the priority three, *Building a culture of safety and Resilience*, awareness and training programmes on Disaster Preparedness will target local community and government officials. The knowledge gained will ultimately being put into action through the implementation of the project activities.

Under priority four, *Reducing the Risk in the key sectors*, project Selamat will aim to strengthen communities' resilience through improving the islands food security.

The Overall Framework of Project Selamat will be to Integrate Disaster Risk Reduction and environmental management. The programme will promote sustainable use and management of natural resources, food security for resilience and adaptation activities to climate change through Disaster Management Planning.

The project Selamat Framework will be as follows:

	Intervention Logic	Objectively verifiable Indicators (OVIs)
Overall Objective	To Build the Resilience of communities in Shivayani Atoll to natural Disasters.	<ul style="list-style-type: none"> ▪ Improved capacity of local communities to conduct disaster risk reduction activities. ▪ Reduced community vulnerabilities attributable to preparedness activities. ▪ Women and youth communities better equipped with knowledge on home kitchen gardens and adaptation to climate change activities, and putting this knowledge into practices ▪ Government officials at Island and Atoll level better equipped with knowledge on Disaster Management planning, and putting this knowledge into practice.
Specific objectives	<ul style="list-style-type: none"> ▪ To promote adaptation activities to climate change through Disaster Management Planning ▪ To promote Environmental Management as part of Disaster Risk Reduction ▪ To build women an youth communities capacities towards self manage resilience 	<ul style="list-style-type: none"> ▪ Communities Resilience improved in one model Island through implementation of Disaster Management Plans, and coastal protection, Environmental Management. ▪ Improved training and capacity at atoll level for Atoll Disaster Management ▪ Disaster preparedness and response improved at Atoll level. ▪ Bio island Concept for Communities Resilience demonstrated and mainstreamed at atoll level.

Expected Results	1. Capacity built to implement Disaster Management Plans at Atoll Level.	<p>1.1 Strategic capacity built at atoll level that will continue the capacity process at island level. Process of Mainstreaming Disaster Risk Reduction at National Level initiated.</p> <p>1.2 Training Capacity built on disaster management planning at atoll level that will the process percolate at island level.</p>
	2. Capacities and mechanisms for Disaster Risk Reduction at atoll and community level strengthen	<p>2.1 Assessment of community preparedness measures in selected Island.</p> <p>2.2 Numbers of local NGOs/CBOs staffs and local community mobilized & to support community actions</p> <p>2.3 Community tools and Educational material developed and strengthen.</p>
	3. Community Resilience Strengthen through integrated Disaster Risk Reduction and Environmental management activities.	<p>3.1 Communities strengthen in one model island through implementation of Coastal Bioshields, Home Kitchen Gardens and waste Management</p> <p>3.2 Chain of communication between the community and local authorities established and strengthen.</p> <p>3.3 Level of information access enhanced through Community Resource Center</p>
	4. "Bio Island for communities Resilience" demonstrated.	<p>4.1 Concept for Communities Resilience demonstrated and mainstreamed at national level. contributes at national level 4.2</p> <p>4.2 Concept that influence the National approach to Disaster Reduction and preparedness.</p>

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