



Study on Post-Tsunami Restoration and Conservation Projects in the Maldives

Marie Saleem and Shahaama A. Sattar



Ecosystems & Livelihoods Group, Asia





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1 Introduction

The Indian Ocean tsunami hit the Republic of Maldives around 9:20am on the 26th of December 2004 (Figure 1). Its effects on the low lying islands- a majority of which are less than 1 m above sea level, was devastating. The Maldives was one of the worst affected countries on a per capita basis (UNEP, 2005). The tsunami claimed 82 lives and 26 persons were reported missing. Though the loss of life was not comparatively high, it severely affected a third of the population and nearly 10% of it were displaced (UNDP, 2006). Out of the 199 inhabited islands, 53 were severely damaged and 14 islands were completely evacuated, several of which have since been abandoned (UNEP, 2005).



Figure 1. The Indian Ocean tsunami as it hit the eastern coast of Male'

The tsunami had a great negative impact on the country's economy, whose main industries of tourism and fisheries are highly dependent on the pristine environment of the Maldives. About \$470 million of physical damage accounted for a 62% loss of the country's GDP, compared with 4.5% in Sri Lanka and 2.6% in Indonesia (UNDP, 2006). Tourism which directly contributes to a third of the GDP and indirectly contributes to more than 70% of the GDP was highly affected due to occupancy rates dropping sharply in the months following the tsunami (UNDP, 2006). The fisheries sector which provides income to a large percentage of the local population also suffered serious losses due to the

reduced output of the fishermen as a result of damages caused to traditional fish processing equipment (MPND, 2005).

Since then the recovery and restoration efforts have re-established much of the way of life in the Maldives which existed prior to the tsunami. The reconstruction and repair of nearly 5000 houses are underway with some of them already completed. The fisheries sector has returned back to normal and the tourism sector has fully recovered (UNDP, 2006). The contribution of donors and aid agencies in this effort is overwhelming and to this day, some agencies still have their presence in the country, working on completing the projects they initiated nearly 4 years ago.

The Impact of the tsunami on the natural environment of the Maldives was immense with widespread erosion, characterised by erosional scarps of 0.3 to 0.5 m high. Changes to coastal morphology are most evident on the islands on the eastern rim, the direction from which the tsunami approached (UNEP, 2005). As beach erosion was among the most serious of environmental issues faced by the Maldivians even before the tsunami (MEC, 2004) and due to lack of baseline data it was difficult to assess the exact damage left by the tsunami. Although natural vegetation was not hugely affected by the tsunami, large areas of *heythi* or coastal vegetation was reported to have been destroyed, most possibly due to erosion. This is understandable as the majority of the species natively found in the Maldives are salt tolerant. UNEP stated that the larger damage on the coastal forest was caused during the post-tsunami cleaning up operation when bulldozers dumped demolition debris and garbage over areas of vegetation and not due to the tsunami itself. (UNEP, 2005).

In the Maldives mangroves either grow along lagoons or in depressions, and are most extensive on the northern atolls (FAO, 1993). At least 13 mangrove species have been recorded, including kan'doo (*Bruguiera cylindrica*), bodavaki (*Bruguiera gymnorrhiza*), ran'doo (*Rhizophora mucronata*), kulhlhava (*Sonneratia caseolaris*), burevi (*Lumnitzera racemosa*), karamana (*Ceriops tagal*) and thela (*Exoecaria agallocha*). They are highly valuable as conservation and protection areas; acting as nursery grounds for species of fish and crustaceans and protecting coastlines from erosion. Until recently, mangrove areas were considered mere mosquito breeding sites and therefore were used for dumping garbage, in an aim to fill them up and dry up the water. However, of late, the value of mangroves has been realized and the government authorities now encourage conservation of these areas. This is evident in the case of K. Huraa where a small mangrove area has been declared as a protected site in June 2006. The UNEP (2005) reported that the undisturbed areas of mangroves proved to be very resilient to the direct impact of the tsunami. The widespread root network of the mangroves acted to sieve large volumes of sand and coral rubble, withstanding strong surge of the waves and increasing the quantity of deposition.

The freshwater lens on the Maldivian islands which generally lie between 1 and 1.5 m below the surface were greatly affected during the tsunami. Due to their susceptibility to pollution, contamination from human activities and salt water intrusion, their vulnerability to the tsunami increased. Ground water was forced up and out of wells and on many islands, the inundation caused saltwater intrusion, resulting in extremely increased levels of salinity (UNEP, 2005). In addition, leaking septic tanks contaminated the water further, rendering it unusable.

One of the major impacts to the natural environment was from tsunami waste. The demolition waste created by the tsunami combined with already existing household waste were scattered throughout the islands. Redistributed waste threatened to contaminate groundwater supplies and the marine environment (UNEP, 2005). Clean-up efforts were made following the tsunami but the UNEP (2005) reported that it did not improve the conditions and in some cases only worsened them. Improper waste management also posed risks to human health by way of illness, infection, injury or the inhalation of smoke.

This study is centred around the post-tsunami restoration and conservation initiatives in the Maldives, with special focus on environmental impacts of the activities that were carried out during these projects. The ARC/ CRC Waste Management Program and Shelter projects of Thaa Vilufushi and Raa Dhuvaafaru were taken as case studies to investigate the activities in detail.

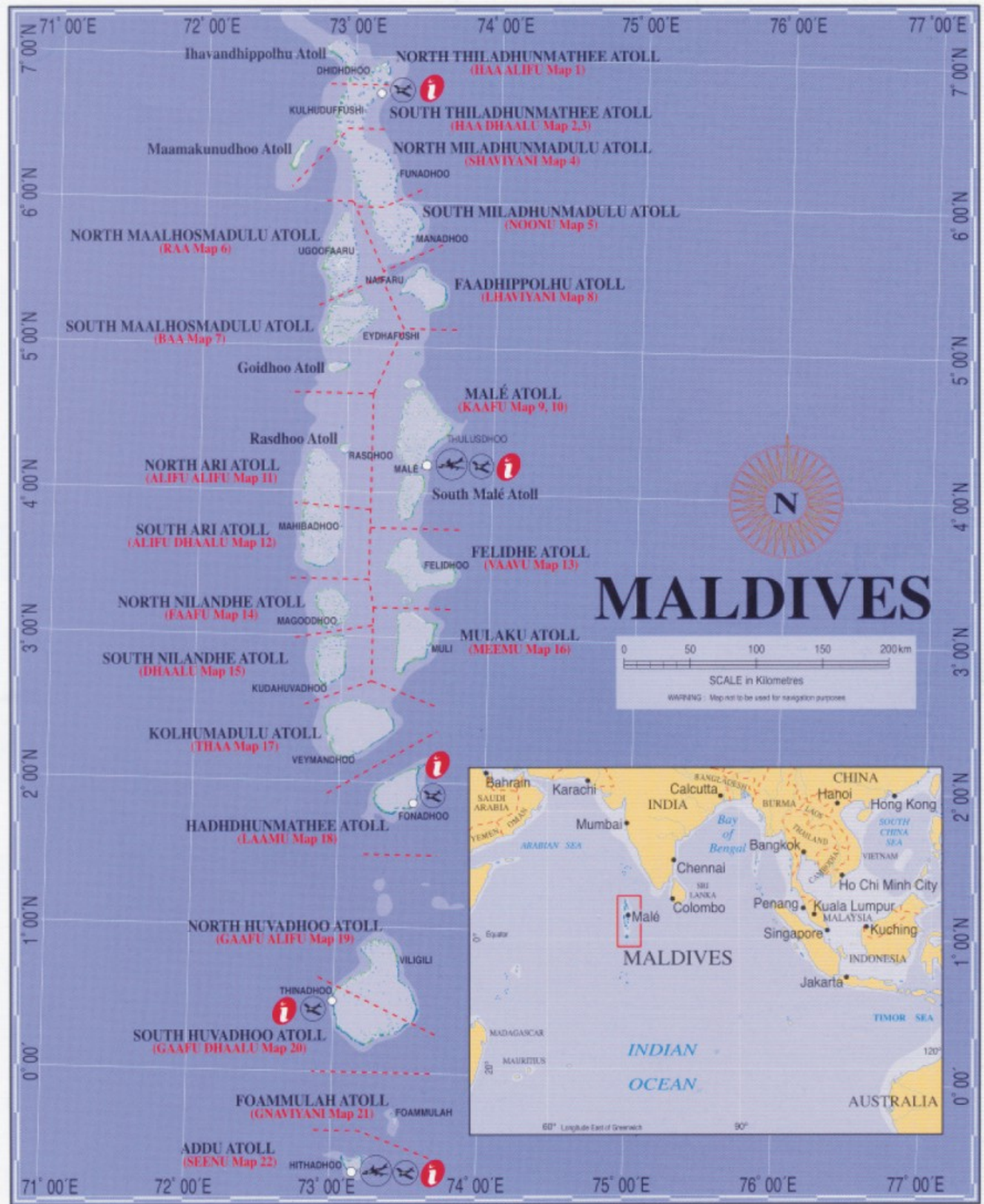


Figure 2. Map of Maldives

Source: Atlas of the Maldives, 2007, Atoll Editions

2 Summary of post-tsunami restoration and conservation initiatives

Below is a summary of major restoration and conservation initiatives that were undertaken after the 2006 tsunami.

Table 2.1. Summary of projects carried out after the tsunami (as of September 2008)

Atoll	Island	Agency	Type of activity	Scope	Duration	Budget (US\$)	Progress to date	Contractor
HA	Hoarafushi	MHUD	Construction	25 houses	July 2006 - December 2007	725,000	DLP	Sun Wind Maldives Pvt Ltd
HDh	Nolhivaranfaru	Chinese government	Construction	47 houses	March 2008 - April 2009	4,500,000	Tender	
HDh	Nolhivaranfaru	Government of Maldives	Construction	134 houses	March 2008 - April 2009	6,700,000	Construction	Alia Construction
SH.	Funadhoo	Chinese RC	Construction	86 houses	December 2006- August 2006	2,494,000	Construction	Sinohydro Corp
R.	Dhuvaafaru	IFRC	Construction	600 houses	April 2006 - April 2008	17,400,000	Construction	Lian Beng
R.	Dhuvaafaru	IFRC	Construction	Power house and power distribution	November 2007 - August 2008	2,400,000	Construction	Power engineering
R.	Dhuvaafaru	IFRC	Construction	Community Facilities (guest house, administration, comm centre, 2 pre-schools)	April 2007 - April 2008	2,000,000	Construction	Lian Beng
R.	Dhuvaafaru	IFRC	Construction	Schools - primary and secondary	April 2007 - April 2008	2,000,000	Construction	Lian Beng
R.	Dhuvaafaru	IFRC	Construction	Sports facility	January 2008 - August 2008	290,000	Tender review	
R.	Dhuvaafaru	USAID	Construction	Harbour	March 2008 - December 2008	3,000,000	Construction	Lian Beng
R.	Dhuvaafaru	IFRC	Construction	Sewerage system	August 2007 - May 2008	3,000,000	Construction	Lian Beng
R.	Dhuvaafaru	Government of Maldives	Construction	Friday Mosque	March 2008 - September 2008	700,000	Concept	

Atoll	Island	Agency	Type of activity	Scope	Duration	Budget (US\$)	Progress to date	Contractor
R.	Dhuvaafaru	Government of Maldives	Construction	Community mosques (2)	October 2007 - August 2008	400,000	Construction	LF construction
R.	Dhuvaafaru	German RC	Construction	Health Clinic	August 2008 - June 2008	400,000	Construction	LF construction
K	Guraidhoo	IFRC	Construction	Hospital for people with Special Needs		272,143	Complete	Maalaa High Rising constructions
K	Maafushi	IFRC / Government of Maldives	Construction	14 houses +2		464,000	Complete	Maalaa High Rising constructions
K	Thulusdhoo	Government of Maldives	Construction	63 houses	January 2008 - March 2009	4,750,000	Construction	Alia Construction
K	Guraidhoo	IFRC	Construction	11 houses		326,000	Construction	Maalaa High Rising constructions
Adh	Maamigili	Government of Maldives	Construction	38 houses		1,102,000	Complete	MTCC
M	Kolhufushi	Government of Maldives	Construction	18 houses North	March 2007 - March 2008	837,000	Government review	United Builders
M	Kolhufushi	Government of Maldives	Construction	37 houses South	May 2008 - January 2009	1,720,500	Government review	A Man Maldives
M	Kolhufushi	Government of Maldives	Construction	85 houses	May 2008 - January 2009	1,480,000	Government review	Undetermined
Dh	Kudahuvadho	IFRC	Construction	50 houses (Stage 1)		3,509,000	Complete	Moreway Arun JV
Dh	Kudahuvadho	IFRC	Construction	59 houses (Stage 2)	April 2006 - May 2007	2,096,156	DLP	Alia Construction
Th	Madifushi	IDB Loan Assistance	Construction	78 houses	October 2008 - November 2008	3,705,000	Tender	Undetermined
Th	Vilufushi	BRC	Construction	250 houses	March 2007 - December 2008	10,000,000	Construction	AAPB
Th	Vilufushi	Government of Maldives	Construction	59 houses	March 2007 - June 2008	3,239,507	Construction	NGM-JV group

Atoll	Island	Agency	Type of activity	Scope	Duration	Budget (US\$)	Progress to date	Contractor
Th	Vilufushi	German RC	Construction	Health Centre	November 2007 - May 2008	100,000	Construction	LF construction
Th	Vilufushi	Government of Maldives	Construction	Island Office	March 2008 - November 2008	100,000	Tender review	Undetermined
Th	Vilufushi	Government of Maldives	Construction	Mosque	December 2007 - December 2008	1,100,000	Construction	Nalahiya Construction
Th	Vilufushi	BRC	Construction	Secondary School	March 2008 - December 2008	1,800,000	Tender review	Undetermined
Th	Vilufushi	BRC	Construction	Sewer project	December 2007 - December 2008	2,350,000	Construction	Undetermined
Th	Vilufushi	BRC	Construction	Power project	March 2007 - February 2009	4,400,000	Tender review	Undetermined
L	Fonadhoo	BRC	Construction	43 houses	December 2005 - March 2007	1,720,000	Construction	Monaza
L	Fonadhoo	IDB Loan Assistance	Construction	16 houses	March 2008 - November 2008	720,000	Concept	Undetermined
L	Gan	FRC	Construction	80 houses	November 2005 - February 2007	2,320,000	Complete	Moreway Construction
L	Gan	FRC	Construction	50 houses (partially completed)	August 2007 - May 2008	1,750,000	Construction	MTCC
L	Gan	FRC	Construction	110 houses (New Suhail Type)	August 2007 - August 2008	4,400,000	Construction	MTCC
L	Gan	FRC	Construction	Hospital	February 2007 - September 2008	1,700,000	Construction	Vimlla Construction
L	Gan	IFRC	Construction	Sewerage system	September 2006 - May 2008	1,500,000	Concept	Undetermined
L	Gan	FRC	Construction	Primary school	February 2007 - June 2008	1,000,000	Construction	Amin Construction
L	Gan	FRC	Electricity		December 2006 - June 2007	1,000,000	Construction	Vimlla Construction
L	Gan	FRC	Construction	Roads	January 2007 - December 2007	1,000,000	Construction	MCPI /PWS

Atoll	Island	Agency	Type of activity	Scope	Duration	Budget (US\$)	Progress to date	Contractor
L	Gan	FRC	Construction	Community facility	February 2007 - June 2008	500,000	Construction	Swift Engineering
L	Gan	FRC	Construction	Sports facility	January 2008 - September 2008	920,000	Construction	Vimlla Construction
L	Gan	FRC	Construction	Pre Schools	February 2007 - May 2008	200,000	Construction	Amin Construction
L	Maabaidhoo	IDB Loan Assistance	Construction	45 houses	March 2008 - March 2009	2,250,000	Tender review	Undetermined
L	Mundhoo	FRC	Construction	9 houses	March 2008 - March 2009	468,000	Pre-award	Undetermined
GA	Dhaandhoo	Saudi Fund	Construction	88 houses	April 2008 - April 2009	4,752,000	Tender review	Undetermined
GA	Gemanafushi	MHUD	Construction	27 houses	December 2006 - January 2008	1,134,000	Construction	Sun Wind Maldives Pvt Ltd
GA	Kondey	MHUD	Construction	9 houses	January 2008 - July 2008	414,000	Construction	Sun Wind Maldives Pvt Ltd
GA	Maamendhoo	Saudi Fund	Construction	84 houses	April 2008 - April 2009	4,536,000	Tender review	Undetermined
GA	Nilandhoo	Saudi Fund	Construction	51 houses	April 2008 - April 2009	2,754,000	Tender review	Undetermined
GA	Villingili	Saudi Fund	Construction	75 houses	April 2008 - April 2009	4,050,000	Tender review	Undetermined
16 Atolls	77 Islands	ARC/ CRC	Waste clean-up/ Construction/ Awareness	79 Waste Management Centres	Dec 2006 – May 2007	6,600,000	Construction completed	
8 Atolls	16 Islands	UNDP	Waste clean-up/ Construction/	16 Waste Management Centres	April 2006 – 31 December 2007	1,600,000	Construction completed	

3 ARC/CRC Waste Management Programme

Solid waste management has been a serious issue faced by the Maldives even before the 2004 tsunami, specifically with the increase in population along with the changes in industry and the increase in Gross Domestic Product (GDP). Solid and hazardous waste management was identified as one of the greatest environmental challenges in the Maldives in the 2004 State of the Environment Report (MEC, 2004) and this problem has increased since then. It was estimated by the UNEP that resorts produce 2.5kg/person/day compared with approximately 0.3 – 0.5 kg/person/day on inhabited islands and 0.8 – 1.0kg/person/day in Male' (UNEP, 2005). These figures are expected to have increased over the years.

3.1 Background

The ARC and the CRC jointly carried out waste management projects on 77 of the affected islands (ARC/CRC, 2007). There were 3 components to the program; 1. To clean up and remove tsunami debris and other waste, 2. Construct waste management centres (WMC) at island level and 3. To carry out an awareness program for waste management and training of community representatives (Glen, 2006). The project was initiated on the 26th of December 2006 and the date of completion was set to be in March 2007 (Glen, 2007). It was completed in May 2007, 2 months after the expected date with post completion monitoring concluding in June 2007 (ARC/CRC, 2007). According to Glen (2006), the budget for the project was USD 6.6 million with \$4.4 million allocated for tsunami clean up and \$2.2 million for the construction of centres and the training program. However, the consultants were unable to obtain a breakdown of the funds that were spent on the project, neither from the Ministry of Housing, Transport and Environment (MHTE) nor from the Ministry of Finance and Treasury. We were informed that only the ARC/CRC had access to the details of the budget and since both organisations have already left the Maldives, it was difficult to access this information.

During the process of the clean up, more than 37,000 m³ of potentially dangerous waste was removed from the islands, which is equivalent to about 2000 garbage trucks (ARC/CRC, 2007). It was estimated that the tsunami created 290,000 m³ of demolition waste (concrete, brick, timber etc.) and this volume added onto 50,000 m³ of already existing household waste and other waste including hazardous and healthcare waste (UNEP, 2005). Several thousand tonnes of tsunami debris was moved within the island to clear community areas and in the process assist with erosion control (ARC/CRC, 2007).

Seventy nine WMCs were built in 76 communities under the ARC/CRC waste management program (ARC/CRC, 2007). Island Waste Management Centres (IWMC) have the capacity to segregate and store non-biodegradable waste in 3 compartments, namely, Plastics, Metals and Residuals (Figure 3). A large area

is dedicated to composting activities of the organic waste. A locked area is also present to store hazardous waste. When the project work was completed, all WMCs were handed over to communities.



Figure 3. Waste management centre at A.Dh. Dhangethi

Training programmes in waste management were held for the islanders and 1470 representatives were trained. (ARC/CRC, 2007). Waste education sessions were also run at the school level and 2027 students participated in these sessions.

During the post-completion monitoring, atoll workshops were conducted in several islands to share lessons learnt together with best practices. Discussions were also held to address common challenges faced by the islands (ARC/CRC, 2007).

3.2 Summaries of outcomes in the Atolls

Communities were encouraged to explore options for the final disposal of waste during the workshops. While it was understood that some islands would need some external support to remove waste, all communities were encouraged to explore options available to them. Prioritisation of islands and atolls for ongoing support was also investigated and two strategies were suggested. One, to focus on islands that did not engage in comprehensive waste management planning from the initial stages, thus requiring more support (islands in Gaafu Alifu, Gaafu Dhaalu, Laamu and Alifu Alifu). Two, to consider prioritising an atoll that had implemented the waste management program satisfactorily (Baa or Dhaalu atoll). The latter would provide a showcase of best practices to other communities.

3.2.1 Ari Atoll

Three islands in Ari Atoll participated in the waste management program (ARC/CRC, 2007). They were the islands of Himendhoo, Mathiveri and Bodufolhudhoo. This atoll was among one of the first to be completed. The ARC/CRC was working with the assumption that the government would organize the final disposal on a regular basis of 3 months. Thus, all 3 islands developed waste management systems incorporating the final disposal by the government and when this was not implemented, the waste management systems started to fail due to pressure of the filling of the WMCs. As a result the WMCs became areas of mosquito breeding which lead to health problems. The islanders sought assistance from the government to deal with these problems but reported that little support was given to resolve them. It should be noted that the islanders found it difficult to accept that the government was not ready to provide a collection system.

None of the islands have completed an Island Waste Management Plan (IWMP) and during the post monitoring visit the ARC/CRC team discussed the process of developing an IWMP with the island community (ARC.CRC, 2007).

3.2.2 Baa Atoll

Five islands participated in the ARC/CRC program: Eydhafushi, Kendhoo, Kihaadhoo, Dharavandhoo and Dhonfanu (ARC/CRC, 2007). The atoll has some waste management programs being conducted by the Atoll Ecosystem Conservation Project which is funded by UNDP GEF and implemented by Ministry of Transport, Housing and Environment. The islands in this atoll have good waste management practices and a high level of waste awareness (ARC/CRC, 2007). Waste-separation at community level was carried out very efficiently on most of the islands and a lot of volunteerism was evident.

The major challenges faced by this atoll were to find solutions to removing recyclables and non-combustibles off the islands (ARC/CRC, 2007). There was interest in recycling but no effort was made to find strategies to attract metal buyers or other recycling options. A consensus was reached that the government or the resorts should be responsible for providing funds for the final disposal.

3.2.3 Dhaalu Atoll

Six islands in Dhaalu Atoll participated in the program: Kudahuvadhoo, Meedhoo, Rinbudhoo, Hulhudheli, Vaanee and Maaemboodhoo (ARC/CRC, 2007). All the islands now enjoy cleaner environments with improved waste management practices. Only the island of Kudahuvadhoo had developed a draft IWMP while the other islands have still to develop their plans.

Islands with voluntary community involvement had better waste management systems (ARC/CRC, 2007). None of the islands had taken steps towards the final disposal of non-combustible waste which was filling up in the WMCs. There was interest in recycling but strategies were not in place to do so. Transferring the waste from the islands to final disposal was discussed at the atoll workshop and it was agreed to develop an Atoll level WMP.

3.2.4 Gaaf Alifu and Gaaf Dhaalu Atolls

Five islands from Gaaf Alifu (Maamendhoo, Nilandhoo, Vilingili, Dhaandhoo and Kanduhulhudhoo) and one island from Gaaf Dhaalu (Gadhhdoo) participated in the program (ARC/CRC, 2007). They were among the initial islands that took part in the program. They were informed that a collection system would not be implemented by the government in the foreseeable future and therefore were encouraged to include this component in their plans. The lack of community ownership appeared to be a major issue and political tensions within the communities were a handicap in mobilising plans and implementing appropriate waste management practices. Waste dumping by or in WMCs was seen as a major improvement. While there was limited separation in some islands others had excellent separation. WM planning was focused on separation, where it will be deposited and who will manage it.

Final disposal was seen as a big challenge. Gadhhdoo household representative focus groups believed that it was the government's responsibility while individual householders who were surveyed considered it to be their own responsibility (ARC/CRC, 2007). The community authorities agreed that WM plans would be useful. There was concern within the community that the WMCs were filling up and also that people would revert back to their old habits of dumping waste throughout the island.

3.2.5 Haa Alifu Atoll

Nine islands participated from haa Alifu Atoll. Namely the islands of Hoarafushi, Thuraakunu, Ihavandhoo, Kelaa, Vashafaru, Dhidhdoo, Baarah, Filladhoo and Utheemu (ARC/CRC, 2007). Most of these islands have implemented waste separation and have improved the islands' cleanliness which is attributed to the WM planning, training and construction. All the islands share the same desire to procure external resources such as vehicles and funding for supervisors but the final disposal of the waste was not considered. The ARC/CRC considered this to be a hindrance to the proper management of waste as they felt that it would be futile to have a supervisor without a proper planning programme in place as it would lead to lesser community involvement resulting in poor separation and filling up of the WMC.

All the islands have developed IWMPs but are awaiting finalization after confirming vehicle arrangements with the GoM (ARC/CRC, 2007). Willingness to

pay surveys has been carried out focused on waste collection and not on other waste management aspects such as final disposal. The situation in the atoll can be improved by a comprehensive system implemented to create awareness through education.

3.2.6 Haa Dhaalu Atoll

Three islands in the atoll participated in the program. They were the islands of Nellaidhoo, Naivaadhoo and Nohlivaranfaru (ARC/CRC, 2007). The two former islands had well established systems to manage the WMCs, while the centre in the latter island was not open at the time of reporting.

The representatives at the atoll workshop agreed that the communities had the responsibility of managing the waste (ARC/CRC, 2007). It was also discussed that if the non-combustible waste was removed from the islands on a weekly basis, the volume would be relatively small. This would amount to a weekly cost of Rf 100 or Rf 1 per household. However, options for payment by community were unclear. None of the communities on the islands were keen on raising funds to manage waste and considered it the government's responsibility to remove waste from the island.

3.2.7 Kaafu and Vaavu Atolls

The waste management program was implemented in early 2006 and these atolls were the first two to participate in the program (ARC/CRC, 2007). At the time of implementation, it was understood that the government would take care of the final disposal and therefore they did not plan for any alternative solutions. Composting was not carried out successfully and as a result a large amount of waste accumulated on the islands.

In the middle of 2006 it became clear that a collection system was not going to be in place in the near future. The islands were visited to encourage communities to modify their disposal practices to burn the combustible waste (ARC/CRC, 2007). However, a few communities in the islands refused to take responsibility for waste management and disposal and they continued to depend heavily on the government to manage their waste. This dependence was possibly due to their proximity to the capital of Male', which has lead to a high degree of reliance on the government to provide them with such services. .

In preparation for a regular collection system in the atoll, MEEW (Now Ministry of Transport, Housing and Environment) carried out a one-off collection of non-combustible waste from the WMCs in Kaafu Atoll (ARC/CRC, 2007). It was agreed between the ARC/CRC and MEEW that the latter would take the lead in the ongoing mobilisation and planning process in the community and also that the ARC/CRC would not return to these islands to support the process.

3.2.8 Laamu Atoll

Eight communities in Laamu Atoll participated in the program (ARC/CRC, 2007). After the project, waste was dumped in one concentrated area and this was seen as an improvement from methods that were previously practiced. However, more awareness had to be raised on the separation of waste at household level, dumping and safe methods of burning waste.

By mid 2007 there were four communities that had not started to use their WMCs due to transportation difficulties or the lack of planning as to how to manage the WMC (ARC/CRC, 2007). Four communities in Gan and Fonadhoo considered hiring a contractor for waste collection. ARC/CRC suggested doing this jointly but communities felt that they needed authority from the Atoll Office in order for this to happen.

A significant amount of interest and motivation was shown by some groups within the community such as youth groups and the Women's Development Committees. However in order to be active in such a programme they felt that they needed the leadership of the government authorities.

3.2.9 Lhaviyani Atoll

Two islands participated from Lhaviyani Atoll: Naifaru and Hinnavaru (ARC/CRC, 2007). Although the draft IWMPs have been developed for both islands they still await finalization. It was identified that the biggest challenges in the atoll was the implementation of the IWMPs, thus ensuring the proper management of the WMCs and devising a strategy and funding scheme for the final disposal of waste. Both communities felt that the government or the resorts in the atoll should provide funding for the transfer of waste from the atoll to the final disposal site.

The WMC in Hinnavaru has not been opened thus far. The community reasoned that since the WMC is situated in a suburban locale if it were to be used the odours emitting from it would be unbearable for the residents of the surrounding area. When the Island Office was questioned about the location of the WMC, they responded that it was the only available space on the island at the time. As a result the surrounding vicinity especially the coastal areas are filled with garbage. They are hoping to get assistance from the resort nearby to clean the island in the near future.

3.2.10 Meemu Atoll

Five islands in the atoll participated in the program (ARC/CRC, 2007). They were the islands of Muli, Dhiggaru, Veyvah, Madifushi and Naalaafushi. The communities in these islands appeared to be motivated and their awareness was of a higher level. The main challenge faced by these islands was the final disposal of plastics and metals; due to the lack of community generated funds

and the want of more information in relation to recyclers. They expressed the need for support from NGOs and the involvement of the government in managing these issues. Transport of waste from the resort dhonis was also considered. Household representatives from some of the islands had expressed an interest in considering contributing a small sum of money for the removal of waste. Yet the government authorities were unwilling to collect information on the available options for the final disposal of waste.

3.2.11 Noonu Atoll

The islands of Maafaru and Kudafaree from the Noonu Atoll participated in the program (ARC/CRC, 2007). An atoll workshop was not held but the islands were interested in conducting one to discuss options for the final disposal of waste. The Chief of the Kudafaree Islands is not on the island due to community tension and therefore the community felt that they were not getting any support from the government authorities. Maafaru had developed an IWMP which they were planning to implement.

3.2.12 Seenu Atoll

The islands of Hulhudhoo and Meedhoo participated from this atoll (ARC/CRC, 2007). A WMC was built on Hulhudhoo in 2006 and was ready to operate on completion. The WDC appeared to have played a lead role in decision making and there was satisfactory cooperation between the Island Office and other committees. A comprehensive IWMP was developed in June 2007. The WMC has a supervisor to assist in the separation of metals and cans. Although the storing of waste appeared to be orderly, the separation of it was not executed efficiently. It was reported that the combustion area had a conflagration without any supervision and hazardous materials were also incinerated during this process.

The final disposal of waste to the Hithadhoo Regional Waste Management Centre was a huge concern. Other pressing issues were creating awareness on waste, and the consequences of burning plastics and other hazardous waste (ARC/CRC, 2007).

The island of Seenu Meedhoo was not originally on the list of ARC/CRC islands but was included in the program as a special project (ARC/CRC, 2007). A single clean up was done under the inspection of the ARC/CRC in accordance to an agreement signed between the agencies and the island. An IWMP was finalised and it was requested that the ARC/CRC conduct an awareness programme for the island's community. A meeting was held with the community. A few members of the community felt that the handful of people who were having tense relationships with the island authorities might not abide by the rules of the IO and therefore jeopardise the waste management system on the island.

3.2.13 Shaviyani Atoll

Three islands participated in the program: Komandoo, Maroshi and Narudhoo (ARC/CRC, 2007). A workshop was not organised in this atoll due to the lack of resources. The island of Maroshi was trying to implement the development of IWMP but found it difficult to obtain funds and find options for the final disposal of waste. Komandoo was waiting to open the WMC once the waste awareness program was completed. There was tension between the Island Office and the community in Narudhoo. Thus the WMC on this particular island was not opened; therefore the community was dumping their waste into an adjacent pit.

3.2.14 Thaa Atoll

Eight communities participated in this waste management program (ARC/CRC, 2007). They are the communities of Buruni, Vilufushi, Madifushi, Dhiyamigili, Guraidhoo, Gaadhiffushi, Thimarafushi and Omadhoo. While the challenges were great in this atoll it was encouraging to observe that all the islands were using one disposal site rather than throwing waste all over the islands. It was reported however, that many of the WMCs were not managed properly due to the Island Offices not procuring leadership nor delegating management to other interested groups.

3.3 Gender Aspects

Gender is defined socially and is identified by the roles and responsibilities of men and women in the society. While gender is a cross-cutting issue in most community projects no specific outputs related to gender were included in this particular project (Glen, 2006). A 'Gender Equality Strategy' was developed as part of the program and it highlights the traditional role of women in looking after waste issues on the island.

Waste on the islands of Maldives has always been an issue that the women of the island dealt with. On most of the islands, it is the responsibility of the Women's Development Committee to organise and undertake the management of the waste disposal areas on the island. According to a roster system they would burn the combustible waste in a certain area while encouraging people to dump the non-combustible waste in separate piles and burying them in another area. Thus the ARC/CRC waste management programme is one that is very much intertwined in the daily lives of the women on the islands.

An issue that needs attention is the difference in the roles men and women play in the decision making process on the islands. Often, during focal group meetings it is the men who are more vocal than the women, sometimes suppressing the participation of the latter. No matter how much the women are involved and interested in community projects; it is frequently the men who contribute to the discussions at decision making level. Thus, it is important that household surveys or interviews with women focus groups are held during such project planning and implementation. Glen (2006) notes that the ARC/CRC

included the WDC during the consultation phase of the programme. However, it is unclear whether these meetings were held separately or with the IDCs and other focal groups, which would affect the outcome of the discussions.

The program would have benefited both men and women by providing a cleaner environment and potential livelihood options. However, most of the WMCs are not functioning as planned and the strategies to obtain funds for the operation of these centres are still not in place on the majority of the islands. Glen (2006) noted that on the islands that have managed to implement salaries, are being paid very little, e.g. Rf 300 per person on the island of Keyodhoo and Rf 500 on the island of Felidhoo.

3.4 Gaps and Problems

One of the major challenges to the proper implementation of the program, both at the stage of cleanup and construction of the centres was the problem of delays due to the contractor. This slowed down the project by 3 months (Glen, 2006).

The concept of waste management is very new to the Maldivians and until recently this has been restricted to the disposal of waste, to the extent that the word used for waste management in Dhivehi, *kuni nathaalun* which means the getting rid of waste. During the project this hindered the process of implementing measures to manage waste as the larger meaning of waste management involving aspects such as minimization of waste, storage, recycling and the final disposal of it affected the community's ability to understand the concept of waste management (Glen, 2006).

Another major obstacle to the execution of the program was the lack of willingness by the community to pay for the management of waste (Glen, 2006). An argument was raised by the island communities that they should not be expected to pay for waste management as was the situation in Male' where a majority of the households and sectors did not pay for the collection and transfer of waste. However, it should be taken into account that a higher level of government revenue is derived from the inhabitants of Male through registration fees and other services. Therefore basic services such as waste management are expected by the people. It is often argued that many of the island households cannot afford to pay for services such as waste management, but it is ironic that many of these households have televisions with cable connections and can afford to pay a monthly fee of approximately Rf250 for that service.

One of the biggest issues the Maldivian islands have to deal with is the problem of garbage washing up on the beaches. The sources of this problem are often the resorts and safari boats. This is evident from the big black garbage bags that wash up on the shores. Although this is an external factor, it is nonetheless an issue the islanders have to deal with (Glen, 2006). While the management of tourist resorts and safari boats instruct their respective operations to dispose of

their waste at Thilafushi, a site used for the filling of land, the boat captains of the garbage boats and safari boats often dump the waste as soon as they get outside the atoll. This results in the waste washing up on the beaches including the beach belonging to that particular atoll.

The biggest obstacle reported by Glen (2006) and ARC/CRC (2007) is the issue of the final disposal of waste. From the available literature it is apparent that ARC/CRC initiated the waste management program on the understanding that the Government of Maldives would organise for the final disposal of non-combustible waste every 3 months from the islands to Thilafushi or other final disposal destinations. Whether this was in a written agreement or not is not clear. It is stated that “Whilst the ARC/CRC may view this as a ‘failed commitment’ on the part of the GoM, the MEEW may view it as a ‘faulty assumption’ on the part of the ARC/CRC” (Glen, 2006). It is evident that if a proper agreement was put in place before the commencement of the project, this assumption would not have been made and its consequences avoided.

A crucial issue that hindered the progress of the project was the lack of financial and human resources and also the institutional constraints at the MEEW (Glen, 2006). An ARC/CRC delegate was placed at the MEEW. However despite the ARC/CRC being a new donor and implementing agency to the post-tsunami Maldives it did not help to clarify a strategy for waste disposal or to improve the understanding of the government processes. It was reported that the ARC/CRC believed a lack of transparency on MEEW's part was also a contributing factor. These issues could also be attributed to the haste in which these post-tsunami projects had to be implemented resulting in the lack of stakeholder consultations and most importantly the lack of time to develop management strategies for such projects.

As a result the community members felt de-motivated and were not enthusiastic to participate and take the initiative to undertake and manage the program. While waste management is seen as the number one environmental issue on the Maldivian islands, it appears the lack of time to plan programmes to rectify this problem has hindered the outcomes of the project.

One of the main impacts arising from the project is the change in knowledge, attitude and behaviour of the community towards waste management (Glen, 2006). It appears that the participants of the waste training sessions demonstrated a higher level of understanding of waste management issues such as different types of waste, how and why waste should be separated and the hazards of burning plastics. However, overall, there appeared to be a lack of knowledge on how to reduce, reuse and recycle waste and also of using methods such as composting which are major components of proper waste management. The communities had a high level of knowledge as to the effects of waste on the environment, their health and their livelihoods (Glen, 2006). However, when it comes to paying for the management of waste created on the

islands, the consensus is that the government or some other party should pay for its disposal. The concept of 'polluter pays' is very new to the Maldivians. The local people are hesitant to pay for the management of waste. A positive aspect of the program is that waste is separated at household level on many of the islands and taken to the centres rather than disposing of it throughout the island as it was the previous practise. There was fear among some communities that if the waste was left to accumulate quickly and was not taken to the final disposal site, the islanders would revert to their earlier habits (Glen, 2006).

The UNEP reported that the most important tsunami-related impact on the coastal vegetation came from clean-up operations (UNEP, 2005). They stated that while the tsunami did not cause much harm directly to the vegetation, clean-up crews caused significant damage on several islands by bulldozing and dumping debris and garbage into areas of forest along the coast. This displays the lack of awareness among the workers as well as the low importance given to the natural environment during the clean-up operation. This could have been avoided by consulting an individual with a background in environmental science. Steps such as informing the contractor involved in the cleanup process (adding a clause in the contract) that action will be taken if the natural vegetation was damaged during the clean-up operation would have led to a reduction of such injury.

3.5 Conclusion

The ARC/CRC management programme was a crucial project that was initiated right after the tsunami hit the Maldives. In spite of the need for such a project, as a result of the haste and urgency in which it was initiated the outcome of it was greatly affected by the ineffectiveness of the planning stage. The clean-up project left the islands "cleaner" and the WMCs also provided an area for the dumping of waste ,however the islands still struggle with the same problems of waste management as before the tsunami due to the lack of mechanisms for the final disposal of waste.

Education and awareness are effective methods in changing the attitudes of people, therefore it is important to provide information concerning the advantages and the disadvantages of the proper management of waste for people to understand and commit to the issue of waste management. In the Maldives, the local community is generally obedient, abiding by rules that are imposed by the island office or even the WDC (Glen, 2006). Thus it is important that some rules are implemented and enforced and in addition, penalties are put in place for those who do not abide by the rules. Of course enforcement will be most effective when legislation is implemented along with awareness.

4 Shelter Project – Thaa Vilufushi

The island of Thaa Vilufushi was one of the worst hit islands in the 2004 Tsunami. . The island was completely flooded and both the island and its infrastructure were damaged extensively. . Direct damage was caused to the housing sector, water and sanitation facilities as well as the fisheries infrastructure. As a result all the inhabitants were moved to the island of Thaa Buruni, which lies south of Vilufushi.

Even before the tsunami, Vilufushi had been chosen as one of the 20 islands to be developed under the “Safe Islands Programme’. Under this project these islands will have seawalls, vegetation enclosures surrounding the island and a drainage system to remove flood water in case of high waves. A plan was in place to reconstruct the island of Vilufushi to three times its size at the time. This was implemented and has resulted in a landmass of approximately 61 ha in contrast to the previous size of 16 ha (Figure 4). The new Vilufushi was designed to fit the same shape as the previously existing island preserving where possible its existing natural wealth.



Photos: Shaahina Ali

Figure 4. Vilufushi pre-tsunami (left) and after the post-tsunami reclamation (right) where the island has been reclaimed to 3 times its natural size

Construction of the island of Vilufushi was carried out in Phase 2 of the construction project. Therefore during this phase, an effort was made to address the key weaknesses of the construction carried out in Phase 1. This allowed the team of monitors to address various delays which might have arisen previously as well as various shortcomings. The main activities which were undertaken to reconstruct Vilufushi included surveys, site preparation, mobilization of dredging and survey equipment, dredging of the borrowed area for land reclamation, stock piles and harbour, profiling the reclaimed land and the existing island to the required levels, construction of the quay wall and breakwaters and the environmental monitoring during construction (EDC, 2005).

Main construction and development activities which were carried out in the project are detailed in Table 4.1 which also details the progress of these projects up to the 4th of November 2008 (NDMC, 2008).

Table 4.1 Main construction and development activities on Thaa Vilufushi

Activity	Goal	Progress	Gaps and weaknesses
Land Reclamation	3 rd quarter of 2006	Complete by March 2007	N/A
Wataniya Communications tower	N/A	Complete and fully operational	N/A
Mosque	Completion by Jan/Feb 2009 Expected handover Feb – April 2009	61% complete	Method for construction of the underground tank was unusual and time consuming
Health Centre	N/A	Complete and fully operational	N/A
250 houses being constructed by BRCS	December 2008	96% complete, target to finish by end of November 2008	N/A
59 government houses and plots	December 2008 Expected handover in February – March 2009	32% complete	Slow progress on the contractors side
BRCS Secondary School	February 2009 (on schedule)	27% complete	N/A
BRC Power system	February – March 2009	33% complete	No reasons for delay
BRCS Sewerage system	October 2008 Expected handover in January 2009	90% complete	Obtaining the approval of outfall design and its construction
Government power system	February – April 2009	Tender documents have been prepared	Not stated
Government sewerage system	January – April 2009	Opening for bidding has been postponed	Not stated
Island Office and Court House	February – March 2009 Expected handover in February – April 2009	35% completed	Changing of building location by the GoM
Sports field (2 phases)	January 2009 (Phase 1) February – March 2009 (Phase 2)	Design provided. Contract documents being prepared	Not stated
Fish Market	Jan /Mar 2009 Expected handover in Feb / Apr 2009	Tender has been evaluated and approved by the Ministry of Fisheries, Agriculture and Marine Resources	Not stated
Pre School	Mar/Apr 2009 Expected handover	Ministry of Education has provided	Not stated

	in Mar/Jun 2009	drawings and BOQ tender	
Desalination plant	Not stated	Consultancy awarded to UBI	Not stated

4.1 Difficulties Faced during the Project

The British Red Cross Society (BRCS) faced a few difficulties while carrying out the project. Some of the major problems occurred when dealing with the community and when tendering out projects.

Regular sessions were carried out with the community and they were kept informed and up-to-date (Figure 5). They were also given the opportunity to ask questions. The agencies observed that issues did arise if this did not happen on a regular basis, for example- the sanitation system. Although the community was kept up to date regarding this system, they were not happy with the location of discharge (i.e. the outflow side of the atoll). The discharge would undergo primary, secondary and tertiary treatment and thus would be clean water at the end of the process. However the community has a misconception that the discharge also includes sludge and is not happy about this being released near the atoll. Thus, they need to be made aware that the sludge is being removed and would be dried out on sludge beds to be used as fertilizers. However, since the water discharged is basically clean water, BRC is looking into the option of recycling this water using an infiltration system. This could then be used for landscaping purposes. This idea will be presented to the community for their feedback and consent prior to implementation.



Figure 5. Community consultation

Work was carried out through the cooperation of the Island Office. Therefore the agencies did not experience any barriers to their work. The British Red Cross Society (BRCS) also formed a Transitional Planning Committee which consisted of representatives from the Island Office, Island Development Committee and various Community-based organizations. Communications and consultations with the community were carried out with the aid of this committee.

Another key problem was the tendering of projects. The agencies had a problem of finding companies with appropriate profiles and had to tender multiple times for certain projects. This resulted in greater costs, and the redesign of certain projects.

4.2 Weaknesses in the project

The BRCS reports that there were no significant weaknesses or information gaps in the project. The EIAs which had been done prior to the project had addressed the main issues which may arise and also provided mitigation measures for such issues and impacts.

Some minor weaknesses of the project which could be taken into consideration in the future are (BRCS, 2008):

- Encouraging a large part of the community into the same activity such as fish processing. This does not aid in increasing the resilience of the society or diversification of livelihoods.
- Confusing and poorly communicated complex grant criteria: resulted in different criteria for the awarding of grants.

4.3 Major delays and gaps which need to be urgently addressed

- Need to initiate the system of calling for tenders for the construction of the government power and sewerage system.
- Failure to complete the tendering process for the construction of the water distribution system on the part of the government.
- The filling of low areas and the modification of the harbour still need to be addressed. Construction of roads will be discussed between Housing and Infrastructure Redevelopment Unit (HIRU), Ministry of Housing and Urban Development and MHTE.
- Fuel supplies, Cable TV, fixed line phones or internet need to be attended to.

- Sanitation system: The community was not aware of the sewage treatment system that was planned to be implemented at Vilufushi resulting in confusion of the placement of outfall. Thus, BRCS has plans to educate and increase awareness of the community on this issue.

4.4 Gender aspects in project design:

There were no significant gender (i.e. with respect to women) aspects in the design and implementation of the project. Women were encouraged to take part in the consultations, although almost 100% of all discussions were noticeably dominated by men. Thus, women were not able to give their ideas on the various aspects of the project, some of which could have had a different output had women used their opportunity to take part in the consultations. An example quoted by BRC is the construction of houses which could have been built in a more “women friendly” fashion with bigger kitchen areas etc.

The fish processing grants benefited both men and women significantly. Although these were not necessarily targeted to a certain gender, they did have benefits particularly for women as this mainly involved smoking, drying, salting etc of fish, which are activities carried out by the women on the islands.

4.5 Environmental impacts of reconstruction work

All reconstruction and dredging work was done after an environmental impact assessment (EIA) was prepared and approved by the MEEW. The EIA was prepared by the Environmental & Dredging Consultancy, an independent Dutch consulting firm specialising in environmental and dredging services (EDC 2005). This EIA highlights the potential environmental impacts which this project would have on the island of Vilufushi and provides mitigation measures for such impacts. A separate EIA was also done prior to the implementation of the sewerage system on the island after reconstruction (Mott MacDonald Pvt. Ltd., 2007). This section (Tables 4.2 and 4.3) highlights the main effects and mitigation measures provided in the two assessments. Details of these could be found in EDC (2005) and Mott MacDonald Pvt. Ltd. (2007). EDC (2005) also details an Environmental Monitoring Programme (Section 11) and an Environmental Management Plan (Section 12) for the reclamation works of Thaa Vilufushi.

Table 4.2. Summary of impacts, their significance and proposed mitigation measures in the post tsunami reconstruction of Vilufushi island in Thaa Atoll. (Refer EDC (2005) for details).

Impacts	Significance	Mitigation measures
Constructional impacts		
a. Land and marine pollution due to waste <ul style="list-style-type: none"> - Debris from tsunami such as coral and concrete blocks - Hazardous materials - Solid waste and waste water from construction vessels 	Adverse	<ul style="list-style-type: none"> - A waste management plan for waste water, oily wastewater and solid waste will be formulated - Detailed plan of removing, sorting out, re-use and taking away of all debris and hazardous materials prior to land filling - Debris from the tsunami such as coral blocks and concrete pieces will be reused - Construction vessels will be equipped with waste water and solid waste handling facilities. - Oily waste water and oily contaminated material will be collected and treated prior to disposal - Solid wastes will be collected and transported to onshore disposal
b. Oil spillage	Minimal	<ul style="list-style-type: none"> - Fuels and lubricants will be stored in leak proof containers and when necessary drip trays will be used
c. Air pollution	Minimal	<ul style="list-style-type: none"> - Precautions will be taken while using stowing pipe and hoses - Engines maintained in good working conditions to minimise emission of pollutants from exhausts - Complete combustion to minimise emission of carbon monoxide
d. Impact on groundwater <ul style="list-style-type: none"> - Salinisation of ground water 	Minimal	<ul style="list-style-type: none"> - Create many low stockpiles along the shoreline of the existing island, which will promote the desalination of the dredged material after rain fall
e. Impacts on fauna and flora including soil	Minimal	<ul style="list-style-type: none"> - Large trees will remain on the island - New vegetation area on the edges of the reclaimed areas - Recommended to collect top soil layer to reuse in island after elevation of the island
f. Impacts on marine environment <ul style="list-style-type: none"> - Loss of marine habitats - Construction of the entrance channel - Sedimentation and turbidity due to dredging and reclamation 	Minimal	<ul style="list-style-type: none"> - Land reclamation area will a limited area of the shallow reef - Limit the seagrass area which is

<p>Post construction</p> <p>a. Change in bathymetry around borrow area due to wave actions and local currents and the resulting sand transport into the large basin at the shallow reef flat</p> <p>b. Changes in flow velocities and directions - Borrow pit will attract some flow if the access channel is open</p> <p>c. Erosion and sedimentation</p> <p>d. Introduction of alien species via the ballast water of ships and vessels involved in the construction works</p>	<p>Negligible</p> <p>Minimal</p> <p>Negligible</p> <p>Adverse</p>	<p>reclaimed to leave about 60% of seagrass</p> <ul style="list-style-type: none"> - Entrance channel to start directly from the atoll side, will result in less damage to seagrass and flat reef area - Construction of a temporary bund around the borrow area to minimise sedimentation - Have a closed reclamation area with one or more settling basins to reduce sedimentation and turbidity - All activity will be monitored -Monitoring activities to study any changes in bathymetry <p>-Close channel prior to the end of the project</p> <p>-Not provided</p> <p>-Refill ballast tanks in the open ocean before entering the Maldives</p>
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Table 4.3. Summary of impacts, their significance and proposed mitigation measures in the EIA for the development of the sewerage system in Thaa Vilufushi (Refer Mott MacDonald Pvt. Ltd. (2007) for details).

Impacts	Significance	Mitigation measures
Construction phase		
a) Loss of vegetation and top soil - Site clearance and excavation - Disposal of construction waste and debris	Moderate	- Collect top soil layer of about 20-30 cm and reuse for laying of the sewer pipelines
b) Increased disposal of solid waste	Minor	- Suitable waste handling, transportation and disposal of all waste generated - Accumulated waste, debris, unused construction materials and construction equipment must be removed from island after completion
c) Air and water pollution due to waste-water disposal - Accumulation of waste in the environment - Leachate and by-products of incomplete combustion	Minor	- Collection of wastewater using a proper sewer network, treatment of wastewater and disposal in an environmental friendly manner
d) Sewage pollution due to leaks from catch pits - Pollutes aquifer beneath the island and surface water	Moderate	-Proper operation and maintenance of pipelines
e) Marine pollution due to oil spillage from fuel used for the vehicles and accidental spillage of hazardous materials	Minor	- Careful handling and proper maintenance of vehicles to minimise or prevent oil leaks -careful handling and disposal of hazardous materials
f) Damage to the marine ecosystem due to excavation or blasting during construction of outfalls	Major	- Maintain precision during construction of outfalls -Minimise the extent of blasting by utilizing the natural channels on reef flat when doing the alignment outfall
g) Decreased quality of ground water quality and quantity due to extraction of ground water	Major	- Sewerage network to be laid above the ground water lens - Only temporary dewatering at proposed pumping stations, to minimise extraction
h) Introduction of alien species via the ballast water of ships and vessels involved in the construction works	Minor	- Refill the ballast tank in the open ocean before entering the Maldives area - Every vessel is required to fill the ballast water management form

5 Shelter Project – R. Dhuvaafaru

Dhuvaafaru in North Maalhosmadulu Atoll (Raa Atoll) is being developed as a sustainable community for the population of Raa Kandholhudhoo who were dispersed during the tsunami 2004. The International Federation of Red Cross and Red Crescent Societies together with the Government of Maldives started several development works on the island in mid 2005. The main construction and development works undertaken in this project are outlined in table 5.1. The pledge made to this project by IFRC is 32 million US dollars and it is estimated that the total cost will amount to approximately 45 million US dollars with the remaining funding coming from the Government of Maldives and USAid.

Table 5.1 Main construction and development activities on Raa Dhuvaafaru

Activity	Progress
562 houses (IFRC) + 38 houses (GoM)	Complete
Pre School, Primary School, Secondary School	Complete and handed over to GoM in August 2008
Community buildings (Auditorium, Community Administrative building)	Complete and handed over to GoM in August 2008
Electricity Network	Complete
Construction of the Power Station	Complete
Sports facility	Ongoing
Waste water collection and disposal system	Complete
Water supply	Complete Rainwater collection tank in each house + 14 community tanks (10,000 l each)
Street lighting	Complete
Road works	Ongoing
Waste management centre	Ongoing – ready for tendering
Health Centre	Complete (German Red Cross)

5.1 Difficulties Faced during the Project

IFRC reports the following difficulties, which were faced during the project duration;

- Working with the community of R. Kandholhudhoo was reported to be a difficult task. This community is known to be demanding and proud. It was expressed that the community was not pro-active and was demanding money for carrying out any activity, which created a dependency on the project rather than a feeling of ownership.
- The other major difficulty arose due to the delay on the part of the government which will be dealt with in Section 5.3.

5.2 Weaknesses in the project

The major weakness in the project appears to be insufficient public participation due to inadequate community consultation and the lack of willingness of the community to participate. The IFRC official reported that a socio-economist was lacking in their team and therefore consultations were not carried out satisfactorily. However, in such cases of emergency arising from natural disasters it is difficult to allocate ample time to consulting before the activities are commenced and implemented. Although public consultation was limited, the issues faced were discussed with the community at different stages, especially during the planning of the household layouts. Thus requests made by the community for wells, fish cutting areas etc. were included in the final design. It should also be noted that a group of young people between the ages of 19 and 28, some of whom had previously worked in CARE and Red Cross organisations were very helpful throughout the project, volunteering to liaise with the project team to carry out the activities. Here, the difficulty was that they were related to the deputy island chief, who apparently was not very popular within the community and therefore were mistrusted and it was assumed that they were paid for the work they were doing.

5.3 Major delays and gaps

The biggest delay during the project was reported to be due to the government. There were numerous delays on the part of the government when agreements needed to be signed between the government and IFRC for release of funds which resulted in some activities being stalled. The change in government at the end of 2008 was reported to have made the existing situation worse. The liaising between the previous government and the project team was more effective. However, with the change of government, his role has been diminished and a newcomer has been given the authority to overlook the recovery projects from the government side, making the process slower and inefficient.

Another delay that was reported is the withholding of the recovery funds allocated for the project by the new government, the reason being that the government had a big budget deficit and therefore needed the money for their own activities. The IFRC official stated that it took him 6 hours at a meeting with several ministers to convince them that the funds could only be used for the allocated activities and not utilised for government projects.

A significant challenge during the recovery project was acute shortages of local staff that left essential gaps in the organisational structure for long periods of time (O'Donnell and Kakande, 2007). Limited compensation levels made it difficult to hire people with the right coordination experience, skills and knowledge which were needed to undertake the activities.

The relocation of the community was planned to take place during a 17 day period. However, the new government required the project to relocate the community to Dhuvaafaru within 24 hours. The team expressed concern for the

many problems which would arise by carrying this exercise out in haste but it was decided that the people would be moved to their new homes on the 9th of December. Thus the project team worked with the government who were responsible for the undertaking of this activity. They met with many difficulties including the loss of personal items belonging to some families and also delays in the arrival of personal effects. This created resentment among the people.

Other delays that were reported during the project were;

- Delays due to the geography and formation of Maldives.
- Delay in importing the materials needed for construction.
- Delays in getting contractors due to their prior commitments.

5.4 Gender aspects in project design

There were no significant gender aspects in the design and implementation of the project and a focus was made to ensure gender equality. Women were encouraged to participate in all group discussions and Women Focus groups meetings were held to give them the opportunity to participate. The IFRC reported that unlike on other islands of the Maldives, men and women mixed and interacted a lot during the meetings they had.

5.5 Environmental impacts of reconstruction work

Several works were initiated on the island as part of the housing project and an Environmental Impact Assessment (EIA) was undertaken prior to the commencement of the works. A separate EIA was also made for the proposed development of the sewerage system and roads in R. Dhuvaafaru (Water Solutions, 2007). What is important to note here is that these development works were initiated after the compilation of an EIA. Both EIAs clearly detail the main impacts of these activities, both in the construction stage and the operational stage. It also highlights mitigation measures which should be implemented to minimize these impacts. Additionally the EIAs also provide beneficial effects of developing the island, which further justifies the projects. Tables 5.2 and 5.3 below highlight the main impacts that were identified (not comprehensive), their significance and proposed mitigation measures. For more details please refer to Water Solutions (2007) and NDMC (2005).

While EIAs were carried out, the environmental monitoring plans that were recommended to be undertaken during the construction stage were not implemented. Thus, the most crucial aspect of EIAs appears to have been neglected, defeating the whole purpose of carrying out EIAs.

Dhuvaafaru was an uninhabited island before the tsunami and a new community has been created on the island with all basic infrastructures in place within 3 and a half years. A major impact to the environment was the clearing of vegetation (about 83% as stated in the EIA, NDMC 2005). However, since no monitoring was undertaken, it is not certain that the recommended mitigation measures

were implemented. A tree planting program was carried out in June 2008 to mark 'Environment Day' and 500 trees were planted which were donated from an owner of an uninhabited island nearby. Land-use plans were developed with large areas of buffer zones or green zones, with parks separating different land use areas. Many of these areas, especially the southern side of the island are barren and funds need to be raised to undertake replanting activities. The IFRC is waiting for the community to take the initiative in making a plan for developing a nursery.

Reclamation of the island has been minimal up to now with only a temporary channel created during the construction stage to access the island. The sand from this activity was used during the roadwork project. However, a harbour is in the process of being built and this would generate sand which will reclaim some areas of the island.

Table 5.2. Summary of impacts, their significance and proposed mitigation measures in the development of the proposed sewerage system and roads in R. Dhuvaafaru (Water Solutions, 2007)

Impacts	Significance	Mitigation measures
<p>Constructional impacts Civil works</p> <p>a. Grading and compacting of roads / Site clearance and disposal of waste</p> <p>b. Dewatering to lay the sewers and construct manholes and pump stations</p> <p>c. Excavating reef areas at outfall locations</p>	<p>Moderate adverse</p> <p>Negligible/ Minimal</p> <p>Moderate adverse</p>	<p>- Manual methods will be used to minimize dusty operations</p> <p>- Water must be pumped using pumps with smallest capacity possible to minimize salinisation of the lens</p> <p>- The sewers should be laid at levels that ensure that dewatering is not required.</p> <p>- Controlled surface blasting (detonation not exceeding 2.2 mm/s), when necessary, should be undertaken on a day which has calm weather and sea conditions;</p> <p>- Any area subject to blasting will be covered with sandbags and blasts will be undertaken within a borehole</p> <p>- Activities should be undertaken within the shortest possible time to minimise negative impacts on the environment</p> <p><i>During the construction stage:</i></p> <p>-Use environmentally friendly materials and methods</p> <p>-Minimize sedimentation and siltation on reef</p> <p>-Use manual methods as much as possible</p> <p>-Organize and inspect the work to minimize impacts</p>

<p>Operational impacts</p> <p>a. Ground water quality</p> <p>b. Lagoon and seawater quality</p> <p>c. Coral Reef and Marine Biodiversity</p>	<p>Moderate adverse</p> <p>Negligible</p> <p>Negligible as shown in modelling studies</p>	<p>-Minimize waste generation -Lay the pipe line of the outfall in the proposed location -Complete the work in shortest time period and monitor impacts during process</p> <p><i>During operation:</i> Outfall: location chosen to minimize impacts to the coral reef and the lagoon water. Shortest possible distance through the lagoon selected to reduces risk of faults in the pipeline and discharge of effluent through faults</p> <p>-Use of pumps and flush tanks; reduce flushing volumes, controlling size of pumps used in households - Ensure that the population does not outgrow safe or sustainable rates of groundwater abstraction</p> <p>- Wastewater disposed into deeper waters beyond the reef</p> <p>- Long-term monitoring to assess impacts; aid in taking mitigation measures when necessary - Minimising effluent disposal impacts</p>
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Table 5.3 Summary of impacts and mitigations outlined in the Environmental Impact Assessment report for the island of Dhuvaafaru (NDMC, 2005)

Impacts	Significance	Mitigation measures
<p>Construction phase Modification of habitat</p> <p>a. Clearing of vegetation (approximately 83%);</p> <ul style="list-style-type: none"> - reduced number of resident birds - reduced open space qualities - reduced scenic views and vistas - alteration of local climate - compaction of island soil <p>b. Dredging and land reclamation</p> <ul style="list-style-type: none"> - alteration of coastline - alternation of erosion/deposition regime - loss of beach and turtle nesting sites - impacts on water quality and associated reef system <p>c. Degradation and pollution of local aquifer due to inappropriate disposal of domestic waste and sewage</p> <p>d. Coastal bund wall; could cause flooding in event of heavy rainfall</p>	<p>Adverse</p> <p>Adverse</p> <p>Adverse</p> <p>Adverse</p>	<ul style="list-style-type: none"> - Retain any large tree or shrub which falls within the allocated development area if possible or relocation of vegetation when necessary - Clearing of vegetation in stages and only when required - Minimise amount of introduced flora and fauna and use of foreign fertilisers - Prohibit capture of terrestrial and marine fauna on the island by the workers - Educate workers on unnecessary vegetation damage - Prohibit exploitation of turtle nests - Use silt screens to minimize sedimentation and turbidity level of water - Construct settling ponds to receive dredged materials - Dredging only one entrance channel; improved water circulation between harbour and boatyard - Carry dredging activities in calm weather - A waste management site will be developed for use during the construction period, where waste can be sorted and stock piled till the Island waste management system is functional - Construction waste can be used for landfill and foundation purposes - Plant cuttings will be burnt in a designated area. - Food wastes will be buried underground - Septic system will be used to manage human wastes - Proper ground levelling so as to make the island slope shoreward to ensure drainage in the event of flooding
<p>Operation phase</p> <p>a. Industrial activities; fish cooking</p> <ul style="list-style-type: none"> - Release large amounts of organic waste as effluents and solid waste 	<p>Adverse</p>	<ul style="list-style-type: none"> - Use a properly installed stove which promotes complete combustion and which is matched to its heating needs

6 Overall Conclusions

The successes and failures of the restoration projects after the tsunami are many and it is evident that there are many common issues faced by the different projects. One of the major challenges in the implementation of the projects was the lack of proactive behaviour from the community which resulted in the absence of a feeling of responsibility of the projects. There appeared to be a dependency on the government and the aid organisations to manage and implement the project activities. On some islands, while the youth groups and WDCs showed initiative and motivation, they still stated that they required leadership from the government authorities for them to be active while on others the government was not taking leadership, nor delegating management to other interested groups. This created a lot of tension between the government authorities and the communities on some islands. As an example, the failure of the waste management program on many of the project islands was due to the lack of leadership on the part of the government authorities and their disinterest in implementing the programs. The dependency of the communities on the government and aid agencies appear to have gone beyond the project activities and now appear to be affecting their day to day lives. This is evident in their behaviour even after being moved to their new communities.

Before the tsunami, the government's role in the community was a very controlling one where permission from the Island Office needed to be obtained before commencing even the slightest activity on the island. This procedure has changed since the tsunami, whereby the aid agencies, including UNDP do not have to go through the Island Office to carry out project activities. It has taken some time to adjust to the new system. Another milestone that has been achieved is the creation of the National Disaster Management Centre which now has a large role to play during such projects by liaising between the communities and the project implementation agencies.

Yet another major weakness in some of the projects was insufficient public participation due to inadequate community consultation and the lack of willingness on the part of the community to participate. The expertise of a socio-economist was lacking on the project teams resulting in inadequate consultations with the community. This led to a lack of awareness on project activities with problems arising in the later stages of the project. Many of these problems could have been avoided if consultations were carried out from the onset of the project. In contrast, regular sessions were carried out with the community in the Vilufushi project and they were kept informed and up-to-date. The agencies found out that issues did arise if there were no regular consultations.

Even with regular consultations, there were some problems with the level of awareness during decision making. An example was in Vilufushi where a Sewage treatment plant was being implemented which treated the water to a

level where it could be used for purposes such as irrigation and the recharging of ground water. The replenishment of groundwater is a very important issue facing small islands such as in the Maldives. While this being the case, the community was refusing to use the water on the island due to a lack of awareness of the quality of the treated water. Thus, the BRCS team was planning to have another community meeting to convince them that the water could be reused. In other cases, there was an increase in awareness as a result of project activities. In many of the islands where WMCs were built, there was an improvement in the dumping of waste. Instead of disposing waste all over the island as previously done, waste was gathered in one area, making the island cleaner, more aesthetically pleasing and so curtailing the breeding of pests.

Due to the nature of the projects and the haste with which they had to be implemented, there was a lack of transparency in the roles of the different agencies involved and as well as the government authorities. This resulted in confusion of responsibilities leading to failure of some projects. One such case was the absence of an agreement between the ARC/ CRC and the government on the waste management project. The ARC/ CRC understood that the government would take responsibility to undertake final disposal every three months once the WMCs were built. However, midway through the project it was evident that the government was not planning to carry out the final disposal and this led to a lot of confusion as to who was to take the responsibility for this activity. While the construction of the WMCs can be seen as a success, the overall project could be viewed as a failure as the whole purpose of setting up the WMCs was defeated.

O'Donnell and Kakande (2007) reported that significant commitments were made with inadequate guidance from relevant needs assessments resulting in the project activities being ineffective. The importance of ongoing assessments which would guide the formulation of long-term programming in a manner that is separated from early concerns to provide immediate relief is highlighted.

A fundamental issue that delayed progress of projects was the lack of capacity-both financial and human resources and also institutional constraints. It was difficult to procure local skilled and experienced manpower and as a result the staff turnover was high within the agencies. This is expected as a large number of skilled staff was required within a short time period due to the nature of implementation of activities.

The most important delays faced by the agencies were from the government and contractors. The delays were encountered when agreements with the government needed to be signed for approval of project activities and also for release of funds. Contractor delays were usually faced during the tendering process and also with selecting companies with right profiles for the work.

The most important activities that were carried out with regard to the environment were Environment Impact Assessments (EIA). EIAs were undertaken for the shelter projects, while one was not done for the waste management project. The result of this is already evident. On the one hand the shelter projects were successful but the waste management project can be seen as a failure. EIAs highlight potential environmental and socioeconomic impacts that will arise from project activities. It also addresses mitigation measures that can be implemented to minimise impacts. The lack of an EIA for the waste management project could be the reason for the failure of some components of the project. An EIA clarifies the roles and responsibilities of different agencies as well. The greatest tsunami related impact on the environment came from the machinery used for the cleanup operations and not from the debris. This could also have been minimised if an EIA had already been carried out.

One of the most important components of the EIA is the Monitoring Plan which is to be carried out during the construction and operation phase. This recommendation has been followed in the Vilufushi project by the contractor. They had hired consultants to monitor the different aspects such as the changes in live coral cover on the reef. In the case of Dhuvaafaru, the IFRC official was not able to clarify if the monitoring program was followed. If the Monitoring Plan is not followed, it defeats the whole purpose of the EIA as it would not be possible to assess if the anticipated impacts occurred and whether the mitigation measures that were implemented had any effects on minimising the same.

With regard to gender aspects, more emphasis was given to gender equality in all projects. However, it was also taken into consideration that in areas such as waste management women have traditionally assumed a larger role. Culturally Maldivian men are more outspoken than women and the latter tend to hesitate in the presence of men. Thus during discussions where both men and women were present, often they were dominated by the men and women's views not heard.

7 Recommendations

- There seems to be a new culture of dependency that has emerged with the tsunami relief work. To minimise this dependency, efforts need to be made to educate and increase awareness among the communities to help them build up independent communities again. NGOs could play an important role in carrying out these activities.
- Community consultation should commence at the onset of the projects with awareness sessions to involve the islanders and increase the feeling of ownership. This would help to avoid delays created by misinformed decision making. A socio-economist should be on the project team from the project planning stage. Due to the traditional gender views of Maldivians, it is important to have meetings with only women to discuss project activities if their views are to be integrated.
- Another point of vital importance is the recommendation of transparency of roles and responsibilities of the different agencies involved including the government. Written agreements or memorandum of understandings should be drawn up before the commencement of projects. It is also useful to carry out a needs assessment or consult existing ones to guide the project activities, so that they can be modified according to the community's requirements.
- Developing the skills of staff at the National Disaster Management Centre through in-house and external training is vital to prepare them to carry out their tasks efficiently and effectively during disasters.
- Encourage agencies to carry out Environmental Impact Assessments before commencing restoration work which would have potential effects on the environment. A significant component of these assessments is the monitoring plan that is proposed to be carried out during construction and operation. The results of the monitoring are used to assess the extent of impacts and to gauge the mitigation measures that are carried out. Thus stricter measures need to be introduced to ensure that accurate monitoring takes place.

8 Consulted Parties

Name	Designation	Organisation/Department
Mr. Muruthallah Mohamed Didi	Director	National Disaster Management Centre
Mr. Anwar Ali	Assistant Director General	Housing and Infrastructure Redevelopment Unit
Mr. Aslam Rasheed	Community Mobilisation Specialist	Environment Research Centre
Mr. Ahmed Muruthaza	Assistant Director	Environment Research Centre
Mr. Hassan Moosa	Director General	Environment Research Centre
Mr. Alastair Burnett	Head of Mission	British Red Cross (BRC)
Ms. Aishath Khalid	Programme Administrator	British Red Cross (BRC)
Mr. Safwan Amjad	Recovery Field Officer	International Federation of the Red Cross and Red Crescent (IFRC)

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International Union for Conservation
of Nature

Ecosystems & Livelihoods Group, Asia
No. 4/1, Adames Avenue
Colombo 04
Sri Lanka

Tel: +94 112559634/35
Fax: +94 112559637

www.iucn.org

