Cambodia Post Disaster Needs Assessment

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FOREWORD

Cambodia is among the four countries that were adversely affected by Typhoon Ketsana between September 26 and October 5, 2009. The Tropical Storm swept through the Philippines, Vietnam, and Lao PDR, finally landing in Cambodia. Typhoon Ketsana first touched the country on September 29, when it was already weakening to a tropical depression, bringing strong winds and heavy rains. The rain created flash floods in most of the northern provinces, from the Northeast (Stung Treng and Ratanak Kiri) to the North (Kampong Thom, Kratie, and Kampong Cham) and the Northwest (Preah Vihear, Siem Reap, and Oddar Meanchey). The flash floods were followed by more moderate flooding in nearby provinces such as Mondul Kiri, Banteay Meanchey, Battambang, Kampong Chhnang, Preah Sihanouk, and Kampot.

The Royal Government of Cambodia responded by mobilizing the national and local administrations, armed forces, and volunteer groups to rescue stranded people and provide immediate relief, including temporary shelter, medicine, and food. The Office of the Prime Minister and the National Committee for Disaster Management oversaw the immediate response. The Cambodian Red Cross and numerous local and international development partners participated in the relief activities, generously giving their time and assistance in the days following the typhoon.

The purpose of this report is to value the impact of Typhoon Ketsana on the human development and economic conditions of the affected areas, identify the main gaps in systemic capacity and the subjacent vulnerabilities, and assess the recovery needs for the short-, medium-, and long-term rehabilitation and reconstruction.

This comprehensive Post Disaster Needs Assessment and Recovery Framework (PDNA/RF) was undertaken in November 2009 following the Damage and Loss Assessment (DaLA) methodology developed by the Economic Commission for Latin America and the Caribbean (ECLAC). This methodology is internationally accepted to measure the impact of disasters and comprises assessments of the direct, indirect, and secondary impacts. The estimates were based on information collected by the assessment team during the field surveys, as well as on information provided by the national and provincial authorities. The Damage, Loss, and Preliminary Needs Assessment will be used as a basis to design the rehabilitation and reconstruction program for Cambodia.

The Royal Government of Cambodia wishes to thank the World Bank for its coordinating role on the report, other development partners for their contributions to the assessments, and the donors of the Global Facility for Disaster Reduction and Recovery for their generous financial support.

ACKNOWLEDGMENTS

This Post Disaster Needs Assessment is the result of a joint initiative of the Royal Government of Cambodia (RGC), development partners, and representatives from civil society organizations, in the context of their global cooperation agreements.

The assessment team was composed of a cross-agency group, led by the National Committee for Disaster Management (NCDM), with participation from a wide range of line ministries including the Ministry of Public Works and Transportation (MPTW), Ministry of Rural Development (MRD), Ministry of Industry, Mines, and Energy (MIME), Ministry of Water Resources and Meteorology (MoWRAM), Ministry of Interior (MoI), Ministry of Environment (MoE), Ministry of Agriculture, Forestry, and Fisheries (MAFF), Ministry of Social Affairs, Veterans, and Youth Rehabilitation (MoSVY), Ministry of Economy and Finance (MEF), Ministry of Education, Youth, and Sports (MoEYS), Ministry of Health (MoH), Ministry of Women's Affairs (MoWA), Ministry of Land Management, Urban Planning, and Construction (MLMUPC), and the Cambodian Red Cross (CRC) and technical experts from a range of agencies, including the World Bank (WB), Asian Disaster Preparedness Center (ADPC), United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), Asian Development Bank (ADB), World Health Organization (WHO), United Nations Development Program (UNDP), Food and Agriculture Organization (FAO), Unicef, Save the Earth, Caritas, Oxfam GB, Plan International, and Netherlands Development Organization (SNV). The PDNA Report was compiled by Veasna Bun (Task Team Leader and WB-PDNA Lead), Manuel Cocco and Brett Jones (PDNA Secretariat and PDNA Report Team).

In all, over 100 individuals from government agencies, civil society organizations, and development partners were involved in the data collection and analysis following Typhoon Ketsana. The PDNA team wishes to acknowledge and thank the government representatives who participated in the PDNA process, both at the national and sub-national levels. Without their time, valuable insight, and support, the team's fieldwork would not have been successful. Also, special thanks go to the Team Assistants that made possible all the logistical arrangements, and without whom this whole exercise would not have been possible.

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Photographs used in this publication were taken by the assessment team unless otherwise indicated. To all of these contributors the team would like to express their deepest thanks and appreciation.

ACRONYMS

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Centre
ASEAN	Association of South East Asian Nations
AUSAID	Australian Agency for International Development
CCA	Civil Aviation Authority
CCA	Common Country Assessment
CCDM	Commune Committee for Disaster Management
CRC	Cambodian Red Cross
DANA	Damage and Needs Assessment
DCDM	District Committee for Disaster Management
DFID	Department for International Development
DIPECHO	Disaster Preparedness Programme European Commission Humanitarian Aid Department
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EWS	Early Warning System
EAC	Electricity Authority of Cambodia
EDC	*Electricité du Cambodge*
FAO	Food and Agriculture Organization of the United Nations
GTZ	*Deutche Gesselschaft fur Technische Zusammeinarbeit*
HDI	Human Development Index
HFA	Hyogo Framework for Action
ISDR	International Strategy for Disaster Reduction
JICA	Japan International Cooperation Agency
LWF	Lutheran World Federation
MIME	Ministry of Industry, Mines and Energy
MAFF	Ministry of Agriculture, Forestry and Fisheries
MOD	Ministry of Defense
MOE	Ministry of Environment

MEF	Ministry of Economy and Finance
MOEYS	Ministry of Education, Youth and Sports
MOH	Ministry of Health
MOINF	Ministry of Information
MOI	Ministry of Interior
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MOP	Ministry of Planning
MPWT	Ministry of Public Works and Transports
MRD	Ministry of Rural Development
MOSVY	Ministry of Social Affairs, Veterans, and Youth Rehabilitation
MOU	Memorandum of Understanding
MOWA	Ministry of Women Affairs
MOWRAM	Ministry of Water Resources and Meteorology
MRC	Mekong River Commission
NAPA	National Adaptation Programme of Actio**n** to Climate Change
NCDM	National Committee for Disaster Management
NEMP	National Emergency Management Plan
NGO	Non Government Organization
PCDM	Provincial Committee for Disaster Management
PSDD	Project in Support of Democratic Development through Decentralization and Deconcentration
REE	Rural Energy Enterprise
RGC	Royal Government of Cambodia
SNAP	Strategic National Action Plan
SNV	Netherlands Development Organization
UNICEF	United Nations Children's Fund
UN/ISDR	United Nations International Strategy for Disaster Reduction
UNDAF	United Nations Development Assistance Framework
UNDMT	UN Disaster Management Team
UNDP	United Nations Development Program
UNRC	United Nations Resident Coordinator

WFP	World Food Programme
WHO	World Health Organization

EXECUTIVE SUMMARY

Typhoon Ketsana hit Cambodia flattening houses, damaging buildings, and causing massive flooding between September 26 and October 5, 2009 before it was downgraded to a tropical depression, with slower winds and heavy rains. According to the National Committee for Disaster Management (NCDM), 14 out of 24 provinces were affected by the storm and subsequent flash floods. The typhoon left 43 people dead, 87 people severely injured, and some 49,787 families directly affected by loss of home or livelihood. As many as 180,000 people were affected (directly or indirectly), equivalent to 1.4 percent of the population. Most of the affected districts are among the poorest in the country. The widespread damage to property, livelihoods, and public infrastructure in these areas will have a long-term impact.

Past natural disasters have had substantial impact in the rural areas where it is estimated that 79.8 percent of the poor reside (CSES 2007).About 80 percent of the Cambodia's territory lies within the Mekong River and Tonle Sap Basin, known to have large fluctuations of water level between the dry and wet seasons. This causes an annual cycle of droughts and floods, damaging agricultural production and livelihoods and constraining economic growth and poverty alleviation. It is estimated that floods causes agricultural losses of USD 100–170 million each year.

Damage and Loss

Damage and loss from Typhoon Ketsana in Cambodia were concentrated in Stung Treng, the south of Preah Vihear, the north of Kampong Thom (by far the most badly hit), and the west of Siem Reap Provinces. The typhoon was followed by flash floods that submerged parts of Ratanak Kiri, Mondul Kiri, Kratie, Oddar Meanchey, Banteay Meanchey, Battambang, Kampong Cham, Kampong Chhnang, Preah Sihanouk, and Kampot Provinces, exacerbating damage and loss.

Recognizing the long-term effect of the typhoon on vulnerable people, the government through the Ministry of Economy and Finance (MEF) as well as National Committee for Disaster Management (NCDM), with assistance from the World Bank and in partnership with other Development Partners, carried out a comprehensive Post Disaster Damage, Loss,

and Needs Assessment (PDNA) to ascertain the extent of the damage and loss caused by the event, and to define a comprehensive and feasible recovery plan. The PDNA estimated the total damage and loss caused by Typhoon Ketsana to be USD 132 million of which damage is USD 58 million and loss is USD 74 million.

Table 1 presents an overall summary of damage and loss broken down by sectors. Some sectors fared better than others: the productive sector had the highest percentage (56%) followed by the social sectors (26%), and the infrastructure sector (18%), while cross-cutting sectors had negligible impact compared to the others.

Table 1: Summary of Damage and Loss (USD)

Table 1: Summary of Damage and Losses (DaLA)			
Sector and Subsectors	**Disaster Effects, US$**		
	Damage	**Losses**	**Total**
Infrastructure	**17,259,051**	**11,487,577**	**28,746,628**
Transport	14,388,832	11,076,698	25,465,530
Water Supply and Sanitation	64,339	392,689	457,028
Water Management and Irrigation	2,779,000	13,000	2,792,000
Energy	26,880	5,190	32,070
Social Sectors	**39,548,563**	**3,333,813**	**42,882,376**
Housing and Shelter	15,281,952	3,294,398	18,576,350
Health	57,072	39,415	96,487
Education	24,209,539	-	24,209,539
Productive Sectors	**1,051,124**	**59,008,162**	**60,059,286**
Agriculture, Livestock and Fisheries	91,270	56,420,846	56,512,116
Industry & Commerce	959,854	2,587,316	3,547,170
Cross-Cutting Sector	**205,358**	**102,767**	**308,125**
Environment	31,073	98,367	129,440
Public Administration	174,285	4,400	178,685
TOTAL	**58,064,096**	**73,932,319**	**131,996,415**

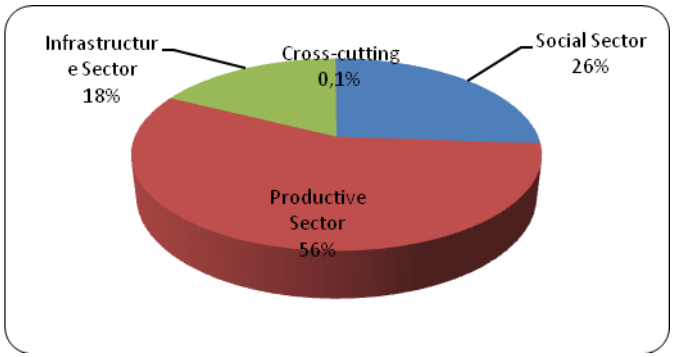
Source: PDNA Team Elaboration (2009).

The largest impact in the productive sector was on the agriculture, livestock, and fisheries sector. Agriculture alone provides more than 30 percent of the Cambodia's gross domestic product (GDP) and is also the mainstay of rural economy in terms of providing food security. In terms of agricultural impact, the typhoon affected 10 provinces, destroying 40,136 hectares and damaging 67,355 hectares of rice crop just before harvest. The loss of potential meat production was also high, making the total Damage and Loss Assessment (DaLA) for the sector USD 56 million. In the industry and commerce sector, the micro- and

agro-enterprises play a crucial role in the economic development of the country: they were the most impacted.

The damage and loss in infrastructure is concentrated in the transport sector. Typhoon Ketsana damaged road networks in 18 provinces (urban, national, provincial, and rural roads). Losses resulted primarily from higher vehicle operating costs and longer freight and passenger travel times associated with deteriorated road conditions. The impact of this damage is particularly significant since the road sector serves the very important role of providing access for the rural population and is essential to reaching economic growth and poverty reduction objectives. Regarding the water management and irrigation sector, the damage was largely due to the removal of the stone pitching from the bed of the canals in the downstream because of the high velocity of water flow and also the erosion of the stone masonry along the bank slopes of the canals. Finally, the damage and loss suffered in the water supply and sanitation sector varied across the affected provinces, with the largest impact in Kampong Thom, Stung Treng, and Kratie. Damage to pipe networks leading to disruption of water supply and affecting revenue generation was the primary cause of damage and loss in the urban water supply system. In the rural areas, the impact was largely due to flooding of tube wells and latrines and soil subsidence below the platform of the wells leading to cracks and eventually resulting in surface runoff.

Figure 1: Distribution of Damage and Loss by Sector



Source: PDNA Team Elaboration (2009).

In the social sectors, the damage and loss was largest in the education sector, followed by housing and health. Schools were largely hit by Typhoon Ketsana (12% of the total schools in Cambodia were affected) and many had to be closed either because of direct flooding or due to inaccessibility to the campus area. The poor quality of non-reinforced concrete floors used in the construction of school buildings and the loosely fitted roof tiles were the primary cause of damage to the school buildings. In the case of housing, the provinces of Kampong Thom, Preah Vihear, Ratanak Kiri, and Kratie were the most affected. In the health sector, while the majority of health centers continue to be in good condition, the existing problem of poor access to health care by the vulnerable population was further magnified by the impact of this typhoon and the subsequent flooding.

Macro-Economic Impact

With major impact on the rice crop but minimal impact on other sources of growth, it is estimated that the typhoon brought a loss of USD 17 million (Riel 69 billion) of value-added to the GDP. This shock would lead to 0.2 percentage point reduction in economic growth for 2009, thus reducing the growth rate from an earlier estimate of 2.1 percent to 1.9 percent.

The impact on fiscal revenues is unlikely to be significant, but the impact on expenditure could be important. The financing for medium- and long-term needs would have a significant impact on fiscal space. As explained in the draft 2010 budget law, which was submitted to the National Assembly in December, overall revenues in 2009 will be lower due to slower economic growth while overall necessary expenditures in 2009 will be higher. Therefore, the financing needed to rebuild physical infrastructure and restore livelihoods will increase the deficit and hence require additional domestic and foreign financing.

Livelihood and Other Social Impacts

The poverty level in the 14 provinces hit by Typhoon Ketsana was higher than the national average, and this typhoon will increase this inequality. Household incomes in these provinces rely primarily on rice farming, crop farming, and access to common property resources such as fish and non-timber forest products (NTFPs) to sustain livelihoods. All these activities have been largely impacted by the typhoon. The conditions are likely to be more severe in 2010 because before the typhoon, approximately 49,000 families were already suffering from food shortage and a great proportion of the rice crop that would have been harvested in November and December 2009 was damaged or destroyed, so potential off-farm jobs from the rice harvest have been lost. The assessment reveals that within a village or commune, the poorest groups and households whose rice crop was totally destroyed were the most vulnerable. These were usually households headed by women, the elderly, and families with disabled members. The indigenous groups living in the mountainous regions of Ratanak Kiri, Mondul Kiri, Stung Treng, and Kampong Thom Provinces were also among the most vulnerable.

Disaster Risk Management Requirements

Typhoon Ketsana provides an opportunity for Cambodia as it highlights some of the fundamental areas for reform in its emergency response and disaster risk reduction systems. The process of data collection and management in both assessing damages and losses and in tracking emergency assistance should be improved, along with capacity building activities for both the line ministries and national and sub-national Committees for Disaster Relief to facilitate their participation in the recovery process. Cambodia's early

warning system should be assessed and investment made in its improvement. Disaster Risk Management (DRM) should be mainstreamed into the activities and policies of Cambodia's line ministries and additional work should be done to strengthen the institutional and legal basis for Cambodia's DRM framework.

Recovery and Reconstruction Requirements

The proposed Typhoon Ketsana recovery framework for Cambodia aims to respond to the reconstruction and recovery needs of the affected communities, while laying down the foundation for longer-term risk reduction measures to reduce the future impact of disasters. To avoid the creation of similar risk in the future for the population and community, the recovery process is aimed to be guided by three key principles namely,(i) transparency, (ii) accountability and results-based implementation, and (iii) community-based, people-centered, and equitable approaches to mitigating future risks.

The priority sectors identified by the PDNA for recovery include: (i) transport, (ii) agriculture, (ii) water management and irrigation, (iv) industry and commerce, (v) education, and (vi) housing; and the priorities have been regrouped according to needs in the short term (0-6 months), medium term (1-2 years), and long term (1-5 years). Table 2 summarizes the requirement for the priority sectors.

Table 2: Recovery and Reconstruction Needs (USD)

Summary of Needs				
Sector and Subsectors	Recovery Needs, US$			
	Short Term	Medium Term	Long Term	Total
Infrastructure	**7.114.206**	**13.406.626**	**85.960.511**	**106.481.343**
Transport	5.124.206	9.264.626	76.360.511	90.749.343
Water Supply and Sanitation	-	500.000	4.250.000	4.750.000
Water Management and Irrigation	1.690.000	2.792.000	3.500.000	7.982.000
Energy	300.000	850.000	1.850.000	3.000.000
Social Sectors	**14.075.690**	**2.648.500**	**2.480.000**	**19.204.190**
Housing and Shelter	12.089.000	2.087.800	-	14.176.800
Health	86.690	560.700	2.480.000	3.127.390
Education	1.900.000	-	-	1.900.000
Productive Sectors	**5.960.000**	**12.800.000**	**41.200.000**	**59.960.000**
Agriculture, Livestock and Fisheries	5.000.000	10.000.000	35.000.000	50.000.000
Industry & Commerce	960.000	2.800.000	6.200.000	9.960.000
Cross-Cutting Sector	**196.085**	**2.396.000**	**2.803.600**	**5.395.685**
Environment	181.000	2.232.400	2.803.600	5.217.000
Public Administration	15.085	163.600	-	178.685
TOTAL	**27.345.981**	**31.251.126**	**132.444.111**	**191.041.218**
Disaster Management				8.937.000

Note: For Education, only Short Term recovery is considered in the Recovery Framework for Typhoon Ketsana. The additional reconstruction effort should be part of other stand alone programs.

Source: PDNA Team Elaboration (2009).

The priorities in the transport sector include reconstruction of national, provincial, and rural road networks damaged by the typhoon and development of specific standards for road construction and maintenance—particularly for the most flood-prone areas.

The recovery of the agriculture sector is crucial, especially with the potential threat on food security in the most affected provinces. The proposed recovery framework includes priority activities ranging from continuing assistance in form of seed, fertilizer, and equipment; scaling up ongoing cash-for-work, food-for-work, and local employment-generation schemes; and creating hazard-resilient agricultural systems.

The needs for water management and irrigation include repair of damaged irrigation schemes, development of a water management strategy for flood and drought risk reduction, as well as increasing the hazard-resilient standards of structures related to irrigation in the long term.

The industry and commerce sector has outlined the following four priorities: repair and replacement of damaged machinery and equipment; upgrading of machinery to make it hazard-resilient; supporting regulatory framework and capacity building; and lastly, undertaking public awareness on disaster risk reduction among the private sector.

The recovery for the education sector will target the facilities that are still damaged, prioritizing by examining, on a case-by-case basis, together with the photographic evidence, school enrollment records and total number of classrooms to determine short-, medium-, and long-term priorities.

In the housing sector, the priority will be to repair/and *Build Back Better* (BBB) the destroyed and most damaged houses in the short term and to review the housing standards and hazard-resilient construction in the medium and long term.

For the sectors that are not identified as a priority, the recovery program would still be guided by the same principles and will integrate disaster risk management in the process.

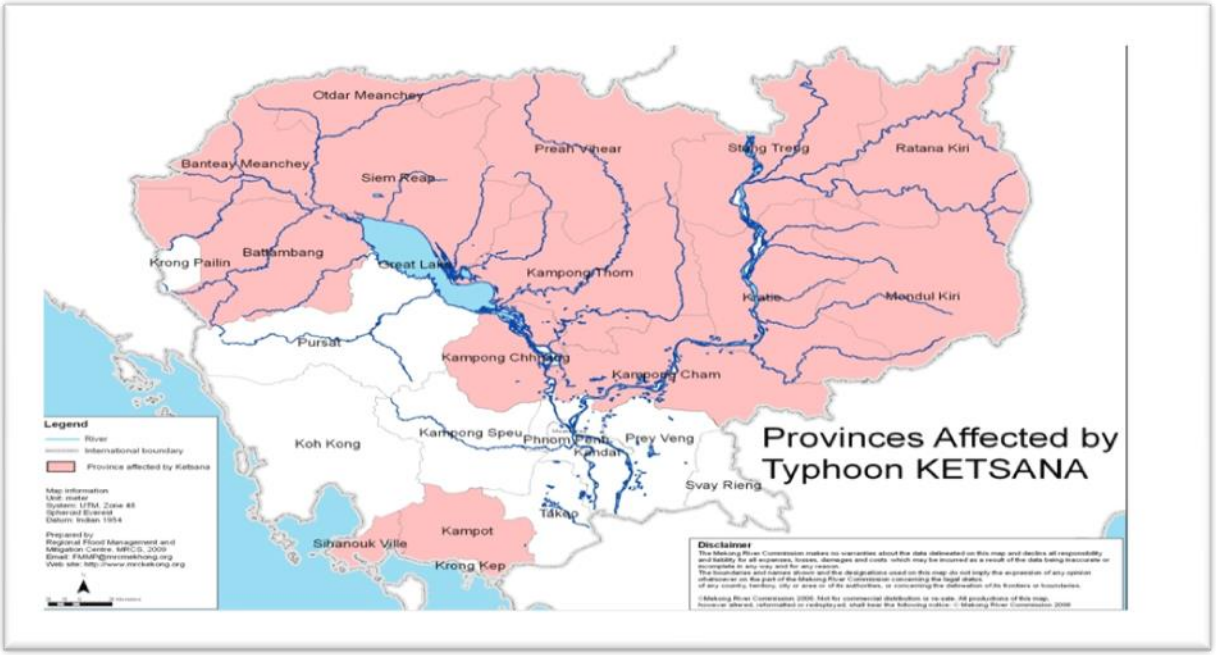
EXECUTIVE SUMMARY (KHMER)

SECTION I: THE 2009 KETSANA TYPHOON AND SOCIO-ECONOMIC BACKGROUND OF CAMBODIA

1.1 Immediate Impact

Cambodia is among the four Southeast Asian countries that were affected by Typhoon Ketsana. Between September 26 and October 5, 2009, the typhoon pursued a path of destruction across Southeast Asia. After submerging 80 percent of the greater metropolitan area of Manila in the Philippines, and wrecking life and property across central Vietnam, the Ketsana front ran an estimated 150 kilometers from the northeastern Lao PDR border toward the center of Cambodia, moving across Stung Treng, the south of Preah Vihear, the north of Kampong Thom (by far the most badly hit), and the west of Siem Reap, flattening houses and damaging buildings before it was downgraded to a tropical depression, with slower winds and heavy rains. The rest of the provinces affected were not directly hit by the storm, but were indirectly affected by the rain and ensuing floods, which in some cases continued up to one week after the storm had passed. The subsequent flash floods submerged parts of Ratanak Kiri, Mondul Kiri, Kratie, Oddar Meanchey, Banteay Meanchey, Battambang, Kampong Cham, Kampong Chhnang, Preah Sihanouk, and Kampot Provinces.

Map 1: Geographic Areas of Cambodia Affected by Typhoon Ketsana



The initial Damage Assessment carried out by the Royal Government of Cambodia (RGC) indicated that up to 14 provinces with 73 districts and 336 communes had been affected by the storm and subsequent flash floods.[1] In total, the typhoon left 43 people dead, 87 people severely injured, and some 49,787 families directly affected by loss of home or livelihood (of which almost 6,200 were evacuated). Though loss of life was not as high as in other countries, as many as 180,000 people were affected (directly or indirectly), which is equivalent to 1.4 percent of the population.

According to the same report, almost 218 houses were completely destroyed, 804 were severely damaged, and more than 10,559 buildings were affected. There has also been widespread damage to property, livelihoods, and public infrastructure in the affected provinces, which will cause long-term impact on the communities' livelihoods.

Most of the affected districts were among the poorest in the country. The weighted average of the poverty headcount based on the number of affected families is 49 percent, against a national average of 30 percent.[2] The loss of livelihoods incurred by the typhoon will risk pushing the affected communities back into deeper poverty, and nullify some of the gains made in recent years.

1.2 Immediate Response

The government responded by mobilizing the national and local administrations, armed forces, and volunteer groups to rescue stranded people and provide immediate relief, including temporary shelter, medicine, and food. The Office of the Prime Minister and the National Committee for Disaster Management (NCDM) oversaw the immediate response efforts; however, the monetary estimate for the amount contributed by the government in its emergency relief effort was not disclosed. Similarly, the Cambodian Red Cross (CRC) and other development partners supplemented government efforts with quick response and relief actions.

Recognizing the vulnerability of the affected people, the government gave high priority to restore livelihood opportunities, while concurrently rehabilitating the damaged infrastructure. The senior officials from the government met with the bilateral and multilateral agencies to discuss the impact of the floods that resulted from Typhoon Ketsana and to provide emergency assistance. The National Committee for Disaster

[1] National Committee for Disaster Management, October 26, 2009.

[2] World Bank Poverty Profile and Trends in Cambodia, 2007.

Management (NCDM) was tasked to coordinate all developmental partners in mobilizing the emergency response operations including the distribution of relief items.

The Cambodian Red Cross immediately took action, working in close coordination with the provincial and district disaster management offices and local authorities to deliver basic goods and services in the most effective and efficient way to the most affected. Development partners played an important role during the response phase working with the local authorities in distribution of emergency relief. Non-governmental agencies like Oxfam, Care, Action Aid, Muslim Aid, and Church World Service responded with relief materials in their project areas. The European Commission through its EC Humanitarian Aid department (ECHO) is contributing EUR 2,000,000 for Cambodia, Lao PDR, and Vietnam. UNICEF provided USD 143,000, WFP USD 875,000, and other organizations reported assistance to Ketsana-affected areas through a part of their ongoing programs.

1.3 Social and Economic Background of the Country and the Affected Areas

The Kingdom of Cambodia is located in mainland Southeast Asia, between latitudes 10° and 15° North and longitudes 102° and 108° East. Its boundaries run along 2,572 kilometers with Thailand (west and northwest), Lao PDR (northeast), Vietnam (east and southeast), and the Gulf of Thailand (southwest) for a total surface area of 181,035 square kilometers.

The total population of Cambodia is 13.38 million people.[3] Cambodia is a Least Developed Country (LCD), with a GDP per capita of USD 823[4] and an estimated 34.7 percent of the population below the national poverty line.[5] Administratively, the country is divided into 23 provinces plus the Phnom Penh municipality with a total of 185 districts and 1,621 communes.[6]

The country economy is mainly agrarian, with about 80 percent of its population living in rural areas[7] and engaged in two main economic activities: agriculture and inland fisheries. Agriculture and Livestock represent 18.8 percent of Cambodia's GDP and mainly consists in rain-fed, subsistence yearly rice crops facilitated by the seasonal flooding of the Tonle Sap.

[3] Royal Government of Cambodia Census, 2008.

[4] International Monetary Fund Estimate, 2008.

[5] National Strategic Development Plan 2006–2010, released 2005.

[6] National Institute of Statistics, 2004.

[7] Royal Government of Cambodia Census, 2008.

Inland fisheries, on the other hand, account for 9.3 percent of Cambodia's GDP, and fish represents about three quarters of the total animal protein intake of the local people. Rice and fish, therefore, form the staple diet of most rural Cambodians and are key factors for the sustainability of local livelihoods.

Typhoon Ketsana hit the poorest areas. The level of poverty in the 14 affected provinces was already 40–45 percent prior to the typhoon while the poverty rates for rural areas and Cambodia as a whole is 39 percent and 35 percent respectively. Households in this area rely primarily on rice farming, crop farming, and access to common property resources such as fish and non-timber forest products.

Typhoon Ketsana hit the poorest people. Of the households affected, the most badly hit were the poorest, as they usually have their housing located in the most vulnerable areas and using the poorest materials and construction techniques.

The informal economy is critical and more vulnerable after the disaster. Informal off-farm activities such as transplanting, harvesting, weeding, planting, clearing bush or forest, unskilled-works in the construction, services, and manufacturing sectors in major cities, which secondarily support their living, were already impacted by the 2008 food-price crisis and the 2009 economic downturn (caused by the global financial crunch). The slowdown of Cambodia's economy has led to a reduction in unskilled labor demand in general and affected rural household income. The months of November and December are usually the period when rural households are busier with harvesting and selling labor for agricultural farming, and also the period when they can accumulate additional cash that they use as a safety net when there is a food shortage. Typhoon Ketsana brought an additional stress to rural livelihoods by greatly affecting these job opportunities.

The conditions are likely to be more severe in 2010. According to the NCDM,[8] approximately 49,000 families were experiencing a food shortage prior to the disaster. The livelihoods of rural households still rely mainly on agricultural farming and access to common property and public goods and services, and rural families often have less access and lower savings to cope with unexpected shocks. Damages caused by a natural disaster such as Typhoon Ketsana can push non-poor households into poverty and further push poor households into the depths of the poverty cycle (see Table 3).

[8] National Committee for Disaster Management, November 10, 2009.

1.4 Vulnerabilities to Natural Disasters

The major natural disasters facing Cambodia are floods and droughts. The southwest monsoon begins around mid-May and lasts until the end of October, and brings over three quarters of the country's annual rainfall. As a result floods along the Mekong River, the Tonle Sap Lake, and the tributaries are recurrent and often convert into major disasters. Mekong River floods affect the provinces of Kandal, Kampong Cham, Kratie, Prey Veng, Stung Treng, Svay Rieng, and Takeo. Flash floods in tributaries around the Tonle Sap Lake affect several other provinces as well. Delays or early ending of the monsoon rains and erratic (volume and period) rainfall have contributed to agricultural droughts.

A large segment of the population lives in the flood plains of the Mekong and Tonle Sap Watersheds. Natural disasters have had significant impact on the country's people and economy. For example, floods accounted for 70 percent of rice production losses between 1998 and 2002, while drought accounted for 20 percent. Cambodia is one of the countries at a relatively high economic risk from multiple hazards. About one tenth of the total area of the country is estimated to be at risk from two or more hazards. Moreover, 31.3 percent of the population and 34.5 percent of GDP are estimated to be at areas of risk from two or more hazards (Dilley et al. 2005).

Urban vulnerabilities are accumulating. As the population in the Mekong floodplain of Cambodia continues to increase mainly due to rural–urban migration, and as major cities such as Phnom Penh and Siem Reap urbanize rapidly—often without adequate land use planning—newer vulnerabilities continue to accumulate. Lack of building codes that respond to country context and their weak enforcement, as well as lack of proper drainage in urban centers have increased the vulnerabilities of urban dwellers.

Increasing rural vulnerability. On the rural front, where about four fifths of the population (and 90 percent of the poor) reside, livelihoods—agriculture, fisheries, and forestry—are subject to more frequent floods and droughts. Deforestation and subsequent soil erosion, inadequate irrigation systems, and water conservation measures to protect against drought have all contributed to increase rural people's vulnerability to natural disasters.

Eighteen percent of the land area of Cambodia is categorized as protected areas. Forests are intensely exploited and deforestation contributes to loss of biodiversity, land degradation, and soil erosion, which increases vulnerability to flooding. Population growth, development, and increasing industrialization all contribute to additional pressures on the environment. Development upstream of the Mekong River and its tributaries also contributes to increased river pollution.

An estimated 72 percent of Cambodians are dependent upon fishing and agriculture for their livelihoods. With 30 percent living below the poverty line and some 15 percent subsisting in

extreme poverty, the population is highly vulnerable to the impact of disasters on food security.

Any major disaster in Cambodia may quickly overwhelm coping mechanisms. An effective, multi-hazard national disaster preparedness and response system is essential to effectively manage an emergency and avoid the rapid escalation of a relatively small-scale disaster into a major national crisis.

Table 3: Affected Assets by Typhoon Ketsana and Flash Floods (As of October 26, 2009)

No.	Province	Dist	Com	Social Sector							Agricultural Sector					Infrastructure Sector			
				Food Shortage / Family	Evacuate / Family	Affected/ House	Destroyed / House	Dispers e/ House	Casualties		Rice Seedling (ha)	Transpla nted Rice (ha)	Subsidia ry Crops (ha)	Livestock		Rural Road Damaged/ Line (km)	National Roads, Province – City Damaged (m)		Irrigation System (Site)
									Deat h	Injur ed				Cow (Head)	Pig (Head)				
1	Preah Vihear	8	37	2,877	1,867	2,745	1	-	-	-	-	3,226	-	14	-	-	-	1,600	3
2	Oddar Meanchey	5	17	1,506	-	-	3	-	-	-	-	1,133	25	-	-	7	8,050	-	4
3	Ratanak Kiri	6	34	4,850	300	778	13	156	3	1	-	3,786	1,490	730	1,534	8	7,000	4,000	1
4	Siem Riep	12	61	1,074	-	-	60	29	8	16	-	3,250	1,085	11	209	40	10,000	78,862	14
5	Kampong. Cham	10	35	1,356	-	-	6	185	3	-	856	6,266	-	-	-	54 km	100	4,785	9
6	Kratie	6	38	3,500	600	2,984	13	-	-	-	148	3,793	377	7	-	4	-	-	9
7	Stung Treng	5	27	3,957	537		-	-	-	-	-	3,716	-	-	-	2	400	5,900	1
8	Kampong Thom	8	64	22,336	2,906	2,906	109	428	20	48	213	19,389	-	60	11	81	-	5,450	50
9	Mondul Kiri	2	9	2,458	-	-	-	-	-	-	-	1,073	49	-	-	3	614	12,000	3

10	Bancheay Meanchey	6	23	790	-	-	10	-	-	2	-	7,693	-	-	-	22	460	5,635	5
11	Battambang	3	6	1,343	-	1,146	-	-	-	-	-	-	-	-	-	6	400	3,600	-
12	Kampot	2	15	-	-		3	6	3	-	-	-	-	-	-	5	-	1,810	1
13	Kampong Chhnang	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	325	-
14	Preah Sihanouk	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	1,080	-
Total		73	336	**48,787**	**6,210**	**10,559**	**218**	**804**	**43**	**67**	**1,217**	**53,325**	**3.026**	**822**	**1.754**	**313,17 km**	**166,73 km**		**102**

Note: Rural Development Sector: 1,472 pumping wells, 224 cement ring open wells, and 6,693 latrines were damaged. Public Works and Transport: The damage caused by the disaster, including Pailin, Svay Rieng, Kandal, Kep, and Koh Kong Provinces.

Source: National Committee for Disaster Management (2009).

SECTION II: SUMMARY OF ASSESSMENT AND SECTORAL REPORTS

2.1 PDNA Methodology

2.1.1 Rationale

Section I describes the immediate impact of Typhoon Ketsana and the immediate response by the Royal Government of Cambodia (RGC) and development partners. In addition to the emergency response, and in order to develop a recovery plan to ensure future disaster risk reduction (DRR), a more comprehensive in-depth assessment of the damage, loss, and needs of affected communities had to be undertaken.

A subsequent multi-agency Post Disaster Needs Assessment (PDNA) for Cambodia was carried out in November 2009 using available resources from the Global Fund for Disaster Risk Reduction (GFDRR). The PDNA exercise was led by the National Committee for Disaster Management (NCDM) and the RGC with the support of the World Bank and development partners.

The four main objectives of the PDNA exercise were:

1. Estimate the overall human and socio-economic impact of the disaster (damages, losses, macro-economic impact, and impact on livelihoods) in the country as a whole and in the affected areas;

2. Outline the basic recovery and reconstruction needs for the affected areas (based on the needs for each economic sector) by preparing a PDNA and recovery framework report;

3. Incorporate Build Back Better (BBB) principles and disaster risk management (DRM) activities into the recovery and reconstruction efforts proposed; and

4. Enhance the capacity of the government and international agencies to carry out the Human Impact Assessment, Damage and Loss Assessment (DaLA), Needs Assessment, and Recovery Framework within the UN-ECLAC PDNA methodology.

The advantages of undertaking the PDNA are:

1. First, ensure credibility in the final Recovery and Reconstruction assistance that Cambodia will request of the international donor community;

2. Second, institutionalize and spread the use of the PDNA methodology to derive standard, comparable results and to improve the future DRM strategic planning for the country;

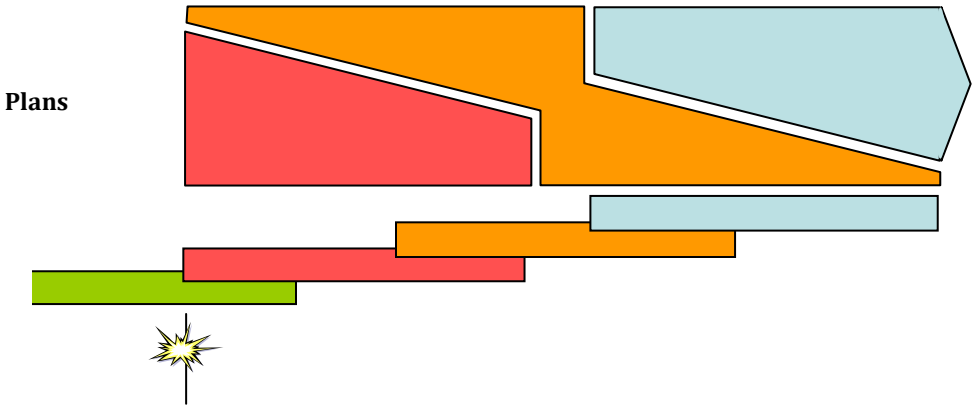
3. Third, provide credible evidence in the requests for recovery grants or loans from development partners; and

4. Fourth, improve accuracy and completeness of the assessment. Past assessments—while likely to have over-estimated damages—have tended to under-estimate economic losses.

2.1.2 Methodology

The Post Disaster Needs Assessment (PDNA) provides a methodology to assess damages and post disaster recovery needs in a way that can provide a framework for the planning of coordinated recovery efforts across different sectors with a risk reduction focus.[9]

Figure 2: PDNA Connecting Emergency Response with Longer-Term Reconstruction and Development



Source: PDNA Team Elaboration (2009).

The approach for this assessment follows the Post Disaster Needs Assessment and Recovery Framework (PDNA/RF) methodology developed jointly by the World Bank, the United Nations Development Program (UNDP), and the European Commission (EC) to complement

[9] From UNDPs Post Disaster Recover Needs Assessment Methodology and Toolkit.

and enhance the Damage and Loss Assessment (DaLA) methodology, which is the backbone of most post disaster analyses. Originally designed by the UN Economic Commission for Latin America and the Caribbean (ECLAC) in the 1970s, the DaLA methodology has been used in post disaster analyses around the world and has been continuously strengthened and refined.

The methodology was used to determine the value of lost assets and the magnitude of losses on economic flows, and to define reconstruction requirements for each sector. See *The Handbook for Estimating the Socio-Economic and Environmental Impact of Disasters*[10] by ECLAC for more information on this methodology, as well as specific sector assessment methodologies recently developed by specialized UN agencies.

The sectors assessed in this report are:

- Infrastructure: Energy, Transport, Water Management and Irrigation, and Water Supply and Sanitation;
- Social: Education, Health, and Housing and Shelter;
- Productive: Agriculture, Livestock, and Fisheries and Industry and Commerce; and
- Cross-Cutting: Environment and Public Administration.

This assessment will analyze three main aspects:

(a) "Damage" (direct impact) refers to the impact on assets, stock (including final goods, goods in process, raw materials, materials, and spare parts), and property valued at agreed replacement (not reconstruction) unit prices. The assessment considers the level of damage (i.e., whether an asset can be rehabilitated or repaired, or has been completely destroyed).

(b) "Loss" (indirect impact) refers to flows that will be affected (e.g., production decline, reduced incomes, and increased expenditures) over the time period until the economy and assets have recovered. These will be quantified at present value. The definition of the time period is critical. If the recovery takes longer than expected, losses might increase significantly.

(c) "Economic and social effects" (sometimes called "secondary impacts") include macro-economic and fiscal impacts; livelihood, employment, and income impacts;

[10] Economic Commission for Latin America and the Caribbean (ECLAC), 2003

and social impacts. The analysis aims to measure the impact of the disaster on such things as economic growth, unemployment, and poverty at the national and sub-national levels.

The assessment of damage and loss provides a basis for determining recovery and reconstruction needs. The assessment of damage provides a basis for estimating reconstruction requirements, while the estimation of loss provides an indication of the reduction or decline in economic activity and in personal and household income arising from disasters. The two estimates are combined to establish overall needs to achieve full recovery of economic activities at the macro-economic level and at the level of individual persons or households.

The conduct of the PDNA involved a number of stages, beginning with the collection of baseline information and data on damage that was provided by the government through different line ministries and offices; the use of other official statistical information; and information collected directly from the affected local government units and communities. The assessment teams reviewed and verified data through special field visits to and surveys in affected areas, and included triangulation and independent verification.

2.2 Summary of Damage and Loss

The total value of damage and loss is almost USD 132 million. Of this total, USD 58 million represents the destruction of physical assets in the affected areas; while almost USD 74 million is estimated losses in production and economic flows. The overall damage and loss estimate includes damage and loss sustained by the entire society, including both public and private sector entities, and cut across all sectors of economic activities.[11]

Of the countries hit by Typhoon Ketsana, the damage and loss figures for Cambodia are lower than those for the Philippines and Vietnam but comparable to Lao PDR (which had similar impacts).

[11] This is the first time that such a comprehensive analysis of the disaster effects has been carried out in Cambodia. For this PDNA exercise, an ambitious list of 15 sectors was originally designed. Due to problems mobilizing the sector teams, insufficient quality analysis or excessive delays in the delivery, Post and Telecom, Cultural Heritage, and Tourism assessments had to be dropped, while Bank and Finance and Gender and Child Protection will be limited to qualitative analysis that will integrate different sections of the report (but will not be included as a separate sector assessment).

Table 4: Summary of Damage and Loss (USD)

Summary of Damage and Losses (DaLA)			
Sector and Subsectors	Disaster Effects, US$		
	Damage	Losses	Total
Infrastructure	**17.259.051**	**11.487.577**	**28.746.628**
Transport	14.388.832	11.076.698	25.465.530
Water Supply and Sanitation	64.339	392.689	457.028
Water Management and Irrigation	2.779.000	13.000	2.792.000
Energy	26.880	5.190	32.070
Social Sectors	**39.548.563**	**3.333.813**	**42.882.376**
Housing and Shelter	15.281.952	3.294.398	18.576.350
Health	57.072	39.415	96.487
Education	24.209.539	-	24.209.539
Productive Sectors	**1.051.124**	**59.008.162**	**60.059.286**
Agriculture, Livestock and Fisheries	91.270	56.420.846	56.512.116
Industry & Commerce	959.854	2.587.316	3.547.170
Cross-Cutting Sector	**205.358**	**102.767**	**308.125**
Environment	31.073	98.367	129.440
Public Administration	174.285	4.400	178.685
TOTAL	**58.064.096**	**73.932.319**	**131.996.415**

Source: PDNA Team Elaboration (2009).

Loss exceeds Damage…and will last longer. Damage represents only 44 percent of the total economic impact of Typhoon Ketsana, while the rest (almost two thirds) is loss. Economic loss represents indirect impact in terms of reduced income, increased operational costs, or extraordinary expenses that had to be faced after the disaster. While the destruction or damage to assets occurred at the time or in the aftermath of the storm, the indirect impact on daily activities unfortunately lasted well beyond it. In some cases, these losses are still being incurred and will go on until the specific damaged assets are fully repaired and/or restored. This is one of the reasons why the speed and efficiency of the post disaster recovery and reconstruction activities are critical.

Almost half of the total damage and loss across all sectors occurred in agriculture, livestock, and fisheries, 43% representing USD 56.5 million. This high damage and loss estimate is due to the substantial loss suffered as the storm and floods ruined or damaged vast extensions of rice paddies close to the harvest. Of all the possible agricultural losses, destruction of crops near to harvest is the most devastating, as it means a complete loss of the crop value once all costs (e.g., upfront investment, labor, and opportunity costs) have already been incurred. Besides the strict economic value of the rice, its specific importance as the backbone of the local economy and especially of rural livelihoods (rice is the staple of the

diet and the typical exchange commodity in rural areas) makes this sector impact critical to human development and the social conditions of the affected population. Moreover, the agricultural sector was already under stress due to the recent food price crisis and the global financial crisis. The combined effect of previous stresses and the impact of the natural disaster have the potential for long-ranging negative impacts, including food security havoc in the most affected areas.

Transport, Education, and Housing were also severely impacted. The road network was damaged in 18 provinces. The rural laterite roads, given their vulnerability, were particularly hard hit. Repairing the most critically damaged segments is crucial to restoring access to services in the most isolated areas. The total impact on the Transport sector is estimated at USD 25.5 million, almost 20 percent of the total damage and loss. In the Education sector, a total of 138 schools were completely destroyed and almost 1,200 were damaged (12 percent of the country's schools), with estimated damage and loss figures almost as big as Transport (USD 24 million). Finally, the Housing sector incurred high damage and loss. With USD 18.5 million (less than 15 percent of the total DaLA), its economic impact is large. But again, besides the raw numbers, its direct impact in terms of displaced people, homeless families, and whole villages that have to be relocated or that are living in very temporary shelter solutions, and in general its importance to restoring people's livelihood in the short term makes it even more critical.

Water Management and Irrigation, Water Supply and Sanitation, and Industry and Commerce are still relevant. The importance of water management for the economic and social development of the country, and its close relationship to flood protection and agricultural production, make the damage and loss calculated for this sector (USD 2.8 million), being of a smaller order of magnitude, still very relevant. Similarly, Industry and Commerce should be taken into account as the vast majority of its USD 3.5 million impact comes from damage and loss in the agro-industry. Finally, the importance of Water Supply and Sanitation is much smaller (roughly USD 0.5 million), though still significant.

Energy, Health, Environment, and Public Administration impacts are small. The damage resulting from the typhoon and the economic impact on these sectors are almost negligible when compared to the above sectors (Public Administration, being the largest, accounts only for 0.13 % of the total DaLA). Yet, analysis has exposed significant vulnerabilities and hopefully will provide useful recommendations to improve resilience of these sectors to future disasters.

2.3 Infrastructure Sector

2.3.1 Transport

Introduction

Cambodia's Transport sector comprises roads, railways, inland water transport, international sea traffic through the ports in Preah Sihanouk and Phnom Penh, and domestic and international air traffic centered on Cambodia's two international airports in Phnom Penh and Siem Reap. Much of the country's original transport infrastructure was destroyed or substantially degraded by decades of war.

The road network is composed of arterial roads that are managed by the Ministry of Public Works and Transport (MPTW) and rural roads managed by the Ministry of Rural Development (MRD). In terms of sheer kilometers, there are 2,117 kilometers of single digit and 3,146 kilometers of double-digit national roads, 6,441 kilometers of provincial roads, and 28,000 kilometers of rural roads.

As the main conduit to socio-economic opportunities for the rural populace, the tangible effects are of a large magnitude. In brief, a vibrant transport sector is essential to both economic growth and the poverty reduction objectives. The government and development partners had made substantial effort to improve road access before many of these arteries were damaged or destroyed by Typhoon Ketsana.

Table 5: Road Classification and Management Responsibilities

Road Classification	Length (Rate)		Number of Bridges (Length)	Management Authority
Single-Digit National Roads	2,117.0 km	5.3%	589 (17,643m)	MPWT
Double-Digit National Roads	3,145.6km	7.9%	698 (15,710m)	
Provincial Roads	6,441.0km	16.2%	904 (16,309m)	
Rural Roads	28,000km	70.5%	N/A	MRD
Total Length	39,703.6km	100.0%	2,445 (58,340m) 1764 Culverts	

Source: MPTW and MRD (2009).

Disaster Impact on Transport

The transport sector in Cambodia suffered both direct and indirect damages, not only to the roads but also to drainage structures and other connecting infrastructure like bridges and culverts.

Table 6: Physical Damages to Transport Sector

Road Classification	Length (km)	Damage Length (km)	Percentage of Damage
Urban and National Roads	5,262.0	48.5	0.92%
Provincial Roads	6,441.0	38.2	0.59%
Rural Roads	28,000.0	543	1.94%

Source: Source: MPTW and MRD (2009).

Rural Road Damaged by Ketsana

Temporary Toll Wooden Pass after Ketsana

PR 2620 Flooded during Ketsana

PR 2620 Damage after Ketsana

As reported by the local population and authorities, the floods submerged and destroyed whole sections of the roads. Heavy transport and other vehicles, nevertheless, caused additional damage due to the poor quality of the foundations and sub-grades and their exposure to prolonged wet conditions. Water erosion also proved most embankments and slopes to be inadequately compacted In addition, the drainage system was non-existent or inadequate in several sections of the low-lying roads.

Proximity to tributaries—rivers, streams, and water basins—was also a factor. Secondary roads of all levels (i.e., national, provincial, and rural) and bridges suffered major damage. Minor damage to other roads occurred primarily because of flooding, fallen trees, construction materials (soil), and poor standards in road design.

The calculation of damage is based on a field visit to the affected provinces, with severe and moderate damage based on the preliminary assessment done by the MPTW and MRD. Damage in other provinces is based on the MPTW and MRD reported damage length for both fully and partially damaged sections. To calculate the cost of direct damage, the types of damage were separated and multiplied by the unit cost per kilometer of road, linear meter of bridge, or cell of pipe/box culvert and weighted against whether it had to be reconstructed, repaired, or maintained. Total direct damage to the transport sector is estimated at USD 14.39 million.

Loss was mainly incurred in the form of higher vehicle operating costs (VOC) and longer freight and passenger travel times associated with the worsened road conditions on key urban, national, provincial, and rural roads. The use of temporary means (e.g., boats, *koyun*, and longer alternative road routes) and urgent repairs with low standards of construction and materials in order to accommodate the temporary traffic exacerbated loss. The higher volume of traffic is expected to continue for an extended period of time during the recovery. The increase in VOC due to the detrimental roads has resulted in faster depreciation of vehicles and higher fuel consumption, thus creating greater demand for imports. If loss of roads is correlated to the volume of traffic, rural roads pale in comparison to urban, national, and provincial ones. Most of rural road users, however, have no choice besides using the damaged rural roads with higher vehicle operating costs.

The calculation of the losses is sophisticated due to the lack of traffic data, which is the most important factor. The assumption is based on previous studies and also on a survey distributed to commune chiefs, villagers, and road users. By considering the annual traffic growth at 10 and 5 percent on each road, respectively, with and without the disaster, the total indirect damage (loss) to the transport sector is estimated at USD 11.08 million. This amount is also based on the assumption that it would take six to eight months to restore the affected roads to their condition prior to the typhoon and flooding.

Damages and loss to the transport sector varied relative to road classification and traffic volumes. Siem Reap Province was the most severely damaged, followed by Ratanak Kiri, Battambang, Banteay Meanchey, and Preah Vihear.

Table 7: Summary of Effects of Typhoon Ketsana on Transport Sector

No	Province Name	Damage Length (km)	Damages (USD)	Losses (USD)	Total (USD)
1	Kampong Thom	58.90	945,595.80	1,171,821.46	2,117,417.26
2	Battambang	34.70	1,392,491.29	1,085,385.27	2,477,876.56
3	Kampot	8.21	473,973.00	729,316.42	1,203,289.42
4	Kep	11.90	464,000.00	307,070.78	771,070.78
5	Kratie	11.60	326,000.00	234,790.20	560,790.20
6	Stung Treng	14.98	407,320.00	292,529.40	699,849.40
7	Ratanak Kiri	75.40	1,704,127.46	551,633.38	2,255,760.84
8	Oddar Meanchey	25.71	456,310.59	771,101.96	1,227,412.55
9	Banteay Meanchey	65.11	1,369,749.43	612,460.78	1,982,210.21
10	Kampong Cham	12.14	463,477.73	1,075,706.43	1,539,184.16
11	Pailin	27.00	405,200.00	203,616.58	608,816.58
12	Mondul Kiri	32.50	937,600.00	257,095.10	1,194,695.10
13	Siem Reap	183.74	3,448,567.60	2,955,944.17	6,404,511.77
14	Kampong Chhnang	36.25	367,458.75	65,403.07	432,861.82
15	Preah Vihear	30.60	1,204,337.23	525,493.86	1,729,831.09
16	Kandal	0.70	11,682.80	114,455.38	126,138.17

17	Koh Kong	0.25	4,960.00	70,688.87	75,648.87
18	Preah Sihanouk	0.08	5,980.24	35,344.44	41,324.68
TOTAL		**629.77**	**14,388,831.91**	**11,076,698.15**	**25,465,530.06**

Source: PDNA Team Elaboration (2009).

Recovery Framework for Transport

Across all levels of government and types of transport that is, roads, railways, inland water transport, ports and main airports, significant progress needs to be made in the restoration and rehabilitation of the physical infrastructure in order to ensure a transportation network connecting all parts of the country, as well as with neighboring countries. High priority should also be given to ensuring that the transportation network is properly maintained, and to encouraging and promoting the participation of the private sector in operations and maintenance. The specific standards of road construction and maintenance, which are even more important for flooded zones, should also be developed and properly implemented.

In order to provide emergency response, 7 urban, 7 national, 6 provincial, and 34 rural roads had to be repaired immediately. The candidate roads were selected based on the priorities of the ministries and the degree of economic return (or, conversely, loss) to the economy.

In addition, the medium-term recovery should address the extant roads while long-term activities should include synthetically upgrading the existing structure of low-level roads by raising them 0.5meters, adding a crushed stone base course, and integrating drainage structures every 300meters for the flooded areas.

The addition of a crushed stone base is a prerequisite for the long-term rehabilitation; it enables the follow-on application of Asphalt Concrete (AC) for urban, national, and provincial roads; and the Double Bitumen Surface Treatment (DBST) for rural roads, in alignment with the government policy for the next 5-10 years. Since the current standard slope of roads is 1:2 or less, which was a factor in the instability and rapid damage of the whole network, the consideration of applying a 1:3 slope should be taken into account.

Table 8: Recovery Needs for Transport Sector In the Short, Medium, and Long Term (USD)

Type of Road	Short Term (0-6 Months)	Medium Term (1-3 Years)	Long Term (3-5 Years)	Total per Road Type

Urban	563,797.85	346,912.25	0.00	**910,710.10**
National	621,679.61	163,943.46	15,496,500.00	**16,282,123.07**
Provincial	135,728.69	1,071,290.06	13,366,750.00	**14,573,768.74**
Rural	3,803,000.00	7,682,480.00	47,497,261.00	**58,982,741.00**
TOTAL	**5,124,206.15**	**9,264,625.76**	**76,360,511.00**	**90,749,342.91**

Source: PDNA Team Elaboration (2009).

2.3.2 Water Supply and Sanitation

Introduction

Rural Water Supply and Sanitation

The data generated by the Cambodian Millennium Development Goals (CMDG) progress report indicates that 61 percent of the rural population has access to rural water supply, and 19 percent to rural sanitation. According to the 2004 Cambodia Socio-Economic Survey (CSES) and the 2004 Cambodia Inter-Census Population Survey (CIPS), a number of the provinces have been found to have "good if not very good" coverage for rural water supplies: Svay Rieng (93 percent) Prey Veng (92 percent), Takev (74 percent), and Kampong Cham (70 percent). A number of other provinces (Kandal (66 percent), Kampong Speu (68 percent), and Kampot (61 percent)) are "doing well". Provinces with lower levels of coverage (up to 2004) were Kampong Chhnang (56 percent), Kratie (56 percent), and in particular Stung Treng (33 percent). At the same time, Prey Veng (6.8 percent), Kampong Chhnang (7.7 percent), and Kampong Speu (8.5 percent) have the lowest levels of access to sanitation. Moving toward the CMDG targets is obviously a significant challenge.

Qualifying the progress of access to improved water and sanitation is heavily dependent on the definitions used and agreed upon by various institutions and organizations.[12] It is evident and has been highlighted by Levisay and Chea (2006)[13], that different major surveys/studies in Cambodia have used different definitions (National Census (1998),

[12] UNICEF/WHO Joint Monitoring Program definitions: http//www.wssinfo.org/en/122_definitions.html.

[13] Levisay and Chea. 2006. Cambodia Rural Water Supply Coverage Analysis Project Report, Water and Sanitation Program/MRD. http//www.wsp.org/UserFiles/file/212007120531_cambodia.pdf.

Cambodia Inter-Census Population Survey (CIPS) 2004, and Cambodia Socio-Economic Survey 2004 (CSES)), resulting in a variance in the generated data. "It is worth noting that, while an internationally accepted definition (based on access to improved water supply which provides at least 20 liters per day per person, (which) is not further than 1,000 meters away) is being used elsewhere, this is not applied in Cambodia".[14] However, the Asian Development Bank has quoted the following definition of access to improved water supply in Cambodia, which seems to be based on the former Seila/MoP criteria (and still in use as an indicator in the commune database): "Improved water is defined by the government as reasonable access (within 150 meters throughout the year) to household connections, public standpipes, boreholes, protected dug wells, protected springs, or rainwater collection (system)."[15]

Urban Water Supply and Sanitation

Currently, whether the urban water supply can reach the Cambodia Millennium Development Goals(CMDG) target or not is still in question. It is noted that although the recent estimation for the CMDG showed that access to safe water in urban areas in 2008 was 71.6 percent, the reported actual implementation of provision of piped water to the urban population was only 52 percent.[16]

There are currently 103 water utilities across Cambodia, including both private and public utilities. Among those, two entities are autonomous, 14 entities are under direct supervision by the Ministry of Industry, Mines, and Energy (MIME), and 87 utilities are located in urban areas.

The Royal Government of Cambodia (RGC) set up the policy to encourage private-sector participation in the urban water supply sector. As a result, the private sector could provide piped water to 21 percent of the total population served in the country, which is 1,338,174 people; yet, privatized provision is still very limited. The majority of urban water supply is

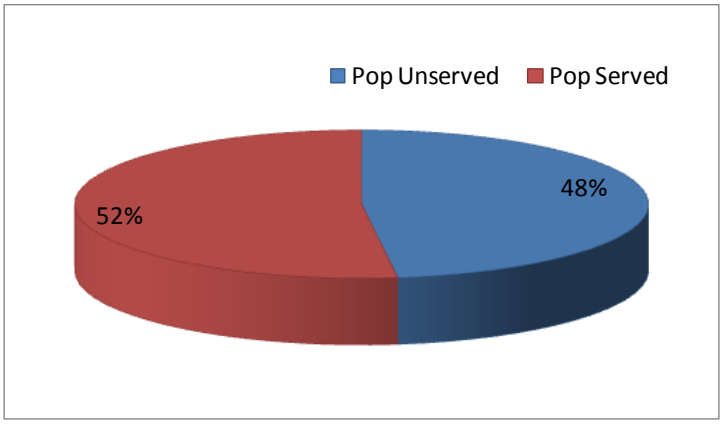
[14] Levisay and Chea.

[15] Asian Development Bank, July 2008. Kingdom of Cambodia: Preparing the Second Rural Water Supply and Sanitation Sector Project, Technical Assistance Report.

[16] Department of Potable Water, Ministry of Industry, Mines, and Energy.

still provided by public utilities, estimated to reach 1,057,157 people. Among those, 83.3 percent (880,056 people) are under the service of the Phnom Penh Water Supply Authority.

Figure 3: Population Served by Clean Water in Urban Areas



Total urban pop: 2,614,440

Pop served: 1,338,174

Source: Department of Potable Water Supply (2009).

Among the affected provinces, the coverage of water supply prior to the typhoon was: Siem Reap 14 percent, Kampong Cham 28 percent, Kampong Thom 63 percent, Kratie 28 percent, Stung Treng 42 percent, Ratanak Kiri 14 percent, and Preah Vihear 13 percent. The coverage seems to be difficult to expand because of the high cost of distribution networks and facilities (e.g., treatment plants) and the pro-poor tariff setting. The expansion of both treatment plants and pipe distribution relies predominately on loans and grants from external development partners.

Disaster Impact on Water Supply and Sanitation

In late September, 14 provinces reported that their water supply and sanitation systems were, to varying degrees, affected by Typhoon Ketsana.. The level of impact, however, varied throughout the affected provinces. It was reported that the three provinces—namely, Kampong Thom, Stung Treng, and Kratie—were severely affected, while the level of impact varied from slight to moderate in the other provinces.

In all affected provinces, the water supply and sanitation sector was predominantly affected by floodwaters brought by the typhoon. The magnitude of damage and loss to the sector was not too severe. In the urban water supply system, the flood caused a short disruption of water supply in the affected areas due mainly to pipe network or intake structure damage leading to temporary closure. The revenue of most water utilities experienced a decline in the months following the disaster because of the short-term disruption of operations and the misreading of water meters that were submerged in floodwaters. A total number of 16 utilities (8 public and 8 private) were affected by Typhoon Ketsana. Many suffered minor damage and loss.

In rural areas, it was observed that the typhoon caused little damage to the structures of the rural water supply and sanitation systems in the affected areas; flooding being the main effect of the typhoon on the water supply and sanitation facilities. The only damage that was seen to be caused by the typhoon was the soil subsidence of soil below the well platforms submerged in floodwaters. This led to cracks in the platforms, making the wells more vulnerable to the pollution of surface runoff. This damage, however, cannot solely be attributed to Typhoon Ketsana: Poor construction quality and design as well as poor maintenance of the system also played a large role.

Although the damages to the physical assets of rural water and sanitation system were not significant, floodwaters overwhelmingly inundated a large number of wells (800) and latrines (1,600) in the affected communities causing fecal contamination to the drinking water sources. The contamination put the public health of the communities at risk of diarrhea and other water-related diseases, especially for communities that relied on wells and surface water as the main drinking water source.

More importantly, the restricted access to sanitation in the affected areas exacerbated the pollution in the water source during the flood. Feces that had been disposed indiscriminately in fields contributed significantly to the contamination of water sources. It was also observed that women and children were the most vulnerable. as flooded toilets

prompted women to go far from home to defecate, and mainly at night for the sake of privacy. Children played and swam in the floodwaters, exposing them to the risk of water-borne diseases that have potential long-term growth and even survival affects.

As per the Damage and Loss Assessment (DaLA) methodology developed by United Nations Economic Commission for Latin America and the Caribbean (ECLAC), the total damage to water supply and sanitation caused by Typhoon Ketsana was USD 0.06 million, where USD 0.05 million incurs to urban water supply, and USD 0.01 million to rural.

The water supply sector incurred most of the damage, with damage to rural sanitation being negligible. For water supply utilities, the estimation of damage was relatively simple to ascertain. It was based on the observations of and the reporting by the utilities on the level of damage. For rural water supply, however, various assumptions based on field observations were required (e.g., the cracked or damaged well platforms). In addition, the level of damage was weighted for different provinces according to the severity of the reported damages.

Damage to urban sanitation (waste water and solid waste) was not assessed in detail by the assessment team. However, it was reported that Siem Reap (148,000 citizens) was the only major urban area (more than 40,000 inhabitants) affected by Typhoon Ketsana. Several areas were completely flooded for up to one week, with roads blocked and municipal services disrupted. The brown water was mixed with the flood and was likely to have impacted people downstream who use the river water for all domestic needs.

The substantial portion of the typhoon's impact on the water supply and sanitation sector was the indirect economic loss to water supply. It is estimated that the economic loss in the water supply and sanitation sector totaled USD 0.39 million, of which USD 0.06 million was a loss in revenue for the water supply utilities, and USD 0.33 million was the loss for cleaning and disinfecting contaminated wells.

To date, however, none of the contaminated wells have been cleaned and disinfected. People have continued to use the water in the wells for drinking purposes despite the poor quality. The estimation of economic loss in the water supply sector was mainly made based on the reported revenue by utilities (for piped water supply system), and the estimated cost for cleaning and disinfecting wells including other related costs (e.g., rural water supply).

As for rural sanitation, although the data on affected latrines in rural communities was also reported by the PDRD, there was no concrete evidence showing damage to the physical assets of rural sanitation facilities. The only observation that was made was that some latrines were flooded during the typhoon, which caused disruption to latrine operations. The assessment team therefore concluded that the physical damage and economic loss in rural sanitation due to Typhoon Ketsana was minimal or negligible.

The results of the assessment show that the overall impact of Typhoon Ketsana on WSS was relatively contained in strict economic terms. The impact of Typhoon Ketsana, in comparison to the "normal" annual flooding in the assessed/affected areas and the natural resilience that rural population tends to have to this kind of disasters is reflected in the assessment figures.

From the rural water supply and sanitation (WSS) perspective, the provinces that were affected most severely are Kampong Thom, Siem Reap, and Kratie. The less-affected provinces were Battambang, Mondul Kiri, Pailin, and Kep. From the urban WSS perspective, the provinces affected most severely were Kampong Thom, Siem Reap, and Kampong Cham while Ratanak Kiri, Stung Treng, Kratie, and Preah Vihear were the least affected.

Table 9: Damage and Loss in Water and Sanitation Sector (USD million)

Sub-Sector Component	Disaster Effects			Ownership	
	Damage	Loss	Total	Public	Private
Urban Water Supply	0.05	0.06	0.11	0.10	0.01
Rural Water	0.01	0.33	0.34	0.34	-
Rural Sanitation	-	-	-	-	-
Total	**0.06**	**0.39**	**0.46**	**0.44**	**0.01**

Source: PDNA Team Elaboration (2009).

Recovery Framework for Water Supply and Sanitation

The Recovery Strategy for Water Supply and Sanitation (WSS) in the affected areas is based on strategic considerations linked with the national development objectives for Cambodia, for example the National Strategy for Rural Water Supply and Sanitation. The construction design standards of WSS facilities and other response mechanisms require urgent attention (e.g., disaster preparedness building (early warning and response mechanism) at all governmental levels).

The long-term recovery program and the reconstruction needs for urban water supply systems do not take into account future expansion of supply. At this stage,

consideration has been given to more robust intake structures (e.g., taking into consideration climate change effects).

Actions and their resulting outputs for the WSS recovery should focus on the following activities:

Medium Term (2 years)

- Damage to urban water supply should be repaired to ensure that customers continue to have access to safe water;
- All contaminated wells need to be cleaned up as soon as possible. Priority should be given to hand-dug wells as they are more likely to be contaminated than tube wells; and
- Severely affected areas should be given priority: Kampong Thom, Kratie, Siem Reap, and Kampong Cham.

Long Term (5 years)

- Quality reconstruction needs to be in place for all piped water systems to minimize future damage by disaster;
- Major structural damages to the rural water supply need to be repaired;
- Rural water supply system (mainly wells) needs to be improved to prevent, as much as possible, floodwater entering the water source;
- New construction of the water supply system needs to be of quality, including systems built by communities;
- Sanitation and hygiene promotion needs to be in place in the affected communities to make people understand possible fecal contamination of the water source due to flooded toilets or open defecation;
- A new latrine design should be available at low cost in the flood-prone areas to reduce the risk of fecal contamination in floodwaters; and
- Provincial governments such as the PDRD should have the capacity to cope with disasters, and should be equipped with equipment that would allow them to clean contaminated water in the immediate aftermath of a disaster.

Table 10: Recovery and Reconstruction Needs Assessment In Water and Sanitation Sector (USDmillion)

Sub-Sector	Medium Term	Long Term
Urban Water Supply System	0.15	1.25
Rural Water Supply	0.35	1.25
Rural Sanitation	-	1.50
Preparedness Program and Capacity Building	-	0.25
Total	0.5	4.25

Source: PDNA Team Elaboration (2009).

The long-term recovery outcomes of the project are directly related to the recommendations made in the Capacity and Recovery Consideration Sections.

The Monitoring and Evaluation indicators/benchmarks are to be developed (e.g., improvement of water points, hygiene education sessions, health improvement indicators, and effectiveness of preparedness program) for all stages of implementation activities.

2.3.3 Water Management and Irrigation

Introduction

The importance of water in the economic development of Cambodia is clearly indicated by the contribution of agriculture to the national gross domestic product (GDP). In 2004, agriculture contributed 32.9 percent to the total GDP at current prices. The water sector is also important to the social development of the country, as about 82 percent of the Cambodian population (2005 figure) lives in rural areas and most of them depend on agriculture. Consequently, the Royal Government of Cambodia (RGC) emphasizes efficient water resources management, especially irrigation and agricultural development, which are core strategies for reducing rural poverty and enhancing food security—the two development problems that rank higher in the national development agenda. Despite the impressive economic performance of the past five years, poverty levels in Cambodia are still high (about 34.7 percent of the population in 2004), particularly in rural areas, which account for 90 percent of the poor.

Management of the water sector is still in an early stage of development: Sector and sub-sector performance indicators have not yet been established for monitoring and evaluating, particularly in the irrigation. The National Strategic Development Plan 2006–2010 (NSDP) and the Asian Development Bank's Country Strategy and Program 2005–2009 have established broad performance indicators applicable to the water sector, including: (i) areas under irrigation, (ii) economic losses from floods and droughts, (iii) sustainability of irrigation schemes, (iv) progress in the development of policy and an institutional framework, and (v) progress in the development of an information management system.

Disaster Impact on Water Management and Irrigation

Water management and irrigation systems in 11 provinces were reported to be affected by Typhoon Ketsana in late September. The level of impact was not the same throughout the affected provinces. The reports from MoWRAM show that Kampong Thom and Kampong Cham were the most severely affected provinces, while the level of impact varied from slight to moderate in other provinces.

Most of the information required for estimating damage and loss in the water management and irrigation sector was provided by the Provincial Department of Water Resources and Meteorology (PDoWRAM).

Water Management

According to Kampong Cham PDoWRAM damage reports, two flood protection dikes were affected by Typhoon Ketsana. Prior to the typhoon, the Tomnup Thma Koul Dike protected the Kampong Cham Town area from high water levels of the Mekong River. Typhoon Ketsana affected this dike causing 170 meters of weakened slopes to slide into the Mekong River. The Tomnup Phdav Chum Dike protected the rural residents in six communes and 3,319 hectares of wet season rice fields in Kampong Cham Province from the Mekong's high waters. According to the site visit, the extent of damage varied widely, ranging from insignificant to significant erosion of bank slopes and the presence of big rate holes in the middle of the dike.

Irrigation

According to PDoWRAMs damage report, up to 75 irrigation systems in four provinces were hit by Typhoon Ketsana. The extent of damage varied from moderate to heavy. Most of the structures were not damaged, often only the stone pitching for the protection of the canal bed downstream of the structure were swept away by the high-velocity water flow. In other cases, the stone masonry protecting canal bank slopes crumbled under the erosion of the downstream bank slope. Three irrigation systems in Kampong Thom Province were visited

between November 15 and 19, 2009), namely: Tomnup 30 Kanha, Tomnup Roluos, and Doun Pov Canals. They were all repaired by Kampong Thom PDoWRAM.

Effects

The direct damage cost to water management and irrigation was estimated at USD 2.779 million. Indirect loss, which involves farm water use (only dry season rice) and selling fish from the reservoir, was estimated at USD 0.013 million. Total damage and loss thus reached USD 2.792 million. A detailed estimate for each province is shown in Tables 11-14.

Table 11: Summary of Damage and Loss in Water Management and Irrigation Sector (USD million)

Item	Total Damage	Direct Damage	Indirect Damage
Total	2.792	2.779	0.013
Water Management	1.100	1.100	
Irrigation	1.692	1.679	0.013

Source: PDNA Team Elaboration (2009).

Recovery Framework for Water Management and Irrigation

Actions for the water management and irrigation recovery should focus on the following activities:

Short Term (0-6 months)

- Repair the most damaged water management and irrigation schemes to ensure that they can protect the urban and rural residents, and that the farmers can continue to get water for the rice fields, with priority to the most damaged areas (e.g., Kampong Thom and Kampong Cham Provinces).

Medium Term (2 years)

- Rehabilitate and upgrade all affected water management and irrigation schemes, and improve and strengthen the reservoir/storage area capacity; and
- Develop a water management strategy to reduce flooding and droughts.

Long Term (5 years)

- Quality reconstruction needs to be in place for all headwork, distribution systems, and drainage systems to minimize future damages by a disaster;
- New construction needs to ensure good standards; and
- Provincial Departments of Water Resources and Meteorology should reinforce their capacity to cope with disasters (in particular the newly established departments).

Table 12: Recovery and Reconstruction Needs Assessment For Water Management and Irrigation (USD million)

Sub-Sector	Short Term	Medium Term	Long Term
Water Management		1.100	1.500
Irrigation	1.690	1.692	1.500
Capacity Building			0.500
Total	1.690	2.792	3.500

Source: PDNA Team Elaboration (2009).

2.3.4 Energy

Introduction

Cambodia has one of the lowest electrification rates in Asia with 17.2 percent of its population of 13.4 million[17] connected to a power supply. Most of the electrification is concentrated in Phnom Penh and a few cities, while outside the provincial towns, power supply is rare and meager. Only about 6 percent of rural households have access to electricity, and another 3 percent own some type of individual power-generating unit. About 91 percent of rural households in Cambodia do not have access to electricity.

Electricity power consumption per capita in 2008[18] was about 88 kWh per year, the lowest in the region. The four neighboring countries have a higher consumption rate: Thailand (1,984.3 kWh), Vietnam (597.7 kWh), Lao PDR (254 kWh), and even Myanmar (92 kWh). In

[17] Provisional figures of 2008 census.

[18] World Bank Data Finder. International Energy Agency, Energy Statistics and Balances of Non-OECD Countries and Energy Statistics of OECD Countries.

contrast, electricity tariffs are among the highest in the world, ranging from US cents 9 to 23 per kWh in Phnom Penh to US cents 20–USD 1 per kWh in rural areas. There is no national grid, and towns are supplied by isolated systems. Table 13 shows the Cambodia's installed capacity and the energy supplied in 2008.

Table 13: Electricity Sector at a Glance

Description	2008	%
Energy Capacity (MW)	384.60	22.33
Energy Generated (GWh)	1,484.1	80
Energy Imported from Thailand (GWh)	274.1	15
Energy Imported from Vietnam (GWh)	100.1	5
Total Energy Available (GWh)	1,858.4	100
Overall Loss (%)	10.44[19]	
Energy Sold to Last Consumer (GWh)	1,664.4	
Number of Registered Consumers	487,426	

Note: *Overall losses of 10.4 percent are lower than expected for Cambodia due mainly to a short volume of HV and MV transmission, as most of the energy is generated and used in the Phnom Penh area. Technical losses in rural areas are estimated at 30 percent.

Source: Report on the Power Sector of Cambodia, EAC (2009).

As this overview shows, electricity is a nascent sector in Cambodia. In particular, across the eight provinces affected by Typhoon Ketsana, namely Kampong Cham, Kampong Thom, Siem Reap, Kratie, Ratanak Kiri, Stung Treng, Oddar Meanchey, and Preah Vihear, the

[19] Overall losses of 10.4 percent are lower than expected for Cambodia due mainly to a short volume of HV and MV transmission, as most of the energy is generated and used in the Phnom Penh area. Technical losses in rural areas are estimated in a 30 percent.

capacity installed and energy sold to consumers account only for 11 percent of the national total.

Table 14: Description of Electricity Sector in Affected Provinces

Province	Number of Consumers	Number of Licensees	Installed Capacity MW	Energy Imported GWh	Energy Generated GWh	Energy Sold to Consumers GWh
Kampong Cham	31,577	25	18.6	27.6	24.5	44.8
Kampong Thom	9,013	9	3.2	0.0	4.6	3.6
Kratie	6,418	5	2.1	1.9	4.4	5.0
Preah Vihear	2,699	4	1.7	0.0	1.4	1.1
Ratanak Kiri	2,667	2	2.0	0.0	5.8	5.0
Siem Reap	23,289	15	12.0	0.0	1.4	117.6
Stung Treng	2,423	2	1.7	0.0	3.5	3.1
Oddar Meanchey	3,387	3	0.7	10.5	0.5	10.5
Affected Provinces Subtotal	**81,473**	**65**	**42.0**	**190.6**	**46.0**	**40.0**
Affected Provinces v. Country	17%	27%	11%	11%	3%	11%
Country Total	**487,426**	**236**	**384.6**	**1,664.4**	**1,484.1**	**374.3**

Source: Report on the Power Sector of Cambodia, EAC (2009).

Following the baseline conditions shown in the table above, more than a quarter of the total number of licensees (27 percent) supply energy to only 17 percent of the registered customers who live in the affected provinces, representing only 11 percent of the total energy consumption. From Table 14it could be inferred that the size of the licensed grids operated in the affected provinces is smaller than in the rest of the country. This is not totally true. In reality, the size of the grids in rural and provincial areas are similar in size, while the grid for the greater metropolitan area of the capital accounts for half of the consumers in the country, and about 70 percent of the installed capacity and the energy

consumed. The baseline status of the electrical infrastructure in the affected provinces is shown in detail in Annex 1.

Disaster Impact on Energy

The impact of the Ketsana disaster on the electricity sector is considered as very low. Following the results obtained during the field survey, only 8.6 percent of the consumers were affected with some cut of supply, while the impact on electricity suppliers was estimated at just USD 32,070. Given the low rate of electrification, averaging 9.6 percent in these eight provinces, only a 0.8 percent of their population was affected by damages to their power supply. **Table 15**summarizes the percentages of customers, consumption rates, and total population impacted across the affected areas.

Table 15: Impact of Disaster on Energy Sector in Affected Areas (%)

	Number of Customers	Capacity (KVA)	Average Supply (kWh/Day)	Electrification Rate	Population Affected
Affected v. Baseline	8.6	8.2	2.1	9.6	0.8

Source: Report on the Power Sector of Cambodia, EAC (2009).

The results show an almost negligible impact on infrastructure. The most affected facilities had very weak resilience and failed to follow building standards. Only 10 electricity suppliers reported some damage and/or loss with a total DaLA of about USD 32,000. Damage was calculated using actual reconstruction costs incurred by the Rural Electrification Enterprises (REEs). Those costs were contrasted with the average respective market price in the country. The general opinion of the suppliers that were interviewed was that Typhoon Ketsana was not very different from other storms during the wet season. *Electricité du Cambodge* (EDC) did not report officially any damage or loss.

Losses were calculated using average monthly consumption before Typhoon Ketsana, and the tariff of each particular supplier (every licensee sets its own sales tariff). Another factor considered was the Incremental Operating Costs after the disaster. For instance, in the case of the damaged dam at the micro-hydro plant, the supplier had to rent a diesel generator to maintain supply, incurring very high operating costs. On the other hand, some suppliers reduced their costs, because the damaged supply meant an overall reduction in the diesel used and, therefore, in the usual operating costs.

In the case of the assessment demand was considered as a constant, since no variation was measured. The suppliers interviewed did not report any change on the client demand side. Damage and loss are detailed in **Error! Reference source not found.**.

Table 16: Damage and Loss in Energy Sector

System Description	
Capacity (KVA)	3,479
Number of Customers	7,036
Damage to Assets	
Generator/Power Plants	1 Micro Hydro Dam
Length of Lines (M)	2,240
Number of Poles (Wood)	49
Number of Meters	53
Number of Meter Boxes	20
Number of Transformers	1
Costs On Assets (USD)	
Generator/Power Plants	10,000
Cost of Lines	2,500
Cost of Poles	1,478
Cost f Meters and Meter Boxes	3,103

Recovery Framework for Energy

The electrical infrastructure, after only two months, has been restored to pre-Ketsana levels. However, needs have been identified for better protecting the rural communities against from a similar disaster, and they are detailed below for the short, medium, and long term.

Cost of Transformers	9,800
Total Cost of Damages (USD)	**26,880**
Operation Losses	
Estimated Revenue Losses (USD)	5,430
Total IOC (USD)	-240
Total Losses (USD)	**5,190**
Total Cost of Damages and Losses (USD)	**32,070**

Source: Report on the Power Sector of Cambodia, EAC (2009).

Short Term (0-6 months)

- Rapid restoration of power supply in the affected areas. At the moment, the supply has been totally restored in the eight affected provinces, with the exception of the reconstruction of a 60 kVA micro-hydro plant dam presently using a rented diesel generator to supplying energy. The owner will assume all costs of reconstruction;
- Clarify responsibilities and accountabilities among line ministries–NCDM, MIME, and the corresponding provincial departments, Electricity Authority of Cambodia (EAC) and *Electricité du Cambodge* EDC. The Disaster Risk Management section could undertake this task; and
- Design an Energy Sector Post Disaster Action Plan that would be followed by responsible agencies as well as public and private suppliers and that would include emergency procedures and post disaster recovery actions.

Medium Term (2 years)

- Train REEs in technical standards and increase their awareness of risks and vulnerabilities; and
- Institutional capacity building for MIME and EAC's officers, as well as for EDC staff in regard to the Energy Sector Post Disaster Action Plan, including workshops and disaster drills, both at the national and province levels, and always in coordination with NCDM.

Long Term (5 years)

Given an estimated growth in demand averaging 30 percent a year for the next five years, sector needs are not directly related to the recovery from Typhoon Ketsana. The MIME with support from international donors has developed a strategy to absorb the expected demand with a reliable energy supply at a reasonable price. New investments in transmission, generation, and distribution would extirpate Cambodia from the least electrified countries in Asia.

For the purpose of this report, long-term needs will only include those in direct relation to disaster recovery, and not those pertaining to the general power sector development. It must be remarked that although improved infrastructure is important, clear procedures and a sound institutional organization are also critical. The sector needs to set up a sustainable structure in the long run through strong sector management, transparent regulations, clear procedures, wide channels of communications, and good coordination among the line ministries: Only then will resilience increase and the sector better withstand disasters. In particular, the following needs have been identified:

- New regulations that integrate specific mandates of sector agencies into one single National Protocol for Disaster Response;
- Awareness-raising campaigns at the village level to inform rural consumers of the vulnerabilities of their electrical installation, appropriate ways of using electricity, and instructions and actions to take in case of disaster; and
- Insurance system to protect private and public suppliers against natural disaster impacts. This insurance scheme would be partly financed by the government and donors through a special Post Disaster Recovery Fund. Technical assistance would be needed to administrate this fund.

Some of the above-mentioned needs like institutional capacity building, an insurance system, and new DRM regulations, could be developed by the core Disaster Risk Management section and so, implemented by the NCDM, with support from specific sector agencies.

Table 17: Cost of Estimated Needs in Energy Sector (USD million)

Needs	Cost
Short Term (0-6 Months)	
Rapid Restoration of The Supply in Affected Areas	50
Clarification of Responsibilities among Agencies	100

Design Energy Sector Post Disaster Action Plan	150
Subtotal	***300***
Medium Term (2 Years)	
Training of REEs	350
Institutional Capacity Building	500
Subtotal	***850***
Long Term (5 Years)	
Energy Section of National Protocol for Disaster Response	350
Communication Campaigns For Energy-Related Disaster Awareness	500
Power Supplier Insurance System against Natural Disasters	1,000
Subtotal	***1,850***
TOTAL	***3,000***

Source: Report on the Power Sector of Cambodia, EAC (August 2009).

In summary, the power sector needs USD 3 million in a five-year timeframe in order to be better protected against natural disasters. Most of the investments relate to institutional low capacity, poor coordination, and lack of incentives, procedures, and regulations. About a third of the estimated cost would address the upgrading of "weak" infrastructure in order to increase resilience against similar disasters.

2.4 Social Sectors

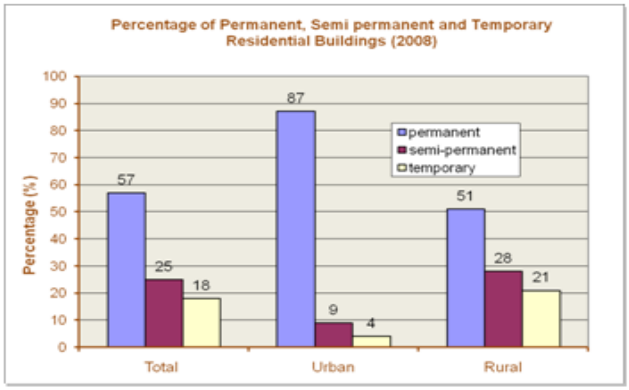
2.4.1 Housing

Introduction

Figure 4: Permanent, Semi-Permanent, and

In terms of Cambodian housing patterns, the snapshot of the housing sector before Typhoon Ketsana is the following: (i) only 57 percent of the residential and partly residential buildings were permanent; (ii) about 25 percent were semi-permanent; and (iii) 18.5 percent were temporary. In rural areas, nearly half of the structures were either temporary or semi-permanent.[20]

Temporary Residential Buildings, 2008 (%)



Source: General Population Census 2008

The tenure status of dwellings/households indicates that the vast majority of houses are occupied (96.2 percent), while rented houses represent 0.4 percent, rent-free houses 0.34 percent, and others just 0.03 percent. In the affected areas, the percentages are similar.

Assets owned by Cambodian households in the affected versus unaffected areas provide an indication of the economic situation. A television is owned by about 58 percent of households, while in the Ketsana-affected areas the figure is 47 percent. A motorcycle is owned by about 37 percent of households, whereas in the affected areas it is 33 percent. Only 4.08 percent own cars/vans at the national level, and a mere 0.03 percent in the affected areas. A hand tractor is owned by about 3.11 percent of the population and only 0.04 percent by those affected by the typhoon. Finally, a personal computer is owned only by about 3 percent of the general population, but in the affected areas it is an insignificant 0.01 percent. The information of household-owned assets in the affected areas is shown in

[20] General Population Census 2008.

Table 18 below.[21]

[21] General Population Census 2008.

Table 18: Household Assets in the Affected Areas

Provinces	No. of HHs	No. of people	Household Assets										
			Radio	TV	Phone	Cell Phone	Computer	Bicycle	Motorcycle	Car / Van	Boat	Big Tract.	Hand Tract.
Banteay Meanchey	144,658	677,872	53,920	85,322	2,136	77,015	3,695	113,983	62,139	7,110	7,907	1,467	18,530
Battambang	209,702	1,025,174	89,678	124,828	3,202	110,707	6,519	151,745	100,929	10,406	10,774	2,785	19,365
Kampong Cham	368,114	1,679,992	147,812	222,162	4,355	149,592	6,352	360,703	175,405	13,557	20,400	1,703	10,112
Kampong Chhnang	100,801	472,341	43,872	52,912	1,103	32,127	1,562	92,126	35,481	2,575	23,647	231	3,204
Kampong Thom	133,878	631,409	55,159	60,602	1,367	42,896	2,309	131,545	50,325	3,619	15,878	658	2,798
Kampot	129,646	585,850	53,935	58,269	1,028	45,160	2,023	128,127	44,906	2,983	2,463	169	1,705
Kratie	65,323	319,217	26,983	29,509	779	25,783	1,195	44,283	27,617	2,399	6,500	219	903
Mondul Kiri	12,270	61,107	4,351	3,557	140	5,712	243	4,251	7,932	690	160	33	586
Preah Vihear	33,115	171,139	13,794	6,646	187	9,308	553	19,060	13,037	807	1,008	108	4,119
Ratanak Kiri	27,485	150,466	9,017	8,110	314	12,293	639	13,603	18,084	1,526	1,644	99	633
Siem Reap	179,754	896,443	71,017	112,831	2,722	105,247	7,550	174,077	101,015	11,391	11,403	448	4,465
Preah Sihanouk	44,656	221,396	13,794	6,646	187	9,308	553	19,060	13,037	807	1,008	108	4,119
Stung Treng	20,922	111,671	11,192	5,850	293	9,492	572	14,179	8,524	862	5,688	91	523
Oddar Meanchey	38,398	185,819	13,115	13,255	525	14,153	625	24,705	14,887	1,166	200	98	5,266

Source: Cambodia General Population Census 2008.

Disaster Impact on Housing

Dwellings were impacted in 14 different provinces and were first reported in early October 2009. The level of impact, however, was not the same across the affected provinces. Four provinces, namely Kampong Thom, Preah Vihear, Ratanak Kiri, and Kratie, were severely

affected, while the level varied from slight to moderate in the other provinces. A total of 10,776 affected houses, of which 218 were fully destroyed, were reported by the local authorities. Details of affected houses by province are shown in Table 19 below.

Table 19: Number of Houses Affected, by Province

Affected Provinces	Fully Destroyed	Partially Destroyed	Total Number Affected
Kampong Thom	109	2,906	3,015
Siem Reap	60	-	60
PreahVihear	1	2,745	2,745
OddarMeanchey	3	-	3
Ratanak Kiri	13	778	791
Kampong Cham	6	-	6
Kratie	13	2,984	2,997
BanteayMeanchey	10	-	10
Battambang	-	1,146	1,146
Kampot	3		3
Total	218	10,559	10,776

Source: Field Assessment and National Committee for Disaster Management reports.

Strong winds, flashfloods, and aftermath effects caused damage to structures, buildings, and household assets, and disrupted economic activity in the affected areas. In general, the incomes of the affected households usually experienced a big cut in the months following the disaster, as dwellers were occupied by the construction of temporary shelter and the restoration of community livelihoods. The affected household income loss is estimated at USD 3,294,398.

One of the fully destroyed houses in Kampong Thom Province. Photo taken by Assessment Team on visit to the affected areas, November 15-20, 2009.

Damage to household assets was generally not counted or reported at either the national or local levels. The assessment of damage to household assets was calculated based on samples/interviews with household heads made in both the most severely affected areas (e.g., Sandan District in Kampong Thom Province) and the least affected areas (e.g., some districts in Siem Reap Province). It is not as straightforward as the structural damage assessment. After the interviews and samples were conducted, the team established replacement costs for both structures and assets, and made some assumptions based on field observations. In addition, the level of damage was weighted for different provinces according to the severity of the reported damage. Total damage to household and structure assets and to the associated losses in each province is shown in the Table 20 below.

Table 20: Damage and Loss in Housing, by Province (USD)

Affected Provinces	Damage		Loss	Total Effects
	Damage to Structure	***Damage to Assets/Stock***	***Amount***	***Amount***
Kampong Thom	3,913,434	483,140	921,734	5,318,308
Siem Reap	340,200	42,000	18,343	400,543
Preah Vihear	3,118,500	385,000	839,191	4,342,691
Oddar Meanchey	17,010	2,100	917	20,027

Ratanak Kiri	1,397,088	118,020	241,822	1,756,930
Kampong Cham	34,020	4,200	1,834	40,054
Kratie	3,457,566	426,860	916,231	4,800,657
Banteay Meanchey	56,700	7,000	3,057	66,757
Battambang	1,299,564	160,440	350,351	1,810,355
Kampot	17,010	2,100	917	20,027
Total	**13,651,092**	**1,630,860**	**3,294,398**	**18,576,350**

Source: PDNA Team Elaboration (2009).

The total damage to the housing sector caused by Typhoon Ketsana is USD 15,281,952, of which USD 13,651,092 represents the damaged structures and USD 1,630,860 the assets.

Similarly to water supply and sanitation, women and children were the most affected by the impact on housing in the communities where the typhoon hit. Damage to houses and household assets (e.g., kitchens) prompted many women to construct temporary shelters, get clean water from secured sources that were generally distant from their places, and prepare food for their families. Many children who escaped the calamity appeared on casualty lists; most had no school to attend; and playing and swimming in the floodwaters increased their risk of immediate and long-term water-borne diseases.

The total economic losses accounted in the housing sector are USD 3,294,398. This number represents the loss of income of the affected households in terms of the opportunity cost of spending time to rehabilitate and reconstruct rather than earn income through regular activities. Losses associated with income-earning opportunities based on household assets were not estimated as the more formal income-earning opportunities were estimated in the Industry and Commerce Assessment, and the necessary level of detailed

information on damaged assets used for informal economic activities is not available in Cambodia.

To date, only a few fully destroyed houses have been reconstructed, but most of the slightly damaged houses have been repaired. To rehabilitate their houses, many owners had access to housing credits from the local commercial banks (which are traditionally risk-averse and charge high interest rates) or they took loans from friends and relatives.

Recovery Framework for Housing

The recovery strategy for the housing sector is based on the generic recovery considerations mostly linked with the development of national policy and sector strategies. The design of disaster-resilient standards for design and construction should receive urgent attention. Priority actions for recovery should focus on the following activities:

Short Term (0-6 months)

- Fix the damaged homes/structures and rebuild the core structures of fully destroyed homes/structures; and
- Provide temporary shelter and basic support.

Medium Term (2 years)

- Completely reconstruct fully destroyed houses;
- Conduct a design standards review/compliance; and
- Raise community awareness by conducting a "Disaster Resilience and Climate Change Adaptation" program.

Table 21: Recovery and Reconstruction Needs Assessment for Housing, by Province (USD)

Needs for Reconstruction	Funding Required
Immediate	12,089,000
Fixing the Damage Parts and Construction of Core Part of Structure	11,980,000
Temporary Shelter and Basic Support	109,000
Medium	2,087,800

Reconstruct the Fully Destroyed Houses	1,237,800
Design Standard Review/Compliance	350,000
Community Awareness "Disaster Resilience and CC Adaptation"	500,000
TOTAL	14,176,800

Source: PDNA Team Elaboration (2009).

2.4.2 Health

Introduction

In the early 1990s, the Ministry of Health started a sector reform process and by 1996, it had approved a Health Coverage Plan. This plan divides the country into 73 operational districts within the 24 provinces. Each operational district covers a population between 100,000 and 200,000 and comprises 10¬20 health centers and one referral hospital. Each health center, therefore, covers a population of about 10,000. Health centers are expected to deliver a "minimum package of activities" that includes basic curative, preventive, and promotional services provided both in the facility and through outreach. Community participation is obtained through village health support groups and health center management committees. Referral hospitals provide a "complementary package of activities" while national institutes, national hospitals, national programs, and training institutions provide third-level service. By the end of 2008, there were 8 national hospitals, 77 operational districts, 76 referral hospitals, 957 functional health centers, and 108 health posts. The Ministry of Health comprises three directorates at the national level: Health Services, Finance and Administration, and Inspection.

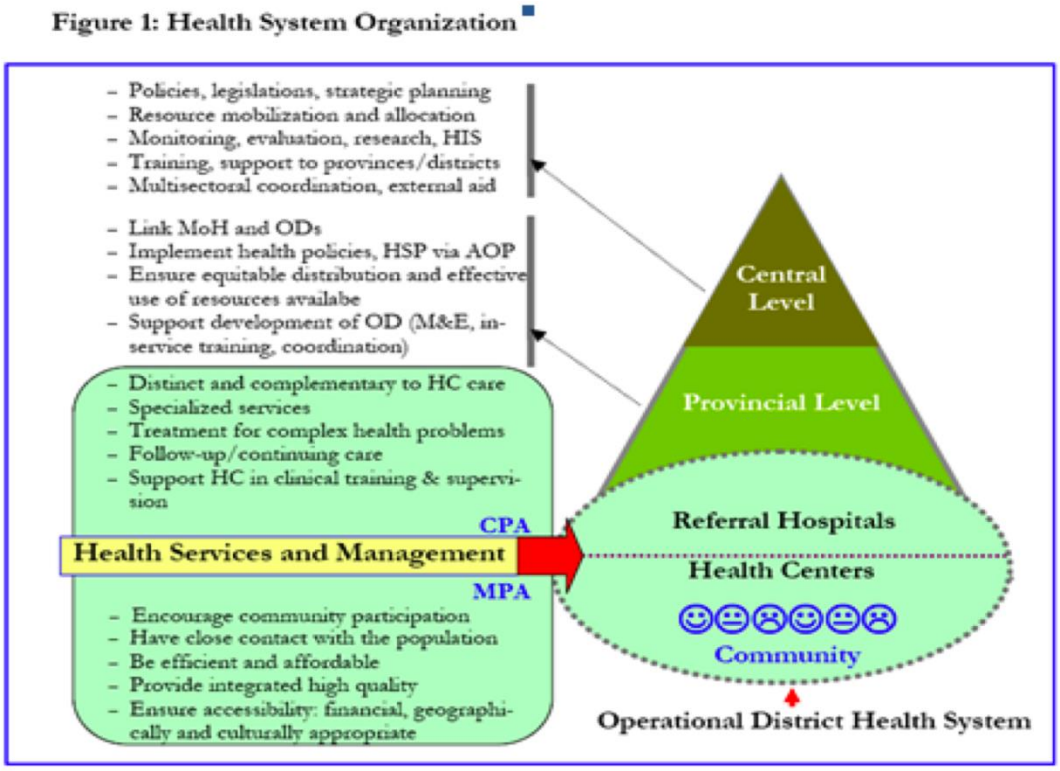
The development of the Cambodian health system is guided by health strategic plan 2008–2015 (HSP2), which addresses the policy direction of the health needs and health improvement of the population in the eight years to come. The impact of quality health services would contribute to the long-term process of poverty reduction, enhancement of the economy, and social development. A natural disaster of significant magnitude could impede or divert the delivery of such strategic health services.

The Vision developed by the HSP2 is "to enhance sustainable development of the health sector for better health and well-being of all Cambodian, especially of the poor, women and children, thereby contributing to poverty alleviation and socio-economic development."

In the Health Sector, the Mission of the Ministry of Health is "to provide stewardship for the entire health sector and to ensure a supportive environment for increased demand and

equitable access to quality health services in order that all the peoples of Cambodia are able to achieve the highest level of health and well-being."[22]

Figure 5: Health System Organization



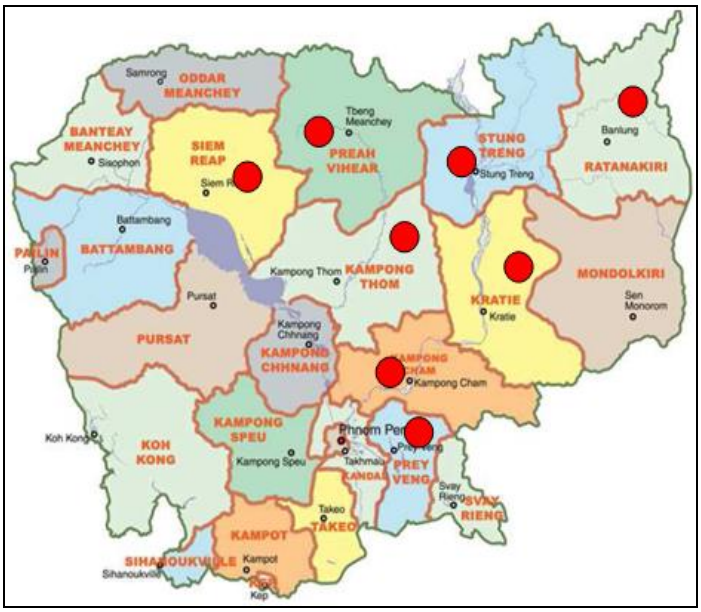
Source: Ministry of Health, 2008

[22] Second Health Sector Strategic Plan 2008–2015.

Disaster Impact on Health

The typhoon left 43 people dead, 67 people severely injured, and some 22,800 families directly affected (of which almost 4,700 were evacuated). Though loss of life was not as high as in other countries, about 180,000 people were affected (directly or indirectly), which is equivalent to 1.4 percent of the population. Map 2 shows the provinces where the affects to the health sector were more pronounced.

Map 2: Provinces with Pronounced Health Affects



Source: PDNA Team Elaboration (2009)

Following Typhoon Ketsana, varying levels of damage to health sector facilities with related service disruption were reported in eight provinces: Ratanak Kiri, Kampong Thom, Stung Treng, Siem Reap, Preah Vihear, Kratie, Kampong Cham, and Prey Veng. In total, 234 health centers and 45 health posts, of which 27 health centers and 9 health posts (which represents respectively 11.5 and 20 percent of the total numbers in the affected provinces) were submerged up to half the building's height (2.50 m) with resultant loss of drugs and medical supplies as well as damage to medical and office equipment and patient records. A small number of health centers/posts were totally submerged, in particular Taveng health center and Tabok and Talao health posts in Ratanak Kiri Province. The MoH health officers from Kampong Kor health center in Kampong Thom Province and Taveng health center in Ratanak Kiri Province reported that these facilities were severely affected (50 percent replacement cost).

While the majority of health centers were in reasonably sound condition, the existing problems of poor access to health care by vulnerable populations were magnified by the flooding. According to the provincial health departments, an estimated 175,667 people required medical care and treatment during the typhoon and floods and in the immediate aftermath, and could not reach their related health facility.

Table 22: Damage and Loss in Health Sector (USD)

Provinces	Damage to Structure: Health Centers and Posts (USD)	Damage to Equipment: Furniture, Medical Equipment, and Medicine (USD)	Loss of Income (USD)
Ratanak Kiri	1,400	55,072	8,002
Kampong Thom	600	0	4,581
Stung Treng	0	0	1,354
Siem Reap	0	0	12,954
Preah Vihear	0	0	1,348
Kratie	0	0	2,388
Kampong Cham	0	0	6,141
Prey Veng	0	0	2,647
Sub-Total	2,000	55,072	39,415
Total (D and L)		57,072	39,415
TOTAL (D+L)		**96,487**	

Source: PDNA Team Elaboration (2009).

Table 23: Submerged Health Centers and Health Posts

Province	***Existing Health Centers***	***Existing Health Posts***	***Submerged Health Centers***	***Submerged Health Posts***
Ratanak Kiri	10	10	5	6
Kampong Thom	56	-	3	-

Stung Treng	10	3	3	-
Siem Reap	26	4	4	-
Preah Vihear	13	19	2	1
Kratie	25	9	2	2
Kampong Cham	45	-	2	-
Prey Veng	49	-	6	-

Source: PDNA Team Elaboration (2009).

The picture exemplifies the impact on Taveng health center in Ratanak Kiri Province. The center was not able to provide health care services either during or immediately after the typhoon.

Of all the provinces, Kampong Thom and Ratanak Kiri were the most affected. The majority of the health centers in the affected provinces were constructed as single story buildings with five rooms: This was then an risk factor underlying the disaster and creating a potential for future losses. The health officers in Ratanak Kiri reported that the Veun Sai health center, being located in an area with high risk of flooding, was totally inundated. In fact, the annual rainy season submerges the Veun Sai almost every year.

Recovery Framework for Health

Recovery Considerations

Health facilities and health services are a community's lifeline in normal times and are especially critical in times of disaster. Sometimes, however, they are severely damaged or left unable to function in the aftermath of a disaster. The MoH should understand the potential long-term benefits of protection and appropriately select sites for health facility construction, taking into account the improvement of the design and construction

standards. Resources for maintenance and repair of health facilities should be planned adequately in annual operational plans (AOPs).

In order to reduce the risk of future loss from disasters, all affected health centers should be retrofitted following the new design of health facility construction. Also, relocation of some health centers to safe areas should be considered.

Short Term (0-6 months)

- Health Outreach Services (*this should be managed within funding approved for 2010 AOPs. Additional resources may be sought only if there is any large disease outbreak occurs*)
  - Provide preventive and curative health care services to affected populations, including basic maternal and child health services
  - Conduct health Outreach Activities in Typhoon Ketsana affected villages, as part of routine health outreach activities from health centers and with support from VHSG, in order to provide preventive and curative care. This will include basic health education on hygiene; the use of abate to control mosquitoes (in dengue affected areas); vaccination of children and women; distribution of clean delivery kits and contraceptives; Vitamin-A and de-worming medicines for children and postpartum women; iron/folate acid supplementation for pregnant and lactating women; insecticide impregnated bed nets to families in the most affected areas for the prevention of vector borne diseases; treatment of diarrheal diseases with Oral Rehydration Salts (ORS); monitoring of the nutritional status of children under five; active disease surveillance and response for all cases presenting symptoms ranging from Influenza-Like-Illness (ILI) to acute respiratory infection/pneumonia, diarrhea, dengue fever, measles (fever and rash).
  - Surveillance data must be analyzed frequently to detect outbreaks and to plan appropriate responses.
- Restoration of priority public health and care services (Total: USD 86,690. Supply of drugs, medical equipment and laboratory test kids should be done from existing stock available at central medical stores and from the national programs)
  - Urgent repair of damaged infrastructure and equipment. Total: USD 86,690.
  - Supply replenishment (mostly antibiotics against acute respiratory infection; diarrheal diseases as well as insecticide treated bed nets, clean delivery kits, contraceptives, and vector control supplies are required to equip the mobile teams visiting affected villages and in preparation for possible outbreaks).

- For malaria and dengue fever, rapid diagnostic tests and anti-malarial drugs are needed for affected provinces. These interventions are essential for preventing the recurrence of numerous vector-borne diseases in flood-affected areas.

Medium Term (2 years)

- Capacity building (Total: USD 360,700. *This should be taking into consideration during 2010 AOPs revision or 2011 AOPs planning*)
  - Providing the HDMC with a data management system, training on health disaster management, strengthening communicable disease surveillance systems for the prevention and control of disease outbreaks, etc. Total: USD 180,000
  - Strengthening Rapid Response Teams at sub national level. Total: USD 40,000.
  - Conducting training workshop on PDNA among provincial disaster management committee. Total: USD 40,000
  - WHO Technical Assistance: Salary and Operating/communication costs for National Professional Officer (NPO). Total: USD 100,700
- Community education and awareness-raising programs (*this should be integrated with minimum package of activities and through community network for health*)
  - Education on prevention from drowning.
- Regulatory framework and policy development (Total: USD 200,000. This should be taking into consideration during 2010 AOPs revision or 2011 AOPs planning)
  - Develop and implement policies, protocols, standard guidelines, and hazard-specific manuals to respond to disasters. Total: USD 200,000.

Long Term (5 years)

- Replacement and upgrade (Total USD 2,480,000. These figures are initial estimates, and not based on detailed engineer design assessments).
  - Retrofitting and moderate upgrade of 30 health centers. Total: USD 2,000,000.
  - Upgrade of 48 health posts. Total: USD 480,000.

Table 24: Regulatory Framework and Policy Development for Health Sector

Priority	Short	Medium	Long Term	Total

	Term	Term		
Adequate Provision of Temporary Outreach Services	0	0	0	0
Restoration of Priority Public Health and Care Services	86,690	0	0	86,690
Replacement and Upgrade of Facilities, Medical Equipment and Supplies	0	0	2,480,000	2,480,000
Capacity Building	0	360,700	0	360,700
Community Education and Awareness Raising Program	0	0	0	0
Regulatory Framework and Policy Development	0	200,000	0	200,000
Total	**86,690**	**560,700**	**2,480,000**	**3,127,390**

Source: PDNA Team Elaboration (2009).

2.4.3 Education

Introduction

Eighteen of the twenty-four provinces and municipalities of Cambodia reported some disruption of services to schools as a result of Typhoon Ketsana. Heavy rain caused flash floods in the more remote Northern provinces, with floodwaters rising at a rate of one meter per hour giving little chance to evacuate materials from the schools constructed in river valleys. High winds damaged the roof tiles of many schools as the tiles are not normally tied down and are held in place only by their own weight. In other cases, the floods were longer lasting with disruption of access resulting in schools being closed. Four students were killed by the storm. In total 1,169 schools were reported by provincial education offices to be affected as shown in the Table 25.

Table 25: Number of Schools Affected by Floods and Wind

No.	Province	Preschool	Primary	Lower Secondary	Upper Secondary	Total	Other
1	Kampong Thom	26	86	14	6	132	2 students died
2	Kampong Cham	12	86	28		126	

3	Kratie	12	46	15		73	
4	Prey Veng					50	2 students drowned
5	Banteay Meanchey	2	29	4		35	
6	Ratanak Kiri	0	38	3		41	16,000 books, fences damaged
7	Siam Reap		358	3		361	
8	Oddar Meanchey					146	
9	Preah Vihear					39	
10	Mondul Kiri	3	5			8	
11	Phnom Penh		10	3		13	
12	Kampong Chhnang		3			3	
13	Stung Treng		109			109	
14	Koh Kong		2			2	
15	Pursat		9			9	
16	Kampot	8	5			13	
17	Kandal	8	1			9	
18	Battambang	Flooded only 2 days; 3 rooms in TualTil primary school collapsed; School Aid Japan is helping with the reconstruction.					

Source: PDNA Team Elaboration (2009).

While the impact of the storm was felt throughout most of Cambodia, a comparison of the total number of schools with those affected by the storm shows that the northern and north-central provinces of Oddar Meanchey, Stung Treng, Siem Reap, Ratanak Kiri, Kratie, Kampong Thom, Preah Vihear, Kampong Cham, and Mondul Kiri were the worst hit.

Table 26: Schools Affected by Floods v Total Number of Schools in Affected Provinces

Province	Total Number	Number Affected by Floods	PercentageAffected
Oddar Meanchey	189	146	77
Stung Treng	157	109	69
Siem Reap	590	361	61
Ratanak Kiri	178	41	23
Kratie	318	73	23
Kampong Thom	599	132	22
Preah Vihear	215	39	18
Kampong Cham	1,060	126	12
Mondul Kiri	90	8	9
Prey Veng	727	50	7
Banteay Meanchey	589	35	6
Phnom Penh	232	13	6
Kampot	481	13	3
Pursat	362	9	2
Koh Kong	130	2	2
Kandal	702	9	1
Kampong Chhnang	366	3	1
Total	**9,431**	**1169**	**12**

Source: PDNA Team Elaboration (2009).

Disaster Impact on Education

Most affected schools experienced disruptions either because the school was flooded or because access to the school was impeded. The length of disruption to teaching varies considerably, but all schools are now believed to have resumed teaching and enrollment has returned to pre-storm levels.

Wind damage to schools was primarily from tiles being blown off the roof, but also from falling trees. In general, the modern concrete school construction withstood the winds while the traditional timber buildings of villages were much more vulnerable. Temporary school buildings of thatch and bamboo were damaged but easily repaired with the resources of the communities that constructed them. Old timber school buildings in bad states of repair became even more dangerous after the storm: The risk of falling tiles from insect ridden timber roofs was sufficient to force their closure.

Flood damage in Ratanak Kiri was extensive because the rapid increase in water levels allowed no time to evacuate materials from the schools. In other provinces, the damage was mostly due to poor quality, non-reinforced concrete floors whose sub-surface crumbled with the flooding. In many cases where there were no construction defects in the flooded buildings, the teachers and students cleaned up and teaching returned to normal with no permanent damage to the building.

Most of the damage observed during field visits to inspect flood-damaged schools was to buildings that were already in a very bad state of repair before the storm. In 90 percent of the surveyed schools, the damage to the inspected school buildings could be attributed to old structures or poor construction. The engineers reported on the current conditions of the buildings, and estimated costs of repair pertained to bringing the building up to an acceptable standard for teaching rather than strictly to repair flood or wind damage. Timber buildings with infested woodwork or termites are, in general, more economically replaced than repaired because of the difficulty in obtaining high-quality timber. The recommendation for thatch and bamboo buildings used as temporary classrooms is also to replace the building with a modern concrete structure that provides a better teaching environment and protection from wind and storms. The expected number of buildings that will need replacement for all of the 1,169 flood-affected schools is 248 buildings, with an additional 1,110 buildings needing repair.

The estimated cost of replacement is USD 147 per square meter. A typical five-classroom building is 360 square meters, so the cost of replacement would be USD 52,920 per replacement building. The cost of repair work is estimated at an average USD 20 per square meter, which would be 14 percent of replacement costs. Furniture costs were estimated at

10 percent of civil works, equipment at 5 percent, and materials at 2 percent. As damage reports were compiled for the Northern provinces where the flashfloods caused the most damage to furniture, materials, and equipment, these figures could be further refined.

Table 27: Projected Cost for Repair and Replacement of Flood-Affected School Buildings

Type of School/Facility	Number of Buildings	Repair and Replacement Cost (USD)	Furniture (USD)	Equipment (USD)	Education Materials (USD)
Full Destruction					
Preschool	5	264,600			
Primary	124	11,324,880			
Lower Secondary	24	1,270,080			
Upper Secondary	5	264,600			
Partial Damage					
Preschool	19	136,800	48,168	6,840	2,736
Primary	838	6,033,600	2,083,018	301,680	120,672
Lower Secondary	195	1,404,000	320,890	70,200	28,080
Upper Secondary	58	417,600	81,864	20,880	8,352
Totals	1,358	21,166,160	2,533,939	399,600	159,840
Grand Total	**$24,209,539**				

Source: PDNA Team Elaboration (2009).

Recovery Framework for Education

Preliminary analysis shows that the full needs of the storm-affected areas would be beyond the scope of the resources immediately available to MoEYS. However, interest has been expressed by NGO's working in the storm-affected areas in assisting with the response.

Funds may also be made available from the existing Asian Development Bank or World Bank-financed programs providing assistance to MoEYS, so a measured immediate response targeting the most in-need schools is feasible. The engineering reports from the Department of Construction can provide the basis for prioritizing response to the most needed areas.

To prevent the recurrence of disasters like Typhoon Ketsana, the MoEYS needs to have a program to maintain school construction and upgrade or replace buildings that are not safe in high winds, floods, or other natural disasters. The next typhoon to hit Cambodia may not take the same path, so these programs must cover all provinces, not just the currently affected areas.

Although possible improvements in building design to withstand high winds and floods were noted, in general the currently recommended designs of MoEYS proved suitable for the extreme winds and unusual flooding caused by Typhoon Ketsana. The buildings that were most affected were already in very poor condition and in need of repair or replacement.

The assessment of the cost of repairs and replacement reflects the poor initial condition of the facilities in the affected region, and highlights the lack of maintenance of education facilities in Cambodia. Table 27 shows that the total estimated cost of replacement and repair works for all flood-affected buildings is USD 24,209,539. Of this, however, only USD 1,900,000 will be part of the Ketsana recovery framework for education. The additional reconstruction effort should be part of any other stand alone program within the Ministry of Education (MoE) school rehabilitation program, to ensure that DRRM is properly streamlined into the national planning.

In the short term, a more-focused response is needed to target the education facilities still having difficulties repairing damage to buildings. The detailed engineering reports on the buildings surveyed in two provinces, covering 12 percent of the flood-affected schools, provide a means for doing this. These reports can be examined on a case-by-case basis, together with an inspection of the photographic evidence, school enrollment records, and total number of classrooms to determine which buildings require repairs or replacement should be a priority.

The Department of Construction estimates that between 5 and 10 percent of the buildings surveyed to date require immediate intervention for schools to resume normal teaching. This needs to be verified when the compilation of all the reports is complete and when they have been screened and prioritized. An estimated USD 1.9 million will be required in the short term to meet these immediate needs.

Short Term (0-6 months)

- Emergency replacement of buildings not suitable for repair. Total: USD 1,500,000;
- Emergency repair of buildings not suitable for teaching. Total: USD 200,000;
- Furniture, equipment, and education materials for new and repaired schools. Total: USD200,000; and
- Total investment. Total: USD 1,900,000.

Medium and Long Term (2-5 years, outside the direct recovery and reconstruction program)

- Replacement of buildings that would be uneconomical to repair, or are unsuitable for teaching purposes. Total: USD 13,124,160;
- Repair of storm-affected buildings to insure that they will be safe in the event of future storms, floods, or other natural disasters. Total: USD 7,992,000;
- Furniture, equipment, and education materials for new and repaired schools. Total: USD 3,093,380;
- Planned maintenance of all school buildings in Cambodia (RGC Annual Budget);
- Systematic upgrading of existing school buildings to make them safer in high winds and more resistant to floods and other natural disasters (RGC Annual Budget); and

Table 28: Recovery Framework and Additional Reconstruction Efforts for Education (USD)

Priority	Short Term	Medium Term	Long Term	Totals
New Construction to Replace Buildings Too Badly Damaged to Repair	1,500,000	11,624,160	0	13,124,160.00
Repair of Buildings Unsuitable for Teaching	200,000	7,792,000	0	7,992,000.00
Furniture, Equipment, and Materials	200,000	2,893,380	0	3,093,380.00
MoEYS Maintenance Program for Schools	0	0	RCG Annual Budget	0
Total	1,900,000	22,309,540	0	24,209,540.00

Source: PDNA Team Elaboration (2009).

2.5 Productive Sector

2.5.1 Agriculture, Livestock, and Fisheries

Introduction

Agriculture provides more than 30 percent of the Cambodia's gross domestic product (GDP).With 85 percent of the population living in the rural areas; more than 60 percent depend directly on agriculture, forestry, and fisheries for their livelihoods. Around 27 percent of the country's population is considered poor, and 90 percent of poor people live in rural areas. Agriculture has thus not only been the biggest contributing sector to GDP but also the mainstay of rural economy providing food security and a marketable surplus to a very large cross section of the population in the country.[23]

The agriculture resources primarily consist of about 2.8 million hectares of cultivated land, of which 91 percent is devoted to rice and the remaining 9 percent to other food or industrial crops (primarily rubber). There are also the fishery resources of the Mekong River

[23] Program Design Document for Institutional Capacity Building and Management Support Program, Ministry of Agriculture, Fishery, and Forestry and Ministry of Water Resources and Meteorology, Technical Working Group on Agriculture and Water, June 2009.

and Tonle Sap Great Lake. The bulk of the population has been, and remains, rice farmers who supplement their income from fishing, or fishers who supplement their income from rice farming. In addition, in some parts of the country livestock provides a major component of household assets. Growth in agriculture has been volatile, but continues to be low at 5-5.5 percent of GDP for the period 2006–2008. Any growth in agriculture has been mainly due to increasing production of paddy rice. Hence, agriculture, livestock, and fisheries have been the main drivers of social and economic growth in rural Cambodia.[24]

In terms of international price commodity, rice contributes significantly and enables the country to export surplus production.[25] Although food security at a national level has been achieved, the household level is still a concern. The poor are also net buyers of food and therefore rising prices often go beyond their purchasing power; this situation leads to transitory food insecurity. Last year when the price rise of food commodities was quite steep globally, the effects were evident in Cambodia. For example, the prices of rice in 2008 witnessed the highest level of increase of the last years with wide variations throughout the cropping season, which caused considerable food insecurity at the household level among the poor. The food insecurity in Cambodia became more acute with a shortfall in local production as well as with rising food prices.

Disaster Impact on Agriculture, Livestock, and Fisheries

On September 29, 2009 Typhoon Ketsana lashed the northeast to northwest areas of the central provinces of Cambodia. In addition to the previous flooding, it brought more rainwater, floods, and havoc to at least 10 provinces—impacting agriculture considerably. The Ministry of Agriculture, Forestry, and Fisheries (MAFF), in the revised estimates of November27, 2009, reported that the typhoon, in those 10 affected provinces, destroyed the rice crop to the extent of 49,136 ha, while 67,355 hectares were partially destroyed. It is important to highlight that when the typhoon struck, rice was nearing the harvesting stage. At this stage, anticipated losses are expected to be at its peak. It is a critical stage of crop growth cycle, and losses could not be recovered in the case of damage. Damage to livestock was reported as 70 cows/buffaloes dead along with 271 pigs and a large number of poultry resources.

<u>Summary of Damage and Loss Assessment</u>

[24] Agriculture and Rural Sector in Cambodia, Asian Development Bank Evaluation Study, Reference Number: SAP: CAM: 2009-32, Sector Assistance Program Evaluation, September 2009.

[25] http://faostat.fao.org/site/567/default.aspx#ancor.

The impact of Typhoon Ketsana on agricultural, especially the rice crop, livestock, and fisheries, has been addressed as a part of Post Disaster Needs Assessment (PDNA) by the agriculture sub-sector teams with the proper coordination with other related sectors/sub-sectors Damage and Loss Assessment (DaLA) to avoid double counting.[26] The economic DaLA[27] for this PDNA is limited to the following two main impacts :(a) impact of the typhoon and flooding on the rice crop; and(b)effect on agriculture, livestock, and fisheries.

In order to assess the overall impact of the typhoon and flooding on agriculture, the DaLA of the rice crop followed four steps and the resulting extent of the effect was placed at USD 49 million. Similarly, the DaLA for livestock was carried out with four steps and the overall effect on livestock was found to be USD 7.32 million. For fisheries, no secondary data were available; hence the primary data was used to assess only two provinces. Two other provinces covered under the field mission reported no damage to the fisheries sector. Field-level functionaries also reported no significant damage to the fisheries. The assessment also reveals that the effect to fisheries was confined to only USD 140,994.Table 29 summarizes the damage and losses to rice crop, livestock, and fisheries.

Table 29: Summary of DaLA for Agriculture Sector (USD million)

	Agriculture	Livestock	Fisheries	Total
Damage	--	0.0870	0.0042	0.0912
Loss	49.28	7.23	0.14	56.65
Total	49.28	7.317	0.1442	56.7412

Source: PDNA Team Elaboration (2009).

While pursuing the DaLA for agriculture, some critical gaps were found in baseline data (not updated, incomplete, and sometimes missing). Efforts are in place to improve agricultural statistics, but there is a long a way to go. Rapid assessment reporting and response mechanisms are not objective, formal, or mandatory. The capacity of National Committee on Disaster Management (NCDM) has to be built as a more effective coordinating agency even for the repository of baseline data.

[26] See UN-ECLAC DaLA Methodology and references in the Annexes.

[27] See the Methodology Section of the Annexes for a detailed explanation on the calculation.

Recovery Framework for Agriculture, Livestock, and Fisheries

In Cambodia, historically, the agriculture sector has been hard hit by the hydro-meteorological disasters—particularly from floods and drought. Damage to the sector adds considerably to the damage and loss sustained nationally. It is this increasing loss to the sector, coupled with food security concerns, that has heightened the need for risk reduction in the sector. The issue of food security has been on the forefront in Cambodia recently due to rising food prices globally. The risk in agriculture is on the rise from the disasters as well as price rise fronts. Further, existing vulnerabilities and risk get more pronounced by external factors: (i) volatile food prices—deterioration of purchasing power; (ii) economic crises—unemployment and income losses; and, (iii) climate variability and change—increased risk of hydro-meteorological disasters.

Transitory food insecurity linked to these risks may result in chronic food insecurity and affect long-term human capital development. The following strategic frameworks could help in long-term risk reduction.

1. Short-term "emergency response" needs to be linked to sustainable rural economic development and development of effective social safety nets;

2. Risk transfer mechanism (micro-credit, insurance, capacity building at the household level, alternate livelihood opportunities, etc.) is to be put in place insulating the poor and marginal farmers as well as less risk-bearing households from the emerging risks; and

3. Coordinated strategies and actions based on reliable and updated information are essential to address risk reduction issues.

For the Post Disaster Needs Assessment (PDNA), the interventions and programs were chosen based on the above strategic frameworks. The immediate interventions were however to provide food, cash, a combination, or something else based on the DaLA findings. The starting point for interventions was to support the restoration of livelihoods of the affected households. Areas close to poor people's livelihoods include cash-for-work, food-for-work, subsidized inputs supply, access to productive assets, and access to non-exploitive credit, for example. The PDNA, as listed

below, combines all these spectrum of needs within the unique context of Cambodia as well as in synergy and convergence with ongoing efforts in the country by multiple actors.

Table 30: Summary of Needs for Agriculture, Livestock, and Fisheries (USD)

Priorities/Interventions	Budget (USD)
Short Term (0-6 months)	
• Emergency Food Aid • Seasonal Supply of Seeds • Supply of subsidized fertilizers, Input tools, livestock and fishery resources • Cash for work, Food for work in large scale to generate local employment • Prevention of epidemics	5–10 million
Medium Term (2 years)	
• Continuing assistance – seeds, fertilizer, tools, capital and capacity building including awareness • Enhanced green trade buffer • Micro-credit, Livelihood Relief Fund • Agribusiness and rural entrepreneurship • Gender sensitive employment generation	10–20 million
Long Term (5 years)	
• Building institutional capacity of key agencies (NCDM, MAFF etc) and providing policy support for their coordinating roles with concerned line departments/ministries • Bringing in financial risk transfer mechanisms to reduce risk in agriculture sector – institutionalization of micro-credit, crop insurance etc • Creating resilient agricultural assets – fisheries and livestock • Forward and Backward linkages of Agriculture, Industry and Commerce	35–45 million

Source: PDNA Team Elaboration (2009).

Financial Instruments for Agriculture, Livestock, and Fisheries

- Prioritization/re-appropriation of emergency lending and food aids program of bilateral and multilateral donors;
- Focus on agriculture risk reduction initiatives of such establishments as development partners and International NGOs; and
- Budgetary support from the Royal Government of Cambodia.

2.5.2 Industry and Commerce

Introduction

Industry accounted for 27.5 percent of the country's GDP in 2008,[28] with 643 factories registered with the Ministry of Industry, Mining, and Energy (MIME) and representing a 14 percent growth if compared to 2007.[29]Most of those factories were garment factories. The production of all factories was a little more than USD 3,550 million.[30]

In 2008, there were 32,619 micro- and small enterprises.[31] This figure shows a small increase of 0.55 percent compared to that in 2007.[32] The total value of production was estimated at about USD 658.5 million, or a 3.24 percent increase from 2007.There were 96,883 people employed in micro- and small enterprises.

The micro- and small enterprises play a crucial role for economic development since most Cambodians depend on micro- and small enterprises to sustain their livelihoods. The

[28] EIC data, compiled from NIS and MEF.

[29] Annual Report of the Ministry of Industry, Mining, and Energy 2008.

[30] Calculated from the figures in Annual Report of the Ministry of Industry, Mining, and Energy 2008.

[31] The typology of industry enterprises was taken from the definitions in the SME Development Framework 2005. Micro-enterprises are defined to employ less than or equal to 10 people, while small enterprises are assumed to have 11-50 employees. The medium size is supposed to have between 51 and 100 people working in that company. The large one must have at least 100 employees.

[32] Calculated from the figures in Annual Report of the Ministry of Industry, Mining, and Energy 2008.

businesses range from making ice, soy, and fish sauce to pure drinking water production. There are 14,050 agro-industrial firms, most of which are rice milling.[33]

[33] Calculated from the figures in Annual Report of the Ministry of Industry, Mining, and Energy 2008.

Table 31shows the number of micro-industry, agro-enterprises, and commercial establishments in each affected province for 2008.

Table 31: Micro- and Agro-Industrial Enterprises in Affected Provinces

Provinces	Micro-Industry	Agro-Industry	Commercial Enterprises
Banteay Meanchey	501	326	9,780
Battambang	826	351	8,802
Kampot	3,950	2,876	6,156
Kampong Cham	2,719	2,429	21,513
Kampong Chhnang	909	823	6,850
Kampong Thom	5,784	5,040	10,333
Kratie	853	506	2,566
Mondul Kiri	85	44	887
Oddar Meanchey	89	51	1,628
Preah Vihear	66	3	3,469
Ratanak Kiri	166	51	2,391
Siem Reab	1,783	1,368	1,463
Preah Sihanouk	145	-	9,235
Stung Treng	182	182	1,080
Total	**18,058**	**14,050**	**86,154**

Source: Figures for micro- and agro-industrial enterprises are compiled from the figures in Annual Report of the Ministry of Industry, Mining, and Energy (MIME) 2008 and SME List 2008 by MIME. Figures for commercial enterprises are taken from Preliminary Results of Nationwide Establishment Listing of Cambodia 2009 by NIS and Listing of Business Establishments in Cambodia's Provincial Towns and Selected Urban Areas by IFC.

Disaster Impact on Industry and Commerce

Agro- and micro-industrial firms were the most affected. Small, medium, and large industrial enterprises were slightly affected, with negligible impact. Most damages in industry were to machinery and equipments. In agro-industry, the damage to machinery and equipment is estimated to be USD 932,104; while for micro-industry it is USD 27,750. Loss due to the interruption of production amounts to USD 2,418,955 in agro-industry and USD 168,361 in micro-industry.

Damages to inventories in the commercial sector were meager. According to the PCDM officials interviewed, commercial residents and street vendors were usually well prepared to resist normal flooding since the water level usually rises slowly, allowing enough time for them to protect their inventories. Damage to commercial housing and other related assets were included in the housing sector. The commercial loss due to forced closure is only USD 2,655. Most commercial owners were able to restore their activities and restart their businesses soon after the disaster. The average number of forced closure was estimated to be only one day in the most affected areas, and in the end is the reason for very contained costs.

Together, the damage at the national level is estimated to be around USD 959,854 while loss is approximately USD 2,589,971. As a result, total damage and loss is about USD 3,549,825.

Table 32shows damage and loss in the industrial sub-sectors.

Table 32: Impact on Industrial Sub-Sectors (USD)

Sector	Damage	Loss	Damage and Loss
Agro-Industry	932,104	2,418,955	3,351,059
Micro Industry	27,750	168,361	196,111
Commercial	-	2,655	2,655
Total	**959,854**	**2,589,971**	**3,549,825**

Source: PDNA Team Elaboration (2009).

From the information that the officials from the Ministry of Economy and Finance (MEF) collected during their field survey on banking and finance, no damage was reported to banks and financial institutions. As the demand for money to repair housing and household assets increased after the disaster, demand for loans from banks and financial institutions also rose. At the same time, delay in debt payment also occurred. Although most of the demand was met by banking and financial institutions, the increase in demand for money provided an opportunity for informal money lenders who could raise interest rates; as a consequence, living standards were affected.

Recovery Framework for Industry and Commerce

In order to rehabilitate and reconstruct the industrial and commercial sector, the following four strategies are outlined:

Short Term (0-6 months):

- First of all, reparation and restoration of the functioning of the sectors needs to be carried out in the short run. A program for damaged and destroyed machinery and equipment should be established, mainly for agro-and micro-enterprises so that production capacity can be restored to levels prior to the disaster. The budget for this program is estimated to be USD 960,000.

Medium Term (2 years)

- Upgrading machinery and equipment is the second priority, which can be carried out in the medium and long term. This will increase production capacity and reduce cost, improving the sector in general.

- Furthermore, better machinery and equipment will increase resilience to future disaster, which help reduce capital damages.

- Capital improvement program for agro-, micro-, and small enterprises should be created through providing loans to micro-finance institutions so that agro-, micro, and small enterprise owners can borrow at subsidy rate to upgrade their machinery and equipment.

- The budget for this program is estimated to be USD 2,000,000 for the medium term and USD 5,000,000 for the long run.

Medium to Long Term (2-5 years)

- *Develop regulatory framework and capacity building*. Industrial and commercial regulatory framework for disaster management and capacity building of provincial and local authorities are essential in the medium and long term.

  - The regulatory framework should focus on timely information and processes for immediate response. Training of officials from relevant ministries on post disaster data collection also would facilitate future assessments.

  - Capacity building activities can be conducted in the medium term at the province level, before moving to the local level in the long term.

  - The budget for the medium term is about USD 500,000 and it is expected to increase to USD 700,000 for the long term.

- *Improve awareness of the local business communities*. Raising the awareness and general knowledge on natural disasters among business owners and employees should be carried out in the medium and long term.

  - In the medium term, the proposed training should focus on the province level while in the long term; the seminars should go down to district level.

  - The budget for the medium term is expected to be USD 300,000 and another USD 500,000 is estimated for the long-term activities.

Table 33: DaLA Needs Recovery Framework for Industry and Commerce (USD)

No.	Priority	Short Term (0-6 months)	Medium Term (2 years)	Long Term (5 years)	Total

1	Urgent reparation and replacement of damaged machinery and equipment	960,000	-	-	**960,000**
2	Upgrading machinery and equipment to make it more resilient against future damages	-	2,000,000	5,000,000	**7,000,000**
3	Regulatory framework and institutional capacity building	-	500,000	700,000	**1,200,000**
4	Public Awareness of disaster prevention (entrepreneurs)	-	300,000	500,000	**800,000**
Total		**960,000**	**2,800,000**	**6,200,000**	**9,960,000**

Source: PDNA Team Elaboration (2009).

2.6 Cross-Cutting Issues

2.6.1 Environment

Introduction

Forests are one of the most important economic and environmental resources of the country, covering over 60 percent (111,020 square kilometers) of the total surface of Cambodia.[34] In 1993, the Royal Government of Cambodia (RGC) introduced private industrial forest concessions as a management instrument for commercial forestry operations, an important source of government revenue and of employment for the local people, but also a cause of land degradation and deforestation, as the system was unable to prevent illegal and unsustainable logging. The RGC's Declaration on Suspension of Forest Concession Logging of 2001 led to an immediate halt in legal concession logging, and by mid-2003 no new concession management plans were approved. However, illegal logging continued in a number of concessions, and in 2003 the RGC decided to establish the Community Forest (CF) as a management mechanism with local, voluntary participation in forest resource management, in order to implement development and ensure a sustainable use of forest resources. Currently, there are 176 CFs consisting of 439 villages, 118

[34] Royal Government of Cambodia, Ministry of Environment, Status of the Environment, 2004.

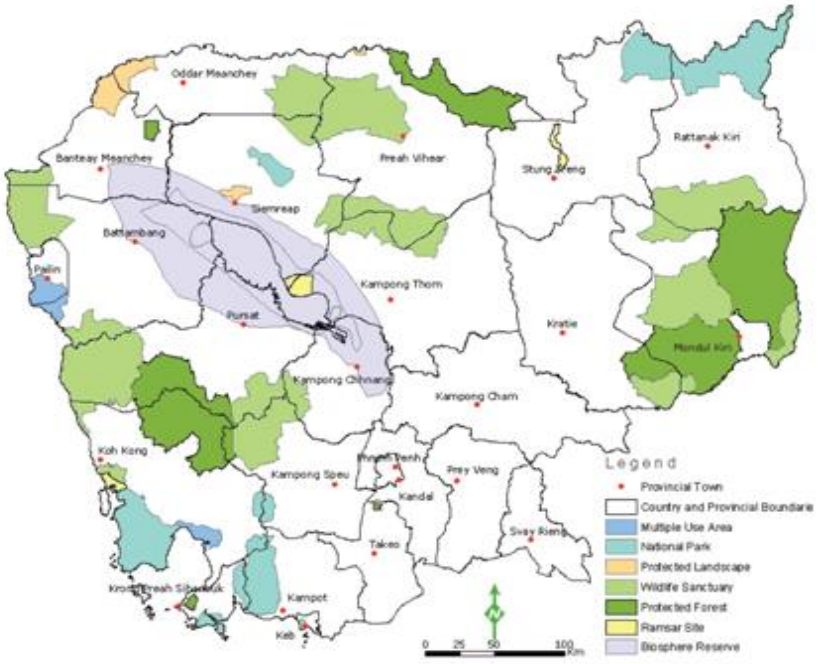
communes, and 61 districts in 16 different provinces (SOE 2004).[35] In total, 45,161 households are included in the different CFs, covering 107,381 hectares of land, most of which is degraded forest area.

There are 23 protected areas (PAs) in Cambodia, covering a total of 3,194,471 hectares (equivalent to 17.64 percent of the country). Similarly to Community Forests (CF), the Ministry of Environment (MoE) developed community protected areas (CPA) to involve local communities in PA sustainable management. Up to December 2008, there were 82 CPAs established, involving 167 villages for a total of 18,121 households on 89,527 hectares in 17 different PAs.

The protected areas are divided in four management zoning systems: (i) a core zone, where only park rangers and researchers are allowed; (ii) a conservation zone, where entry is managed by the park director and small-scale NTFPs is allowed under strict control to support local ethnic minorities' livelihood; (iii) a sustainable use zone, where development and investment activities may be allowed under special circumstances by the RGC; and (iv) a community protected area zone, where the community can be granted land ownership (i.e., residential lands, paddy fields, and field gardens).

[35] Update (June 2009) still to be made official: 377 CFs covering 347,730 ha and additional 13 sites that have the potential to be CF (covering additional 20,203 hectare). This indicates a total CF potential in Cambodia of 390 CFs covering an area of 367,943 hectare.

Figure 6: Protected Areas of Cambodia with IUCN Designation



Source: MoE, ADB, and UNEP (2003).

Disaster Impact on the Environment

The path of the tropical storm touched only four of the affected provinces, all of them very rich in forest resources. From the Northeastern Lao PDR border toward the center of the county, the Ketsana front ran an estimated 150 kilometers through Stung Treng, the south of Preah Vihear, the north of Kampong Thom (which was by far the most badly hit), and the west of Siem Reap, before it was downgraded to a tropical depression, with slower winds and heavy rains. The rest of the provinces were indirectly affected by the rain and the subsequent floods, which in some cases continued up to one week after the storm had passed. The total forest area affected is an estimated 234,426 hectares, of which 12,893 hectares were completely destroyed.[36]

The storm and subsequent floods affected many environmental-related assets: water (quality and access), fish stocks and fisheries, agro-ecosystems and crops, forests and protected areas, for example. They also impacted the services that some of these ecosystems provide (e.g., as a storm buffer, erosion and landslide alleviator, a source of

[36] See the Methodology Section of the Annexes for a detailed explanation on the calculation.

income, and a source of traditional medications). In particular, as the provinces struck were among the most rural and the poorest, the impact was more pronounced on those communities that rely heavily on the forest by-products, like the CPA and CF communities.

Human Development Impact

Most rural households practice a multi-livelihood strategy. Gathering non-timber forest products (NTFPs) remains a crucial component of household survival strategies in most rural areas, providing a source of both subsistence and cash income to offset seasonal food shortages. While average annual income from NTFPs may account for about 40 percent of total household income, it accounts for only 25 percent in the "richest" group (where off-farm activities and livestock provide the bulk of income), but for 90 percent of the total income for the "poorest."[37]

Box 1:Resin, A Non-Timber Forest Product

Since the 1980s, resin tapping has become the most important source of cash income for rural households. Estimates of annual production range from 11 to 18 thousand tons, of which 8–14 Ktons were exported to Vietnam and Thailand. The remainder is sold locally to meet domestic demand of more than 250,000 Cambodian households to seal and waterproof their boats each year, and to varnish furniture and houses. The annual revenue of resin sourced from 5 of the 15 forested provinces is approximately USD 5–8 million.

Studies on resin harvest and processing in Mondul Kiri province indicate that the yield per tree is 30-40 liters/year (Evan et al. 2003). In 2004, dry season price ranged from Riel 21,000–23,000 per 30 liter-container and Riel 8,000–18,000 per 30 liters in the wet season. Average income per family was USD 340 per year based on data from four villages. Thus, total income for the four villages was estimated at USD 61,000 per year. Most of the proceeds were used to purchase rice for household consumption. Currently, resin products fetch Riel 60–70,000 per 30-liter container.

Source: Tola (2009) and IOM (2009)

This valuation methodology identified overall loss due to Typhoon Ketsana mainly as the loss of income for these affected CPAs and CFs. Even if the overall figures are small compared to other sectors (like infrastructure or production), their relative impact on the local economy and the livelihoods of these communities is very significant. It is estimated that the disaster disrupted the collection of NTFPs for six months before communities were able to restore the pre-disaster volume of collection by exploiting other areas. The impact on human development in terms of disruption of sources of cash income, therefore, has been considerable.

In Kompong Thom and Stung Treng Provinces, in the CPAs living inside Bang Per's Wildlife Sanctuary (WS), like the Chi Auk-Boueng Prey community (see Annexes), the impact of Typhoon Ketsana was particularly dramatic. These communities are extremely poor and are mostly composed of *Kui*people, a cultural minority that can be considered indigenous to the

[37] UNDP, National Human Development Report Lao PDR, 2001.

area and therefore more vulnerable. As we have seen, the poorest people in the rural areas are those who depend most heavily on non-timber forest products (NTFPs), not only as their major source of cash income, but also as a major component of food security in the household economy. These communities have seen how the storm virtually destroyed 30 percent of the *chutil* trees, from which they extract a resin for insolating fishing boats, making candles, and selling to the local markets and exporters. Typhoon Ketsana destroyed both their crops and the *chutil* (their traditional safety net to offset the food shortage), making their situation critical. A similarly critical situation stands for Tonle Sap's fishing communities.

The situation of other communities in potentially affected PAs (like Phnom Kulen National Park and Preah Vihear Protected Landscape) has yet to be fully assessed. And although the PA authorities did not identify or report any damage, it does not mean there was none. The Macro-Economic and Social Impacts section of the PDNA report further analyzes the situation of such cultural minorities and other similar vulnerable groups.

Summary of Damage and Loss Assessment

Many of the major impacts of the storm were related to multiple sectors of the economy besides Environment, given its cross-cutting nature and its implications with many human activities. Typhoon Ketsana impacted agricultural ecosystems, crops, tree plantations, livestock, and fish stocks; the access to water and its potential contamination; the infrastructure affected by floods and/or mudslides; and many other environment-related impacts will be addressed by the respective PDNA sectoral teams and are not included in this environmental DaLA to avoid double counting.[38] Some qualitative considerations will still be necessary to highlight the combined impact on local livelihoods and human development, but the economic Damage and Loss Assessment for this ENA will be limited to two main impacts: (a) impact of the storm and flooding in urban waste management; and (b) effect on forest ecosystems and protected areas.

Impacts on Urban Waste Management

Siem Reap (148,000 citizens) was the only major urban area (more than 40,000) affected by Typhoon Ketsana. Several areas of the city were completely flooded for up to one week, with roads blocked and municipal services disrupted. Solid waste is disposed at a site within the city's boundaries for posterior open burning. Solid waste management and garbage collection are a responsibility of the Department of Environment (DoE), and therefore are included in this Environment Needs Assessment (ENA). The environmental degradation

[38] See UN-ECLAC DaLA Methodology and References in the Annexes.

caused by inadequate disposal of waste can be expressed by the contamination of surface and ground water through leakage, soil contamination through direct waste contact or leakage, air pollution by burning of wastes, spreading of diseases by different vectors like wind, birds, insects, and rodents, or uncontrolled release of methane by anaerobic decomposition of waste. In the particular case of the Ketsana flooding in Siem Reap, the flood could have potentially caused sanitary and environmental havoc through contamination of surface water if landfills had been hit and damaged by floods, or if uncollected garbage had been spread by the floods to other city areas. However, the damages and losses were very contained, and no economic impact has been reported by the provincial authorities.

Regarding the damaged assets, luckily enough the dumping site in the city was not flooded; so there was no direct damage to the landfill, and the garbage was not dispersed and did not contaminate the city's water system.

Concerning the garbage collection service, the provincial authorities intensified their efforts with additional personnel and more frequent collection for the flooded areas as soon as they became accessible. They were able to restore the normal status within the first week after the flooding (by mid-October) and did not report any increased costs, arguing that the officials and civil servants and workers voluntarily accepted the extra workload, the case being an emergency. Therefore, no economic losses have been accounted to the waste management.

Impacts on Forest Ecosystems and Protected Areas

The replacement cost of the damaged hectares only represents the minimum replacement cost if the government decided to replant.[39]Using this most conservative approach, the total damage is calculated at USD31,073.

Table 34: Damage and Loss for Industry and Commerce (USD)

Total Damages	31,073.14
Losses (CPA)	34,037.57
Losses (CF)	64,329.13

[39] Estimation by the Office for Forest Management of the Forest Administration (FA), MAFF, 2002. See Methodology for more details on the calculation.

Total Losses	98,366.70
Total DaLA	129,439.84

Source: PDNA Team Elaboration (2009).

The losses have been calculated as the disruption of income from non-timber forest products (NTFPs) collection for the affected community protected areas (CPA) and community forests (CF). An estimated 1,995 hectares of CPAs and 3,770 of CFs were destroyed.[40] Using these assumptions, the losses were calculated at USD34,038 to CPAs and USD64,329 to CFs, for a total loss of USD98,367.

Recovery Framework for the Environment

Urban Waste Management

Following the national Waste Management guidelines and objectives,[41] the Recovery Framework for Environment will propose the following priorities:

- Improvement of waste management regulatory framework and institutional capacity: legislation related to waste management should be updated and expanded, and the government capacity should be strengthened;
- Improvement of waste collection systems and upgrading of disposal sites do not necessarily have to be difficult or expensive. The existing clean development mechanisms (CDM) financing opportunities for solid waste management should be explored to facilitate the financial feasibility of these projects; and
- Public awareness and participation programs for waste management should be developed through environmental education and training programs that involve active CSO participation with the objective of increasing general public knowledge about SWM best practices.

Environment: Strategic Priorities for Environmental Management

Building on the strategic development objectives for the Environment of Cambodia,[42] and its latest formulations,[43] the Recovery Framework for Environment will focus on the following principles:

[40] See Methodology for more details on the calculation.

[41] Royal Government of Cambodia, Sub-Decree on Solid Waste Management No. 36 , 1999.

- Support environmental valuation for Cambodia: A thorough and detailed environmental valuation for the country will broaden the environmental knowledge of all stakeholders will facilitate the prioritization and decision-making processes related to environmental management and will also facilitate future assessment exercise (for disasters or for CC scenarios valuation) and financing for environmental management;

- Enhance community-based forest and protected area management: Involving local communities in the real planning, decision-making process, and forest and PA management will secure but also regulate their rights of use, ensuring equity and benefit distribution but also preventing encroachment and illegal activities; will foster sustainable management of natural resources and support the environmental protection; and will improve food security, income generation, and ultimately livelihoods, linking with the broad poverty reduction strategies and community development objectives; and

- Integrate the disaster risk management and climate change adaptation agendas with that of environmental management: from the national to the province level, and involving not only provincial DoEs but also PA authorities, forest administrators, and communities. Disaster risk management (DRM) can be mainstreamed as a strategy for community-based resource management and area conservation management plan. Community-based DRM can complement current strategies, focusing on strengthening people's adaptive capacities to the impact of natural hazards, climate change, and environmental degradation.

Short Term (0-6 months)

- Urban Waste Management
  - No immediate economic impact was reported, so no action is proposed.
- Forest and Protected Area Management

[42]'The Rectangular Strategy of the Royal Government of Cambodia, Rectangle I (Enhancement of the Agricultural Sector), Side 4 (Forestry Reform) outlines the following principles: (i) sustainable forest management policy; (ii) protected area system; and (iii) community forestry.

[43] "Environmental Management in Cambodia: Lessons and Experiences", by H.E. Mok Mareth, Senior Minister, Minister of Environment, 2007.

- Immediate recovery and potential food emergencies in Bang Per Wildlife Santuary and Tonle Sap Biosphere communities,[44] which have reported substantial impact on their livelihoods through disruption of NTFPs collection and destruction of crops.

- Two supervision missions to identify community impact to and mid-term needs for Phnom Kulen National Park and Preah Vihear Protected Landscape,[45] which host communities that may have been moderately impacted (even if the PA authorities did not report any damage).

- Disaster Risk Management capacity development program that will probably be designed for the National Committee for Disaster Management should involve the MoE and MAFF and include DRM for the environment.[46]

- Total investment: USD 181,000.

Medium Term (2 years)

- Urban Waste Management
  - Regulatory framework and institutional capacity building: Establish a waste management coordination and information center for Cambodia (USD 200,000).
  - System improvement in Siem Reap: Estimated USD 1 million (including financing through CDM opportunities).
  - Public awareness campaign in Siem Reap, estimated USD 50,000.
  - Total investment: USD 1,250,000.
- Forest and protected area management
  - Environmental valuation study at the national level: USD 150,000.

[44] USD 50,000 for Bang Per and USD 75,000 for Tonle Sap are estimated as the financial needs to restore their livelihoods.

[45] USD 10,000 estimated to carry out a supervision mission and assess mid-term needs for these PAs.

[46] The additional cost of including Protected Areas and Forest Administration Authorities in the proposed "Strengthen Sub-national capacity to implement Community-based Disaster Risk Management Interventions" is estimated in an additional USD 36,000.

- CPA and PA management in Bang Per, Phnom Kulen, P Vihear, and Kulen-Promtep (estimated USD 1.32 per hectare per year). Total: USD 752,400.
- Disaster risk management and climate change adaptation capacity development program for provincial DoEs.[47]Total: USD 80,000.
- Total investment: USD 982,400.

Long Term (5 years)

- Urban Waste Management
  - Regulatory framework and institutional capacity building: Capacity building for Siem Reap municipality: USD 60,000.
  - System improvement in four main cities in the North (additional four): Estimated USD1 million (including CDM development, USD 250,000 each).
  - Recycling program (Siem Reap): Estimated USD 250,000.
  - Total investment: USD 1,310,000.
- Forest and Protected Area Management
  - Environmental valuation study at the national level (annual update system, USD 15,000 per year): USD 45,000.
  - Extend CPA and PA management to years 3–5 for the same PAs (estimated cost USD 1.32 per hectare per year): Total: USD 1,128,600.
  - Disaster risk management and climate change adaptation response systems for provincial DoEs (USD 80,000 per province).[48]Total: USD 320,000.
  - Total investment: USD 866,600.

Table 35: Recovery of Environmental Management (USD)

[47] Estimated at USD 20,000 per province (only for four affected provinces: Stung Treng, Preah Vihear, Siem Reap and Kampong Thom).

[48] Estimated at USD 80,000 per province, for the four most affected provinces: Stung Treng, Preah Vihear, Siem Reap and Kampong Thom.

Area	Priority	Short Term	Medium Term	Long Term	Totals
Urban Waste Management	Regulatory Framework and Institutional Capacity Building	0	200,000	60,000	**260,000**
	Improving Waste Collection Systems and Upgrading of Disposal Sites	0	1,000,000	1,000,000	**2,000,000**
	Public Awareness and Participation	0	50,000	250,000	**300,000**
	Total	**0**	**1,250,000**	**1,310,000**	**2,560,000**
Forest and PA Management	Environmental Valuation	0	150,000	45,000	**195,000**
	CBA and PA Management	145,000	752,400	1,128,600	**2,026,000**
	DRM and CC Adaptation Programs for Environment	36,000	80,000	320,000	**436,000**
	TOTAL Forest and PA	**181,000**	**982,400**	**1,493,600**	**2,657,000**
	Total	**181,000**	**2,232,400**	**2,803,600**	**5,217,000**

Source: PDNA Team Elaboration (2009).

Proposed Partnerships and Financial Mechanisms

- Urban Waste Management
  - Regulatory framework and institutional capacity building: the European Commission has been active in this sector in Cambodia (Integrated Environment Information System in Siem Reap, INTEGRITAS); capacity building and policy reinforcement in waste management; others: related UN agencies, like WHO and UNEP.
  - System improvement: The private sector through the establishment of public-private partnerships (PPP) should take the lead. The World Bank and Asian Development Bank can provide expertise for the development of solid waste management-CDM that will strengthen the financial feasibility of system upgrades and foster investment opportunities.

- Public awareness: Implemented by local NGO/CSO, and funded by various donors.

- Forest and Protected Area Management

  - Environmental evaluation: The Asian Development Bank and the World Wildlife Fund (WWF), given their experience in Tonle Sap and assessing Cambodian biodiversity. The UN Environmental Program and the World Bank (WB) also have done some excellent work in environmental economics and can leverage on the expertise of the World Bank Institute and similar research institutions.

  - CBA and pa management: It is expected that the next global agreement on climate change–even if not the boldest–will foster an exceptional increase in REDD/CDM for forestry funding schemes in the medium and long term. That is the reason why such an ambitious investment plan has been proposed. The projects will be sponsored primarily by donors and global funds, and implemented by agencies and CSOs such as WB, UN-REDD, WWF, etc.

  - Disaster risk management and climate change (CC) adaptation: It is expected that the next global agreement on CC will also increase the adaptation funding exceptionally. The projects would therefore be financed by such new generation adaptation funds from such institutions as the Global Fund for Disaster Risk Reduction (GFDRR) and the Rockefeller Foundation, and would be implemented by the partners as the WB, ISDR, and ADPC.

Table 36: Recovery Framework for the Environment (USD)

Area	Priority	Short Term	Medium Term	Long Term	Totals
Urban Waste Management	Regulatory Framework and Institutional Capacity Building	0	200,000	60,000	**260,000**
	Waste Collection Systems Improvement and Upgrading of Disposal Sites	0	1,000,000	1,000,000	**2,000,000**
	Public Awareness and Participation	0	50,000	250,000	**300,000**
	Total	**0**	**1,250,000**	**1,310,000**	**2,560,000**
Forest and PA Management	Environmental Valuation	0	150,000	45,000	**195,000**
	CBA and Protected Area Management	145,000	752,400	1,128,600	**2,026,000**
	DRM and CC Adaptation Programs for Environment	36,000	80,000	320,000	**436,000**
	TOTAL Forest and PA	**181,000**	**982,400**	**1,493,600**	**2,657,000**
	Total	**181,000**	**2,232,400**	**2,803,600**	**5,217,000**

Source: PDNA Team Elaboration (2009).

2.6.2 Public Administration

Introduction

This section covers an estimation of the damages to the public administration sub-sector. Losses are considered minimal as the sector continued functioning throughout the storm, and so are not considered. The public administration sub-sector is further narrowly defined as commune, district, and provincial own offices and functions, as all other technical line ministries and offices are directly managed by respective national ministries, hence assessed directly by a separated thematic sector team (for instance, damages and loss to

agriculture and its sector office/branch buildings and functions are assessed by the agriculture team).In other words, this assessment on the public administration sub-sector in Cambodia is in principle assessing damages and loss to commune, district and provincial offices (Sala Khum, Sala Srok, and Sala Khet) and disruptions to their functions.

Commune/*Sangkat* Offices.[49] Commune offices in pre-Ketsana's conditions varied in terms of physical structures, facilities,(such as resource centers, filing, and record keeping) as well as their utilization. There are 1,621 communes in Cambodia. The Asian Development Bank supported Commune Council Development Projects (CCDPs) phase 1 and 2 allowed the Royal Government of Cambodia to construct a total of 697 new commune offices in 23 provinces outside the capital Phnom Penh. The remaining 924 communes are operating in their existing buildings with varying degrees of quality. Most are in poor condition and in need of renovations or require completely new construction. Presently, there is no pipeline project/plan to deal with these 924 commune offices.

District/*Khan*.[50] Cambodia has 193 districts/*khans*, and municipalities. District/municipal offices are usually made of concrete, but the majority of the buildings were built before 1993.District authorities have so far not been given substantial functions (unlike the commune and provincial authorities) and have operated as an arm of the province. The new law on the administrative management of the capital, provinces, municipalities, districts, and *Khathe* district/municipality will soon require office space, facilities, equipment, staff, and its own budget to undertake the newly transferred functions.

Provinces. The 23 provinces and the Capital of Phnom Penh are presently considered as the most functional tier of sub-national administrations with better offices, facilities, equipment, and staffing. This tier also has the human resources and network capacity to deal with the aftermath of natural disasters (such as, conducting damage assessments, and reporting and providing immediate assistance).The National Committee for Disaster Management (NCDM) and the Cambodian Red Cross (CRC) have branches in each of the provinces and are decentralizing some of their functions to the provinces to conduct damage assessments following natural disasters.

Disaster Impact on Public Administration

The damage to the public administration sector from Typhoon Ketsana was limited in scope, causing direct damages to a commune building and minor roof damage to the district

[49] *Sangkat* is urban equivalence of commune.

[50] Khan is urban equivalence of district.

military and police headquarters in Kampong Thom Province (see picture and estimation of direct damages below). In addition, the typhoon caused damage in Ratanak Kiri Province, with floods damaging buildings in Andong Meas and Taveng Districts. Administrative documents and civil registration records in these two remote districts were seriously damaged by the floods (see below pictures).The governor and police commissioner of Andong Meas District state that these two headquarters will need to be relocated to higher grounds and that they have no plans to move back to the two buildings.

Prior to the field assessment, the team gathered baseline information and reports from the NCDM, CRC, provincial governors' offices, a limited number of NGOs, ADB, and UNDP. However, information related to the damage and loss incurred by the above-defined "public administration sub-sector" is extremely limited. Only Kampong Thom and Ratanak Kiri Provinces reported physical damage to commune and district buildings and records. In this respect, the team decided to conduct a field assessment on damages to the public administration sub-sector in Ratanak Kiri, Kampong Thom, and Siem Reap Provinces (November 13-20, 2009). Assessments of damage in other provinces, districts, and communes were carried out through email and phone calls.

In total, direct damage and loss to the public administration sub-sector caused by Typhoon Ketsana is estimated at USD 178,685. This includes costs to repair damaged structures and facilities as well as relocation of two offices in low-lying areas.

Picture 1: **Andong Meas, Ratanak Kiri**

District Office under Ketsana's Water and After

Remaining records in newly rented office

Taken on 30 September 2009 and 14 November 2009

Picture 2: **Sandan, Kampong Thom**

A view from the back From the entrance

Losses for this sector are considered minimal and have not been calculated. While there are some loss due to building closures and relocation, these have not been factored into the overall calculations.

In terms of other considerations, Typhoon Ketsana has unavoidably deepened the burden on government expenditures and compounded the negative effect of the global economic crisis on overall revenues. It should be also noted that although the government was able to collect revenues in excess (if compared with its annual planned figures shown in the annual budget law) in 2007 and 2008, a similar trend is not foreseen for 2009. As explained in the draft 2010 budget law, which was submitted to the National Assembly recently, overall revenues in 2009 would be lower while overall expenditures in 2009 would be higher than the figures in the adopted law. As such, the government has already spent from its national reserves to stimulate the economy. In another words, there will be a higher deficit than expected in 2009.

Optimistically, however, the draft 2010 budget law forecasts 3 percent of GDP (USD 11,774 million) and a decreased budget deficit from 6.08 percent of GDP in 2009 to 5.3 percent of GDP in 2010.For the public administration sub-sector, the draft bill predicts a significant decrease of provincial revenues in 2010, hence requiring increased transfer (of about 71 percent) from the treasury if compared to the 2009 budget law.

Of note, the draft law does not show specific lines of expenditures for Typhoon Ketsana recovery. The bill actually focuses on same prioritized sectors as in 2009 with a significant increase for security and defense. This means it is likely that the public administration sub-sector will not receive government funds for recovery.

Recovery Strategy for Public Administration

The 2010 Commune Sangkat Fund (CSF) allocation was endorsed by the Royal Government of Cambodia on October 14, 2009. Compared to 2009, the CSF allocation is slightly increased for all communes according to the formula. There is no special increase for Ketsana-affected communes to cover the damage they incurred.

Short Term (0-6 months)

- Repair damaged buildings, room beams, fences, and cut and remove fallen trees for the district offices and police offices;
- Provide funds for rental of temporary premises while repair is undertaken;
- Replace/photocopy administrative and civil registration records damaged by the storm; and
- Repair furniture damaged by the storm.

Medium and Longer Term (2-5 years)

- Consider retrofitting of public administrative building in high-risk areas;
- Relocate offices in vulnerable areas when possible; and
- Ensure vulnerability to natural hazards is taken into account in the placement and construction of new public buildings.

Table 37: Recovery of Public Administration Buildings (USD)

Recovery	Short Term	Medium Term (2 Years)	Total

	(0-6 Months)		
Building Repair and Relocation	5,885	160,000	165, 885
Equipment	9,200		9,200
Rental of New Office During Reconstruction		3,600	3,600
Records	800		
TOTAL	**15,085**	**163,600**	**178,685**

Source: PDNA Team Elaboration (2009).

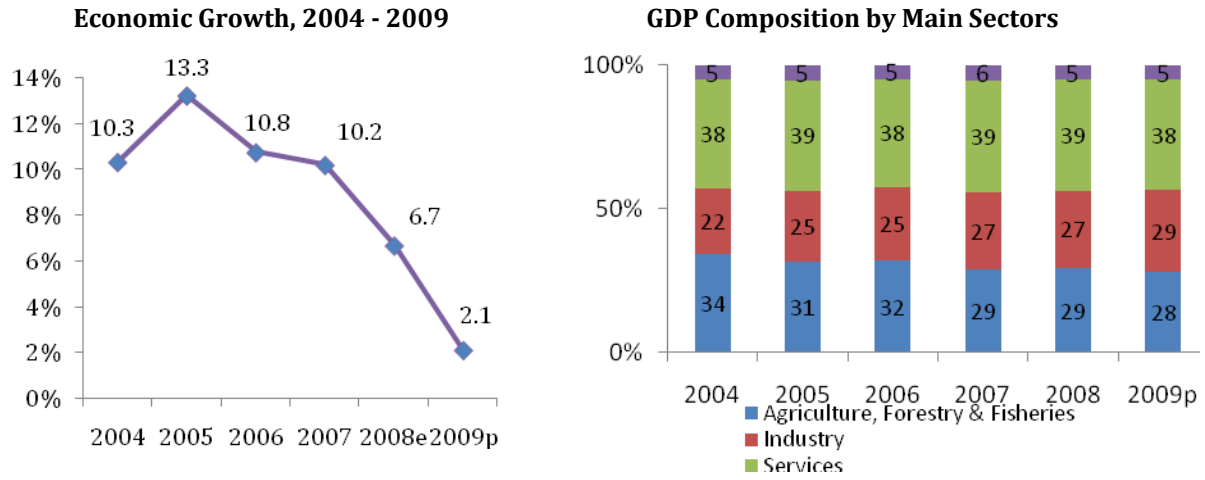
SECTION III: MACRO-ECONOMIC AND SOCIAL IMPACTS

3.1 Macro-Economic Impact

3.1.1 The Cambodian Economy Pre-Ketsana

After a remarkable economic performance over the past 15 years and with a record double-digit growth for four straight years from 2004 to 2007, the Cambodian economy started to shrink in 2008 and is expected to fall significantly in 2009, in part due to the impact of the global downturn. The growth of GDP slowed to 6.7 percent in 2008 and is projected to decline to 2.1 percent in 2009.[51] Most indicators pointed to a slowdown in the economy, and some others suggested a possible bottoming out in the first half of 2009. While agriculture and the informal economy will provide well-needed income, only a recovery in the tradable sectors (including tourism) will drive growth to the levels Cambodia used to have, and any recovery is very much dependent on a rebound in the global economy (in particular in the United States, the European Union, and the Korean markets).

Figure 7: Economic and Sector Performance, 2004-2009



Source: MEF (2009).

Cambodia's agricultural sector represented 29 percent of GDP in 2008 and continued to show good prospect in 2009 even though garment exports and the tourism and construction sectors become more depressed. The annual paddy rice production in 2008

[51] The government projected 2.1 percent growth for 2009. Other institutions projected negative growth for 2009: International Monetary Fund (-2.7), World Bank (-2.2), and Asian Development Bank (-1.5).

expanded by 6.7 percent over that of 2007; it has a continued positive outlook for 2009 despite sporadic droughts, floods, and most recently, Typhoon Ketsana. The sector employs some 60 percent of the country's labor force whose income is subject to large swings with commodity prices (including rice, cassava, and rubber) and weather dependence. Garment exports, the country's key foreign exchange industry, started slowing down at the end of 2008 and growth become negative by the first half of 2009, with exports falling by 26 percent. A similar trend is visible in the tourism and construction sectors. While tourist arrivals grew by 5.5 percent in 2008, indicators from the first half of 2009 pointed to a decline of -1.1 percent over that of 2008. The tourism sector is expected to slowly recover by the end of 2009 while the construction sector is expected to bottom out. Construction projects approved during the first six months of 2009 dropped by an annualized rate of 25 percent.

Construction is projected to bottom out with visible signs of rebound by 2010, reflecting gradually growing capital inflows to the sector. Lending from commercial banks to the construction sector grew 26 percent by mid-2009, regaining ground for recovery in 2010. But flows of credit to the real estate sector remain subdued with no clear signs of stabilization before the end of this year. Over the first half of 2009, there was evidence of stress on the corporate sector, including a 40 percent plummeting of new firm registration for businesses and the closure of 16 percent of the garment factories (net of opening). The observed corporate vulnerability and the impact on employment, wages, and poverty are expected to lead to increased nonperformance loans by the end of 2009.

The external sector is stable but the accumulation of the foreign exchange reserve has slowed down. Gross foreign reserve growth slowed markedly and grew merely by a year-on-year rate of 6 percent in June 2009, reaching USD 2.18 billion. The growth was much lower than its average annual rate of 34 percent over the past three years. External accounts still show a large current account deficit, but have adequate financing. Several flows are "self-correcting" (e.g., lower garment exports partly offset by lower raw material imports). Although private capital inflows (i.e., FDI and to a lesser extent remittances) have slowed down, external assistance remains strong, and FDI showed some signs of bottoming out in 2009.

On public finance, revenue is expected to shrink. The impressive growth in domestic revenues since 2004 averaging 25 percent per annum may not materialize in 2009. Over the first half of 2009, all key revenues—mainly tax revenue, non-tax revenue, and capital revenue—pointed to an annualized decline of -12 percent, -22 percent, and -48 percent respectively. Weak tourism receipts and import duties (including shrinking construction materials-related imports) put the revenue collection target under increasing strain. At the same time, expenditures increased by 12 percent and are likely to continue to increase, especially with fiscal packages introduced earlier this year to boost the economy and tax holidays extended for key supporting industries. As a result, the fiscal deficit is projected to widen to -6.1 percent of GDP (up from -2.8 percent in 2008) and additional foreign and domestic financing is also expected to expand.

The USD 253 million (Riel 1,053 billion) fiscal deficit (before grants) is financed by external assistance (grants and loans). Hence, the deficit may not require any domestic financing; despite cash deposits have stayed steady at USD 694 million by June 2009. In addition, in December 2008, donors pledged disbursements for 2009 at around USD 1 billion, a level slightly higher than that of 2008.

Necessary policy responses taken to stimulate the economy are broadly appropriate. The prime minister recognized the impact of the global crisis in February 2009 and launched the preparation of a three-pronged response: macroeconomic and financial sector policies; fiscal policies; and sector responses. While overall appropriate, the specifics of the response have been of limited reach, in part reflecting the constraints the authorities face.

In the area of response under monetary policy, the Central Bank, after focusing on excess growth in credit during the first half of 2008 (with, appropriately, a doubling of reserve requirements effective July 2008 and a tripling of capital requirements over three years, decided in September 2008), focused on the issues of tight liquidity and banking sector risks. Two sub-decrees on banking governance and fit and proper tests were introduced in November 2008. An overdraft facility of USD 100 million was created in January 2009. The reserve requirements were brought down from 16 to 12 percent in February 2009. A 15 percent restriction ceiling on real estate lending introduced in July 2008 was also removed in February 2009. Banking sector supervision was intensified, including with assistance from the Asian Development Bank and the International Monetary Fund. An international agency credit rating agency, Moody's has revised its systemic support rating for Cambodia downwards from Ba1 to B1, after a review completed in June 2009, putting the credit risk in the Cambodia's banking system at a moderate level. The law on Financial Lease was adopted in May 2009 to secure the rights and duties of all parties involved in financial lease operations. The Central Bank in June 2009 created an Executive Commission for Developing the Inter-Bank and Exchange Market to regulate the bonds and securities of the Central Bank.

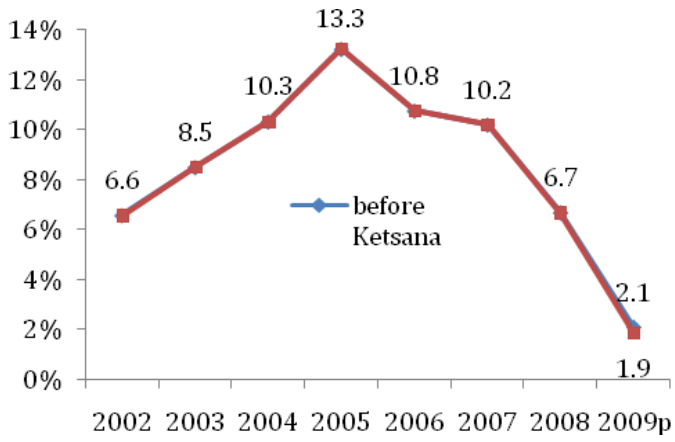
A higher fiscal deficit is expected as the government introduced a number of stimulating fiscal packages to support domestic demand. The 2009 budget law was amended and adopted by the parliament in May 2009 to provide additional financing for priority activities to save the economy, which included additional tax holidays for key investments (e.g., agriculture and garment industry), tariffs and VAT incentives for supporting industries, funds allocated to train laid-off workers, and a 20-percent wage increase of civil servants. The Public Financial Management reform program has been reinforced to improve efficiency of budget execution and its policy management. Marked progress was evident, including closing additional unused government accounts, 18 government ministries and institutions using ANZ Royal Bank services for salary payments, extending the use of commercial bank (ACLEDA) in handling state revenue and expenditure transactions, including the payment of government salaries in rural areas. Twenty-five ministries have set up the departments of internal audit and 13 are operational.

3.1.2 Impact of Ketsana on the Economy

The impact of Typhoon Ketsana on the economy is mainly through the agriculture sector—damage to the rice crop. 49,000 hectares of rice were destroyed by the storms and floods and 67,000 hectares were affected, resulting in a total loss of 130,000 tons of paddy rice. The impact on livestock was minimal as 70 cows/buffaloes, 270 pigs, and 12,000 poultry were killed.

The impact on the other three drivers of the economic growth—garment export, construction, and tourism—were minimal. The typhoon affected a small number of family-based agro-enterprises and micro-enterprises because the provinces are not industrial based. The typhoon and floods did not cause damage to major construction as big residential and commercial construction projects are concentrated in the capital city of Phnom Penh and in major urban areas.

Figure 8: Impact on Economic Growth, 2009



Source: MEF (2009) and PDNA (2009).

With a major impact on the rice crop but a minimal impact on other sources of growth, it was estimated that the typhoon brought a loss of USD17 million (Riel 69 Billion) of value-added to GDP. This shock would lead to 0.2 percentage point reduction in economic growth for 2009, thus reducing the growth rate for 2009 from earlier estimates of 2.1 to 1.9 percent.[52]

The impact on fiscal revenues is unlikely to be significant, but the impact on expenditures could be important. The financing for medium- and long-term needs will have a significant impact on the fiscal space. As explained in the draft 2010 budget law, which was submitted to the National Assembly in December, overall revenues in 2009 will be smaller due to the slower economic growth, while the overall necessary expenditures in 2009 will be higher. The financing needed to rebuild physical infrastructure and livelihoods after the typhoon will create an even higher deficit and therefore will require additional domestic and foreign financing.

[52] If projected growth figures from other institutions are used and applying 0.2 percentage point of reduction in growth, the 2009 figures are: International Monetary Fund (-2.9), World Bank (-2.4), and Asian Development Bank (-1.7).

The rice prices in those provinces and elsewhere remained stable thanks to the rice harvest season. Rice and other basic food item prices largely remained stable in November, according to the FGDs with villagers, commune councils, and provincial officials in Stung Treng and Kampong Thom. Rice prices data collected by the Ministry of Agricultural, Fisheries, and Forestry (MAFF) confirmed this conclusion (Table 38). Rice prices in Battambang, Preah Sihanouk, and Banteay Meanchey were stable in October and November. The rice prices that were collected by the National Institute of Statistics to produce the monthly consumer price index also showed relative stability during the aftermath of the typhoon.

Table 38: Prices of Second-Grade Rice (NeangMenh)In Selected Provinces Post Ketsana (USD)

Battambang	October 7	October 14	October 28	November 11	November 18
(Rice Mill Battambang)	1,700	1,950	1850	1900	1750

Preah Sihanouk	October 9	October 12	November 13	November 16	November 20
(PsarLeu)	2500	2500	2000	2000	2000

Banteay Meachey	October 7	October 14	October 28	November 11	November 18
(Rice Mill O Ambil)	1,869	1,875	1725	1725	1725

Source: CPI, National Institute of Statistics (2008).

Table 39: Prices of Rice in Phnom Penh Post Ketsana (USD)

Type of Rice	July	August	September	October
Quality No.1, Phaka Kanhey	2,735	2,753	2,758	2,765
Quality No.2, Neang-Menh	2,230	2,245	2,245	2,250

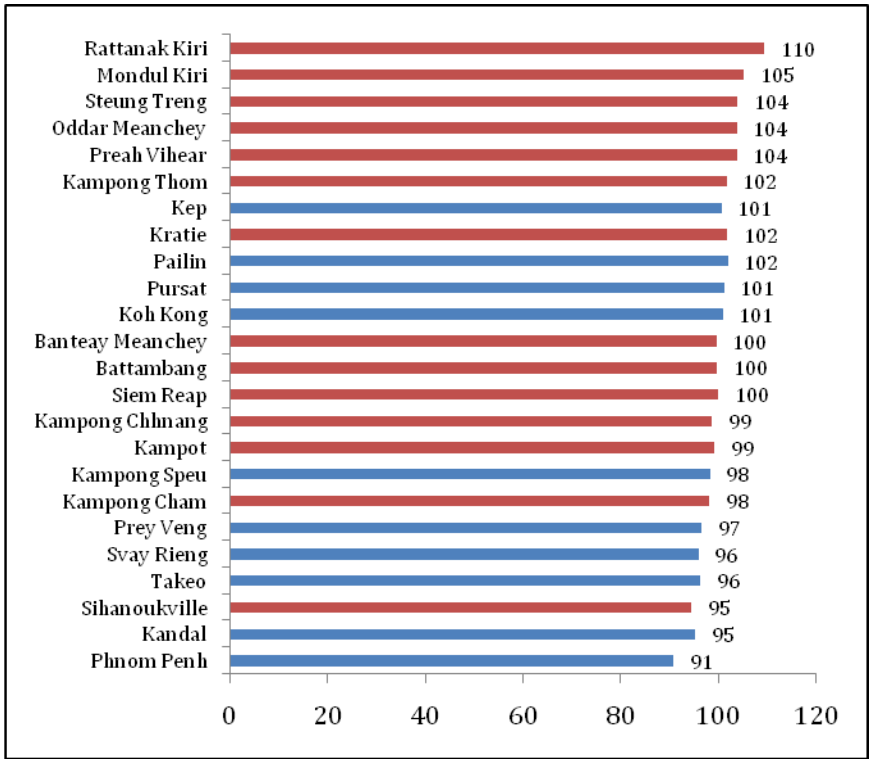
Source: CPI, National Institute of Statistics (2008).

3.2 Social Impact

3.2.1 Impact on Livelihoods and Income

The typhoon hit 14 provinces where the poverty level was relatively high compared to other provinces. A calculation of the poverty score[53] by the Ministry of Planning and the Ministry of Interior's National Committee for Decentralization and Deconcentration using five main indicators from the Commune/Sangkat database showed that except Kampong Chhnang, Kampot, Kampong Cham, and Preah Sihanouk, 2007's poverty score for other disaster-affected provinces in the Northeast, North, and Northwest (i.e., Mondul Kiri, Kratie, Ratanak Kiri, Stung Treng, Preah Vihear, Oddar Meanchey, Banteay Meanchey, Siem Reap, and Kampong Thom) are between 100 and 110. This means that these provinces are relatively poorer than those in the East, South, and Southwest.

Figure 9: Poverty Score by Province, 2007 (>100=Poorer; <100=Richer)



Source: Commune Database Poverty Score (2007).

The level of poverty in these provinces was already 40–45 percent prior to the typhoon while the poverty rates for rural areas and Cambodia as a whole were 39 and 35 percent respectively. Poverty estimates using Cambodian's household survey in 2004 suggested that

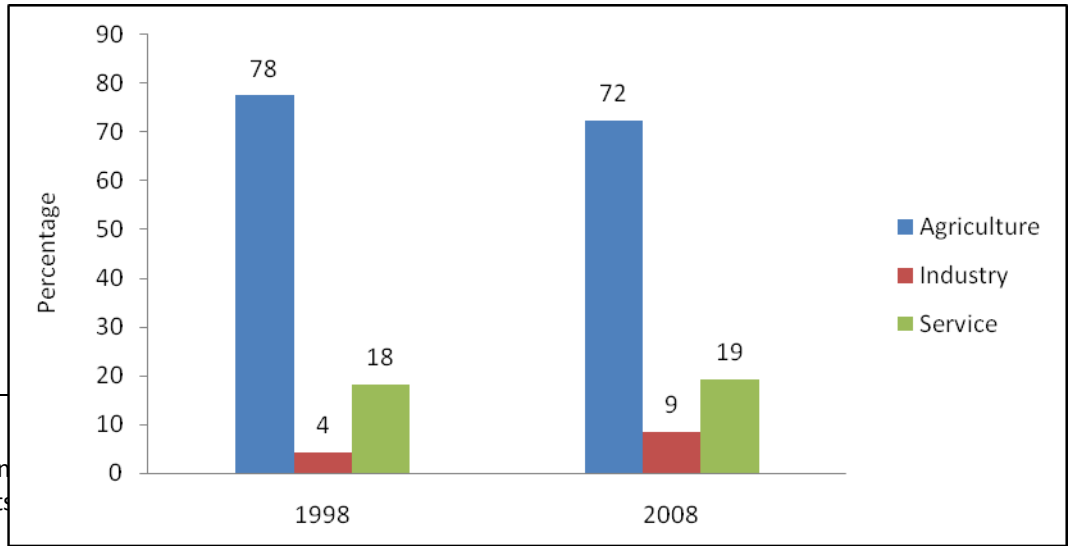
[53] The calculation of a provincial score has four steps. First, five indicators—(i) percentage of households who have access to a water supply 150 meters from the dwelling; (ii) percentage of households with a thatched roof; (iii) percentage of primary school age children not attending school; (iv) percentage of adult literacy age 15-45; and (v) proportion of births attended by a skilled health personnel—are chosen to calculate a score for a commune. Then, the commune scores in a district are used to calculate an average score for the district. And finally, district scores are used to calculate an average score for the province.

45 percent of population in the upland region were living below the national poverty line.[54]If it is assumed that the poverty rate in the mountainous region was reduced by 4 percentage point from 2004 to 2007 (paralleling the reduction in rural poverty), the rate of poverty in the mountainous region would have been around 41 percent in 2007.

The general profiles of households in these provinces suggested that households rely primarily on rice and other crop farming, and access to common property resources such as fish and non-timber forest products. Agriculture, rice farming in particular, is the major source of food consumption and sources of income, which provide staple food for dietary consumption and 60–80 percentage of total household income.[55]Results from General Population Census of Cambodia 2008 released in August 2009 show that as much as 72 percent of 7 million people in the Cambodian labor force, which also applicable to rural population in these 14 provinces, are dependent on agriculture.

The opportunity cost of Typhoon Ketsana and the global economic downturn has meant a loss of informal, off-farm activities (e.g., clearing land, planting, weeding, transplanting, and harvesting,) and urban unskilled labor (i.e., in the construction, manufacturing, and service sectors). For rural households, November and December represent an accelerated period of income generation, either harvesting their own crops or selling their labor to other farms: These jobs were decimated with Typhoon Ketsana. The slowdown of Cambodia's economy has led to a reduction in the urban/peri-urban unskilled labor demand in general and affected remittances to the rural economy.

Figure 10: Employed Population by Industrial Sector, 1998 and 2008



[54] Kn Country Units

[55] Estimates on average income and sources of income of rural households in Cambodia, like in other developing countries, remain very challenging because rural households do not have regular monthly salaries or earnings. Their income from selling rice or other subsidiary crops depends heavily on favorable weather, thus providing unstable income over time. However, to the best of the knowledge and findings from the FGDs in two different villages each in Stung Treng and in Kampong Thom Provinces, the average Cambodian in a rural area earned approximately Riel 300,000–450,000 (USD 73-110). 2008 GDP per capita was around USD 740 per year or USD 62 per month.

Source: MoP, General Population Census of Cambodia, 1998 and 2008.

While rural Cambodians are highly vulnerable to risks and shocks (see Risk Profile section), the typhoon and its subsequent flash flood was another blow to the current livelihoods of Cambodian rural households in the provinces. The conditions are likely to be more severe in 2010 because approximately 49,000 families were already in a food shortage situation before the typhoon[56]and the Ketsana has damaged additional hectares of rice crop that would have been harvested in November and December.

Box 2: Typical Livelihood Changes in Koh Khorndin, Stung Treng District

Income from rice cultivation: In this village, almost all of the families cultivate 1-2 ha of wet rice from May to July. There are about 214 ha in total under cultivation, and average yields range from 1.5 to 2 tons per ha. This gives an approximate total annual yield for the village of 374.5 tons, equivalent to 2.9 tons per household/family. Around 20 ha were reported to be destroyed by the disaster. Assuming the rice price now is Riel 1,000 per kg (an average of 35 tons lost) or Riel 35,000,000 (USD 8,537) were lost to Ketsana.

Income from other crops: The village is involved in dry season and riverbank cultivation crops like maize, cucumbers, vegetables, water melons, and soybean. Income from this varies, with fluctuations reflecting market demand. During the FDG, 9 ha of crops were reported to have been destroyed by the disaster.

Fishing: Half of the households—69 out of 130— rely on fishing to earn their living. The price for a typical catch before Ketsana, keeping in mind that it can double in provincial markets, ranged from Riel 2,700 to 5,500 per kg. On average, these households have a gross income of about Riel 6,162,200 per year. Labor, gasoline, and daily expenses are around Riel 1,546,238 per year. This yields an estimated net income per year of Riel 4,546,963 (USD 1,154). Based on these figures for the 69 households, we can estimate an annual gross income to the village from fishing alone of at least USD 79,625. The loss of fishing activities and income are estimated at one month in peak season, compounded by an escalation in the price of fish to as much as Riel 8,000 to 15,000 per kg. The increase of fish prices is attributed to lower catches and higher demand by an influx of lowland people to the provinces.

Source:FGDs Note, Stung Treng.

Although extreme cases of starvation in the affected villages have not happened, in part due to immediate relief efforts and traditional household and community coping mechanisms, the impact in 2010 and beyond should not be under-estimated as the level of food insecurity is at risk and coping mechanisms are under threat. After the tropical storm, immediate relief efforts were provided by the government, the Cambodian Red Cross, and international and national development partners. Household- and community-level coping mechanisms, such as exploiting common-pooled resources and borrowing food or cash from relatives or friends, also provided short-term relief. In the past, rural households have

[56] NCDM, Presentation on November 10, 2009.

dealt with natural disasters by migrating short-distances for agricultural work and seeking loans from informal moneylenders and Micro-Finance Institutions (MFIs). These solutions work over the medium term for certain members of the household (i.e., adults) and expose others (i.e., women and children) to vulnerabilities. Unlike past disasters, however, the effects of Typhoon Ketsana are likely to be more severe after the rice harvest season ends in January 2010 and to remain severe until the next harvest season. Also expected to come under pressure are common-pooled resources like forests and fisheries.

3.2.2 Other Social Impacts

Selling durable assets and pulling children out of school have not yet widely occurred, yet studies in the past suggest differences. A nationally representative survey with 2,200 households nationwide conducted by the Cambodia Development Resource Institute in May 2008[57]showed that selling jewelry, watches, cows, buffaloes, pigs, and poultries were options that helped households cope with rapidly rising food prices in early 2008. Taking children out of school to help with domestic work and to find food were also common. As a last resort, agricultural and residential plots were sold to stem the further deterioration of living conditions.

The covariate shocks may bring even more serious social impacts, like criminality or domestic violence. However, based on the conclusion from the FGDs in Stung Treng and Kampong Thom, villagers and local authorities said that they had not observed an increase in domestic violence, a deterioration of community solidarity, or an escalation of local crime.[58] In some cases, by contrast, villagers and local authorities said that household-level solidarity had been strengthened as husbands and wives doubled their efforts to earn a living.

Table 40: Types of Shocks/Risks in Selected Provinces

	Shock/Risk	
Study Site	**Idiosyncratic**	**Covariant**
Banteay Meanchey and Battambang	• Illness • Death of household head, loss of household head due to migration or abandonment • Landlessness/loss of land • For demobilized soldiers, arrears in government	• Crop loss or low yields • Border closings

[57] Impact of High Food Prices in Cambodia.

[58] Villagers admitted domestic violence and sexual abuse were existed in their communities before Ketsana. But they have not seen any signs of immediate rising during the aftermath of Ketsana.

	payments	
Phnom Penh	• Illness • Unemployment • Death of household head, loss of household head due to migration or abandonment • Loss of housing	• Economic/labor market shocks
Prey Veng	• Illness (including water-borne diseases) • Death of household head, loss of household head due to migration or abandonment • Landlessness/loss of land	• Floods and drought • Low rice yield • Low demand for agricultural labor
Ratanak Kiri and Mondul Kiri	• Illness (i.e., HIV/AIDS, TB, diarrhea, cholera, and malaria) • Malnutrition • Landlessness • Livestock death caused by disease	• Crop loss due to drought, wild animals, and insect infestation • Wildfires • Flash floods

Note: The table summarizes shocks identified during interviews in case study sites. It is not a representative and exhaustive analysis and should be taken as illustrative.

Source: Muny et al. (2004) and IOM (2009).

While 30 percentage of the Cambodian population lives below the poverty line, in general a large proportion of Cambodians in both urban and rural areas are vulnerable to idiosyncratic risks (e.g., illness, death of household head, and loss of land) and covariant shocks such as natural disasters (e.g., flood, drought, insect infestation, fires, and wildfires) and economic-wide crisis. These shocks are particularly desperate if they occurred in rural and urban poor families. Livelihoods of rural households still rely mainly on agricultural farming and access to common property resources and fewer assets and lower savings to cope with such shocks. **Error! Reference source not found.** provides typical risks/shocks Cambodians have been facings although the study did not cover all 14 provinces that were hit by Typhoon Ketsana. Shocks caused by natural disaster or health can push non-poor households into poverty and further-push poor households into the depth of the poverty cycle.

3.2.3 Vulnerable Groups

Box 3: Who Are the Most Vulnerable In Cambodia?

- People with disabilities
- Internally displaced persons and repatriated refugees
- Demobilized soldiers
- Children, especially orphans and street children
- Abandoned elderly
- Women who are head of household
- HIV/AIDs individuals
- Ethnic minorities in the mountainous regions
- Sexual abuse victim
- Human trafficking victims
- Land mine and UXOs victims

Source: Provincial Profiles, Stung Treng, Kratie, Siem Reap, OddarMeanchey, Preah Sihanouk, BanteayMeanchey, and

Kampong Cham.

Within villages and communes, it was confirmed that the poorest groups[59] and households not only had their rice crops totally destroyed, but they had few assets or savings to cope with the aftermath—in brief, they were the most vulnerable. The poorest households are usually households headed by single women who have been widowed, divorced, or abandoned by their husbands, the elderly who have been abandoned by their children, disabled husbands, and HIV/AIDs spouses.[60]

The indigenous groups who traditionally live in the mountainous regions of Ratanak Kiri, Mondul Kiri, Stung Treng, and Kampong Thom Provinces were among the most vulnerable groups. They number approximately 100,000–190,000 (NGOF 2006), with about half living in Ratanak Kiri and Mondul Kiri.[61]

Within households, it appeared that women, children, and the elderly were the most vulnerable during the disaster and in the post-disaster period. During the typhoon and floods, children and the elderly were reported to have fallen ill because they were evacuated to sites where the necessary facilities (e.g., toilet, clean water, and shelter) and their hygienic conditions were below standards. After the disaster, while the male adults spent time outside the village or in some cases traveled to cities for work, women often had to take on significantly increased responsibilities to do household chores and sustain families.

[59] The lists of the poorest and next poorest households are available in almost all villages of the 14 provinces. The lists can be obtained either through the *Identification of Poor Household Program* at the Ministry of Planning in Phnom Penh or the Department of Planning in each province. They are a very important source of information for targeted interventions.

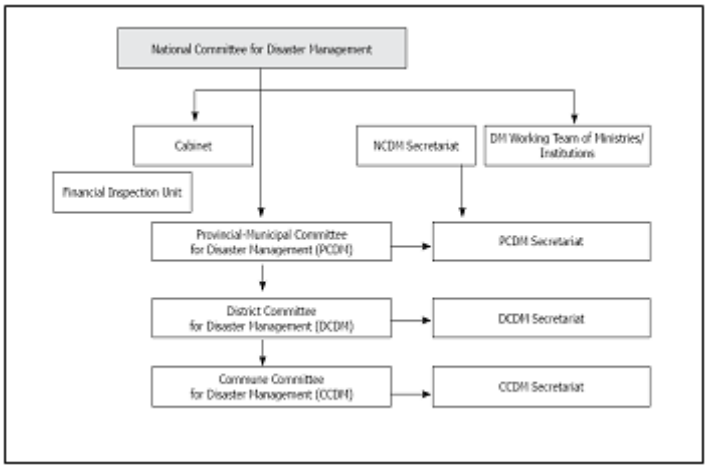
[60] The Provincial Profiles are prepared annually by the Provincial Department of Planning using the Commune/Sangkat database and provide figures and types of vulnerable groups in their respective provinces.

[61] There are 20 ethnic minorities living in the upland regions: Kui, Punong, Stieng, Tumpuan, Jarai, Kreung, Brao, Kachak, Lun, Kavel, Khaonh, Kraol, Mil, Thmon, Kanchrok, Poar, Suoy, Khmer Daoem, Suoy, Soch, and R'ong.

SECTION IV:
DISASTER RISK MANAGEMENT IN CAMBODIA

4.1 Country Risk Profile

Cambodia is one of the most disaster-prone countries in Southeast Asia. The country's National Poverty Reduction Strategy (NPRS) explicitly identifies natural disasters, particularly flood and drought, as critical factors that increase the socio-economic vulnerabilities of the rural poor, including placing a disproportionate burden of coping with the effects of disasters. Over the past ten years, Cambodia has been affected by a series of exceptional floods and by widespread but highly localized agricultural droughts. While agricultural production is dependent on this annual flooding cycle, particularly severe floods in recent years (notably 2000, 2001, and 2002), together with prolonged periods of dry weather, have caused considerable economic damage, losses in rice production, and a number of fatalities. The country had not faced a typhoon or severe storm until Typhoon Ketsana hit on September 29, 2009.



4.2 Institutional and Legal Framework for Disaster Risk Management

4.2.1 National Level

The Royal Government of Cambodia established the National Committee for Disaster Management (NCDM) fifteen years ago, recognizing that the country's geographic local exposed it to natural disaster and perceiving that a country-wide coordinating body was needed to manage the respective risks. The NCDM is headed by the prime minister as president with membership comprising all ministers, as well as representatives of the Royal Cambodian Armed Forces, Cambodian Red Cross, and Civil Aviation Authority.

The NCDM is composed of five departments: (i) Emergency Response and Rehabilitation; (ii) Administration and Finance; (iii) Information and Relations; (iv) Preparedness and Training; and, (v) Search and Rescue. It also has a working group on Disaster Coordination, Response,

and Recovery with five sub-working groups (Emergency Response; Food Security; Health; Small-Scale Infrastructure, Hygiene, Water, and Sanitation; and, Preparedness and Mitigation).

4.2.2 Sub-National Level

The Committees for Disaster Management branch into the provinces, districts, and communes, and retain similar governing structures and officers across all levels. The Provincial Committees for Disaster Management (PCDM) are designed to mirror the NCDM, with the provincial governor as the head and membership drawn from the provincial departments of the ministries as well as representatives from the police, army, gendarmerie, and the Cambodian Red Cross. At the district level, district chiefs and relevant officers should be designated members of District Committees for Disaster Management (DCDM). In some provinces, Disaster Management Committees exist at the commune level.

4.2.3 Roles and Responsibilities

The Disaster Management Committees at the sub-national level are intended as a coordination body and are responsible for providing overall guidance to all its members. They are responsible for coordination, facilitation, and guidance to all line ministries and also play a coordination role with other development partners for overall disaster management activities in the province, rather than the actual implementation of programs. Line ministries are the agencies tasked with implementation. Similarly, the PCDM/DCDM offices are responsible for synthesizing overall information about disaster management and/or damage and needs reports based on information received from concerned sectors and then submitting a comprehensive report to the NCDM.

4.2.4 Administrative Procedures and Policies

The national efforts for laying out policy on disaster management have evolved since 2001, including a number of decrees, circulars, and orders for setting up national as well as sub-national institutional mechanisms. The key national decrees issued by the Royal Cambodian Government are: Decree No. 0202/040 of 2002 on the Establishment of the NCDM; Sub-Decree No. 30 of 2002 on the Organization and Functioning of the NCDM; Sub-Decree No. 61 of 2006 on the Establishment of the CCDM; Circular No. 01 of 2002 on Disaster Preparedness and Response; Circular No. 02 of 2001 on Reduced Preparedness and Disaster Management; Provincial *Dey Ka* (Order) of

2007 on the Establishment of Disaster Management Commissions; and, Provincial Order of 2007 on the Establishment and Functioning of the PCDM. In addition, the RCG through the NCDM issues an annual Circular on Disaster Preparedness and Response, which is shared with all stakeholders prior to the beginning of flood season.

A Disaster Management law has been drafted and is under review by the Ministry of Interior; it addresses mechanisms for national and local authorities, division of responsibilities, and the role of private companies and international organizations.

In early 2009, the Royal Cambodian Government with the cooperation of the National Committee for Disaster Management (NCDM) and the Ministry of Planning (MoP) launched the Strategic National Action Plan for Disaster Risk Reduction 2008–2013 (SNAP–DRR). The objective is to foster a multi-stakeholder partnership to reduce the social, economic, and environmental impact caused by natural and human-induced hazards by incorporating disaster risk reduction into the policies, strategies, and plans across all sectors at all levels. Some of the most relevant project stakeholders are UN-ISDR and ADPC, which have been providing technical support in the development of the SNAP in Cambodia with funding from the European Commission.

4.3 Disaster Risk Management in the Poverty Reduction Strategy and Country Development Plans

The National Strategic Development Plan (NSDP) for 2006–2010 synthesizes the goals and objectives of the Rectangular Strategy, National Poverty Reduction Strategy (NPRS), and Cambodia Millennium Development Goals (CMDG). It does not directly address disaster risk reduction (DRR) but incorporates it in the areas of social welfare, water resources management, agriculture, and rural development. Within these priority sectors, the DRR activities that have been identified include: protecting rural areas from the natural hazards of flood and drought; enabling communities for disaster preparedness and risk reduction; and, reducing the vulnerability of the poor to external shocks, including natural hazards.[62]

In 2006, the government approved the National Adaptation Program of Action to Climate Change (NAPA). Both the SNAP–DRR and the NAPA seek to address Cambodia's vulnerability to hazards, although the latter focuses on responding to extreme weather events and slow-onset changes in climate and the former focuses on wider issues. Both complementary to and supportive of the NAPA, the SNAP–DRR has designated activities to synergize implementation and monitoring of both plans.

[62] National Strategy for Disaster Preparedness, Chapter IV: Key Strategies and Actions (2009).

At the national level, some key ministries included disaster risk management in their core programs. The Ministry of Education, Youth, and Sports (MoEYS), for instance, is implementing a mainstreaming disaster risk reduction into educational sector by including DRR practical measures and concepts into the national school curricula of grade 8 in two main subject matters, geography and earth science. The Ministry of Health (MoH) is implementing "Safer Hospitals" campaigns and DRR integration into the health sector with the support of World Health Organization (WHO), as a part of the support to World DRR Campaigns promoted through the International Strategy for Disaster Reduction (ISDR) for Cambodia. Both initiatives are supported by the European Commission. The Ministry of Water Resources and Meteorology (MoWRAM) is playing an active role in providing flood and weather forecasting and early warning information to national and sub-national government agencies, local authorities, and the public through television, national radio, and local newspapers. In the aftermath of a natural disaster, the Ministry of Agriculture, Forests, and Fisheries supports the immediate recovery of the agricultural sector by providing rice seed and fuel.

Similarly, at the sub-national level where development partners are implementing disaster risk management (DRM) projects, disaster risk reduction measures have been integrated into the local development plans. This is particularly true in four provinces seriously affected by Typhoon Ketsana. In Kratie Province, for example, ongoing projects relating to DRR are being carried out by the ADPC, Action Aid, Oxfam GB, Oxfam Australia, and other local partners. These province and its districts and communes recently have included disaster risk reduction measures in their three-year investment programs—a tangible progress. In stark contrast, little progress has been made in the three provinces lacking DRR projects: Kampong Thom, Ratanak Kiri, and Siem Reap.

Despite a number of key government policies and pronouncements recognizing the importance of disaster risk reduction, the actual practice of government institutions and local governments remain focused primarily on responding after the occurrence of a disaster event. While some government ministries are already implementing DRR activities and projects, their efforts are largely uncoordinated and potential synergies with other ministries, local governments, international organizations, non-governmental organizations, and civil society are not fully realized. The SNAP–DRR facilitates the identification of disaster risk reduction activities of the various government ministries and agencies, and consolidates them into a single comprehensive program of action.

4.4 Assessment of Disaster Preparedness and Response Interventions

One of the challenges for effective disaster risk management in Cambodia is the limited capacity of the National Committees for Disaster Management (NCDM). The NCDM tends to convene primarily in response to natural disasters and while interested in risk reduction activities, lacks both the technical skills and the budget to do so. To make the shift from

disaster response toward a disaster risk reduction approach, the NCDM needs to increase its human resources and technological capacity. A second challenge is the lack of Disaster Risk Management (DRM) legislation. Although the institutional and legal framework mandates that the NCDM and its Secretariat have the primary responsibility for disaster management in Cambodia, the exact legal authority of the Committee to exercise its responsibilities is unclear and the budget limited. Passage of the draft DRM law would provide the legal basis for a DRM budget and further define the respective responsibilities

There are similar challenges at the sub-national level. The existing decrees and sub-decrees establish province-, district-, and commune-level committees for disaster management, but implementation of responsibility is limited by capacity and funding. Non-governmental organizations or external support in targeted provinces have lead to the development of plans for disaster response based on the roles and responsibilities assigned at the national level, but there is little capacity to implement them due to lack of resources, awareness, and training. No plans are in place to cover multi-hazard, large-scale emergencies. In the event of a prolonged impact of flooding and another province-wide emergency, the challenges of responding to two simultaneous disasters could be overwhelming for national-level responders. The section below provides detailed information on the assessment of preparedness and response capacity for different DRM interventions.

4.4.1 National and Sub-National Risk Assessment

There is no overall national risk assessment, and important tools like hazard, vulnerability, and risk maps are not in place. However, some progress has been made at the sub-national level. For example, the Flood Probability Maps of 14 communes in Leuk Dek District of Kandal Province and Peam Ro District of Prey Veng Province are being prepared by the Mekong River Commission Secretariat under its Flood Management and Mitigation Program. Similarly, in 2007, the World Food Program (WFP) supported the Department of Geography to produce a drought map at the commune level in selected provinces like Banteay Meanchey, Siem Reap, Kampong Thom, Kampong Cham, Kampong Speu, Prey Veng, and Svay Rieng. There are isolated good examples of risk maps, but they are not comprehensive and cover only small areas where projects have occurred.

Statistical information on local risks, hazards, and vulnerabilities has been generated under various externally aided projects but there is no system at the national and sub-national levels to update such information on a periodic basis or to collect and synthesize all information and analyze where key gaps in risk mapping occur. In practice, hazard data and vulnerability information are collected, updated, and disseminated by individual national authorities and partner agencies to serve their project purpose.

4.4.2 Early Warning Systems at the National and Sub-National Levels

The Ministry of Water Resources and Meteorology (MoWRAM) is mandated to produce and disseminate forecasts to the entire country. At the same time, the Regional Flood Management and Mitigation Center of the Mekong River Commission is responsible for producing and disseminating flood forecasts and early warning information for its member states in the Lower Mekong Basin, including Cambodia. At the local level, the Cambodian Red Cross plays an important role in disseminating flood forecasts to the communities. The forecast and early warning information is disseminated regularly during flood season (June to November) through television, mass media, FM and AM radio channels, and local newspapers.

However, the capacity of MoWRAM across all levels is limited due to insufficient funding, dated communication systems, and lack of equipment. The monitoring of floodwaters, droughts, and other disasters is reasonably effective; the forecast and early warning information from the national level usually reaches existing networks at the provincial but not the commune level. During Typhoon Ketsana, it was noted that the affected provinces (e.g., Kampong Thom, Ratanak Kiri, and Siem Reap) could not communicate in a timely manner with the authorities and residents of their communes, resulting in higher damage.

4.4.3 Public Awareness

There is a high degree of awareness among local people and authorities about annual flooding and drought; however this has not translated into a better preparedness strategy at the province and district levels. Specific awareness-raising components have been incorporated in projects being implemented by development partners, and the disaster management committees have been participating in educating local people on disaster risks and impacts. For example, in Kratie Province, where Action Aid, ADPC, Oxfam GB, and the Cambodian Red Cross have ongoing projects, public awareness campaigns are being carried out and IEC materials are disseminated to the local people. However, in provinces like Kampong Thom, Ratanak Kiri, and Siem Reap, which were part of the PDNA, there are no activities related to public awareness. Moreover, several commune-level officials said that when they communicated information about the typhoon to villages, there was general disbelief and some families living very close to the swollen rivers decided against evacuation. As in other disciplines, where externally funded projects are being implemented, the provincial information and culture department is involved in designing and disseminating disaster-specific awareness material: There is no sustained mechanism to educate local people on a regular basis.

4.4.4 Capacity Building

As mentioned in earlier sections, the existing capacities of all the disaster management committees from national to commune as well as in the line ministries to deal with disasters are less than desired. There is no strategy for upgrading the skills of national and sub-

national officials resulting in inconsistent understanding of disaster management, lack of adherence to regional or international protocols, and inconsistent decision-making at the local-level intervention. No accreditation, evaluation, or feedback system exists either for the current training programs or for skill improvement activities carried out by the Cambodian Red Cross and other developmental partners. The NCDM has a separate training unit but so far has not developed a strategy for conducting regular training for its members from line ministries. It also has no plan—or resources even if a plan did exist—to upgrade its own skills in coordinating with other technical agencies, research institutes, and universities to develop capacity building programs. Sporadic training and capacity building activities are being conducted by external partners for disaster management officials at the province, district, and commune levels, but the scope and coverage are limited to the project areas.

4.4.5 Disaster Response

In the aftermath of Typhoon Ketsana and the subsequent flooding, the National Emergency Coordination Center with the National Committee for Disaster Management (NCDM) assumed a more strategic coordination role than in past disasters. During the response phase, the NCDM streamlined information regarding relief distribution and the need for emergency relief, including food, clothing, medical supplies, and other emergency kits. The emergency response and relief activities were undertaken by humanitarian organizations, including national and international non-governmental organizations (NGOs) and the Cambodian Red Cross.

The Damage and Loss Assessment (DaLA), however, suffered for lack of systemic protocols, making it difficult to carry out and resulting in imprecise data. The communes reported their damages to the provinces mainly in hard copy handwritten forms. These forms were later sent as a hard copy or by fax first to the national-level line ministries and later from the national line ministries to the NCDM. In the end, the damage figures varied substantially between the line ministries and the NCDM.

Tracking relief distribution, either within the government or among NGOs, was exposed as another systemic failure. Moreover, Typhoon Ketsana exposed weaknesses in the system for tracking relief distribution. The NCDM is unable to give a total figure on relief distributed by the government as each line ministry delivers its own assistance through its department and is not obliged to share this figure with the NCDM. The NCDM has no database or system for tracking assistance distributed by NGOs or other development partners. While the NGOs have all been willing to share their figures individually, without a central repository for data, there is no system for the government to track a collective figure of external emergency relief assistance.

Search and rescue activities were undertaken in the provinces by the Royal Cambodian Armed Force (RCAF), with the help of local authorities and the provincial armed forces like

the police, army, and military police. However, there is no effective system of command and control that allows personnel from a variety of departments to work in a coordinated response mechanism and provide logistical and administrative support to operational staff by avoiding duplication of efforts. In addition, equipment for emergency response at the sub-national level is extremely limited to inexistent. For example, local police officials in Kratie reported having to borrow boats from private citizens to undertake search and rescue operations. Similarly, the provincial-level capacity for immediate response and coordination with humanitarian agencies is very weak due to a paucity of skilled human resources and lack of a systematic inventory of available resources that can be mobilized during major emergencies.

4.4.6 Mainstreaming and Financing Disaster Risk Reduction

Typhoon Ketsana highlighted the need to improve Cambodia's disaster risk financing system. Following the experience from major flooding in 2000, the national government reports that it allocates budget for disaster response annually. However, none of the provinces visited on the Provincial Damage and Needs Assessment (PDNA) could cite the exact amount allocated. Officials from NCDM noted that funds for emergency relief are allocated to the line ministries from the Office of the Council of Ministers and the line ministries following the line ministries' request. The line ministries then allocate the budget to provincial line departments annually. It became evident during this assessment that the streams of funding from the Royal Government of Cambodia to the provinces for emergency relief could be neither traced nor ascertained.

At the sub-national level of government, the annual budget for disaster risk reduction activities is virtually inexistent. Disaster Management Committees in the provinces, districts, and communes depend on development partners for disaster preparedness and response projects and programs.

4.5 Priorities for Disaster Risk Reduction in Cambodia

4.5.1 Reducing Risk in the Recovery Process

Rather than simply reconstruct facilities and basic services, the recovery process provides a physical opportunity as well as a basis for the collective motivation to introduce or expand structural (physical) or non-structural risk reduction elements. If recovery is pursued without this planning, Cambodia runs the risk of re-creating the very same conditions of vulnerability for returning villagers or the next generation.

Table 41: Illustrative Examples for Integrating Risk Reduction Into Cambodia's Recovery Process

Infrastructure Sector	Productive Sector

- Introducing DRR assessments for the construction of new roads, bridges, and other major infrastructure.
- Integration hazard awareness into land-use planning.
- Ensuring building codes integrate DRR and ensure compliance and enforcement of building codes.
- Promote the increased use of hazard-resilient designs (e.g. flood proofing and seismic safety) in housing programs in hazard-prone areas.
- Promoting diversified income opportunities and supplementary income generation in high-risk areas.
- Promote effective programs of crop diversification, including the use of hazard-resistant crops.
- Integration of emergency, food security, poverty alleviation, and rural development program.

Social Sector

- Promoting hazard-resilient construction for new schools and hospitals.
- Incorporating DRR into the school curriculum.
- Implementing disaster preparedness plans in schools and hospitals.
- Public awareness campaigns that can change individual behavior and encourage reducing household risk.

Cross-Cutting

- Strengthening capacities to protect ecosystems that can help reduce disaster risk.
- Combating environmental degradation that enhances disaster risk (i.e., deforestation).
- Reducing the vulnerability of female-headed households to disaster.

Source: PDNA Team Elaboration (2009).

However, planning to integrate disaster risk reduction (DRR) into the recovery process is essential but not sufficient by itself. Equal attention and resources need to be invested in the long-term policy commitment and disaster risk management (DRM) systems in order to affect real change.

Typhoon Ketsana provides an opportunity for Cambodia as it highlights some of the fundamental problems in Cambodia's emergency response and DRR systems and provides impetus for improvement. The key lesson learned from the recent floods clearly shows that a robust DRM system is required: One connects the institutional and legal provisions to the communities, draws on best practices learned from sub-national disaster risk management projects, and institutionalizes these practices into Cambodia's DRM system. The following are key priorities areas where focus should be given in Cambodia's program of risk reduction.

4.5.2 Priority Medium- and Long-Term Needs

Disaster Risk Reduction (DRR) implementation should be a national and local priority with a strong institutional commitment and adequate budgeting, including: finalizing and receiving endorsement of the existing national disaster management policy and legislation; strengthening the national and sub-national disaster response and DRM coordination mechanism—particularly in provinces affected by Typhoon Ketsana; conducting institutional assessments of national and sub-national disaster management committees, their effectiveness, resource allocation, and training needs; and, institutional capacity building of the Committees for Disaster Management at the province, district, and commune levels.

Strengthen the national and sub-national capacity to implement disaster risk management interventions, including: integrating DRM/DRR into national development policies and planning in specific sector-ministries at the national and sub-national levels; developing and implementing disaster-resilient sector adaptation plans based on the SNAP—particularly for agriculture, water resources, health, and education.

Identify, assess, and monitor hazard risks and enhance early warning systems, including: assessing the technical capacity of the Department of Hydrology and Meteorology at the province level and thus generate information critical to improving the early warning systems; establishing a disaster management information system at the national and sub-national levels to compile data of hazard, vulnerability, and risk information based on existing data; setting up and equipping database systems for maintaining, updating, and sharing information; and, developing multi-hazard early warning systems at the national, sub-national, and commune levels.

Use knowledge, innovation, and education to build a culture of safety and resilience, including: establishing mechanisms to exchange information between national and sub-national levels; promoting DRR education and training at the national, sub-national, and commune levels; promoting gender and cultural sensitivity training as integral components of DRR; and, instilling public awareness of DRR across all geographic regions.

Mainstream DRR into policies and programs of relevant government ministries, including: incorporating DRR in the National Poverty Reduction Strategy and National Development Plans based on the priority activities of the SNAP; integrating DRR into climate change adaptation programs; promoting food security to enhance community resilience; promoting appropriate structural and non-structural mitigation measures; incorporating DRR into land-use planning and other technical measures; and, developing a funding mechanism to address disaster risks at the national and sub-national levels.

Strengthen disaster preparedness for effective response at all levels, including: strengthening national and sub-national mechanisms and capacities for preparedness and

response, such as enhancement of coordination and communication systems; preparing and periodically updating disaster preparedness and contingency planning; establishing emergency funds; and, strengthening data management and collection in the emergency response phase.

Table 42: Priorities for Disaster Risk Reduction in Cambodia

	Disaster Risk Reduction Components	Time Frame[63]				Total Needs (USD)
		2009-2010	2009-2011	2009-2012	2009-2013	
1	**Prioritized DRR Implementation with a Strong Institutional Commitmentat the National and Sub-national Levels**					
1.1	Finalize and receive endorsement of the existing national disaster management policy and legislation.					262,000
1.2	Strengthen the national and sub-national disaster response and DRM coordination mechanism, especially in provinces affected by Typhoon Ketsana.					
1.3	Conduct institutional assessments of national and sub-national disaster management committees, their effectiveness, resource allocation, and training needs.					
1.4	Build the institutional capacity of the Committees for Disaster Management at the provincial, district, and commune levels.					
2	**Strengthen National and Sub-national Capacity to Implement Disaster Risk ManagementInterventions**					

[63] The time frame for the DRM priorities has been fixed based on the SNAP-DRR (2008–2013) implementation period.

2.1	Integrate DRM/DRR into national development policies and planningin specific sector-ministries at the national and sub-national levels.					690,000
2.2	Develop, based on the SNAP, national sector adaptation plans, covering such key sectors as agriculture, education, health, transport, and water resources.					
2.3	Implement sector adaptation plans at the local level by each sector.					
3	**Identify, Assess, and Monitor Hazard Risks and Enhance Early Warning**					
3.1	Establish a disaster management information system at the national and sub-national levels to compile data on hazard, vulnerability, and risk and to strengthen the system for maintaining, updating, and sharing information.					6,022,000[64]
3.2	Assess the technical capacity of the Department of Hydrology and Meteorological at the provincial level and thus generate information critical to improving the early warning systems.					
3.3	Develop a comprehensive, multi-hazard early warning system at the national, sub-national, and commune levels.					
4	**Use Knowledge, Innovation and Education to Build a Culture of Safety and Resilience**					

[64] For activity 3.3, the estimated cost is USD 5 million. However, exact cost would be calculated based on the assessment of existing hydro-met stations and services as per 3.2.

4.1	Establish mechanisms for information exchange between the national and sub-national levels.					478,000
4.2	Promote DRR education and training at the national, sub-national, and community levels.					
4.3	Promote gender and cultural sensitivity training as integral components of DRR.					
4.4	Promote public awareness of DRR at the national, sub-national, and community levels.					
5	**Mainstreaming Disaster Risk Reduction into Policies and Programs of Relevant Government Ministries**					
5.1	Incorporate DRR into the National Poverty Reduction Strategy and National Development Plans based on the priority activities of the SNAP.					763,000
5.2	Integrate DRR into climate change adaptation programs.					
5.3	Promote food security to enhance community resilience.					
5.4	Promote appropriate structural and non-structural mitigation measures.					
5.5	Incorporate DRR into land-use planning and other technical measures.					
5.6	Develop a funding mechanism to address disaster risks at the national and sub-national levels.					

6	**Strengthen Disaster Preparedness for Effective Response at All Levels**					
6.1	Strengthen national and sub-national mechanisms and capacities for preparedness and response, such as enhancement of coordination and communication systems.					722,000
6.2	Prepare and periodically update disaster preparedness and contingency plans.					
6.3	Strengthen systemic protocols of the national recovery process, including a data system to keep track of emergency relief and recovery assistance.					
6.4	Strengthen data management and collection of damage figures.					
	TOTAL					**8,937,000**

SECTION V:
RECOVERY AND RECONSTRUCTION REQUIREMENTS

5.1 Guiding Principles for Recovery

In recent years, disasters have come to be studied as socio-environmental by nature and linked with socially created risk. In this view of risk, a disaster event occurs from the confluence of both a hazardous phenomenon, such as the Ketsana storms, and the vulnerable conditions of the affected communities. Vulnerability is intimately related to social processes in hazard-prone areas and is also usually related to the social fragility, environmental susceptibility, or lack of economic resilience of the population.

But natural disasters also provide an opportunity to increase the awareness of the public and policy-makers about a country's exposure to disaster risks and explore strategies to reduce this risk. A reconstruction and recovery program that fails to take into account a country's initial exposure to risk is sowing the seeds for future disasters. The fundamental objective is that risks must be reduced in the recovery process to avoid repeating the disaster.

Table 43: Key Elements of Disaster Risk Management

Disaster Risk Reduction and Transfer			*Disaster / Emergency Management*		
Risk Identification	**Risk Reduction**	**Risk Transfer**	**Preparedness**	**Emergency Response**	**Rehabilitation and Recovery**
Hazard Assessment (Frequency, magnitude and location)	Physical / Structural Mitigation Works	Insurance / reinsurance of public infrastructure & private assets	Early warning and communications systems	Humanitarian assistance	Rehabilitation / Reconstruction of damaged infrastructure
Vulnerability Assessment (population & assets)	Land use planning and building codes	Financial market instruments (CAT bonds, weather index hedge funds)	Contingency planning	Clean up, temporary service restoration,	Macroeconomic stabilization and budget management
Risk Assessment (a function of hazard & vulnerability)	Economic incentives for pro-mitigation behavior	Privatization of utilities	Emergency responder networks	Damage Assessment	Revitalization of affected sectors
Hazard	Education,	Calamity funds	Shelter facilities	Mobilization of	Incorporation of

monitoring and forecasting (GIS, mapping & scenario building)	training and awareness of risks and prevention	(regional / national or local reserve mechanisms)	& evacuation plans	recovery resources (public, multinational, insurance)	disaster risk reduction in reconstruction activities

Source: Samoa: Post Disaster Needs Assessment, draft (November 2009).

Table 43 outlines the key elements of comprehensive disaster risk management. Activities fall broadly into two areas: long-term planning actions that aim to reduce communities' overall risk of disaster losses, and event-centric activities that seek to prepare for specific scenarios, and respond, manage, and recover from emergencies as they arise. The Cambodia Recovery Framework aims to respond to the rehabilitation and recovery needs of the affected communities, but in tandem, lay down foundations for longer-term planning to reduce overall losses and better address disaster risk management.

The following set of guiding principles should govern the implementation of Cambodia's recovery and reconstruction program to ensure that the same conditions that put the population and assets at risk are not recreated. The purpose of these principles is to enhance the effectiveness of recovery and reconstruction efforts, increase transparency and accountability, and ensure that resources are translated into results on the ground. The principles seek to guide a reconstruction program that will build back stronger and more resilient communities and draw on lessons learned from recovery and reconstruction programs in other countries.

- A Transparent, Accountable, and Results-Based Recovery and Reconstruction Program
  - The recovery program should have a straightforward system for monitoring activities, tracking funds, and evaluating projects and programs that will be implemented by all stakeholders, including the provision of regular and transparent reporting against all funding sources.
  - All agencies involved in the recovery, reconstruction, and rehabilitation program should undertake appropriate audits of their activities and funds and make the results publicly available at regular intervals.
- Community-Based, People-Centered, and Equitable Approaches
  - Community-based, participatory approaches that engage local communities in decision-making, implementation, and monitoring of activities should be adopted to increase the quality and speed of reconstruction, align projects with real needs, and lower the risk of misuse of funds.

- Projects should maximize the use of local initiatives, resources, and capacities. Planning and execution should be based on local knowledge, skills, materials, and methods, taking into account the need for affordable solutions.

- Although disasters increase the vulnerability of all, groups who are already disadvantaged may need special assistance and protection. Particular priority should be given to the poor, female-headed households, orphans, and people with disabilities.

- The capacity of local communities should be built at every stage of the relief and recovery effort, with a focus on reducing vulnerability to future disasters.

- Mitigating Future Risks

  - Risks need to be systematically incorporated into all aspects of Cambodia's recovery program and all stakeholders must place a priority on future safety in the planning and implementation of the recovery process. Moreover, developing and strengthening institutions, mechanisms, and capacities to build resilience to hazards should be an inherent characteristic throughout all sectors involved in the recovery process.

5.2 Overview of Sector Requirements

The sector Damage, Loss, and Needs Assessment is presented in Table 44. The sector needs are the result of the independent sector assessments that were summarized in Section III. They are not constrained by resource availability and, therefore, reflect a comprehensive plan for recovery in the sector as well as measures to ensure heighted resilience to future natural disasters.

Table 44: Summary of Damage, Loss, and Needs Assessment (DLNA)

Summary of Damage, Losses and Needs (DLNA)							
Sector and Subsectors	Disaster Effects, US$			Recovery Needs, US$			
	Damage	Losses	Total	Short Term	Medium Term	Long Term	Total
Infrastructure	**17.259.051**	**11.487.577**	**28.746.628**	**7.114.206**	**13.406.626**	**85.960.511**	**106.481.343**
Transport	14.388.832	11.076.698	25.465.530	5.124.206	9.264.626	76.360.511	90.749.343
Water Supply and Sanitation	64.339	392.689	457.028	-	500.000	4.250.000	4.750.000
Water Management and Irrigation	2.779.000	13.000	2.792.000	1.690.000	2.792.000	3.500.000	7.982.000
Energy	26.880	5.190	32.070	300.000	850.000	1.850.000	3.000.000
Social Sectors	**39.548.563**	**3.333.813**	**42.882.376**	**14.075.690**	**2.648.500**	**2.480.000**	**19.204.190**
Housing and Shelter	15.281.952	3.294.398	18.576.350	12.089.000	2.087.800	-	14.176.800
Health	57.072	39.415	96.487	86.690	560.700	2.480.000	3.127.390
Education	24.209.539	-	24.209.539	1.900.000	-	-	1.900.000
Productive Sectors	**1.051.124**	**59.008.162**	**60.059.286**	**5.960.000**	**12.800.000**	**41.200.000**	**59.960.000**
Agriculture, Livestock and Fisheries	91.270	56.420.846	56.512.116	5.000.000	10.000.000	35.000.000	50.000.000
Industry & Commerce	959.854	2.587.316	3.547.170	960.000	2.800.000	6.200.000	9.960.000
Cross-Cutting Sector	**205.358**	**102.767**	**308.125**	**196.085**	**2.396.000**	**2.803.600**	**5.395.685**
Environment	31.073	98.367	129.440	181.000	2.232.400	2.803.600	5.217.000
Public Administration	174.285	4.400	178.685	15.085	163.600	-	178.685
TOTAL	**58.064.096**	**73.932.319**	**131.996.415**	**27.345.981**	**31.251.126**	**132.444.111**	**191.041.218**
Disaster Management	-	-	-				8.937.000

Source: PDNA Team Elaboration (2009).

5.3 Strategic Priorities

This Post Disaster Needs Assessment (PDNA) proposes Transport (roads), Agriculture, Water Management and Irrigation, Industry and Commerce, Education, and Housing as priority areas of focus in the recovery process.

The priority requirements listed below are the output of the sector teams' participation in the PDNA and while government and development partners played a key part in this mission, the recommendations do not represent priorities formed in formalized, in-depth consultations with donors and the government, nor do they take into account available funding. Rather, they represent areas that merit particular attention and areas where the short-, medium-, and longer-term intervention is deemed most critical.

5.3.1 Transport (USD 90,749,342.91)

A total of USD 90,749,342.91 is proposed for the recovery and rehabilitation of the damaged physical infrastructure of the national, provincial, and rural road networks. Creation of specific standards for road construction and maintenance in flood-prone zones should be developed and implemented as a part of the recovery process.

Short Term (0-6 months): Road sections damaged by Typhoon Ketsana (7 urban, 7 national, 6 provincial, and 34 rural roads) require repair. The candidate roads were selected based on the priorities of the ministries and represent roads essential for normal economic activity.

Medium Term (2 years): The remaining flood-damaged roads should be synthetically upgraded by elevating the roads 0.5meters to a crushed stone base course and adding additional drainage structures every 300meters in flood-prone areas.

Long Term (5 years):To reduce the potential for future damage, laying down a crushed stone base will allow posterior application of Asphalt Concrete (for urban, national, and provincial roads) and Double Bitumen Surface Treatment (for rural roads), in alignment with the government policy for the next 5–10 years. Longer-term planning should also consider applying a slope of 1:3 rather than the current standard slope of 1:2 to increase stability and resilience to damage.

Potential Financial Instruments: Designate USD 20 million of the government budget for annual road maintenance (which will increase to USD 40 million per year in the long term); USD 15 million was allocated by the People's Republic of China; USD 3.5 million by ADB from existing projects to support the recovery of the national road N. 56 and urban roads in Siem Reap Province; and other donors such as the World Bank Recovery Project. The cost of the overall transport sector recovery in the short, medium, and long term is summarized below.

Table 45: Transport Sector Recovery in the Short, Medium, and Long Term (USD)

Type of Road	Short Term	Medium Term	Long Term	Total per Road Type
Urban	563,797.85	346,912.25	0	**910,710.10**
National	621,679.61	163,943.46	15,496,500	**16,282,123.07**
Provincial	135,728.69	1,071,290.06	13,366,750	**14,573,768.74**
Rural	3,803,000.00	7,682,480.00	47,497,261	**58,982,741.00**
Total	**5,124,206.15**	**9,264,625.76**	**76,360,511**	**90,749,342.91**

Source: PDNA Team Elaboration (2009).

5.3.2 Agriculture, Livestock, and Fisheries (USD50-70 million)

A total of USD 50-70 million is proposed for the recovery and rehabilitation of the Agriculture, Livestock, and Fisheries Sector, including increasing the food security in the affected areas. The following activities have been deemed priority recovery needs in this sector:

Short Term (0-6 months): Increase the volume of emergency food aid sent to the most critically affected provinces to avoid transitory food insecurity and arrest food price rises; enhance the seed supply for the subsequent dry season (e.g, rice, maize, cassava, sweet potato, vegetables, mung bean, groundnut, soybean, and sesame); supply fertilizers, tools, livestock, and fishery resources to the most affected farmers and fishermen; and establish large-scale cash-for-work, food-for-work, and local employment generation schemes.

Medium Term (2 years): Continue short-term assistance schemes (e.g., seed, fertilizer, tools, capital, and capacity building) to strengthen the recovery process; develop policy options to increase the Green Trade buffer of 7,000 tons of rice-equivalent reserves and replenish the emergency stock; enhance agriculture and livestock production and small agri-business/rural entrepreneurships through the provision of seed, tools, micro-credit, livelihood relief funds, extensions, and other means; focus on gender-sensitive alternative employment generation to compensate loss of livelihoods in the immediate post disaster period.

Long Term (5 years): Strengthen the national capacity for emergency response to food crises (focusing on the institutional capacity of agencies such as NCDM, MAFF, and MoWRAM); build capacity at the household level (e.g., focusing on small holders and creating storage facilities, seed banks, and grain banks); integrate emergency, food security, poverty alleviation, and rural development programs; promote crop insurance as a risk-transfer mechanism; strengthen the link between agriculture and industry and commerce to reduce risks and to increase incomes and production; support the commercialization of agriculture, livestock, and fishery products; and create resilient agricultural fisheries and livestock assets ensuring community participation.

Potential Financial Instruments: Prioritization/re-appropriation of emergency lending and food aid programs of bilateral and multilateral donors; retroactive financing of government emergency agricultural relief; agriculture risk reduction initiatives of traditional development partners, international NGOs, etc.; and budgetary support from the Royal Government of Cambodia.

Table 46: Agriculture, Livestock & Fisheries Recovery Cost in Short, Medium, and Long Term (USD)

	Short Term	Medium Term	Long Term	Total
All Priorities	5–10 million	10–20 million	35– 45 Million	**50– 75 million**

Source: PDNA Team Elaboration (2009).

5.3.3 Water Management and Irrigation (USD 8,982,000)

Actions for Water Management and Irrigation recovery should focus on the following activities:

Short Term (0-6 months): Repair the most severely damaged irrigation schemes to protect the urban and rural residents, and ensure that farmers can continue to access water for agricultural cultivation.

Medium Term (2 years): Rehabilitate and upgrade affected irrigation schemes and strengthen the reservoir/storage area capacity. The development of a water management strategy that reduces flood and drought risks should also be considered a medium-term priority.

Long Term (5 years): Retrofit all existing networks, distribution systems, and drainage systems to a minimum standard in order to reduce future damages by a disaster; and design all of the new irrigation systems with disaster-resilient standards. Moreover, the staff of Provincial Departments of Water Resources and Meteorology should be trained to increase their capacity to respond to and prepare for natural disasters—in particular the newly established.

Potential Financial Instruments: Funds from MoWRAM Strategic Development Plan 2010–2012 and support from the ADB project for rehabilitation of the existing irrigation infrastructure.

Table 47: Water Management & Irrigation Recovery Cost in Short, Medium, and Long Term (USD)

Sector	Short Term	Medium Term	Long Term	Total
Water Management	-	1,100,000	1,500,000	**2,600,000**
Irrigation	1,690,000	1,692,000	1,500,000	**4,882,000**
Capacity Building	-	-	500,000	**500,000**
Total	**1,690,000**	**2,792,000**	**3,500,000**	**7,982,000**

Source: PDNA Team Elaboration (2009).

5.3.4 Industry and Commerce (USD 9,960,000)

In order to rehabilitate and reconstruct the industrial and commercial sectors damaged in Typhoon Ketsana, the following priorities are outlined:

Short Term (0-6 months): Repair the most damaged and replace the destroyed machinery and equipment, primarily for agro- and micro-enterprises, so that the production can be restored to the level prior to the disaster.

Medium Term (2 years): Upgrade inefficient machinery and equipment to increase production, reduce costs, strengthen resilience to future disasters, and reduce future capital damage. A capital improvement program for agro-, micro-, and small enterprises should also be created through the provision of loans to micro-finance institutions so that agro, micro, and small enterprise owners can borrow at subsidized rates to upgrade their machinery and equipment.

Long Term (5 years): Improve the industrial and commercial regulatory framework to integrate DRM into the national planning of Industry and Commerce; train officials from relevant ministries on post disaster data collection for Industry and Commerce; raise the awareness and general knowledge of local business owners and employees (focusing first on the province level, and progressively down to district level) about natural disasters.

Potential Financial Instruments: Government budget, the private sector, and international development partners like the World Bank or the Asian Development Bank.

Table 48: Industry and Commerce Recovery Cost in the Short, Medium, and Long Term (USD)

	Priority	Short Term	Medium Term	Long Term	Total
1	Urgent Reparation and Replacement of Damaged Machinery and Equipment	960,000	-	-	**960,000**
2	Upgrade Machinery and Equipment to Make It More Resilient against Future Damages	-	2,000,000	5,000,000	**7,000,000**
3	Regulatory Framework and Capacity Building	-	500,000	700,000	**1,200,000**
4	Raise Awareness of Entrepreneurs	-	300,000	500,000	**800,000**
Total		**960,000**	**2,800,000**	**6,200,000**	**9,960,000**

Source: PDNA Team Elaboration (2009).

5.3.5 Education (USD 1,900,000)

The recovery program for Education should be concentrated on the short term and targeted to the education facilities that are still having difficulties repairing damage to buildings. The

Department of Construction detailed engineering reports can provide the basis for prioritization by examining, on a case-by-case basis, together with the photographic evidence, school enrollment records and total number of classrooms to determine short-, medium-, and long-term priorities. It should be noted however that on a more mid and long term basis there is the need to rebuild and repair the schools that are vulnerable at a national level, and is recommended that the Ministry of Education include this priority in its school rehabilitation program.

Potential Financial Instruments: RGC annual budget (the full needs would be beyond MoEYS resources), reallocation of existing Asian Development Bank- or World Bank-financed programs, and international NGOs.

Table 49: Overall Education Recovery Cost in the Short Term (USD)

Priority	Short Term
New Constructions to Replace Buildings Too Badly Damaged to Repair	1,500,000
Repair Buildings Unsuitable For Teaching	200,000
Furniture, Equipment, and Materials	200,000
MoEYS Maintenance Program for Schools	0
Total	**1,900,000**

Source: PDNA Team Elaboration (2009).

5.3.6 Housing (USD 14,176,800)

The following strategic considerations should be taken into account to achieve a sustainable recovery plan:

Short Term (0-6 months): Repair damaged houses and provide temporary shelter to families that are still homeless.

Medium Term (2 years): Rebuild the core structures of fully destroyed private houses and structures; review design standards for private houses; and increase community awareness on disaster-resilient building standards.

Potential Financial Instruments: Government budget, international development partners such as the World Bank and the Asian Development Bank.

Table 50: Housing and Shelter Recovery Cost in the Short, Medium, and Long Term (USD)

Priority	Short Term	Medium Term	Long Term	Total
Repair Damaged Houses	11,980,000	-	-	**11,980,000**
Temporary Shelter and Basic Support	109,000	-	-	**109,000**
Reconstruction of Completely Destroyed Houses	-	1,237,800	-	**1,237,800**
Design Standard Review/Compliance	-	350,000	-	**350,000**
Community Awareness on Disaster Resilient Housing	-	500,000	-	**500,000**
Total	**12,089,000**	**2,087,000**	**-**	**14,176,800**

Source: PDNA Team Elaboration (2009).

5.4 Additional Sector Recovery Needs

The following needs are not ranked by priority but are grouped by sector: These sectors are equally important and disaster resilience should be considered in any recovery or sector improvement plans. Further details about sector needs can be found in Section II of the Post Disaster Needs Assessment (PDNA) report.

5.4.1 Infrastructure Sector

Water Supply and Sanitation (WSS), USD 4,750,000: In the short term, restore access to the most critical WSS facilities (cleaning contaminated wells). In the medium and long term, rehabilitate rural and urban WSS structures damaged in the storm; and design new latrines in flood-prone areas to reduce the risk of fecal contamination in floodwater.

Energy, USD 3,000,000: In the short term, design an energy sector Post Disaster Action Plan that includes emergency procedures and post disaster recovery actions. In the medium and long term, upgrade "weak" grids following national standards (i.e., stronger poles, lines of larger section, appropriate earthing, and insulation); develop Rural Energy Enterprises (REEs) technical standards and provide DRM training; build institutional capacity of the Ministry of Industry, Mines, and Energy (MIME), Electricity Authority of Cambodia (EAC), and *Electricité du Cambodge* (EDC) as part of the energy sector Post Disaster Action Plan through workshops, disaster drills—both at the national and province levels—in coordination with the NCDM; introduce new regulations that integrate specific mandates of sector agencies into one single National Protocol for Disaster Response; develop communication campaigns at the village level to inform residents of the vulnerabilities of their electrical facilities appropriate ways of using electricity, and instructions and actions to take in case of a disaster.

5.4.2 Social Sectors

Health, $3,127,390: in the short term, improve provision of health care services; investigate reported disease outbreak and provide appropriate treatment; provision of medical equipment and supplies; and restore priority public health and care services to the pre-disaster situation. In the midterm, replace and upgrade health facilities to improve quality of health service delivery beyond the pre-disaster situation; develop a data management system for the Health Disaster Management Committee (HDMC) and comprehensive standard reporting format; further strengthen communicable disease surveillance systems for the prevention and control of disease outbreaks; develop community education and awareness raising programs; and establish guidelines and funding mechanism for rapid response following disasters. Long term priorities include: replace and/or upgrade health centers and posts in flood prone areas; establish an early warning and alert system of impending disasters; develop a regulatory framework and adequate policies to streamline

DRM into Public Health Management and health infrastructure development. Proposed Partnerships and Financial Mechanisms include technical assistance from the WHO, government resources and resources from other development partners.

5.4.3 Cross-Cutting Sectors

Environment, USD 5,217,000: In the short term, address the immediate recovery and potential food emergencies in Bang Per Wildlife Sanctuary and Tonle Sap Biosphere communities and undergo an economic valuation of the environment. In the medium and long term, increase forest and protected areas management, introduce DRM and a Climate Change (CC) Adaptation capacity development program for provincial Departments of Environment (DoE); establish waste management competence and an information center to ensure resilience against future disasters; improve the regulatory framework on DRM and CC Adaptation; introduce emergency response systems for provincial DoEs. Proposed Financial Mechanisms for Urban Waste Management include: the European Commission (EC), which is active in Siem Reap through the INTEGRITAS project; relevant UN agencies such as the WHO and UNEP; the private sector, through the establishment of public-private partnerships; and the WB/ADB for the development of a Solid Waste Management-Clean Development Mechanism (CDM) that will strengthen the financial feasibility of upgrading the systems and foster investment opportunities. Proposed Financial Mechanisms for Forest and Protected Area Management include: the ADB, WWF, UNEP, and WB/WBI for environmental valuation; REDD/CDM for forestry funding schemes; agencies and CSOs (e.g., the WB, UN-REDD, and WWF) for CBA and protected area management implementation; and new generation Adaptation funds, GFDRR funds, and the Rockefeller Foundation for funding DRM and CC Adaptation capacity building programs, with the WB, ISDR, and ADPC as implementing partners.

Public Administration, USD178,685: In the short term, repair damaged buildings, room beams, fences; cut and remove fallen trees for the district offices and police offices; provide funds to rent temporary premises while repairs are undertaken; replace and photocopy administrative and civil registration records that were damaged; and repair or replace damaged furniture. In the medium and long term, retrofit public administrative buildings in high-risk areas, relocate vulnerable offices whenever possible; and ensure vulnerability to natural hazards is taken into account in the placement and construction of new public buildings.

5.5Tentative Donor Commitment by Sector

Summary of Recovery Framework					
Priority Sector and Subsectors	Planned Development Partner Commitment	Recovery Needs, US$			
		Short Term	Medium Term	Long Term	Total
Infrastructure					
Transport	RGC, P.R. China, ADB, WB	5,124,206	9,264,626	76,360,511	90,749,343
Urban Roads		563,798	346,912	-	910,710
National Roads		621,680	163,943	15,496,500	16,282,123
Provincial Roads		135,729	1,071,290	13,366,750	14,573,769
Rural Roads	WB	3,803,000	7,682,480	47,497,261	58,982,741
Water Management and Irrigation	MOWRAM, ADB, WB	1,690,000	2,792,000	3,500,000	7,982,000
Water Management		-	1,100,000	1,500,000	2,600,000
Irrigation	ADB	1,690,000	1,692,000	1,500,000	4,882,000
Capacity Building		-	-	500,000	500,000
Social Sectors					
Housing and Shelter	RGC, ADB, WB	12,089,000	2,087,800	-	14,176,800
Repair damaged houses	WB	11,980,000	-	-	11,980,000
Temporary shelter and basic support		109,000	-	-	109,000
Reconstruction of completely destroyed houses	WB	-	1,237,800	-	1,237,800
Design standard review/compliance		-	350,000	-	350,000
Education	RGC, ADB, WB, INGOs	1,900,000		-	1,900,000
Replace buildings that are too badly damaged to repair	WB	1,500,000	-	-	1,500,000
Repair of buildings which are unsuitable for teaching		200,000	-	-	200,000
Furniture, Equipment and Education materials		200,000	-	-	200,000
MoEYS Maintenance program for Schools		TBD	TBD	TBD	-
Productive Sectors					
Agriculture, Livestock and Fisheries	RGC, DPs, INGOs	5-10 million	10-20 million	35-45 million	50-75 million
Priority 1: Food, fertilizer, seeds		TBD	TBD	TBD	TBD
Priority 2: Cash for work, seeds, replenish emergency stock		TBD	TBD	TBD	TBD
Priority 3: Capacity building and policy support		TBD	TBD	TBD	TBD
Industry & Commerce	RGC, Private Sector, WB	960,000	2,800,000	6,200,000	9,960,000
Reparation and replacement of damaged machinery and equipment	WB	960,000	-	-	960,000
Upgrade machinery and equipment to make it disaster-resilient		-	2,000,000	5,000,000	7,000,000
Regulatory framework		-	500,000	700,000	1,200,000
Small industru and agirbusiness recovery	WB				
Raise awareness of entrepreneurs		-	300,000	500,000	800,000
Disaster Management					8,937,000

Source: PDNA Team Elaboration (2009)