SFG2744

MINISTRY OF ECONOMY AND FINANCE

EMERGENCY RESILIENT RECOVERY PROJECT FOR THE NORTHERN AND CENTRAL REGIONS (ERRP)

ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK (ESMF)

PEST MANAGEMENT PLAN (PMP)

Final Report

December, 2016

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DNA	National Directorate of Environment
DNA	National Directorate for Water
DPASA	Provincial Directorate of Agriculture and Food Security
DPS	Provincial Directorate of Health
DPOPHRH	Provincial Directorate of Public Works, Housing and Water Resources
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ERRP	Emergency Resilient Recovery Project
ESMF	Environmental and Social Management Framework
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GOM	Government of Mozambique
MEF	Ministry of Economics and Finance
MICOA	Ministry for the Coordination of Environmental Affairs
MASA	Ministry of Agriculture and Food Security
MISAU	Ministry of Health
MITADER	Ministry of Land, Environment and Rural Development
MOPHRH	Ministry of Public Works, Housing and Water Resources
MSDS	Materials Safety Data Sheet
NGO	Non-Governmental Organization
PARPA	Action Plan for the Reduction of Absolute Poverty
PEDSA	Strategic Plan for Agricultural Development
PNI	National Irrigation Program
PNISA	National Agriculture Investment Plan
RPF	Resettlement Policy Framework
SDAE	District Services of Economic Activities
SDSMAS	District Services of Health, Women and Social Affairs
SDPI	District Services of Planning and Infrastructure
UNDP	United Nations Development Program
USD	United States of America Dollar
WB	World Bank
WHO	World Health Organization

1. INTRODUCTION

In 2015, following a formal request by the Government of Mozambique (GoM), the World Bank approved a total amount of US$40 million for the recovery of infrastructure that had been destroyed by the natural disasters that occurred at the end of 2014 and the beginning of 2015 in the central and northern regions of the country. The Financial Agreement for this funding was signed by the GoM, represented by the Ministry of Economy and Finance (MEF), and the World Bank on the 26th of October 2015. The agreement and funding will be implemented over a period of 4 years under the emergency resilient recovery project for the northern and central regions being implemented by the Government of Mozambique.

This project is related to specific existent arrangements of projects funded by the Bank, being implemented by a number of Mozambican government institutions namely: (a) the Ministry of Public Works, Housing and Water Resources (MOPHRH) through National Directorate of Management of Water Resources (DNGRH) for dike rehabilitation under the Water Resources Development Project (WRD); (b) the National Irrigation Institute (INIR) for irrigation under the Sustainable Irrigation Development Project (PROIRRI); (c) the Administration of Water and Sanitation Infrastructures (AIAS) for drinking water supply under the Cities and Climate Change Project (CCCP); and (d) the Ministry of Education and Human Development MINEDH for climate-smart schools under the Education Sector Support Program (ESSP).

The World Bank Policy (OP 4.09) requires that a pest management plan be prepared for projects that are likely to use or induce the use of pesticides for pest control. Thus, the present Integrated Pest Management Plan is prepared as an annex to the Environment and Social Management Framework (ESMF) and the Resettlement Policy Framework (RPF), with a view to provide guidance on integrated pest management that places emphasis on biological methods to control pests, and minimizing the use of synthetic pesticides that have detrimental impacts upon the natural environment as well as human health. The Safeguard Policies set by the World Bank (WB) as well as the Mozambique Environmental and Social Management regulations, stipulating that the financing of development plans and programs shall be subject to an assessment and the mitigation of potential environmental and social impacts of future projects, shall be followed.

The IPMP is required as the irrigation schemes project under the remit of INIR will potentially contribute to scaling-up of crop production that would induce the use of agricultural inputs including inert chemicals to control pests. Additionally, the construction of schools under MINEDH activities may also lead to the use of pesticides for treatment of pests such as termites in sites proposed for construction of new schools.

The IPMP enables the early identification of likely negative environmental and social effects associated with the potential use and handling of pesticides induced by increased

agricultural activities as a result of the rehabilitation of the irrigation schemes, as well as use of pesticides to control termites in sites proposed for construction of new schools infrastructures. The present IPMP is therefore complementary to the ESMF and RPF that will guide future construction/rehabilitation of public infrastructure, specifically with regards to the safe location of projects, identification of issues associated with deforestation, soil erosion, pollution of soil and water resources, waste management, and other factors related to the installation, operation and maintenance of projects including the rehabilitation of the irrigation systems.

The stated natural disaster events have destroyed infrastructure and left many people without conditions to produce food. Some of these infrastructures were schools, dams and dykes, water conservation and irrigation systems. The most devastated provinces were Zambezia and Nampula. To mitigate some of these effects, the World Bank is funding projects providing for the rehabilitation of irrigation and water supply systems as well as rehabilitation and construction of schools. The availability of water in the communities can increase the chances of increased production areas for intensive vegetable and other crops production using irrigation. The production intensification may lead to concentration of food resources and favorable conditions for the emergence of pests and diseases. The presence of pest will therefore induce the need for control of such pests. Many farmers believe that use of chemicals is the only efficient way to control pests. The project aims to train farmers on developing a sustainable way to use Integrated Pest Management. Similarly, Schools infrastructure that will be constructed will take place in Zambezia, Nampula and Niassa provinces, where new schools are planned to replace those that are in climate-vulnerable sites. One of the most common method for the treatment of termites in construction sites has been the use of pesticides.

2. PROJECT DESCRIPTION

The Emergency Resilience Recovery Project has four components, and each of these will be implemented by the different institutions involved, under the coordination and management of the Steering Committee.

2.1 Component A - Resilient Infrastructure Rehabilitation

The activities to be financed and implemented under this component are the rehabilitation and/ or reconstruction of dikes; irrigation schemes; potable water infrastructure in the Licungo River and education infrastructures. These areas were recommended in a Joint Assessment of Damage undertaken by the GoM, the World Bank, United Nations and European Union in April 2015. All rehabilitation works related to water, specifically the rehabilitation of dikes, irrigation schemes and the supply of potable water, will be undertaken in the Licungo Watershed. The rehabilitation and construction of classrooms will be undertaken in Zambezia, Niassa and Nampula provinces.

2.1.1 Sub-Component A.1 - Rehabilitation of Dikes and Damaged Weirs/ Dams

This sub-component envisages rehabilitation and strengthening of dikes and weirs, including the Nante and Nicoadala dikes and Eribacela weir, which serve as important flood protection infrastructure.

The Nante dike extends over 30 kilometers between Nante and Intabo, and the second part of the dike is adjacent to the Licungo River. The dike serves as a fluvial dike that protects the natural habitats, roads and agricultural land (approximately 10,000 hectares) which are used by about 54,000 people. It is expected that the Nicoadala dike is also rehabilitated to help protect investments made on the Mziva irrigation system, under the PROIRRI Project.

Finally, the rehabilitation of the Eribacela weir will complement the works being done for the Munda-Munda scheme that will be rehabilitated under this Project. Given the urgency of this sub-component, retroactive financing will be used to ensure swift action on the rehabilitation of damaged dikes and related infrastructure.

2.1.2 Sub-component A.2 – Rehabilitation of Rural Infrastructure in the Maganja da Costa District

The work to be carried out under this sub-component will focus on the rehabilitation of irrigation infrastructures in the Maganja da Costa District. These infrastructures will include irrigation systems, rural access roads, bridges and the electricity supply line. Out of a total of 1,850 damaged hectares, two schemes across the Maganja da Costa District are considered a priority. The two priority systems are Munda-Munda (400 hectares) and Intabo (300 hectares). The PROIRRI Project will provide support in the preparation of feasibility studies as well as in the conception of the rehabilitation works, taking into account existing contracts they have with project design and supervision companies.

The rehabilitation works of the irrigation systems will be complemented with the rehabilitation of an electricity supply line of 18 km between Nante and the systems; and a gravel road between Niquidua and Malei (including the Niquidua - Malei Bridge and structures), in order to recuperate the road access to the systems. The investment on the irrigation systems and the dikes will have a direct impact and contribution to the mitigation of the flood risks efforts already being employed by the GoM.

2.1.3 Sub-component A.3 – Rehabilitation of Mocuba Drinking Water Supply

The sub-component will focus on rehabilitating and restoring the design capacity of the intake of the Mocuba drinking water supply system, and conducting a study on the long-

term and sustainable upgrade or replacement of the intake pumping station and related infrastructures.

At present, less than 5% of the Mocuba population benefits from this water supply system. Most of the population of the district depend on wells and other unsafe water supply sources. The water outlet at the Lugela River and other water supply systems in Mocuba are extremely vulnerable to floods, and these have been seriously damaged by the 2015 floods. Given the extreme fragility of the water outlet and threats from the river, only minimum investments will be made under this project, and these will be related to temporary and emergency repairs. A detailed study will be undertaken to determine and inform how the system may be upgraded or replaced in a resilient and sustainable manner.

2.1.4 Sub-component A.4 –Rehabilitation and Reconstruction of Climate Resilient Schools

This sub-component will focus on rehabilitating and constructing climate resilient schools, including: (a) rehabilitating conventional classrooms; and (b) constructing mixed-material classrooms. Given the high exposure and vulnerability to floods, storms, and earthquakes, the rehabilitation of these infrastructures should be undertaken using a multi-risk assessment approach, in that the necessary quality is employed in the design and quality of the works to ensure that the infrastructures can bear these risks associated with natural disasters.

The works will involve the rehabilitation of 433 damaged conventional classrooms and the construction of 1,038 improved mixed classrooms to replace the conventional classrooms that were completely destroyed by natural disasters. Classrooms that will be built with mixed materials will involve participation of the community, using non-conventional materials. This component will be a pilot in terms of using new construction techniques with the aim of development more resilient structures, as recommended by the first phase of the climate-smart Schools Project. The implementation of this component will also include the involvement of civil society organizations, with the aim of ensuring the involvement of the community throughout the life cycle of the project.

The technical assistance component will provide support for i) the identification of better and resilient construction techniques and local materials; ii) selections of design and shape of the classrooms, taking into account risk zone (area of risk); and iii) on-the-job training of contractors and communities, as well as quality control.

2.2 Component B - Technical Assistance for Resilience Recovery and Vulnerability Reduction

This component focuses on enhancing the capacity to manage risks associated with natural hazards. Community engagement and outreach will also play a significant role

under this component with regards to the rehabilitation of schools and early warning systems. This component will be complemented by resources from the GFDRR destined for the climate-resilient schools project.

2.2.1 Sub-component B.1 - Improving the Implementation of Resilient School Construction

This sub-component will provide technical assistance for the rehabilitation and construction of climate-resilient schools, including for: (i) the identification of resilient construction techniques, ii) the section of sites and the positioning of classrooms, and iii) quality assurance and quality control. The Safer Schools Project, funded under the GFDRR will complement this work.

The second phase of the GFDRR will provide support for the definition of relevant construction norms for risk zoning/ identification; the management of hazard, exposure and vulnerability information; and on-the-job training for resilient school construction. This support will be piloted in two provinces. One of the ultimate objectives is to ensure that local builders adopt the culture of climate-smart construction for public and household infrastructures, to ensure that future natural disasters have minimal impact on the communities.

2.2.2 Sub-component B.2 – Training for Disaster Risk Management and the Recovery Framework

This sub-component will support a program of activities to strengthen the capacity of relevant government institutions and communities to manage and respond to disaster risks, including: (a) developing a proposal for rehabilitating meteorological and hydrological measurement stations and enhancing access to data in the Licungo basin; (b) rehabilitating the damaged hydro-meteorological network; (c) installing meteorological and hydrological measurement stations; (d) evaluating early warning systems and proposals for reinforcing community preparedness; (e) building the capacity of relevant national and local government institutions on early warning systems; (f) building the capacity of local disaster risk management committees to prepare emergency plans; and (g) developing a framework to enhance capacity in recovery and reconstruction.

The project will ensure that INGC and local communities have better access to hydro-meteorological information and forecasts of impact from the National Meteorological Institute (INAM) and from the DNGRH. The procurement and management of these activities shall be under the responsibility of the Ministry of Public Works, Housing and Water Resources (MOPHRH), through DNGRH, and in close coordination with the existing Transforming Hydro-Meteorological Services Project.

2.2.3 Sub-component B.3 – Study on the Licungo Watershed Management

This sub-component will be carrying out a study on watershed management in the Licungo River to reduce the vulnerability of dikes and other hydraulic works in order to develop long-term recommendations based upon a detailed understanding of the hydrology and flood return periods in the watershed. It will develop a risk model and address the question of how such damages can be minimized if a flood of similar scale were to strike again in the future. The terms of reference of the study will be elaborated after a presentation of the Initial Draft Report of the Licungo Watershed Resources Development Plan, which is being undertaken by the DNGRH at present.

2.3 Component C - Project Implementation, Monitoring and Evaluation

This component will finance Project implementation, monitoring and evaluation costs for MOPHRH (for DNGRH), MINEDH, INIR, and AIAS.

2.3.1 Sub-component C.1 – Project Implementation, Monitoring and Evaluation by DNGRH/MOPHRH

This sub-component will cover: (a) strengthening the capacity of the Project Steering Committee for overall Project coordination; and (b) strengthening the capacity of MOPHRH (DNGRH) for Project management, coordination, monitoring and evaluation, including: (i) fiduciary (i.e. financial and procurement management); (ii) environmental and social assessments; (iii) preparation of Project reports; and (iv) monitoring and evaluation.

2.3.2 Sub-component C.2 – Project Implementation, Monitoring and Evaluation by MINEDH

This sub-component will cover: strengthening the capacity of MINEDH for Project management, coordination, monitoring and evaluation, including: (a) fiduciary (i.e. financial and procurement management); (b) environmental and social assessments; (c) preparation of Project reports; and (d) monitoring and evaluation.

2.3.3 Sub-component C.3 – Project Implementation, Monitoring and Evaluation by INIR

This sub-component will cover: strengthening the capacity of INIR for Project management, coordination, monitoring and evaluation, including: (a) fiduciary (i.e. financial and procurement management); (b) environmental and social assessments; (c) preparation of Project reports; and (d) monitoring and evaluation.

2.3.4 Sub-component C.4 – Project Implementation, Monitoring and Evaluation by AIAS

This sub-component will cover: strengthening the capacity of AIAS for Project management, coordination, monitoring and evaluation, including: (a) fiduciary (i.e. financial and procurement management); (b) environmental and social assessments; (c) preparation of Project reports; and (d) monitoring and evaluation.

2.4 Component D - Contingency Emergency Response

This component will allow for an immediate response in the event of a crisis or an eligible emergency when necessary. The component will provide financing from emergencies in the event of another natural disaster, which includes a component for Contingency Emergency Response which will reduce risks of damage on infrastructure and will guarantee continuity of activities and rapid rehabilitation where required. In the event of an adverse event which creates a major disaster, the GoM may request the World Bank to channel resources through this component for an Immediate Response Mechanism (IRM). If the activation of the IRM is deemed necessary, the MOPHRH, through the DNGRH shall be Coordinating Authority and shall have the responsibility of coordinating and implementing the IRM. Details of this component (including activation criteria, eligible expenditure, specific implementation arrangements and staff needs for the coordination authority) will be provided in the IRM Operations Manual, and will undergo a process of consultation and authorization.

3. PROJECT IMPLEMENTATION ARRANGEMENTS

The project will be implemented by a number of institutions working in different areas, these being: The Ministry of Public Works and Water Resources (MOPHRH), through the National Directorate of Management of Water Resources (DNGRH); the Ministry of Education and Human Development (MINEDH); the Ministry of Agriculture and Food Security (MASA) through the National Irrigation Institute (INIR); and the Water Supply and Sanitation Infrastructure Administration (AIAS). In terms of institutional arrangements, and given the multisectoral nature of the project in dealing with emergencies, it is expected that the project is implemented by existing units from the aforementioned institutions. Where specific units to deal with emergencies are non-existent, these are to be created and staff to be recruited.

The project will be managed by a **Steering Committee**, which will be led by the Ministry of Economy and Finance (MEF) and the National Disaster Management Institute (INGC). The Steering Committee has the role of coordinating, monitoring and supervising the implementation of the project. It is equally responsible for analyzing progress reports submitted by the implementation units every trimester.

The **inter-institutional coordination** role will be led by the National Directorate of Management of Water resources that was selected, and will be responsible for the day-to-day implementation and oversight of activities. The DNGRH will recruit a project coordinator and will have the role of consolidating and harmonizing the reports submitted by the different sectors. DNGRH will subsequently submit all consolidated reports to the Steering Committee as well as to the World Bank.

INIR will be responsible for implementing and managing activities related to PROIRRI. INIR has representation at the provincial level and oversees policy, strategic, and operational issues related to irrigation. The project will rely upon the long-term irrigation service providers and strategic partners' setup by the PROIRRI Project for the day-to-day execution of Project activities, taking into account the need for a strong technical expertise on the ground for the planning, coordination, execution and monitoring of Project activities.

MINEDH is currently resourced with a pool of experienced procurement officers, and therefore it will use existing resources for implementation arrangements and management related to the construction of classrooms component of the project. MINEDH has much experience with Bank projects and is familiar with implementation and supervision procedures recommended under safeguards policies triggered by this Project.

AIAS will also use existing implementation arrangements and share resources from other projects. AIAS is responsible for the provision of urban water infrastructure in all urban areas with the exception of large cities and sanitation infrastructure, including drainage across the country. A separate Project Agreement will be required for AIAS, as this is an independent agency with financial and procurement autonomy.

Although a sub-component of this project will be implemented by different entities, it is of upmost importance that the project is managed correctly to ensure coherence as well as to ensure that the objectives and the expected results of the project are met. Each entity involved in the project cycle, including the coordinating functions of the MOPHRH and the Steering Committee, have a key role and responsibility in the timely implementation of activities, in monitoring and evaluation, as well as in the submission of reports.

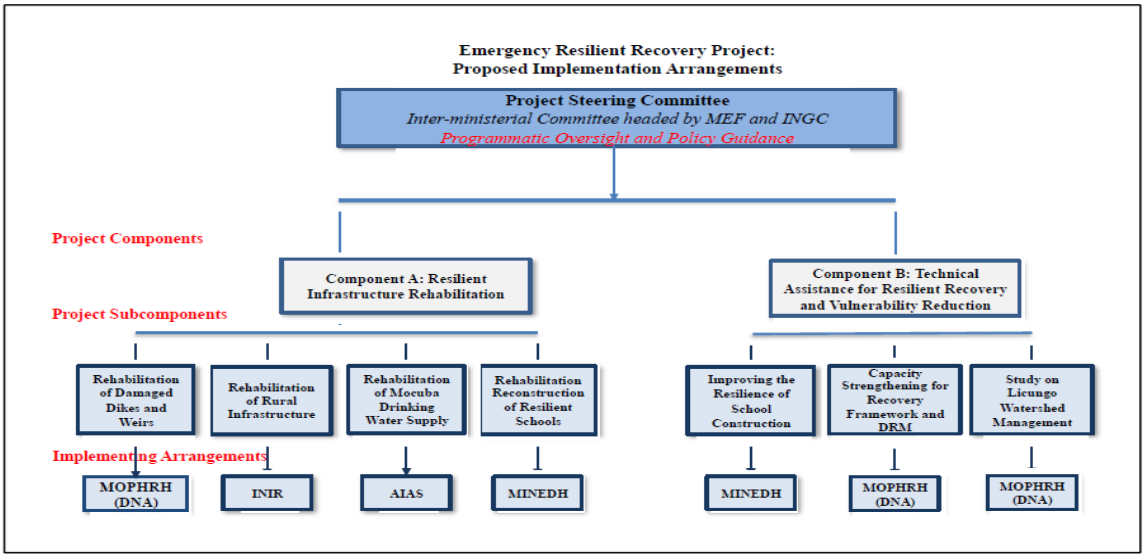

Figure 1: Implementation Arrangements

Source: *World Bank, Project Appraisal Document for Emergency Resilient Recovery Project for the northern and central regions*

4. TARGETED PROJECTS AREAS

4.1 General Description of Context in Mozambique

Mozambique comprises a national territory of 799,380 km^2 of which 2% consist of inland water bodies and 13% national parks and 21% of forest cover. The country is located in the sub-Saharan East of the African Continent, bordering with Tanzania in the North, Malawi, Zambia and Zimbabwe in the West, South Africa and Swaziland in the South and the Indian Ocean in the Eastern part which encompass a 2,500 km of coastline and an exclusive economic zone of 200 nautical miles. The country has thirty-nine major rivers which drain into the Indian Ocean, and an impressive environment, which constitutes a significant public asset and is the basis upon which much of its recent macro-economic development and poverty reduction has been achieved. All the key sectors of the Mozambican economy (i.e. agriculture, mining, tourism, forestry, fisheries and wildlife) are based on natural resources. Mozambique's rich ecosystems, biodiversity and natural resources hold a significant exportable value and commercial potential.

It is of upmost importance to highlight that despite these impressive environmental and agro-ecological climate of Mozambique, country is extremely vulnerable to natural disasters namely; floods, drought, and cyclones due to its geographic location, its climate conditions, extremely high levels of poverty and exposure of people to these disasters as well as the limited availability of resources in the country to build resilience. Mozambique is considered the second most geographically exposed to natural disasters country in Africa. The recurrence of natural disasters in the country on annual basis have adverse impacts not only on the human lives, but also on livelihoods, infrastructure and hamper development and growth investments and efforts. This is particularly evident with the floods that occurred in 2014 and 2015, that had negative impacts in the central and northern regions of the country, particularly in the proposed project areas (Zambezia, Niassa and Nampula). More recently with the El Nino phenomena which started at the end of the last quarter of 2015, natural disasters have been affecting parts of the country, hitting particularly the southern and central regions of Mozambique with droughts and floods. According to the Vulnerability Assessment carried out by the Food Security and Nutrition Technical Secretariat (SETSAN), in March 2016, El Nino has affected close to 1.5 million people, and humanitarian needs in terms of food assistance, severe and acute malnutrition treatment as well as in terms water, hygiene and sanitation have been prioritized for the affected groups.

Albeit significant advances have been achieved in Mozambique over the last decade in terms of improvements in the social sectors (i.e. health and education) as well as in the general economy (with an annual GDP of 7-8% until 2015), the country continues amongst the poorest in the world and still close to half of the population lives in poverty. The 2015 Human Development Index ranked Mozambique 180 out of 188 countries. Access to adequate health and education services and other facilities remain challenging, particularly with the fast population growth rates. Access to potable water, and

infrastructures such as roads, bridges and electrical power is also increasing at a very slow pace and reaching less than 40% of the Mozambicans.

The ERRP offers an opportunity for early warning and flood control systems in areas that are susceptible to floods, awareness raising on climate change and its adverse effects, and ensuring that all development projects take into account resilience to shocks and disasters in that the population in general does not suffer, and there are no losses in major investments during the development process.

5. THREE PROJECT TARGETED AREAS

The Emergency Resilience Recovery Project has been designed to be implemented over a 4-year period, in specific provinces in the central (Zambezia) and northern (Niassa and Nampula) regions of Mozambique. The provinces of Zambezia, Niassa and Nampula were identified and selected because they were particularly adversely affected by the impacts of natural disasters of 2014 and 2015 and thus required the need for reconstruction and rehabilitation of infrastructure damaged by these disasters. The three provinces have been exposed to flooding, strong winds, erosion, and a combination of these hazards, which have created significant damages accounting for severe losses and damages in human lives, livelihoods and infrastructure. In total, the three provinces have about 11.5 million inhabitants which is reported to account for approximately 44 percent of the country's population. The three provinces also have extremely high incidences of poverty, and subsequently are amongst the provinces with poorest populations in the country.

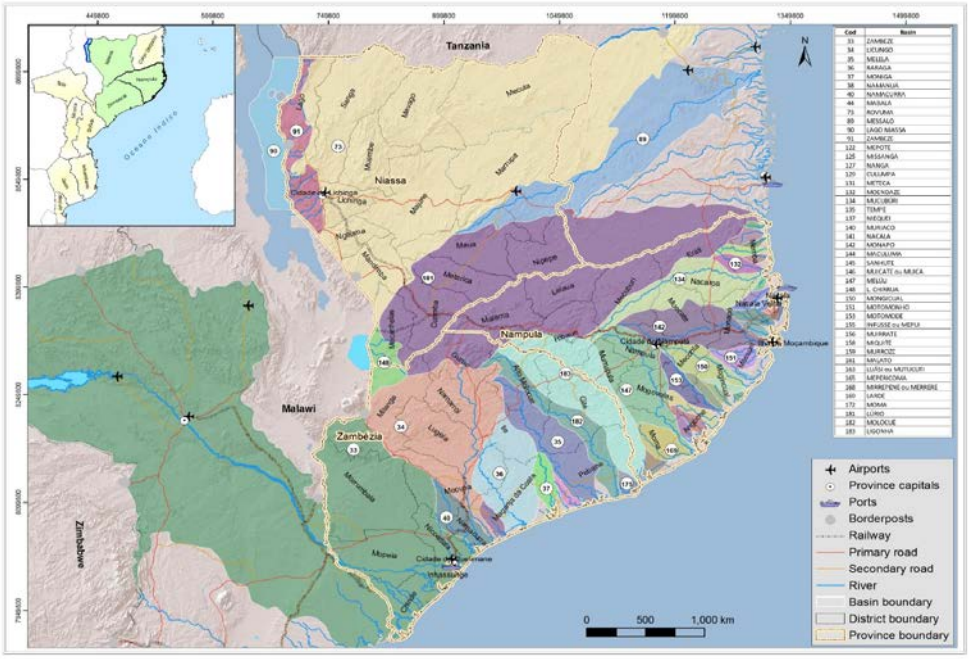

Figure 2: The three provinces defining the project area

5.1.1 Zambezia

Zambezia province is the second most populous in Mozambique, with a projected population of 4.5 million (INE 2010), and has an area of 103 127 km², mostly covered by the Zambezi and Licungo rivers and their tributaries. The province is located in the central-northern region, bordering Sofala, Tete, Niassa and Nampula provinces. The capital of Zambezia is Quelimane. The province is divided into 16 districts, of which at least 3 will be covered by the ERRP, these being Maganja da Costa, Mocuba and Nicoadala where most of the activities under sub-component A.1 of the ERRP targets. Specific sub-projects identified to be implemented in Zambezia include the rehabilitation of dikes and weirs, reconstruction of rural infrastructures (roads, bridges and electrical power) linked to the irrigation schemes of Munda-Munda and Mziva, and the rehabilitation of the Mocuba water supply system. The rehabilitation and reconstruction of resilient schools will also be undertaken in the Zambezia province, in flood-prone districts still to be identified.

Zambezia has a tropical climate with two annual seasons dominated by rains. Between May and September, the climate is generally cold, and from November to March is the raining season. The rest of the year, October to April, is considered the transition period. The province is subdivided into two ecological zones: i) “Alta Zambezia”, located in the northern interior of the country, with moderate climate conditions and generally low temperatures. In this region forestry is the predominant activity; and ii) “Baixa Zambezia” located in the coastal and southern region of the province. This region is characterized by very high and humid temperatures, and is susceptible to floods in the coastline, in the margins of the Licungo River and in the delta of the Zambezi River. The province has ideal agro-climatic conditions, fertile soils and is endowed with water resources.

Zambezia, like most provinces in Mozambique, has a predominantly agriculture based economy, and because of the characteristics of the province, particularly of Baixa Zambezia, the agriculture season is cyclically affected by floods. Natural resources, timber and minerals, also contribute largely to the income of the province.

Zambezia is reported to have about 200 health units (including the provincial hospital based in the capital Lichinga, health centres and health posts in urban and rural areas). In relation to health indicators, Zambezia is reported to have high levels of malaria, diarrhea, and water-borne illnesses as a result of the humid climatic conditions and the occurrence of cyclical floods. The HIV/ AIDS prevalence rate for the province was of 12.6% in 2009.

Education levels in Zambezia provinces are still very low as close to 70% of the provinces population is illiterate. Access to schools, as in the rural setting throughout the region, is also very low. Another reason for the poor education levels in the province are recurrent natural disasters which disrupt attendance of school by children for various reasons including temporary resettlement due to destruction of their homes and destruction of the schools themselves.

Although Zambezia province is endowed with water resources (due to the rivers that flow in the province) access to potable water is a major issue. No community located in the rural areas of Zambezia have access to a piped water network, and most of the population in these areas collect their water from water pumps, boreholes or directly from rivers.

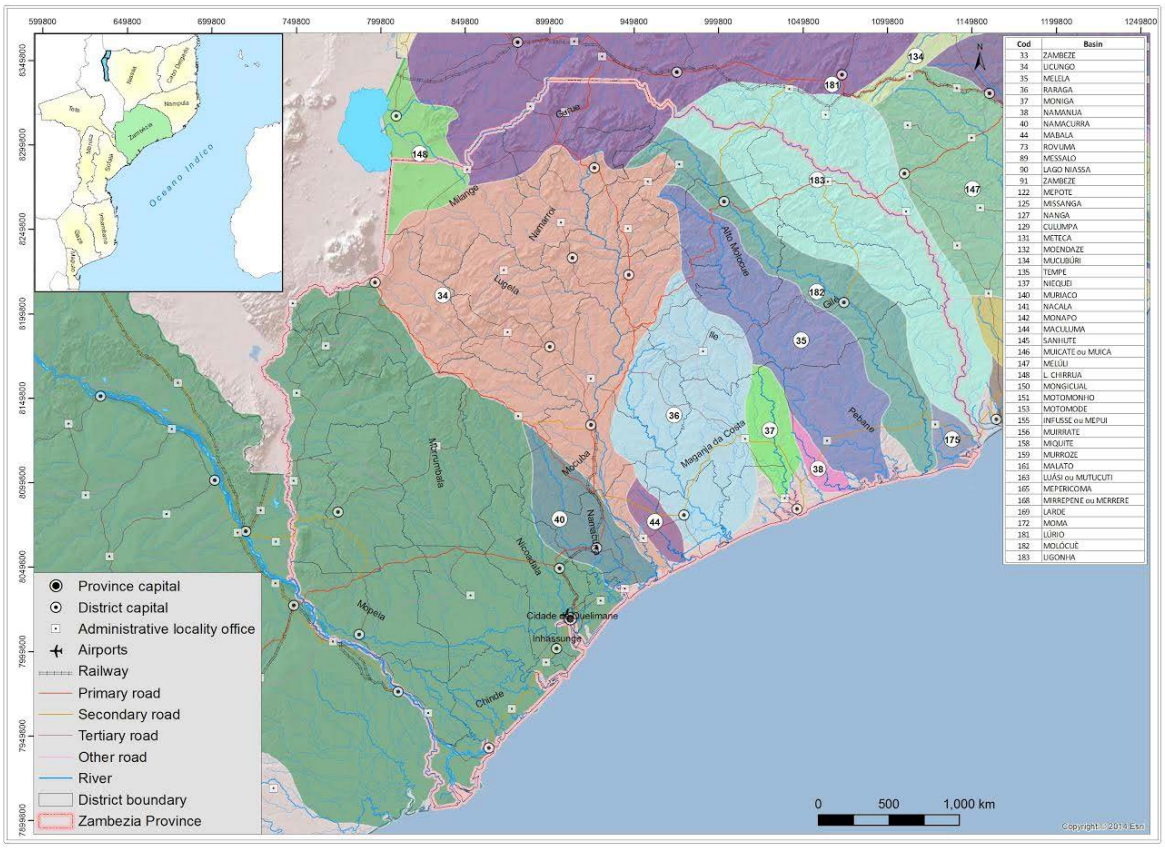

Figure 3: Map of Zambezia province

5.1.2 Niassa

Niassa is Mozambique's largest province with an area of 122,827 km^2, covering approximately 16 per cent of the country's total area and remains one of the world's last genuine wildernesses. On the other hand, Niassa has a population of 1,027,037 and is the most sparsely populated province in the country. The Ruvuma River forms much of the northern boundary of the province with Tanzania while Lake Niassa forms the western border of the province, separating it from Malawi. The province shares borders with Zambezia, Nampula and Cabo Delgado. It has 15 districts and Lichinga is the capital of the province. For Niassa, the key activities under the ERRP will involve the rehabilitation and reconstruction of climate-resilient schools. Vulnerable and risky areas will also be contemplated for the province in the event of an emergency, which will trigger the implementation of the component on contingency emergency response. The districts of focus will be defined during the preparation and implementation phases of the project.

Niassa's climate is based on two annual seasons, humid and dry, and is predominantly rainy with an annual precipitation that varies between 800 and 1,800 mm, mostly in October and March. The province has three hydrographic basins: the Rovuma Basin, the Zambezi and Lúrio Basin. Because of these hydro-climatic conditions, Niassa is extremely susceptible to floods.

Niassa's economy is predominately based on agricultural and constitutes as the main source of employment and incomes of the rural population of the province. Apart from agriculture, Niassa's income is largely dependent on natural resources, with forestry and livestock also making major contributions to the development of the province.

In terms of health services, the province is said to have 137 health units (including the provincial hospital based in the capital Lichinga, health centres and health posts in urban and rural areas). All district capitals have maternity wards. All health units have a source of water which are also used to supply surrounding communities. In that last few years Niassa has seen an increase in the diseases such as malaria, cholera, tuberculosis and HIV/AIDS resulting from a number of issues including influx of people, natural disasters, unhygienic practices and poor sanitation, to mention a few. In 2004 Niassa is said to have had an HIV/AIDS prevalence of 11.1%, and the districts with the highest prevalence were Cuamba, Mandimba, Maua, Lichinga and Maua, given their proximity to urban areas, to Malawi, and road corridors.

In terms of education and access to schools, the situation in the province is improving, however very challenging given the disperse population and distances between communities. Niassa is said to have total of approximately 876 schools (covering all levels from primary to secondary education).

The province has 1,285 sources of water, of which 1,116 are operational and is reported to have a coverage of 64% of drinkable water in 2006 – his number might have increased significant with the new water supply system built in Cuamba. As with the education and health networks, coverage and access to water sources by the vast population is a challenge given the size of the province, the low and disperse population density.

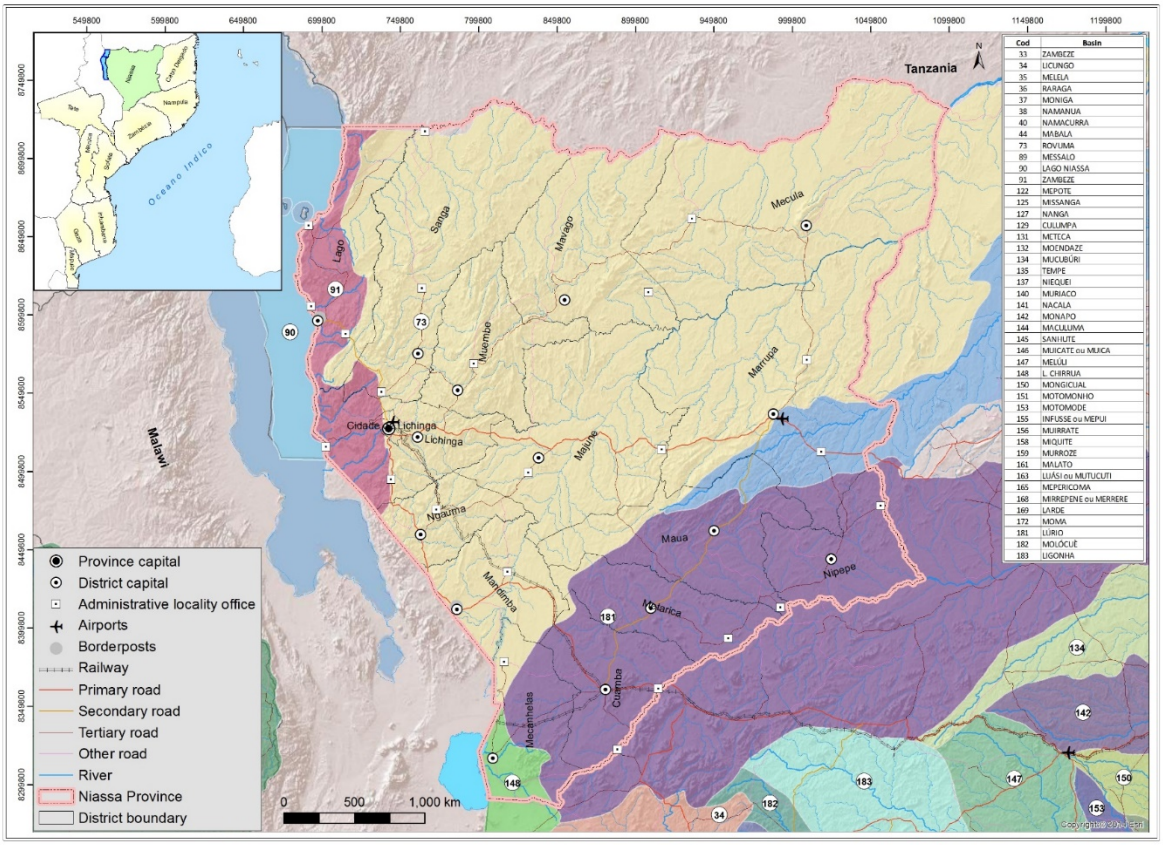

Figure 4: Map of Niassa province

5.1.3 Nampula

The province of Nampula is located in northern Mozambique, sharing borders with the provinces of Cabo Delgado to the north-east, Niassa to the north-west and Zambezia to the south, with a population of 3.9 million people (2007 Census), and an area of 79,010 km². The province's population growth rate is 2.39 % and the population's total life expectancy is 37 years. Gross birth rate is high at 41.7%, but it is offset by a high mortality rate of 27.3%.

Nampula has a humid tropical climate, very similar to that of Zambezia province, characterized by a hot and rainy period that goes from November to March and a dry season that goes from May to October. The average temperature is 24.7 C and the annual average rainfall amount is 1095 mm. The month of September which is the driest, reaches up to 7 mm of rainfall and January is the most humid with average of 241 mm. The province is well endowed with rainfall, averaging 1059 mm per year, is considered one of the most productive areas in the country, and is normally divided into a coastal, a central and an interior region with reference to environmental and economic characteristics. Agriculture is the dominant economic activity, historically with a mixture of small-scale, mainly subsistence agriculture and larger units producing cash crops such as cotton, cashew and tobacco (DNPO 2000; Cruzeiro do Sul 2002; EIU 2006). At the

coast, fishing and coconut farming are additional important sources of subsistence and income. Except for agricultural processing plants, there is only a small number of larger industrial enterprises in Nampula. The principal port for the province is Nacala on the northern coast of the province. Tourism is not yet developed, but the historically important Ilha de Mozambique (i.e. Mozambique's first capital) draws visitors.

Like Niassa, Nampula is also one of the largest territories in the country, and is the most populous. It is bordered on the north by Cabo Delgado Province, Niassa Province on the northwest, Zambezia Province on the southwest, and the Indian Ocean to the east. The province has 18 districts, and the capital is Nampula. Similar to Niassa, key activities under the ERRP in Nampula will involve the rehabilitation and reconstruction of climate-resilient schools. Vulnerable and risky areas will also be contemplated for Nampula in the event of an emergency, which will trigger the implementation of the component on contingency emergency response. The districts of focus will be defined during the preparation and implementation phases of the project.

Nampula province has 11% of the country's (81,000 km 2), 21% of the population: (4.1 million), 14% of the national GDP. Nampula's economy is predominantly based on agriculture and commerce (71% of the province's GDP). The region is a major producer of cotton, and is known as the Cotton Belt of Nampula. Also produced in the province are cashew nuts, tobacco, gems and other minerals. Many of the cotton and tobacco farms in Nampula Province are state-owned.

Agriculture is the main economic activity in the province of Nampula and is complemented by the creation of small animals (especially poultry). The potential for the development of agriculture is 4 500 000 ha for rain-fed agriculture, 74 000ha for irrigated agriculture and to 83 000ha for forestry. Nampula also have favorable conditions for livestock husbandry practices, especially in bovine, goat, sheep and poultry in the districts of Mogovolas, Moma, Angoche and Nampula-Rapale which have some infrastructure for the expansion of the activity.

In terms of education, Nampula is considered to have the highest illiteracy rates in the country. Data from 2007, of the human development index report, shows that Nampula is the third worse province of the country with respect to Human Development Index (HDI) (2.24), Human Poverty Index (HPI) (53.6), and life expectancy at birth (44.3 years), ahead only of the provinces of Cabo Delgado and Zambezia. Nampula is the fifth worse province with respect to poverty incidence (69% of the population), and children vulnerability. More than 92% of the population does not have access to electricity, 78% are deprived of access to radio and clean water, and 75% has no access to health assistance. Nampula is the third province with respect to adult illiteracy rate (64% in 2007), and is the province with the lowest gross and net rates of enrolment amongst the population in schooling age, both in the primary and secondary levels. In the primary school, for each teacher there are, on average, 61 students.

Estimates from the Ministry of Health indicate that the rate of prevalence of HIV/AIDS in Nampula is 8% in 2007 (table 4b), which is similar to the national average. It is estimated that the impact of this, and other endemic illnesses such as malaria, have a very significant negative impact on the ability of the families, particularly of the poorer and more vulnerable, to engage in income generation and poverty reduction activities. For example, it is known that the incidence of malaria is higher and more devastating during the sowing (raining and hot) season, when peasants also are less well fed and need more energy for the heavy work ahead. It is expected that HIV/AIDS will have a very significant demographic impact, with all its subsequent economic and social consequences.

The potable water supply network in Nampula still does not cover the majority of the population. According to INE data only 32% of the population of the province has access to safe drinking water. Some of the reasons for this include scarcity of infrastructures as well as limited availability of resources for expansion.

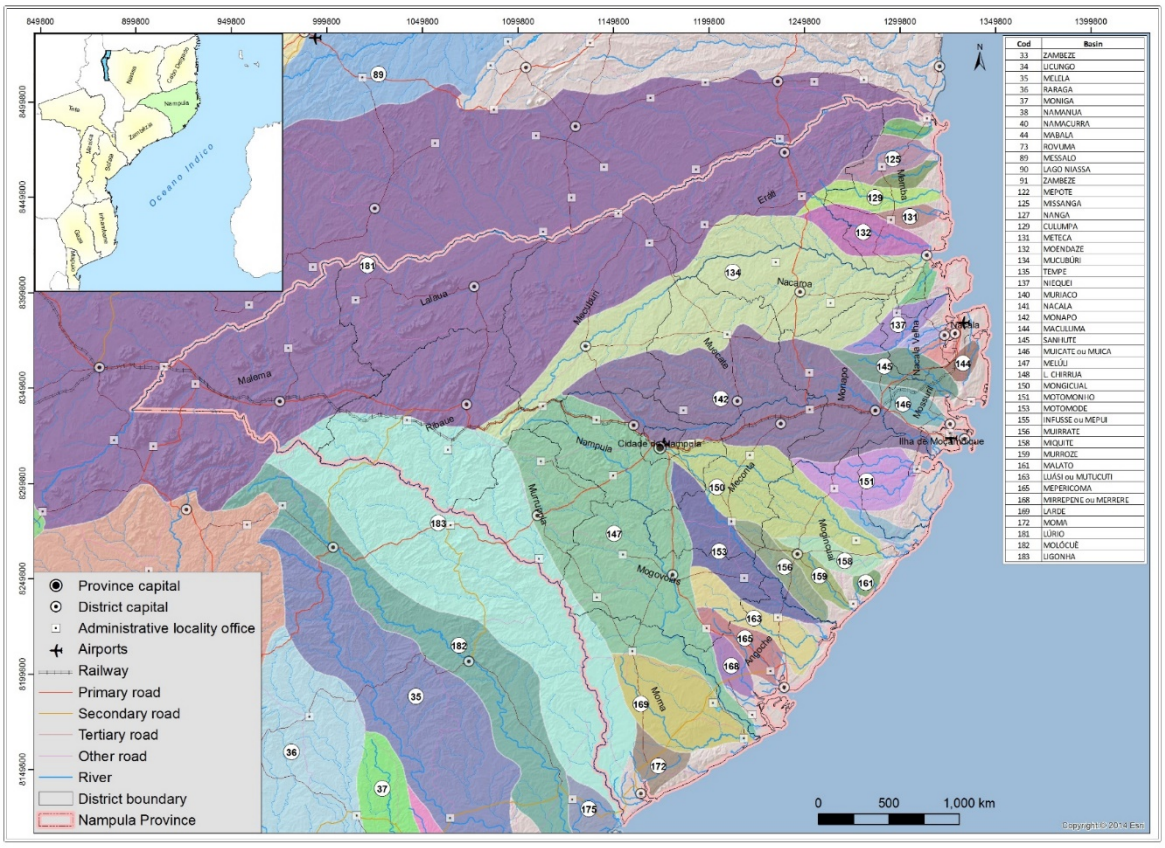

Figure 5: Map of Nampula province

6. POLICY AND INSTITUTIONAL FRAMEWORK

6.1 Suitable international best-practice policies guidelines

The framework for the management of pesticides and chemicals in the project areas as well as for pest management will be informed by a suite of policies and legislation

published by bodies such as the World Bank Group of companies, the Food and Agriculture Organization (FAO) of the United Nations, as well as the United Nations Environment Programme. It may so happen that some of the principles are sufficiently covered in country legislation but where this is not the case, the broad guidelines provided by the international best-practice guidelines will take precedence. The sets of documents consulted and the specific precepts of reference to the PMP include the following:

1. The World Bank Group General Environmental, Health, and Safety (EHS) Guidelines for Annual Crop Production, 2016, which advocates:
    a. Performance measures considered achievable in crop production which would include best-practice measures for soil conservation and management, pest management, use of fertilizer, etc.
    b. The principle of minimizing the use of pesticides by implementing a pest management and disease early-warning system;
    c. Pests to be managed through a process that combines integrated pest management that combines chemical and non-chemical approaches to minimize pest impact, while also minimizing the impact of such measures on the environment;
    d. Pesticides should be used only to the extent necessary under an Integrated Pest Management (IPM) and Integrated Vector Management (IVM) plan, and only after other practices have either failed or proved inefficient;
    e. The IPM should promote the principle of using biological pest and disease control methods first ahead of using pesticides;
    f. Considering use of green manure. Cover crops, or mulching techniques to maintain soil cover thus reducing use of inorganic fertilizer in agriculture;
    g. Personal Protective Equipment (PPE) to be used in according to Material Safety Data Sheets (MSDS) and as per stipulations in the Integrated Pest Management Plan;
    h. Promoting recycling of residues and other organic materials through composting
    i. As well as adopting management practices in line with General EHS Guidelines in managing risks (i.e. fire, management of solid waste, soil and water conservation, use and management of pesticides, chemicals, etc.).
2. Food and Agriculture Organization. International Code of Conduct on Pesticide Management. Revised Guidelines on good Labelling Practice for Pesticides, 2015.
    a. Provides sound measures foe the labelling and handling of pesticide in ways that will optimize positive environmental benefits and minimize undesirable impacts on the environment.
3. United Nations Environment Programme. Sound Management of Chemicals. UNEP's contribution to the 2020 goal.
    a. This provides comprehensive guidelines for the selection, storage, use and management of chemicals (e.g. pesticides) in places where they are used

in ways that will minimize potential impacts on the environment and promote positive benefits.

4. The World Bank Group General Guidelines on Environmental Health and Safety, 2007.
    a. Provides general environmental health and safety issues as well as well as general risks in the management of solid waste, soil and water conservation, use and management of pesticides, occupational health and safety, etc.

6.2 Country specific legislation and guidelines

Mozambique has passed pesticide legislation (***Ministerial Diploma 153/2002 of 11 September 2002*** (Pesticides Regulation) and ***Decree 6/2009 of 31 March 2009*** (Pesticides Management Regulation)). However, government capacity to implement effectively the pesticide legislation remain weak.

The regulations do not always explicitly outline the importance of adopting a more holistic approach to the matter, as is the case with the WB approach and specific guidelines that among other aspects favor Integrated Pest Management (IPM) techniques, which can be defined as a mix of farmer-driven, ecologically-based pest control practices that seeks to reduce reliance on synthetic chemical pesticides. It involves (a) managing pests (keeping them below economically damaging levels) rather than seeking to eradicate them; (b) relying, to the extent possible, on non-chemical measures to keep pest populations low; and (c) selecting and applying pesticides, when they have to be used, in a way that minimizes adverse effects on beneficial organisms, humans, and the environment. The WB policy calls for assessment of the nature and degree of associated risks, taking into consideration the proposed use and the intended users in the procurement of any pesticide in Bank-financed projects. Under the WB approach it is a requirement that any pesticides that will be used, manufactured, packaged, labelled, handled, stored, disposed of, and applied must be handled per standards acceptable to the World Bank. This plan has included internationally accepted guidelines on storage, labelling, application, and disposal of obsolete pesticides.

As for the national regulations, at times it is as if the country could adopt a free market for pesticides where the respective use could be promoted without this posing serious risks.

Notwithstanding, these shortcomings in the legislation encompass a strong element of control over the whole cycle of pesticide use. According to the aforementioned legislation, only pesticides registered with the then National Directorate of Agrarian Services (DNSA) now National Directorate of Agriculture and Silviculture (DNAS), under the current Ministry of Agriculture and Food Security (MASA), can be used in Mozambique. These include a list of pesticides products that are classified according to their toxic potential (Article 9). Out of the 188 registered pesticides, 109 are class III; 67

class II and only 12 class I (Class I being the most toxic). The composition and physical-chemical characteristics of the pesticides proposed for registration are to conform to the specifications from the World Health Organization (WHO) and the United Nations Food and Agricultural Organization (FAO) and should appear on the label. The regulation also requires proper packaging and handling, which meet the necessary requirements regarding occupational health and safety.

Emphasis is currently placed on the identification, classification, proper storage and disposal of obsolete pesticides of which 900 tones are believed to be stored under poor conditions throughout Mozambique.

Another legal instrument that is mentioned in this PMP is the Environmental Quality Standards and Effluents Emissions Regulation approved by the Council of Ministers in May 2004 (Decree 18/2004) and published in the government's gazette (*Boletim da República number 22 of 2 of June 2004*). It is aimed at controlling and maintaining the level of concentration of pollutants at an admissible level. The former Ministry for the Coordination of Environmental Affairs (MICOA) and current Ministry of Land, Environment and Rural Development (MITADER) is responsible for ensuring compliance with this Regulation, in close collaboration with the Ministry of Agriculture and Food Security (MASA).

There are no specific policies concerning pest management and crop protection in the context of IPM approaches in Mozambique. Research into plant health and to a certain extent IPM approaches have been carried out by the National Agrarian Research Institute (IIAM) and the Eduardo Mondlane University (UEM). Currently IPM approaches in the field are at an early stage of development in Mozambique. Agricultural practices presently rely substantially on the use of conventional pesticides.

Institutional capacity is represented at central, provincial and district levels. At the central Level and according to Pesticides Regulations Ministerial Diploma 153/2002 DNSA/DNAS of the MASA, through its Registration Unit, MASA is the official agency responsible for the registration of pesticides and the issuing of permits for their use, after approval by the National Directorate of Health (DNS/MISAU), the former National Directorate for Environmental Impact Assessment (DNAIA/MICOA), and current National Directorate of Environment (DNA) and the National Institute for Agrarian Research – Department of Animal Science (IIAM/DCA).

MASA has established a Technical Advisory Committee, which provides advice on issues related to the Pesticide Regulations. This Committee includes representatives from various departments within MASA and other Institutions (MITADER, MISAU, the National Institute for Standardization and Quality-INNOQ) as well as the private sector. The Provincial Directorate of Agriculture and Food Security (DPASA) through the Agricultural Services is the institution responsible for inspecting whether users have use, handling or transportation permits. These provincial services are also entrusted with the

responsibility of monitoring the use and impact of pesticides from agricultural activities and report to DPTADER (Provincial Directorate of Land, Environment and Rural Development). In principle at the district level pesticide use, handling and transportation is controlled by the District Services of Economic Activities (SDAE)/Agricultural Division), which works with an extension team in providing training for farmers on this matter. It should be noted that extension workers are scarce and their deployment on the ground still leaves a lot of areas unattended in Mozambique. There are also capacity and work experience limitations characterizing these workers, which hamper their ability to provide assistance as it would be desired under the provisions of this PMP. As explained below and in the three environmental and social safeguards instruments for this Project, reliance on this category of agents for pest management needs to be adequately considered and ultimately be done on a case by case basis.

Despite continuous efforts being made by the various government-led agriculture projects, particularly in terms of awareness raising, it still can be said that the capacity to deal with pesticide management issues remains relatively weak in Mozambique. The above-mentioned institutions face limited human, material and financial resources to carry out their activities. For example, pesticide residues are not being monitored on export crops, nor on crops for the domestic market; poisoning statistics by pesticides are not available; and medical staff at rural clinics is not trained to recognize and adequately treat pesticide poisoning; and antidotes are not systematically available in rural areas, and in certain remote provincial and district urban centers. As a result, health risks prevail among people and animals, which makes the WB approach to integrated pest management even more appealing.

In the context of this Project it is recommended to rely on some of the strategic partners such as private companies and NGOs to successfully implement this PMP. Several NGOs, private companies/businesses and specialized and/or experienced Civil Society Organizations (NGOs/established and trained Farmers Associations, etc.) can be actively and systematically involved in the process to successfully implement or help to go along with the implementation of this PMP. Experience has shown that there are several NGOs and private companies that have their own strong agriculture units, with well-trained and capable personnel, including those with the necessary knowledge and skills to deal with pesticides. Also one Safeguard Specialist Focal Point (at local level) and two Provincial Community Management Officials (one in each province), who will be part of the PCU, will need to be involved in capacity building with regard to Pest and Pesticide Management Approaches.

In Mozambique there are institutions that control the implementation of PMP and the institutions are represented at all levels of the country. These institutions include the Ministry for Land, Environment and Rural Development, which is represented at the provincial level by the Provincial Directorate for Land, Environment and Rural Development as well as the Provincial Directorate of Agriculture and Food Security. Both institutions are represented at the district level by the District Services of Economic Activities.

7. PEST MANAGEMENT STRATEGY AND ACTION PLAN

The importance of pest management and specifically integrated pest management is included in the existing strategic and action plans as the Poverty Reduction Action Plan (PARP) and the Strategic Plan for Agricultural Development (PEDSA).

The Poverty Reduction Action Plan (PARP) 2011-2014 is the medium-term strategy of the Government of Mozambique for operationalization of the Five-Year Government Program (2010-2014), focused on combating poverty and promoting a culture of work, with a view to achieving inclusive economic growth and reducing poverty and vulnerability in the country. One of PARP's main general objectives is increasing agricultural and fisheries production and productivity, with the attendant impact on food supply, which are a determining factor for reducing the incidence of poverty, and plays an important role as a source of income for around 80% of the country's population. To achieve this the priority PARP's challenge is to expand access to factors of production, particularly for women, with greater emphasis on adequate technologies, quality inputs, and enhancing the capacity for surveillance and control of plant and animal pests and diseases, as well as improving and making better use of water for agricultural purposes.
The Green Revolution, approved by the Government of Mozambique in 2007, signaled the Government´s reaffirmation of its priority to increase agricultural production and productivity, establishing a directive for the transformation of an essentially subsistence agriculture into commercial agriculture.

The PEDSA's strategic objective is to "Contribute to food security and agricultural producer incomes in a competitive and sustainable way, guaranteeing social and gender equity". In relation to the first general objective it shall be stressed the PEDSA's strategies to achieve pest and disease controls to improve crops and animal breeding increase public awareness of the importance of controlling pests and diseases in a safe and sustainable way and the respective control mechanisms to promote the use of technologies for the integrated control of pests and diseases, including biological methods whenever viable.

IPM is a knowledge intensive and interactive approach. Thus, the success of IPM depends largely on developing and sustaining institutional and human capacity to facilitate experiential learning for making informed decisions in integrating scientific and indigenous knowledge to solve specific problems. Poor communication between farmers, extension has often led to poorly-targeted research or to poor adoption of promising options generated by research.

The need to accurately identify and diagnose pests and pest problems and understand ecosystem interactions could enable farmers with biological and ecological control opportunities and in making pragmatic pest control decisions. Therefore, a strong linkage between researchers, governmental authorities and the implementers of IPM techniques is required.

In Mozambique farmers are aware that pesticides are poisonous but their responses still create a major occupational health and environmental risk. There is a need to implement awareness campaigns to raise the understanding of the potential environmental and human health impacts related to inadequate use of pesticides as well as the benefits of the integrated pest management practices.

More training is required for farmers on the implementation of integrated pest management and for pesticide users. We will use the Learning-by-doing/discovery training programs and experiences to indicate that farmers are most apt to adopt new techniques when they acquire knowledge and skills through personal experiences, observations, analyses, experimentation, decision-making and practice. This allows farmers to identify farmers' own knowledge and for farmers to understand how IPM applies to their own farms. The second way is to recover collective memory - Pest problems often emerge because traditional agricultural methods were changed in one way or another, or lost. These changes can sometimes be reversed. We will use group discussions to try to identify what changes might have prompted the current pest problem. The last one is to use smallholder support and discussion groups - Weekly meetings of smallholders, held during the cropping season, to discuss pests and related problems can be useful for sharing the success of various control methods. However, maintaining attendance is difficult except when there is a clear financial incentive (e.g., credit).

Demonstration plots - Subsidized experiments and field trials at selected farms (farmer-field school) can be very effective at promoting IPM within the local community. These pilots demonstrate IPM in action and allow farmers to compare IPM with ongoing cultivation supported by synthetic pesticides.

Promotional material - Basic written and photographic/figures guides or even videos of pest identification and crop-specific management techniques are essential for training and could be an important factor in motivating farmers to adopt IPM.

The project will train a lead farmer and extension agents around the target regions. We expect to train 100 lead farmers and extension staff and each one can train an additional 10 farmers individually.

Training on use of pesticides shall include the following:

a) Pesticide selection – Indicating the list of authorized pesticides per target pests, indicating its level of toxicity and hazardous, possible harmful effects and past experience using those pesticides for the pest and the crop.
b) Understanding the Pesticide Label – Explain all the information included in the label.
c) Pesticide Transport – Give indications on how to transport pesticides in order to avoid any leakages and contact with persons or animals.

d) Mixing and Loading Pesticide – Explain the importance of this to ensure proper dilution of the concentrated pesticide and the need to use protective clothing.
e) Pesticide Storage – Give indications on how to store pesticides – site location (not allowed in flood areas), security (against illegal entries, as well as children and livestock), isolated from other houses, be well ventilated, waterproof roof, have a current inventory list of pesticide stock.
f) Container Disposal – Give indications on how to destroy used pesticide containers
g) Obsolete pesticides – Explain the risks associated with obsolete pesticides and procedures to be followed.
h) Calibration, product quantity and pesticide application – Explain the importance of application, equipment calibration and how to do it.
i) Determining the Amount of Chemical to Use – Give explanations on methods to find out the amount of chemical to apply per hectare and its level of dilution
j) Important Cautions related to the Application of Pesticides – Give indications on important cautions for safe use of pesticide (see box bellow)
k) Toxicity, Human Protection and First Aid – Explain the possible effects of pesticide on human health, ways of pesticides entering in the body, importance of protective clothing & other protective equipment, basic first aid for pesticide exposure (with skin, mouth, eye or respiratory system).

8. STATUS OF AGRICULTURE, FORESTRY

Mozambican's economy essentially depends on agriculture. Mozambican agriculture is predominantly subsistence, characterized by low levels of production and productivities. In seeking a solution to this problem, the Mozambican Government approved the Green Revolution Strategy in 2007. This was in an attempt the boost farming in the country.

Mozambique's efforts have been increasing significantly with the implementation of the Green Revolution Strategy and the participation of the private sector. Farming includes agriculture and livestock. Cereals in general represent the main crops grown in the country, while chicken and cattle represent the major options for livestock.

The forestry industry is also prominent although with massive exploitation of wood. The main worry at this point is that although there are forestry plans formulated by the government, these are unfortunately not under implementation. There is a need for supervision services to check the implementation of these plans.

Over 80% of the total cultivated area is used for rain-fed production of basic food crops, with maize, cassava and beans occupying around 60% of the total. Horticulture occupies only 5%, and cash crops (sugarcane, cotton, tea, oil plants, tobacco) only about 6%. Apart

from these, 40% of households use native plants and herbs in their diet and for medicinal purposes.

One of the main problems affecting agriculture is its low productivity, which is among the lowest in Southern Africa for many products. This is due to a combination of factors, including traditional farming practices and the low use of inputs. Agriculture in Mozambique is mainly subsistence, where less than 10% of households sell their surpluses of maize, cassava or cotton. The plots are farmed with hand tools and manual labor, and a minimal use of improved seeds (10% in the case of maize, 1.8% for rice), chemical inputs (4 -5%) or animal traction (11.3%).
Improved inputs are rarely used because of their cost and limited supply. Fertilizers and pesticides are only used by a small proportion of rural households. Regional and provincial data shows that their use is primarily associated with cash crops.

The traditional cash crops (cotton, sugarcane and tobacco) have been farmed since colonial times, and their organization and regulation is at an advanced level. These crops are usually produced through a concession system in which the State signs contracts allocating territories to concession companies that will carry out development and rural extension. The companies in turn provide producers with technical assistance and training, as well as production inputs (seeds, fertilizers, pesticides, sacks) and in some cases credit for investment. The concession company is the exclusive buyer in its area of influence, and pays the producer full value less the cost of the inputs and the repayment of credit advanced for investment.

There are also market-oriented food crops, such as cashew nuts, vegetables and fruit. In addition, a series of new crops has emerged in recent times, aimed exclusively at the market, including sesame, paprika, jatropha and castor oil. These crops have been appearing and disappearing in accordance with the immediate pressures of the evolving market. Crops grown as raw materials for biofuels should also be highlighted here, as world demand is creating market opportunities whereby countries such as Mozambique can develop their agricultural sectors: Mozambique can be competitive thanks to its favorable agro-climatic conditions, the availability of land and water (north of the Save River), availability of labor and access to infrastructures (ports, railways, etc.).

Livestock also plays a vital role for the rural population although its contribution to the national economy is incipient. In 2008 it represented 10% of total agricultural production and contributed only 1.7% of GDP, but 65% of rural families have chickens, 25% have small ruminants (mainly goats), 12% have pigs and 6% have cattle (TIA, 2007). Only 11.3% of small farms use animal traction, mainly oxen, most commonly in the southern and central provinces where there is greater experience in the use of animals for farming activities and transport. In the northern region, cattle farming did not develop due to the high prevalence of tsetse and trypanosomiasis.

The main constraints on the development of livestock production, particularly of cattle, are the following: (i) low production and productivity of existing herds due to the low genetic quality of the breeding animals and unsuitable management practices; (ii) a weak network of veterinary assistance for the family sector; and (iii) lack of infrastructures for watering and managing cattle. With regard to livestock, the main cause of low productivity is the poor vigilance and disease control capacity and the deficient supply of veterinary services. This is also related to poor access to an extension system, which should not concentrate only on cattle, but also on the small animals that are mainly produced by women.

In relation to forestry, according to the 2007 forestry inventory, forestry coverage is estimated at 54.8 million hectares, i.e. 70% of total land area. 26.9 million hectares consist of productive forest, 13.2 million hectares comprise forest reserves, and the remaining 14.7 million are occupied by multi-use forest.

8.1 Relevant IPM experience within the project area

Knowledge regarding the use of IPM principles in the Project area is to some extent available, but it is rarely put into practice and often strongly emphasized by local key agriculture promoters, such as local extension workers and other agricultural officers. This may be due to the prevailing perception that chemicals are more effective than any other cultural practices that could be adopted. However, farmers in a number of districts prefer crop rotation (i.e. summer for maize) and winter crops (horticulture and a number of beans) and intercropping (cereals and vegetables and legumes) as being efficient in pests control. It is to be expected that these techniques could also be applied in the large areas to be developed under the ERRP Project, as they are common practices in Mozambique. Research services in the Zambezia region should be strengthened to present research based evidence of the most appropriate pest control methods for extension workers to be able to disseminate them to farmers as part of training.

8.2 Current Pest Management Practices

At present pest and plant disease control is limited by a combination of lack of knowledge, equipment, supplies and finance. In general, smallholder farmers in the project area take various measures to minimize or avoid pest infestations such as weeding and application of insecticides and herbicides. Weed control is generally achieved through a combination of tillage-seedbed preparation by several passes of the traditional ox-drawn plough (or manually) and subsequent inter-row weed control cultivations in row crops. Comprehensive data on pesticides use are not available, but most farmers referred to *Cypermethrin*, *Mancozeb*, *Cobox* and *Teodan*, all under Class III (least toxic), as the main pesticides they use. Pesticides are purchased from private vendors. Applications are conducted without proper equipment and according to some information, expiration dates are not always observed.

Control of birds and wild animals (scarce in the targeted area) are mainly done by using the traditional way of scaring (the use of scarecrows is very common especially in cereal production areas), chasing and guarding of animals.

8.3 Existing and Anticipated Pest Problem

There is no updated and systematic survey on pests and diseases affecting crops and livestock in the target areas or even in Mozambique. Some of the main pests that affect a wide range of crops within the country are the Red Locust/Grasshopper (*Nomadacris septemfasciata*), Elegant Grasshopper (*Zonocerus elegant*) and the African Armyworm (*Spodoptera exempta*) that affect several crops, as maize, beans, tomato, sorghum and rice and consequently affecting the food security, occurring practically in the whole country, regularly.

Basically all provinces of the country have experienced periodic outbreaks and regular invasions by locusts and grasshoppers. The African armyworm (*Spodoptera exempta*) is a major episodic migratory crop pest over much of Eastern and Southern Africa.

Invasive fruit fly (Bactrocerainvadens), an exotic and devastating pest of fruits and vegetables that can have a severe impact on sustainable agriculture and rural livelihoods, as well as on the export markets, as it prevents producers from meeting sanitary and phytosanitary standards. The invasive fruit fly, *B. invadens*, is the main fruit fly of quarantine importance in Africa. It has a wide host range including 40 fruit species. In Mozambique, the invasive fruit fly, *Bactrocera invadens*, was first detected in Cuamba district, Niassa province in 2007. Subsequent detections were made in 2008, in the Northern provinces of Cabo Delgado, North of Nampula province, and punctually in Manica, Zambezia and Tete province. This invades species spreading to Centre and South of Mozambique. To control the spread of the pest, the Mozambican government prohibited the transit of fruit from northern and central Mozambique, slicing producers' revenues for the past two seasons. Granivorous birds affects rice plantations as well as sorghum and maize, while field rats also affects several crops. Other pests like sucking bugs and caterpillars have been reported on beans and vegetables in small scale productions units.

8.4 Pesticides management

Farmers in rural and remote areas in general regard pesticides as a major occupational health and environmental risk. In particular, some pesticides are often sold in non-standard containers without proper instructions, effective protective clothing and equipment is seldom available (even where it exists it is not used), on-farm storage sites are highly hazardous (sun and rain exposure), used containers are washed-out in local water bodies and the containers re-used for other purposes, of which some domestic ones without proper precautions. Farmers have a limited knowledge and the lack of application

of safety practices. As said the same applies to those who are supposed to assist them in their endeavors.

Data on pesticides poisoning and environmental contamination are often not available or difficult to obtain, since no regular government system exists for regular monitoring of the risks. Additionally, medical personnel at rural clinics are not well trained to recognize and adequately treat pesticide poisoning, and antidotes are not systematically available in rural and in some remote provincial and district/municipal urban areas.

In summary the main pesticide management problems in the project targeted area and in Mozambique in general are:

- Uninformed use when applied, which may result in problems for human health and the environment, especially the contamination of soils and water. Signs of soil/water contamination/depletion have been observed in some areas, including soil salt accumulation;
- Use of out-of-date pesticides (observed in most of areas);
- Use of non-authorized and/or non-labelled pesticides or the use of re-packaged pesticides;
- Application without the adequate equipment, with an increase of the risk of contamination;
- Use of empty pesticide's packages for domestic use, washed in rivers and leading to their contamination.
- Lack of adequate monitoring of pesticides use and handling is carried out.

The Government through its various investments in the sector is clearly deploying continuous efforts. However, there is a need to improve current pest and pesticide management practices within the country and more in particular, in the Project areas, especially given the fact that one of the objectives of the Project is to set the path to be followed in the future regarding the promotion of rural development based on lessons learned.

The following actions are recommended, which are based on experience on the ground and may need to be further expanded and refined:

Table 1: Overview of pesticide management

Nr	Area of intervention	Recommended interventions
1	Strategic aspects	▪ Promote IPM within ERRP area, if available, to reduce the reliance on pesticides; ▪ Promote the design and implementation of monitoring plans that reduce pesticide use, improve pesticide selection, use, storage and disposal and create awareness

Nr	Area of intervention	Recommended interventions
		with regard to health impacts and impacts on the environment, etc.
2	Operational aspects	▪ Promote the use of precautionary measures such as the use of protective clothing and proper equipment, cleaning of spray equipment, wash after completing spraying activities and observing re-entry points, observation of expiration dates and disposal of containers in an environmentally acceptable manner and proper storage of the remainder of pesticides ▪ Rational application of chemical fertilizers ▪ Promote the use of bio-agriculture, using natural manure as both a possible pesticide on targeted species, as well as fertilizer
3	Education and capacity building	▪ Awareness raising and sensitization campaigns on the rational application methods and IPM practices: selection of the most appropriate pesticides for a specific crop, when and how much to spray to reduce economic damage, when to repeat spraying, etc.

There is clearly the need to bring about additional and continuous capacity building in all areas in order to build up existing farmers' inclination of implementing IPM techniques, keeping chemical use at a minimum. Where such use is unavoidable experienced practitioners should be approached and asked to provide different forms of assistance in dealing with sensitive and practical matters. Reference is made to local operators that have longstanding presence in the project area and effective lines of communication with local farmers and adequate knowledge and capacity to deal with some of the matters.

Applied research involving local research stations, extension workers, private farmers and their companies as well as NGOs should be encouraged and funded in order to conduct practical and simple experiments on the most effective ways of controlling plant and animal diseases using local knowledge and resources, which are less intrusive culturally, chemically and biologically at the same time.

9. ENVIROMENTAL, OCCUPATIOAL AND PUBLIC HEALTH POTENTIAL IMPACTS, MITIGATION MEASURES AND MONITORING

Bearing in mind that the projects to be included under ERRP project would be small scale projects, it is expected that there will be a need for intensive use of pesticides. The potential impacts related to the use of pesticides are:

- ✓ Increase in soil toxicity;
- ✓ Decrease in water quality for consumption and irrigation;
- ✓ Proliferation of aquatic weeds;
- ✓ Loss of biodiversity in particular of aquatic species;
- ✓ Toxicity to fish;
- ✓ Poor crop yield;
- ✓ Unacceptable levels of pesticide residues in harvested produce and in the food chain;
- ✓ Poisoning of workers/farmers and detrimental effects on human health;
- ✓ Increased number of accidents and injuries;
- ✓ Risk of termite attack on property – specifically of classrooms and school furniture reconstructed using mixed construction methods using local materials such as wood.

The main mitigation measures are the avoidance of pesticide use or use at a minimum, giving preference to other techniques as cultural practices that can help prevent build-up of pests, biological and chemical inputs. In case of use of pesticides, users shall strictly enforce the Decree Nr. 6/2009 - Pesticide Management Regulation. In order to implement IPM approaches it will be crucial to:

a) Embed IPM approach during the implementation of project activities, taking into account other IPM experiences within the region;
b) Implement participatory approaches in IPM within the target communities to learn, test, select and implement IPM options to reduce losses due to pests and diseases;
c) Establish a monitoring system that provides early warning on pest status, beneficial species, regular and migratory species;
d) Collaborate with other NGOs that implement IPM programs.
e) Improve capacity building and training on IPM.

The table below lists the environmental, public health and occupational impacts and respective mitigation and monitoring measures that are to be observed with regards to use of pesticides for the irrigation component of the proposed ERRP in Zambezi province.

Table 2. Potential impacts, mitigation measures and monitoring indicators

Pesticide management issue	Potential impact	Mitigation measure	Indicators of monitoring	Institutional responsibility
Excessive use of (out-of-dated) chemicals, disposal of containers in rivers and stream, use of non-authorized and/or non-labelled pesticides.	Decrease in water quality for consumption and irrigation Proliferation of aquatic weeds Loss of biodiversity in particular of aquatic species	▪ Regulatory application of pesticides (type, labelling and quantity); ▪ Promote recycling of containers; ▪ Monitor aquatic biodiversity and weeds.	Number of farmers using pesticides properly (observing expiration dates and dosages); Number of aquatic weeds; Abundance (n/ha) of plant resource species (e.g. medicine, food); Patterns of water quality referred in the regulation (Decree 18/2004);	Agricultural (DPASA, SDAE including extension workers) and environmental (DPADER, SDPI) authorities, health authorities (DPS) (SDSMAS)
Excessive use of (out-of-dated) chemicals, use of non-authorized and/or non-labelled pesticides	Increase in soil toxicity	▪ Regulatory application of pesticides (type, labelling and quantity); ▪ Promote the use of cultural and biological control measures (Table 1).	Patterns of soil quality referred in the regulation (Decree 18/2004) Number of farmers using biological and cultural measures.	Agricultural (DPASA, SDAE including extension workers) and environmental (DPADER, SDPI) authorities, health authorities (DPS) (SDSMAS)

Pesticide management issue	Potential impact	Mitigation measure	Indicators of monitoring	Institutional responsibility
Excessive use of obsolete chemicals, use of polluted water	▪ Poor crop yield; ▪ Above acceptable levels of pesticide residues in harvested produce and in the food chain;	▪ Regulatory requirements on pesticides management; ▪ application of pesticides (Materials Safety Data Sheet and quantity); ▪ Promote the use of cultural and biological control measures.	Productivity per crop; Availability of information on MSDS and Quality of the product; Number of farmers using biological and cultural measures.	Agricultural (DPASA, SDAE including extension workers) and environmental (DPADER, SDPI) authorities
Excessive use of insecticides for the control of termite colonies in existing classrooms or prior to use of wood for reconstruction	▪ Decay of wood, causing rapid deterioration of reconstructed classrooms; ▪ Potential destruction of the same infrastructure during a subsequent natural disaster or climatic shock;	▪ Avoid contact with susceptible timber; ▪ If termite has already penetrated into the wood, destroy the colony with pesticides (taking into account the use of control); ▪ Use of wood that is naturally resistant to termites		Agricultural (DPASA, SDAE including extension workers) and environmental (DPADER, SDPI) authorities Contractors and local communities involved in construction works
Use of empty pesticide's packages, washed and disposed in rivers,	poisoning of workers/farmers and detrimental effects on human health	▪ Promote the recycling of packages; ▪ Regulatory application of pesticides (type, MSDS) labelling and quantity);	Observed changes in the following areas: • Number of farmers recycling containers;	Agricultural (DPASA, SDAE including extension workers) and environmental (DPADER, SDPI) authorities, health authorities (DPS) (SDSMAS)

Pesticide management issue	Potential impact	Mitigation measure	Indicators of monitoring	Institutional responsibility
consumption of polluted water, excessive use of chemicals	Toxicity to fish	▪ Monitor aquatic biodiversity and fishing activity; ▪ Promote first aid training to farmers.	• Number of packages washed and disposed in rivers; • Patterns of water quality referred in the regulation (Decree 18/2004); • Fishing yields; • Number of farmers trained in first aid.	
Pesticides Handling without Personal Protective Equipment (PPE)	Increased number of health issues associated to exposure to pesticides	▪ Promote the use of personal protective equipment; ▪ Promote first aid training among farmers.	Number of workers/farmers using personal protective equipment; Number of workers/farmers trained in first aid; Number of accidents/injuries per season.	Agricultural (DPASA, SDAE including extension workers) and environmental (DPADER, SDPI) authorities, health authorities (DPS) (SDSMAS) private and other employers, e.g. NGOs.
Treatment of empty containers	Hazard to the environment, including people	▪ Incineration in designated sites; ▪ All glass, metal or plastic containers should be rinsed out with water at least 3 times ▪ The wash-water should be disposed of correctly in properly designed soak pits so that it does not	Number of empty containers directed to recycling companies; Quantity of waste directed to incineration; Number of constructed, properly designed soak pits for washing pesticides containers,	Agricultural (DPASA, SDAE including extension workers) health authorities (DPS) (SDSMAS) and environmental (DPADER, SDPI) authorities

Pesticide management issue	Potential impact	Mitigation measure	Indicators of monitoring	Institutional responsibility
		become a hazard to the environment; ▪ The lids of all containers should be removed and taken separately to recycling; ▪ Glass or plastic containers must be taken to recycling companies - ▪ Glass or plastic pesticide containers which cannot be broken or punched with holes must never be left around in case people use them for some other purpose; ▪ Each metal container should be made unusable by punching holes in the top and bottom and then crushing it. Flattened containers are easier to bury or dispose of at the dumping site; ▪ All residual waste materials that cannot be recycled should be properly incinerated.		

Main areas of and issues for intervention	Actions required
IPM mainstreaming	Integration of IPM into the project key components of: (i) Identification of key stakeholders; (ii) Construction of resilient schools using local materials; (iii) production and commercialization of smallholder agriculture: and (iv) make it a practical element affecting all aspects of extension and training; (v) Recording and dissemination of success stories in IPM.
Minimize use and reliance on chemical pesticides	(i) Promote adoption of IPM practices through farmer education and training; (ii) Develop strategies to move farmers away from pesticide-dependent pest control practices and promote use of biological control; (iii) Promote research on traditional knowledge and practices on pest control; (iv) Promote controlled methods for the eradication of termites in wood amongst contractors and communities engaged in the construction of schools.
Change current pest management practices	(i) Allocate adequate resources to implement National Plant Protection Policy (ii) Increase IPM awareness amongst policy makers and farming community; (iii) Abolish free distribution of pesticides to farmers and promote safe handling and application of pesticides; (iv) Increase knowledge/ capacity of SDIPs and of SDAEs in order for them to control of termites during construction activities using wood or timber construction materials; (v) Ensure that pesticides vendors promote safe use and handling of pesticides.
Enforcement of legislation and Public awareness	(i) Strengthen institutional capacity of MIC (to the extent needed) and MITADER to effectively supervise compliance with pesticide legislation; (ii) Civil society involvement in dissemination of relevant legislation to raise public awareness on environmental and health impacts of pesticides.
IPM research and extension	(i) Strengthen IPM research at MASA/Relevant Research Institutions including IIAM; (ii) Strengthen IPM extension; (iii) Strengthen collaboration between MITADER and MASA for field implementation of IPM; (iv) Involve the Private Sector, NGOs and Communities in promoting IPM activities; (v) Implement participatory approaches in IPM for farmers to learn, test, select and implement IPM options to reduce losses due to pests and diseases.
Environmental and health hazards of pesticide misuse	(i) Promote public awareness on environmental and health impacts associated to poor handling of pesticides; (ii) Regular assessment of pesticide residues in irrigated agricultural production systems and in harvested produce.

	(iii) Monitoring of pesticide poisoning in the farming and rural communities. (iv) Adoption of precautionary measures to minimize environmental contamination by pesticides from irrigated fields.
Increase in vector populations and of vector-borne diseases such as malaria	(i) Develop IPM working group and create a database of major pesticides users as well as cases of pest outbreaks; (ii) Collaborate with other IPM programs in the region; (iii) Establish strong collaboration between Africa Stockpile Program and national malaria control project; (iv) Conduct regular vector surveillance.
Monitoring	(i) Establish a participatory monitoring system that provides early warning on pest status, (ii) identify at what level economic losses will occur, (iii) identify main pest species, beneficial, regular and migratory species (iv) Dissemination of success stories on IPM.

In general, pesticide misuse may also result in: (i) Elimination of the natural enemies of crop pests and consequent loss of natural pest control that keeps the populations of crop pests very low; and (ii) Development of pest resistance to pesticides, encouraging further increases in the use of chemical pesticides, thus, exacerbating the environmental and health impacts of pesticides.

9.1 Promoting the IPM for ERRP

To mitigate the impacts, the general approach of the ERRP should avoid or promote minimum pesticide use as well as ensuring that any necessary use is informed by best management practices that are in line with IPM approaches as per World Bank's OP 4.09 and BP 4.01 (OP 4.09/BP 4.01) on Pest Management and Environmental Management respectively. The exact IPM approach should be defined according to the needs of the farmers in relation to crops to be produced, site conditions and capacity of the farmers to adopt and implement new techniques.

A needs assessment shall be conducted to determine the type of pesticides based on widely produced crops and specific training program shall be defined and implemented for farmers, farmer leaders, and district extension workers working in the project are. The training will be crop based with farmers being organized into groups led by farmer leaders to ensure ownership and sustainability of the best practices to be recommended. Farmer leaders approach is usually effective in disseminating technologies to farmers as most farmers tend to learn by seeing.

In addition to identification of pest control for crops, the IPM for the ERRP shall include a component for the management and control of termites in wood, as wood will be one of

the recommended and used local materials for the reconstruction of resilient classrooms using mixed materials. The Objectives of an IPM approach are:

Table 3: Objectives of IPM

One of the limitation likely to influence low adherence to IPM is the perception that pesticides are more effective in eliminating pests which affect crops. More information on pest behavior need to be made available to the public so that decision is made based on scientific evidences. Widespread use of pesticides in agriculture seems effective as initial application will kill most of insects, bugs or worms, however, some manage to survive. Certain aspects of their physiology, or behavior allows them to resist the chemical effects. In cases where resistance has a heritable basis, it becomes more common in the next generations, making the chemical the agent of selection which favors the more resistant form of the pest. On the other hand, pesticides use kills most of the natural pest predators, allowing the pests to multiply more rapidly. With time, the population of resistant pest increases, a phenomena known as **pest insurgence** which causes an even greater damage to the crops**.**

Therefore, the success of any IPM strategy depends not only on the ability of the Project to define an IPM program and link it with strategic partners (private companies or NGOs), but also on the capacity of the different actors (government, extension service, farmers, private organizations, strategic partners) to disseminate information on the benefits of IPM and communicate to the farmers the disadvantages of use of pesticides, o allow them to make better decisions. Investment in training and capacity building in several topics of IPM and the implementation of this PMP is therefore recommended. It is recommended that the Project hires an experienced IPM specialist to act as both principal technical resource person and facilitator (for training), for which national expertise is available. He should liaise with relevant agricultural services including research services in the fulfilment of his/her objectives.

Important training aspects could be done with lead farmers or involving experienced farmers. The success of IPM will depend largely on developing and sustaining institutional and human capacity to facilitate experiential learning for making informed decisions in integrating scientific and indigenous knowledge to minimize potential detrimental impacts of the use of pesticides. Poor communication between farmers and extension workers and other agricultural and government officers could lead to poorly-targeted research or to poor adoption of promising options generated by research. Ideally some of the training should be led by farmers themselves targeted to other farmers. In essence farmers need to know effectively that pesticides are highly neurotoxic designed to kill (killing insects can lead to killing of birds and fish that feed on the poisoned insects). Farmers should also be informed about use of preventive and natural alternatives. If pesticides are to be used, organic pesticides that are bird, fish and animal-friendly produces.

9.2 Approved Pesticides

The proposed ERRP under the World Bank funding is to rehabilitate the irrigation infrastructures damaged by floods in Zambezia province, and will not fund pesticide acquisition for farmers. However, as it is expected that pesticide use will be induced by improvements of the irrigation system, it is recommended that a provisional list of less harmful pesticides be elaborated that can be used as a guide to procure pesticides if needed by beneficiaries farmers of the rehabilitated irrigation systems. For his reason, a list of registered pesticides in Mozambique is provided as an Annex of the Pesticide Regulation (Ministerial Diploma 153/2002 of 11 September 2002) and covers among others: cypermethrin, deltamethrin, mancozeb and dimethoate. The list is updated on a regular basis and Annex 1 of this document presents the latest version updated in December 2015. Annex 2 of this document presents the WHO Pesticide Classification List by level of risks. The list could guide the classification of pesticides eventually to be used b beneficiaries of Munda-Munda and Nante irrigation schemes in Zambezia province.

10. PRACTICAL MEASURES FOR INTEGRATED PEST AND PESTICIDE MANAGEMENT

Based on issues that have been identified in previous chapters, this section provides a general outline of various types of pest control strategies known and applied in Mozambique and that can be further investigated and disseminated in wider areas, including the project area, on the basis of evidence. These include a brief review of techniques for biological control, cultural control, chemical control, quarantine and physical or mechanical control, chemical control and botanical control.

10.1 Strategy for Intervention and Pesticide Management Action Plan

10.1.1 Biological Control

Biological control involves the use of biological agents and predators to control pests and diseases. The method is usually successful in crops such as cassava and involves conservation or optimization of the impact of living agents that already exist in the ecosystem, artificially increasing the number of natural enemies in the agro-ecosystem, introducing the new natural enemies' species where these were non-existent.

Evidence shows that every living organism has its natural enemies and diseases, which keep its population at balance. Natural enemies include predators, parasitoids, nematodes, fungi, bacteria, viruses etc. The use of predators, parasitoids, nematodes, fungi, bacteria and viruses to maintain the population density of pests at a lower level than would occur in their absence is a common method under biological control or simply bio-control.

In the plant kingdom resistance to pests is the rule rather than the exception. In the coevolution of pests and hosts, plants have developed defense mechanisms. The mechanisms may be either physical (waxy surface, hairy leaves etc.) or chemical (production of secondary metabolites) in nature. Pest-resistant crop varieties either suppress pest abundance or elevate the damage tolerance level of the plant. In other words, genetic resistance alters the relationship between pest and host. The inherent genetically based resistance of a plant can protect it against pests or diseases without recourse to pesticides.
For the ERRP project research, extensionists, farmers of all classes, and particularly family, small and medium farmers should be stimulated to work together to make experiments and come up with combinations that are suitable for the area.

10.1.2 Cultural and Crop Sanitation Practices

Pests may also be controlled through the adoption of improved cultural and crop sanitation practices. Some of these include:

- ✓ **Crop rotation**: this practice is used to depress weeds and/insect pests and diseases in some crops. For example, *Striga* in sorghum and millet can be controlled/reduced by planting a trap crop like groundnuts or cotton;
- ✓ **Intercropping**: the field is used to grow two or more crops at the same time, which among them interchange disease control elements, and thus minimizing the abundance of pests;
- ✓ **Relay cropping**: where one crop is relayed with another to reduce the infestation of weevils, for example;
- ✓ **Fallow**: the field is not cultivated for some years in order to control various parasitic weeds;
- ✓ **Cover crops**: these are leguminous crops, which are grown to suppress weeds in the field. They can be intercropped or not and they protect and cover the field e.g. pumpkins;
- ✓ **Trap crops**: these induce the germination of a pest. The trap crop can be intercropped or rotated with a susceptible host (e.g. groundnuts, cotton etc.).
- ✓ **Mulching**: this is covering of crop fields by dry grasses to control weeds and conserve soil moisture (e.g. in banana, tomato field etc.);
- ✓ **Hand pulling and hoes weeding**: these practices are the most common and being used by small-scale farmers. In moments of relative abundance of labor in rural areas this practice can be adopted easily;
- ✓ **Burning**: land clearing and destroying infected plants/crops. Although it is fundamental to ensure that burning is strictly controlled and limited to the areas and species being targeted and do not spread to other areas;
- ✓ **Fertilizer/manure application**: the application of nutrients in the form of either inorganic fertilizer or farm-yard manure reduces both the infestation of fields by weeds (e.g. *Striga*) and losses in crop yield;

- ✓ **Use of disease free planting material**: e.g. cassava cuttings, sweet potato vines etc.;
- ✓ **Pruning**: done in tea, orange tree etc. to reduce insect pests and diseases that might infest the crop;
- ✓ **Thinning**: done to reduce plant population in the field (e.g. in maize, rice, sorghum and cotton etc.).

As with biological control existing knowledge and experiments in the project area should be used and/or carried out to identify the practices that are more suitable to local conditions. Based on evidence these should be disseminated among the beneficiary farmers and the beneficiary farmers and technical support services – extension services.

10.1.3 Physical and Mechanical Control

These are measures that kill the insect pest, disrupt its physiology or adversely affect the environment of the pest. They are different from cultural measures as the devices or actions adopted are directed against the insect pest instead of modifying agricultural practices. The hand picking of cotton strainers from cotton plants, banana weevils from banana pseudo stems, killing American bollworm from tomato plants are forms of physical control while the use of a fly swatter against annoying flies is a form of mechanical control. Some of the mechanical measures are relatively easy to apply where and when there is abundance of manpower.

10.1.4 Chemical Control Methods

These measures involve the use of herbicides, insecticides and fungicides to manage weeds, pests and diseases. As already explained throughout this document they should be used under certain conditions and when the other less intrusive and poisonous measures have proved to not be effective. All the aspects of capacity building of individuals and institutions should be used to ensure that the use of chemicals is not done to the detriment of the health of humans and other living organisms and consequently ensuring a healthy environment.

They can be applied as liquid spray, in the form of granules, powder or fumigation in stores. Registered pesticides (Annex 1) can be recommended as a component of IPM packages. These are registered under Pesticide Regulation (Ministerial Diploma 153/2002 of 11 September 2002) and as mentioned, updated on a yearly basis. Annex 1 is the list approved in December 2015 and currently in use.

10.2 Institutional Strengthening, Training and Capacity Building

The success of IPM depends largely on developing and sustaining institutional and human capacity to facilitate experimental learning for making informed decisions in integrating scientific and indigenous knowledge to solve specific problems. Poor communication

between farmers and extensionists could lead to poorly-targeted research or to poor adoption of promising options generated by research.

As discussed before there are already several experiences in IPM in Mozambique, including in the target conservation areas that included capacity building and training. However, the adherence to this approach is something that take time, as it is related with changes in behavior. Therefore, there is a need of additional and continuous capacity building in target areas in order to build up existing farmers' inclination of implementing IPM techniques, keeping chemical use at a minimum. Community associations whenever possible should visit other IPM programs in the region.

A training program shall be defined and implemented for farmers, farmer leaders, and district extension workers, the training will be crop based with farmers being organized into groups led by a farmer leader. The method for training farmers and farmer leaders would include several methodologies: as Learning-by-doing/discovery training programs (in farmers own land), Farmer field school (where farmer groups are led, step by step in growing the crop during the season from planting to harvest and increasingly into post-harvest activities and even marketing); discussion groups, preparation of communication material, activities under young education programs.

In addition training on use of pesticides shall include the pesticide selection, understanding the pesticide label, pesticide transport, mixing and loading pesticide, pesticide storage, container disposal, obsolete pesticides, calibration, product quantity and pesticide application, determining the amount of chemical to use, important cautions related to the application of pesticides, toxicity, human protection and first aid.

Awareness-raising programs and training on IPM techniques and safe use of pesticides shall be inclusive for women and vulnerable groups, since experience show that these are the most impacted persons by pest and pesticides use and storage (toddlers, handicapped, elderly, etc.). There should be an articulation with other actors with IPM programs, as the Provincial Directorates for Agriculture and other partners.

Farmers in Mozambique do not have technical insight on a safe use of pesticides as a way of pest control. Some may have access to pesticides and even use, but the way the use, the dosage, and many other related practices may be harmful to both pants and environment. Also the lack of technical abilities in identifying pests and apply appropriate pesticide at the correct dosage has been a problem in a good part of Mozambican farmers. Considering that some of pesticides are poisoners, farmers should use some appropriated equipment to prevent themselves as they apply. Some of the equipment are accessible in the local market at affordable price, but because of lack of knowledge, farmers do not protect themselves.

In line with this situation, there is a need of capacity building activities to overcome the problems. The present project intends to develop and implement a training program to

farmers. The project will cover, not being limited to, aspects related to identification of pest and definition of appropriate control measure. Control practices must be friendly to the environment. In case of deciding to use pesticide, which pesticide to use, depending on the pest, the dosage required, application method, use of PPE, etc. Farmers should likewise know the possible side effects of each pesticide.

11. IMPLEMENTATION MANAGEMENT OF THE PMP

The overall monitoring and oversight of the PMP shall be the responsibility of the site engineer, with support from the district services for economic activities (SDAE) which are responsible for agriculture and environmental management and have designated staff for these roles. They shall have a copy of the PMP, the ESMF as well as the project document, and will be responsible for reporting any abnormalities to the site engineer, the districts authorities and to DPSA should any issue arise.

In terms of the day to day monitoring, the site engineer as well as extensionists shall fulfil this role, the former will do so during the period of reconstruction and/ rehabilitation works, specifically of classrooms, and shall ensure that mitigation measures are being employed where necessary. The latter will play a critical role during training provision for farmers (or famer field schools using demonstrations).

With guidance from the relevant project proponent entities' Safeguard Teams, district services shall develop a quarterly monitoring plan, to ensure that the measures identified in the PMP are indeed being implemented by farmers, where agriculture is concerned; and by contractors, where construction of schools is the case.

12. INDICATIVE BUDGET

The costs of PMP implementation will depend on a number of factors including the number of beneficiaries of the irrigation schemes, availability of pesticides vendors in the project area, the availability of active extension group and NGOs, the scale and details of the program to be agreed upon. Key government actors such as DPASA, SDAE, DPS, SDSMAS, DPADR, and SDPI will need to be directly involved particularly in regulating use and monitoring of pesticides.

The tables below provide an estimated budget for the implementation of the PMP, monitoring, auditing and training/capacity building that will be required specifically to be managed by the environment and social management unit. The budget has been broken down into different components and the total amounts correspond to the level of effort required to plan, implement and monitor the use of pesticides in the schools construction and irrigation projects in Zambezia, Nampula and Niassa provinces, taking into consideration the likely use of pesticides under the proposed projects.

Table 4: Estimated Budget for the Implementation of PMP – Irrigation project

Item	Amount in (000 USD)
Implementation of the PMP	
Project Implementation kick-off	20.00
Identification of agribusiness and other pesticides distributors/vendors in the project site	80.00
General Technical Assistance	150.00
Specific Technical Assistance	100.00
Monitoring	150.00
Inspection	90.00
Annual Review	50.00
Regular Audits	100.00
Training and Capacity Building	
Specialized Trainings in PMP for EO	45.00
Health, Safety and Security in the Workplace	
Health, Safety and Security in the Workplace	150.00
Preparation and Implementation of detailed IPMP	
Preparation and Implementation of detailed IPMP	200.00
Total	**1,135.00**

The total cost for the preparation and implementation of the IPMP for the irrigation project is of USD 1, 135.00.

Table 5: Estimated Budget for the Implementation of the PMP – schools infrastructure in Niassa

Item	Amount in (000 USD)
Implementation of the PMP	
Project Implementation kick-off	15.00
General Technical Assistance	50.00
Specific Technical Assistance	50.00
Monitoring	60.00
Inspection	45.00
Regular Audits	25.00
Training and Capacity Building	
Specialized Trainings in PMP for EO	45.00
Health, Safety and Security in the Workplace	
Health, Safety and Security in the Workplace	90.00
Preparation and Implementation of detailed IPMP	
Preparation and Implementation of detailed IPMP	100.00
Total	**480.00**

The total cost for the preparation and implementation of the IPMP for schools construction in Niassa province is of **USD 480,000.00**.

Table 6: Estimated Budget for the Implementation of the PMP – schools infrastructure in Nampula

Item	Amount in (000 USD)
Implementation of the PMP	
Project Implementation kick-off	15.00
General Technical Assistance	50.00
Specific Technical Assistance	50.00
Monitoring	60.00
Inspection	45.00
Regular Audits	25.00
Training and Capacity Building	
Specialized Trainings in PMP for EO	45.00
Health, Safety and Security in the Workplace	
Health, Safety and Security in the Workplace	90.00
Preparation and Implementation of detailed IPMP	
Preparation and Implementation of detailed IPMP	100.00
Total	**480.00**

The total cost for the preparation and implementation of the IPMP for schools construction in Nampula province is of **USD 480,000.00**.

Table 7: Estimated Budget for the Implementation of the PMP – schools infrastructure in Zambezia

Item	Amount in (000 USD)
Implementation of the PMP	
Project Implementation kick-off	15.00
General Technical Assistance	50.00
Specific Technical Assistance	50.00
Monitoring	60.00
Inspection	45.00
Regular Audits	25.00
Training and Capacity Building	
Specialized Trainings in PMP for EO	45.00
Health, Safety and Security in the Workplace	
Health, Safety and Security in the Workplace	90.00
Preparation and Implementation of detailed IPMP	
Preparation and Implementation of detailed IPMP	100.00
Total	**480.00**

The total cost for the preparation and implementation of the IPMP for schools construction in Zambezia province is of **USD 480,000.00**.

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14. ANNEXES

14.1 Annex 1: Registered Pesticides in Mozambique (June 2015)

lista de pesticidas - Dezembro -2015 (1).:

14.2 Annex 2: WHO Pesticide Classification List

Table 1. Extremely hazardous (Class l a): Active Ingredients of Pesticides (Common name):

Aldicarb	Difethialone	Parathion-methyl
Brodifacoum	Diphacinone	Phenylmercury acetate
Bromadiolone	Disulfoton	Phorate
Bromethalin	Ethoprophos	Phosphamidon
Calcium cyanide	Flocoumafen	Sodium fluoroacetate
Captafol	Fonofos	Sulfotep
Chlorethoxyfos	Hexachlorobenzene	Tebupirimfos
Chlormephos	Mercuric chloride	Terbufos
Chlorophacinone	Mevinphos Difenacoum	Parathion

Highly hazardous (Class l b) technical grade active ingredients of pesticides (common name)

Acrolein	Ethiofencarb	Omethoate
Allyl alcohol	Famphur	Oxamyl
Azinphos-ethyl	Fenamiphos	Oxydemeton-methyl
Azinphos-methyl	Flucythrinate	Paris green {C}
Blasticidin-S	Fluoroacetamide	Pentachlorophenol
Butocarboxim	Formetanate	Pindone
Butoxycarboxim	Furathiocarb	Pirimiphos-ethyl
Cadusafos	Heptenophos	Propaphos
Calcium arsenate	Isazofos	Propetamphos
Carbofuran	Isofenphos	Sodium arsenite
Chlorfenvinphos	Isoxathion	Sodium cyanide
3-Chloro-1,2-propanediol	Lead arsenate	Strychnine
Coumaphos	Mecarbam	Tefluthrin
Coumatetralyl	Mercuric oxide	Thallium sulfate
Zeta-cypermethrin	Methamidophos	Thiofanox
Demeton-S-methyl	Methidathion	Thiometon
Dichlorvos	Methiocarb	Triazophos
Dicrotophos	Methomyl	Vamidothion
Dinoterb	Monocrotophos	Warfarin
Edinofenphos	Nicotine	Zinc phosphide

Table 3. Moderately hazardous (Class II) Technical Grade Active Ingredients of Pesticides (Common name)

Alanycarb	Endosulfan	Paraquat

Anilofos
Azaconazole
Azocyclotin
Bendiocarb
Bensulide
Bifenthrin
Bilanafos
Bioallethrin
Bromoxynil
Brobuconazole
Bronopol
Butamifos
Butylamine
Carbaryl
Carbosulfan
Cartap
Chloralose
Chlordane
Chlorfenapyr
Chlorphonium chloride
Chlorpyrifos
Clomazone
Copper sulfate
Cuprous oxide
Cyanazine
Cyanophos
Cyfluthrin
Beta-cyfluthrin
Cynalothrin
Cypermethrin
Alpha-cypermethrin
Cyphenothrin
Deltamethrin
Diazinon
Difenzoquat
Dimethoate
Dinobuton Nabam
Diquat Naled

Endothal-sodium
Esfenvalerate
Ethion
Etrimfos
Fenitrothion
Fenobucarb
Fenpropidin
Fenpropathrin
Fenthion
Fentin acetate
Ferntin hydroxide
Fenvalerate
Fipronil
Fluxofenim
Formothion
Fuberidazole
Gamma-HCH
Guazatine
Haloxyfop
Heptachlor
Imazalil
Imidacloprid Sodium
Iminoctadine
loxynil
loxynil octanoate
Isoprocarb
Lambda-cynalothrin
Mercurous chloride
Metaldehyde
Metam-sodium
Methacrifos
Methasulfocarb
Methyl isothiocyanate
Metolcarb
Metribuzin
Molinate

Pebulate
Permethrin
Phenthoate
Phosalone
Phoxim
Piperophos
Pirimicarb
Prallethrin
Profenofos
Propiconazole
Propoxur
Prosulfocarb
Prothiofos
Pyraclofos
Pyrazophos
Pyrethrins
Pyroquilon
Quinalphos
Quizalofop-p-tefuryl
Rotenone
Sodium fluoride
Hexafluorosilicate
Spiroxamine
Suiprofos
Terbumeton
Tetraconazole
Thiacloprid
Thiobencarb
Thiocyclam
Thiodicarb
Triazamate
Trichlorfon
Tricyclazole
Tridemorph
Vernolate
Xylylcarb

Acephate
Acetochlor
Acifluorfen
Alachlor
Allethrin

Chlormequat (chloride)
Chloracetic acid
Chlorthiamid
Copper hydrixide
Copper oxychloride

Dichlorbenzene
Dichlorophen
Dichlorprop
Diclofop
Dienochlor

Ametryn
Amitraz
Azamethiphos
Bensultap
Bentazone
Bromofenoxim
Butroxydim
Chinomethionat
Cucloate
Cyhexatin
Cymoxanil
Cyproconazole
Dazomet
Desmethryn
Dicamba
Dichlormid
Diethyltoluamide
Difenoconazole
Dimepiperate
Dimethachlor
Dimethamethryn
Dimethipin
Dimethylarsinic acid
Diniconazole

Table 4: Technical Grade Active Ingredients of Pesticides Unlikely to Present Acute Hazard in Normal Use (Common name):

Acephate
Acetochlor
Acifluorfen
Alachlor
Allethrin
Dinocap
Diphenamid
Dithianon
Dodine
Empenthrin
Esrocarb
Etridiazole
Fenothiocarb
Ferimzone
Fluazifop-p-butyl
Fluchloralin
Flufenacet
Fluoroglycofen
Flurprimidol
Flusilazole
Flutriafol
Fomesafen
Furalaxyl
Glufosinate
Hexazinone
Hydramethylnon
Iprobenfos
Isoprothiolane
Isoproturon
Isouron
Malathion
MCPA-thioethyl
Mecoprop
Mecoprop-P
Mefluidide
Mepiquat
Metalaxyl
Metamitron
Metconazole
Methylarsonic acid
Metolachlor
Myclobutanil
2-Napthyloxyacetic acid
Nitrapyrin
Ametryn
Amitraz
Azamethiphos
Bensultap
Mecoprop
Mecoprop-P
Mefluidide
Mepiquat
Metalaxyl
Metamitron
Metconazole
Methylarsonic acid
Metolachlor
Myclobutanil
2-Napthyloxyacetic acid
Nitrapyrin
Ametryn
Amitraz
Azamethiphos
Bensultap
Bentazone
Bromofenoxim
Butroxydim
Chinomethionat
Chlormequat (chloride)
Chloracetic acid
Chlorthiamid
Copper hydrixide
Copper oxychloride
Nuarimole
Octhilinone
N-octylbicycloheptene
Dicarboximide
Oxadixyl
Paclobutrazol
Pendimethalin
Pimaricin
Pirimiphos-methyl
Prochloraz
Propachlor
Propanil
Propargite
Pyrazoxyfen
Pyridaben
Pyridaphenthion
Pyridate
Pyrifenox
Quinoclamine
Quizalofop
Resmethrin
Sethoxydim
Simetryn