



MINISTRY OF AGRICULTURE AND FOOD SECURITY

LESOTHO

Agricultural Productivity Program of Southern Africa (APPSA)



VOLUME 1

ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK (ESMF)

Prepared for:
Ministry of Agriculture and Food Security
Maseru
Lesotho

APPSA Safeguards Documents

The Agricultural Productivity Program of Southern Africa (APPSA) safeguards documents are intended to provide complete documentation for the requirements of a holistic environmental and social safeguards management system for the project. For Lesotho, two environmental safeguards documents have been prepared:

Agricultural Productivity Program of Southern Africa (APPSA) Lesotho
Volume 1: Environmental and Social Management Framework (ESMF)

Agricultural Productivity Program of Southern Africa (APPSA) Lesotho
Volume 2: Integrated Pest Management Plan (IPMP)

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Acronyms and Abbreviations

AEO	Area Agricultural Extension Officers
AfDB	African Development Bank.
AIA	advanced informed agreement.
AIDS	Acquired Immunodeficiency Syndrome
AIPO	The African Intellectual Property Organization.
APPSA	Agricultural Productivity Programme in Southern Africa
ARIPO	The African Regional Intellectual Property Organisation.
BP	Best Practice (of the World Bank)
BSL	Biosafety Level
CA	Conservation Agriculture
CAADP	Comprehensive Africa Agriculture Development Programme
CBD	Convention on Biological Diversity.
CBO	Community-Based Organization
CC	Community Councils
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
CERC	Contingency Emergency Response Component
CFC	Chlorofluorocarbons.
CGIAR	Consultative Group for International Agricultural Research
CMS	Conservation of Migratory Species
CSA	Climate Smart Agriculture
DAO	District Agricultural officer
DAR	Directorate of Agricultural Research
DDCs	District Development Committees
DEO	District Environmental Officer
DFID	Department for International Development (UK)
DoC	Department of Culture.
DoE	Department of Environment
DPPA	Directorate of Planning and Policy Analysis
EA	Environmental Assessment
EAP	Emergency Action Plan
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EIS	Environmental Impact Study
EMP	Environmental Management Plan
eRH	Equilibrium Relative Humidity (
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plans
ESMP	Environmental and Social Management Plan
ESSF	Environmental and Social Screening Form
FA	Framework Agreement
FAO	Food and Agriculture Organization
GAP	Good Agricultural Practices.
GBV	Gender-based violence.
GDP	Gross Domestic Product.
GIIP	Good International Industry Practice
GM	Genetically Modified.
GMO	Genetically Modified Organism.
GOL	Government of Lesotho.

GRM	grievance redress mechanism.
GRS	Grievance Redress System.
GTZ	German Technical Cooperation Agency
HEPA	high-efficiency particulate air
HIV	Human Immunodeficiency Virus
HRH	human resource for health.
ICT	information and communications technologies
IDA	International Development Agency
IFAD	International Fund for Agricultural Development
ILO	International Labour Organization
INDF	Interim National Development Framework.
IP	Intellectual Property
IPDM	Integrated Pest and Disease Management.
IPMP	Integrated Pest Management Plan.
IPPC	International Plant Protection Convention.
IPR	Intellectual Property Rights.
IPV	intimate partner violence.
ITCZ	Inter-Tropical Convergence Zone
LAA	Land Administration Authority
LDTC	Lesotho Distance Training Centre.
LENAFU	Lesotho National Farmers Union.
LHWP	Lesotho Highlands Water Project
LIPAM	Lesotho Institute of Management
LMO	living modified organism.
LRMIS	Livestock Registration, Marking and Information Systems
LSA	Late Stone Age
M&E	Monitoring and Evaluation
MAFS	Ministry of Agriculture and Food Security
MCC	Millennium Challenge Corporation
MFDP	Ministry of Finance and Development Planning
MFLR	Ministry of Forestry and Land Reclamation
MIS	Management Information System.
MLGC	Ministry of Local Government and Chieftainship
MoH	Ministry of Health
MSA	Middle Stone Age
MTEC	Ministry of Tourism, Environment and Culture.
MTICM	Ministry of Trade, Industry, Cooperatives and Marketing
NAC	National Aids Council
NAIP	National Agricultural Investment Programme
NARS	National Agricultural Research System
NEP	National Environmental Policy.
NES	National Environmental Secretariat.
NGO	Non-Governmental Organisation.
NIH	National Institute of Health (US)
NSDP	National Strategic Development Plan.
NUL	National University of Lesotho.
OP	Operational Policy (of the World Bank)
PCB	Poly-Chlorinated Biphenyls.
PCN	Project Concept Note
PCP	public consultation plan
PDO	Programme Development Objective
PIU	Programme Implementation Unit

PMP	Pest Management Plan.
PMU	Project Management Unit.
POPs	Persistent Organic Pollutants.
PPE	Protective Personal equipment.
PRS	Poverty Reduction Strategy.
PSC	Project Steering Committee (
PSCEDP	Private Sector Competitiveness and Economic Diversification Project.
PVP	Variety Protection.
R&D	Research and Development
RCoLs	Regional Centres of leadership
RDC,	Rural District Council
RH	relative humidity
RRO	Regional Research Office
RTC	Research Technical Committee
SADC	Southern Africa Development Community
SADP	Smallholder Agricultural Development Project
SPS	sanitary and phytosanitary.
UNDP	United Nations Development Programme
UPOV	International Union for the Protection of New Varieties of Plants.
VDCs	Village Development Committees
WAMP	Wool and Mohair Project
WASA	Water and Sewage Authority
WB	World Bank
WIPO	The World Intellectual Property Organization.
WTO	World Trade Organization.

EXECUTIVE SUMMARY

Introduction

The Government of Lesotho (GoL) is seeking funding to participate in the Agricultural Productivity Program in Southern Africa (APPSA), under the Ministry of Agriculture and Food Security (MAFS) with the objective of increasing the productivity of horticulture (fruits and vegetables crops systems) through the introduction of improved varieties and modern farming technologies. The proposed APPSA will support agricultural technology generation and dissemination by supporting the strengthening and scaling up of Regional Centres of Leadership (RCoLs) to carry out research activities of regional importance through regional collaboration. The total cost for the proposed Program activities in Lesotho is approximately US\$20 million.

Project Components

The proposed program will have three components:

i. Technology Generation and Dissemination

This component will support technology generation and dissemination activities associated with Regional Centres of Leadership (RCoLs). This will include research activities targeting the technology priorities defined through regional dialogue and consistent with a regional priority setting study. The component will also support regional dissemination programs or technology transfer subprojects to link Centres of Leadership to institutions in other countries and enable scaling up of innovations.

APPSA Lesotho will aim at improving horticulture (fruits and vegetables) technologies and improving the capacity of MAFS to strengthen technical training of beneficiary farmers, extension agents and advisory service providers. The priority project types for Lesotho include:

- Crop genetic diversity improvement (germplasm collection, characterization, conservation and exchange);
- Crop breeding and improvement for adaptability, economic and spillover effect;
- Integrated pest and disease management development;
- Development of postharvest technology and innovation techniques;
- Irrigation technologies/innovations development;
- Production systems and management technologies integration (e.g. planting dates, soil fertility improvement);
- Dissemination and technology transfer.

APPSA will also support regional information sharing and exchange activities with other participating countries.

ii. Regional Centre of Leadership Strengthening

This component will support capacity building for at least one Regional Centre of Leadership (RCoL). APPSA will support: (i) the upgrading of research infrastructure; (ii) improving management and performance systems; (iii) scientific training at the post graduate level and to upgrade skills through short courses or targeted training; and (iv) strengthening seed, regulatory and related services.

Investments in seed and related services will focus on increasing the capacity of pre-basic and basic seed production for targeted commodities under APPSA, increasing analytical capacity

for Genetically Modified Organisms (GMO) detection and mycotoxin analysis, and technical assistance to identify and address regulatory gaps within the technology generation and dissemination system, if necessary.

APPSA will provide financing for rehabilitation and upgrading of 8 regional and field trial stations to prioritize the limited resources available under APPSA.

iii. **Coordination and Facilitation**

This component will support implementation of the program and coordination activities. At the national level the program will be fully integrated into MAFS. APPSA will also provide an opportunity to scale up the use of multi-stakeholder platforms within the program to ensure all actors within the national agricultural research system are involved.

Objectives of the Environmental and Social Management Framework

This ESMF has been prepared because the location and design of the Program activities and subprojects, and the magnitude of their impacts are not precisely known at project appraisal stage, although the types of potential Program activities that could take place have been defined. The principal aim of this ESMF is to provide a framework for addressing all environmental and social safeguards issues in APPSA activities and subprojects from screening, preparation, through review and approval, to implementation.

The Environmental and Social Management Framework (ESMF) is the main decision-making Environmental and Social Safeguards instrument for the project and will be adopted for the various sub-projects or supported with site specific Environmental Assessments (EAs) or Environmental and Social Management Plans (ESMPs) as the site-specific program and project implementation instruments. It is a Dynamic instrument that will be reviewed and updated during the course of the project, whenever it is deemed necessary, to include lessons learned and new information relevant for the environmental and social management of the project.

Overview of the Legal Framework

A policy and legal review of Lesotho legislation established that the industrial and agricultural systems are supported by a host of laws and regulations for the protection of human beings and the environment at large. Among them the Lesotho Environment Act (2008) establishes the Department of Environment as the lead agency in environmental protection. The Department in turn has established Environmental Units within the line Ministries to further institutionalize its functions nationwide. It has also given the line Ministries the responsibilities of protecting the environment in the course of their duties. On the other hand, the World Bank Environmental and Social Safeguards Policies require some measures to be taken to protect the physical environment from all forms of degradation and to prevent any potential social impacts.

The Safeguard Policies that will be triggered by the APPSA include the following:

- 1.OP/BP 4.01: Environmental Assessment as a result of potential negative impacts
- 2.OP/BP 4.09: Pest Management due to anticipated increase in use of fertilizers and chemicals by farmers.
- 3.OP/BP 4.11: Physical Cultural Resources. The policy is triggered as a precautionary measure because in other projects in Lesotho, historical cultural artifacts have been found at some construction sites.
- 4.OP/BP 4.37: Safety of Dams. Due to the anticipated inclusion of small-scale earth dams to harvest and store water for research stations under the RCoLs.

The Involuntary Resettlement Policy (OP/BP 4.12) was not triggered for Lesotho, mainly because the rehabilitations and refurbishments will be within the footprint of the existing research stations.

Further the Lesotho APPSA Project is to adhere to the World Bank Group General Environmental Health and Safety Guidelines (EHS), namely i) General EHS Guidelines; ii) Perennial crop production EHS Guidelines (2015); iii) Annual crop production EHS Guidelines.

Program Setting

Lesotho is predominantly mountainous, with the mountain zone covering approximately 65% of the total land area. This land is mostly characterized by steep slopes with fragile soil formations which are extensively degraded. Only 9% of Lesotho's land is arable and over 80% of this is found in the lowlands, where it is not used for agriculture only, but for other purposes such as settlement. However, the arable land is susceptible to severe soil erosion. The country has over the years experienced severe deterioration of agricultural land due to a set of natural and manmade factors among which may be pointed out: heavy summer rainfalls usually on bare ground following the vegetation-less winter months, overgrazing on steep slopes in the mountains and foothills. Soil loss through erosion is currently estimated at about 13.2 tonnes per hectare totalling 40,000 tonnes per annum. This loss of topsoil with its higher organic content is also accompanied by loss of nutrients leading to overall impoverishment of land and reduction in the soil horizon.

The population of Lesotho in 2017 was estimated at 1, 958,042 (www.cia.gov). The population is currently at 2.2 million growing at an average rate of 0.28% per annum. Approximately 5% of the population was over 65 years of age, with another 19.5% of the population under 15 years of age. Approximately 28% of the population live in the urban areas, some 70% of the total population lives in the fertile lowlands, where the land can be most readily cultivated; the rest are scattered in the foothills and the mountains. The population density in the western half of the nation is relatively higher, with the capital of Maseru, and the smaller cities of Mafeteng, Teyateyaneng, and Leribe attracting the most people. About 35% of the youth are unemployed. The prevalence of HIV/AIDS has had a significant impact on the population of Lesotho, and the prevalence rate in 2016 was estimated at 25%. Literacy rate for the total was estimated at 79.4% in 2015 (70.1% for males and 88.3% for females).

Most land in Lesotho is allocated and held under customary tenure. Traditionally, use rights for residential and crop lands were allocated by a hierarchy of traditional authorities to household heads who then passed this on mainly to their male heirs. Grazing lands and forests and other communal resource areas were used and managed under the administration of traditional authorities on behalf of the king. Most communal land is allocated for grazing. It is estimated that about two thirds to three quarters of all land in Lesotho is used for grazing.

Lesotho's economic performance is reliant on agriculture, livestock, manufacturing and mining. Agriculture contributes approximately 7.4% to Gross Domestic Product (GDP), industry 34.5% and services 58.2%. Significant natural resources include diamonds and water. Agriculture is still the country's most important generator of employment. With roughly 70% of the population living in rural areas, farming provides as much as 45% of employment. Although little more than 10% of land is arable, crop farming is the mainstay of income for rural residents – mostly traditional low-input, low-output rain fed cereal production and extensive animal grazing.

Project Safeguards Capacity

The proposed structure for the Project Implementation Unit (PIU) has a provision for an environmental and social safeguards specialist who will make sure that the project is complying with all the safeguards issues. It is recommended that two specialists – an Environmental Safeguards Specialist

and a Social Safeguards Specialist - be engaged. This will ensure that the various environmental and social requirements are catered for adequately. The safeguards team can be strengthened by incorporating the District Agricultural Officers, who can be trained in the requirements of the ESMF and then assist in its implementation in their districts. The safeguards specialists will be responsible for the implementation of the requirements of this ESMF.

Main Environmental and Social Impacts

At the Project Concept Note (PCN) stage, APPSA was rated environmental and social assessment Category B and thus most of the subprojects will fall within this category. There will not be a Category A subproject funded by APPSA. However, to ensure that subprojects stay within Category B an Exclusion List as part of the Environmental and Social Screening Process has been prepared which lists the types of subprojects that are not eligible for funding under APPSA Lesotho. These are:

- Subprojects that require acquisition of land and physical or economic displacement of people.
- Subprojects that block the access to or use of land, water points and other livelihood resources used by others
- Subprojects that encroach onto fragile ecosystems, marginal lands or important natural habitats (e.g. ecologically-sensitive ecosystems; protected areas; natural habitat areas, forests and forest reserves, wetlands, national parks or game reserve; any other environmentally sensitive areas)
- Subprojects that Impact on physical cultural resources of national or international importance and conservation value
- Subprojects that have risks assessed as requiring biosafety levels BSL-3P and BSL-4P containment.

The risk and impact identification of APPSA Lesotho subprojects and activities was considered for the following three project implementation phases:

1. Construction/refurbishments Phase:
Rehabilitation and construction of physical infrastructure; farm, laboratory, and office equipment; and information technology and knowledge management systems (including seed storage facilities, greenhouses, chemical stores, growth chambers, and plant tissue facilities.;
2. Research and Development Phase:
Research and Development activities at the improved research facilities;
3. Technology Dissemination Phase
Dissemination of horticulture technology to the farmers.

The table below summarises the main environmental and social impacts from the three phases

No.	PROJECT PHASE	KEY NEGATIVE IMPACTS	KEY POSITIVE IMPACTS
1.	CONSTRUCTION / REFURBISHMENT PHASE	<ul style="list-style-type: none"> • Dust, • Noise, • Occupational health and safety (OHS) risks, • Public safety from refurbishment works (construction traffic, etc.), • Spillage of oil/lubricant wastes and • Construction debris/waste. • Disposal of potentially toxic materials e.g. asbestos, electric fittings with mercury, etc. • Spread of diseases. • Breaking of social fabric 	<ul style="list-style-type: none"> • Improved aesthetics • Creation of jobs • Income to material suppliers • Improvement in livelihoods and local economies

No.	PROJECT PHASE	KEY NEGATIVE IMPACTS	KEY POSITIVE IMPACTS
2.	RESEARCH AND DEVELOPMENT PHASE	<ul style="list-style-type: none"> • Impacts on water quality from laboratory chemicals, • Waste management (hazardous waste, chemical waste, sharps, contaminated waste, and possibly radioactive waste depending on what type of equipment and instruments may be used); • Biosafety (depending on level of research anticipated) • Soil and land degradation 	<ul style="list-style-type: none"> • Creation of jobs after refurbishment period • Creation of more long-term jobs • New technology developed and on offer • Diversification of productivity possible • Enhancement of livelihoods of communities • Raising of income levels • Improvement of productivity and lifestyles
3.	TECHNOLOGY DISSEMINATION PHASE	<ul style="list-style-type: none"> • Water resources (e.g. abstraction of water for irrigation) • Pollution of water sources and soil due to agro-chemical inputs • OHS risks to farmers • Health risks to communities due to contamination from agrochemicals • Land degradation • Loss of fragile ecosystems (e.g. wetlands) • Risks of IP being stolen or patented by other parties • Overcrowding of indigenous varieties by GMO • Erosion of indigenous knowledge systems • Risk to resource poor farmers of potentially reduced capacities 	<ul style="list-style-type: none"> • Improved aesthetics • Income levels for suppliers and contractors raised. • Creation of more long-term jobs • Enhancement of livelihoods of communities • Raising of income levels • Improvement of productivity and lifestyles. • Food and nutritional security • Use of evolved agricultural practices • Global recognition of research innovations • Maintaining the biological diversity and ecological balance • Maintaining the livelihood of the poor

Proposed Mitigation

The potential impacts were analysed and mitigation measures /or environmental and social management plans for the identified potential impacts were proposed. Typical mitigation/management measures for these impacts include:

- Proper disposal of construction waste and demolition debris, including recycling.
- Noise reduction adaptation for equipment during construction.
- Use of dust suppression measures during demolitions and construction
- Enforcement of safety precautions including the use of Protective Personal equipment (PPE)
- Instituting proper waste management systems to address all waste streams during each of the project phases. This will cover, biohazardous waste, radioactive waste, chemical waste as well as general solid and liquid waste.
- All operational areas must have appropriate containment and proper disposal of used lubricants.
- All water resources to be protected from all forms of pollution that may emanate from the research activities
- Exposure to radiation must be limited to below the threshold levels at all times
- All chemical must be stored appropriately in accordance with their characteristics preferably in a separate chemical store room.
- A patent system should be introduced to protect intellectual property rights
- Measures should also be taken to protect indigenous knowledge systems and also to protect the poorly resources farmers from having their indigenous varieties being flooded out of the market by GMOs.

Public Consultation and Grievance Redress Mechanism

The APPSA PIU responsibility to effectively engage stakeholders in achieving the project objectives for the benefit of all. The ESMF outlines a public consultation plan (PCP) which describes the objectives of the PCP, the key stakeholders, information disclosure and consultation means, grievance redress mechanism, feedback and monitoring.

As part of the continuous consultation process, there will be a grievance redress mechanism in place. The grievance redress mechanism (GRM) will be a system by which queries or clarifications about the project will be responded to, problems with implementation will be resolved, and complaints and grievances will be addressed efficiently and effectively. The Grievance Redress Mechanism will mainly be for being responsive to the needs of beneficiaries and to address and resolve their grievances through the following step by step approach;

1. The access point for impacted/concerned people
These will be as close to the users as possible and will be used to collect or receive the grievances.
2. Grievance log
Every grievance will be recorded and classified as urgent or non-urgent, and assigned to an officer.
3. Acknowledgement stage
Every complaint will receive a formal written acknowledgement, containing the expected turnaround time.
4. Assessment stage
The assigned officer will follow up all aspects of the complaint, both internal and external, to ensure that the key facts are identified and clarified.
5. Response
The Complainant will be provided with the resolution within the timescales promised. The complaints will be followed up to confirm that the complainants are satisfied with the response given.
6. Room for appeal
The Complainant will be provided with an alternative for appealing if they are not satisfied with the response to their query.
7. Resolution
The final resolution must be clear and fair. The Lesotho APPSA - PIU as a whole must be aware of the complaints and any underlying issues. The project will also plan actions to remove these and prevent future recurrence

Environmental and Social Monitoring

In addition to monitoring the implementation of mitigation measures proposed to address environmental and social impacts during construction/refurbishments of research facilities, research activities at the improved research facilities and dissemination of horticulture technology, the overall performance and effectiveness of the Program can be assessed through monitoring the following indicators:

- Number of infrastructure rehabilitated.
- Quality of construction materials for the refurbishments.
- Reports on quality of water discharged from the establishments.
- Number of employment opportunities for locals.
- Number of new employees engaged by the project.

- Ratio of men to women employed by the project (ensure equity in the recruitment processes).
- Number of safeguards training courses conducted for staff.
- Ratio of men to women trained (ensure equity in the training processes).
- Establishment of a waste segregation system with well-established handling and treatment method for each waste stream, including hazardous waste.
- Implementation of the public consultation plan.
- Number of new and resistant crop varieties introduced.
- Number of farmers involved in new technology trials segregated by gender.
- Institution of planned maintenance of machines and buildings.
- Biosafety management systems in place.
- Patenting programme in place.

Training and Capacity Building

Currently there is little capacity within the Directorate of Agricultural Research (DAR) to implement environmental and social requirements necessary to manage the potential environmental and social risks and impacts resulting from the construction/refurbishment of research facilities, research activities at the improved research facilities and dissemination of horticulture technology. Thus, the ESMF recommends various trainings in order to build capacity within the PIU and RCoLs to manage environmental and social risks. This includes training in environmental and social risks of APPSA Lesotho, environmental and social impact assessment, pest management, water and crop management, pesticide management, maintenance, hygiene and sanitation, HIV/AIDS awareness and research facility management. Total training costs are estimated at approximately USD 38,200.

ESMF Budget

The estimated cost for the implementation of the ESMF, which covers technical assistance, site specific Environmental and Social Impact Assessments (ESIAs) and Environmental and Social Management Plans (ESMPs), mitigation measures, monitoring, training and audits is USD 504,000.00.

However, it must be noted that ESIAs and ESMPs will be prepared for all subprojects, and these provide cost estimates for the implementation of specific mitigation and management measures for those subprojects.

Guidelines for Subproject Screening, Appraisal, Approval and Implementation

All the refurbishments and research work will be conducted at the Department of Research's (DAR) existing facilities, including many of the trial runs. Some farmers will also be selected to participate in these technology trial runs. Environmental and social screening will be conducted on both the DAR research stations and the farmer trial run plots. DAR will conduct the environmental and social screening on all the participating research stations and selected farmers, so as to avoid or minimize adverse environmental and social impacts. They will use the Environmental and Social Screening Form (ESSF) together with information on typical subproject impacts and mitigation measures in the environmental and social management plans. The main objective of the ESSF is to determine if the subproject will require any special planning reports such as ESIA, ESMP, IPMP, Biosafety Management Plans, etc.) may have to be developed and implemented. These will require extra resources to prepare and this may require amendments to the subproject design. The ESMF also provides guidelines for conducting annual reviews and preparing annual reports.

The ESMF recommends that the proposals made herein (and those made in the IPMP) must be implemented adequately to mitigate the consequential environmental and social impacts of the project activities; and to enhance the positive attributes. It is also recommended that the Department of Environment (DOE) and other relevant line ministries should carry out monitoring activities to ensure that the prescribed mitigation measures are being implemented.

1 INTRODUCTION

1.1 The Agricultural Productivity Program for Southern Africa (APPSA)

The performance of agriculture in southern Africa has generally improved compared to previous decades, although the sub-region as a whole still suffers from periodic food deficits. This is mainly because Southern Africa is vulnerable to climate shocks, which have adversely impacted food security. Further climate change and variability is likely to increase the vulnerability of most of the southern African countries. Thus to maintain productivity and ensure resilience, in the face of more frequent and more severe shocks, the countries have to adopt climate-smart agricultural practices. The improvements in agricultural productivity can be achieved by investing in agricultural Research and Development (R&D), coupled with technology adaptation and dissemination.

The World Bank is supporting the implementation of an Agricultural Productivity Programme in Southern Africa (APPSA) with the objective of increasing the productivity of maize, rice and legumes through the introduction of improved varieties and modern farming technologies. The six-year project was approved by the World Bank Board on March 14, 2013 with US\$ 90 million in International Development Agency (IDA) financing for Malawi, Mozambique, Zambia (US\$29.8 million to each country); and the Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) (IDA Grant of US\$0.6 million).

The programme supports agricultural technology generation and dissemination by supporting the strengthening and scaling up of Regional Centres of Leadership (RCoLs), in research on programs of regional importance through regional collaboration. For identified regional priority programs, APPSA supports efforts to scale up and develop national research centres into regional centres of leadership. Within the three participating countries, Malawi is focusing on maize-based farming systems, Mozambique on rice-based farming systems, and Zambia on food legumes-based farming systems (beans, cowpeas, groundnuts, pigeon peas, and soybeans). As a regional program, APPSA was designed to include expansion to additional countries, and over the course of APPSA implementation, countries like Angola, Swaziland, Madagascar and Lesotho indicated interest in participating.

The approach of the APPSA project is to advance the concept of R&D on a regional scale by concentrating resources within a reduced number of specialized research institutes serving a shared technology space for the countries. This has the advantage of:

- Reducing duplication by allowing a single regional research institute to undertake work that otherwise would be done in parallel within multiple national research institutes;
- Capturing economies of scale by concentrating resources within a single institute, where they can achieve a critical mass;
- Increasing the payoffs to research by facilitating dissemination of improved technologies across national borders, thereby vastly increasing the number of beneficiaries;
- Mitigating the isolation that frequently occurs in small, fragmented research institutes by creating effective mechanisms for facilitating knowledge exchange and technology transfer.

APPSA Lesotho will establish RCoLs on horticulture based on its potential to generate food and income generation opportunities. Activities will concentrate on vegetables and fruits such as potatoes, tomatoes, apples, peaches, apricot, plums, cherries and pears.

1.2 Purpose and Objectives of the ESMF

This ESMF was prepared because the location, design and magnitude of the potential APPSA Lesotho subprojects and activities are not yet known at the present project appraisal stage, although the general types of activities are known. Its purpose is to ensure that APPSA Lesotho adequately identifies all anticipated and potential environmental and social safeguards issues that are likely to be manifested implementation of activities under the project. The ESMF provides a guide for the integration of environmental and social considerations into the planning and implementation of the subprojects and activities proposed under APPSA Lesotho from screening, preparation, through review and approval, to implementation. It further provides a basis for environmental and social assessments of all subprojects to be carried out under this proposed financing. It also allows for the establishment of relevant capacity building and training needs, in order for the recommended measures to be implemented effectively.

The main objectives of the ESMF are to:

- Establish clear procedures and methodologies for the environmental and social assessment, review, approval and implementation of investments to be financed under APPSA Lesotho;
- Specify appropriate roles and responsibilities, and outline the necessary reporting procedures, for managing and monitoring environmental and social concerns related to project investments;
- Determine the training, capacity building and technical assistance needed to successfully implement the provisions of the ESMF and any site-specific supplementary safeguards instruments;
- Establish the project funding required to implement the ESMF requirements;
- Provide practical information resources for implementing the ESMF.

The ESMF focuses on the nature and extent of significant adverse environmental and social impacts that may result from any refurbishing of facilities, research and development of new agricultural technologies and eventual dissemination of the developed technologies. The ESMF also serves as a framework for screening environmental and social issues for all possible Program activities that will be undertaken.

The ESMF also describes a process that will ensure that the substantive concerns of the relevant World Bank Safeguard Policies and Lesotho legislation are addressed during the implementation of the selected agricultural activities.

The Environmental and Social Management Framework (ESMF) is the main decision-making instrument for the project and will be adopted for the various sub-projects or supported with site specific Environmental Assessments (EAs) or Environmental and Social Management Plans (ESMPs) as the site-specific program and project implementation instruments. , It is a Dynamic instrument that will be reviewed and updated during the course of the project, whenever it is required, to include lessons learned and new information relevant for the environmental and social management of the project.

1. The ESMF outlines several principles, which include: A systematic procedure for participatory screening of project sites and subproject activities for environmental and social considerations;
2. A step-by-step procedure for predicting the main potential environmental and social impacts of the planned project and subproject activities;
3. A typical environmental and social management plan for addressing negative externalities during project/subproject implementation (planning, construction and operation);
4. A step by step monitoring and evaluation system for implementation of mitigation measures;

5. An outline of recommended capacity building measures for environmental and social planning and monitoring of the subproject activities; and
6. A budget to ensure that the Program has adequate resources to meet its own interests, especially financial resources for the preparation and implementation projects' and subprojects' ESIA's and ESMPs.

The ESMF basic principles and requirements will be applied throughout the entire Project life cycle. Furthermore

1.3 Structure of the Report

This framework is organized as follows:

Chapter One provides background information to the proposed Agricultural Productivity Programme in Southern Africa (APPSA) in Lesotho. It outlines the objectives of the Environmental and Social Management Framework, and the approach and methodology that was taken in developing the framework.

Chapter Two provides an overview of the project description including the justification for the proposed project in Lesotho, aim and objectives of the project, and its major components.

Chapter Three describes Lesotho's relevant policies, laws and institutional set up which regulate and manage resource utilization, protection of sensitive areas including aquatic and land ecosystems, land use control and protection of endangered species. It then explains the institutional set up which supports the regulatory framework.

Chapter Four provides an overview of baseline information of Lesotho's key environmental and social issues such as land resources, water resources, biological resources, land tenure, land use, socio-economic and livelihoods conditions, archaeological, historical and cultural heritage.

Chapter Five discusses the risks and impacts due to, and on, the proposed project activities, the nature and potential sources of the main environmental and social impacts in the implementation and operation of the project activities.

Chapter Six summarizes a process for public consultation during project implementation.

Chapter Seven outlines the typical environmental and social management plan for the impacts for integration into the agriculture related project activities. The plan includes responsible authorities for collaboration in the implementation of the mitigation measures. The chapter includes recommendations of appropriate monitoring activities by different stakeholders at local level, district level and national level to ensure compliance with the mitigation measures.

Chapter Eight outlines the monitoring Plan. The lead implementing Agent (MAFS) with the help of relevant authorities must monitor the environmental and social effects of project implementation and the success of mitigation measures. This should be done with the assistance of experts drawn from all spheres of the environment that may be affected.

Chapter Nine describes the relevant environmental and social training and capacity building measures for stakeholders at all levels to adequately participate in the implementation. The chapter includes specific training activities for the stakeholders and the cost estimates to facilitate the training programme. It also describes the implementation plan by providing information on the proposed implementation arrangements, particularly at the subproject level where all the activities will take

place. The chapter also gives a summary of the costs required for training and the sources of funding for the other project activities.

Chapter Ten describes the process for ensuring that environmental and social potential impacts are adequately addressed through the institutional arrangements and procedures used by APPSA for managing the identification, screening, preparation, approval and implementation of subprojects.

Chapter Eleven is the Bibliography.

Chapter Twelve contains the Appendices: Environmental and Social Screening Guidelines, S Safeguards Checklist for General Supervision, Guidelines for Annual Reviews and Annual Report, a summary of the World Bank Safeguards Policies, a list of Consulted Stakeholders, a Brief on Germplasm Improvement, an Archaeological Chance Finds Procedure, and the APPSA Lesotho Grievance Redress Mechanism.

2 DESCRIPTION OF APPSA LESOTHO AND ITS ACTIVITIES

2.1 Program Description

APPSA's Project Development Objective (PDO) is to increase the availability of improved agricultural technologies in participating countries in the Southern Africa Development Community (SADC) region. APPSA pursues this objective by:

- i. Establishing Regional Centers of Leadership (Rcols) on commodities of regional importance, thereby allowing regional specialization around priority farming systems and more strategic investment in agricultural research capacity;
- ii. Supporting regional collaboration in agricultural research, technology dissemination, and training; and
- iii. Facilitating increased sharing of agricultural information, knowledge, and technology among participating countries.

APPSA has four components: (1) Technology Generation and Dissemination; (2) Strengthening the Institutional and Enabling Environment for Technology Adaptation; (3) Contingency Emergency Response Component; and (4) Project Management, Monitoring and Evaluation, and Regional Coordination. The four are described below in the Lesotho context.

Component 1: Technology Generation and Dissemination

Component 1 will support technology generation and dissemination activities associated with the commodity or commodity group being targeted by the RCoLs. This will include regional R&D activities developed in the initial set of APPSA participating countries in the areas of legumes and conservation agriculture/climate adaptation; (ii) additional activities in horticulture as part of the expansion of regional collaboration to include Lesotho; and new frontier R&D activities to be developed over the course of implementation by participating countries.

The core focus of APPSA supported technology dissemination activities in Lesotho will therefore aim at improvements around the horticulture technologies. All activities financed under Component 1 will be undertaken through collaborative R&D projects involving the participation of at least two countries. R&D projects will support collaborative research, technology dissemination, training, and other activities (e.g. knowledge exchange).

Lesotho will participate in R&D projects relating to horticulture, as well as in R&D projects relating to the commodity farming systems being targeted by RCoLs in other countries.

Technology generation priorities: Research priorities are expected to cover the full range of issues associated with horticulture (fruits and vegetables) including germplasm improvement (breeding) for resistance to pests and diseases and tolerance to abiotic stresses (drought, heat); germplasm collection and characterization; integrated pest and disease control; seed production, supply and delivery systems; conservation agriculture and climate adaptation measures; soil fertility improvement; post-harvest activities including processing and storage; and food safety (mycotoxin and aflatoxin management).

Germplasm are living genetic resources such as seeds or tissues that are maintained for the purpose of plant breeding, preservation, and other research uses. These resources may take the form of seed collections stored in seed banks, trees growing in nurseries, etc. Germplasm collections can range from collections of wild species to elite, domesticated breeding lines that have undergone extensive human selection.

Germplasm Characterization is the description of plant germplasm. It determines the expression of highly heritable characters ranging from morphological or agronomical features to seed proteins or molecular markers. Characterization of germplasm is essential to provide information on the traits of accessions assuring the maximum utilization of the germplasm collection to the final users. For germplasm characterization the Lesotho APPSA project will employ both morphological and molecular characterization (marker-assisted research)

Germplasm improvements involves plant breeding to change the traits of plants in order to produce desired characteristics. It has been used to improve the quality of nutrition in products for humans and animals. Plant breeding methods have been an evolving technology, as levels of knowledge of the underlying mechanisms and the control of the process of generating and selecting superior plant types have been increasing. There are four main areas of plant breeding:

- i. plant breeding based on the selection of observed variants, disregarding their origin;
- ii. generation and selection of expanded variation by controlled mating;
- iii. monitoring the inheritance of within-genome variation and selection of specific recombinants - marker-assisted breeding.
- iv. the creation and introduction of novel variation into genomes through genetic engineering.

Traditional breeding methods are based on the complementarity between parental characteristics. However, little or nothing was known about which part of the genome came from which parent until the advent and dissemination of molecular marker technologies, which made it possible to monitor the transmission of chromosome segments in the progeny.

To begin with the types of technology generation will be fairly simple, with the germplasm improvements employing the traditional breeding methods. However, with time one or more of the research centres will begin to be involved in more complex marker assisted research activities, which may necessitate more sophisticated equipment/instrumentation, i.e. for germplasm conservation the Lesotho APPSA project will use in situ, ex situ and in vitro (under slow growth) approaches (Table 2-1). In vitro culture allows germplasm to be securely maintained in a disease-free environment. The use of in vitro culture techniques offers the possibility of cleaning the available germplasm for conservation or use. Distribution of germplasm across the borders will also be safer, in terms of germplasm health status.

Table 2-1: Germplasm Improvement Techniques

	Activity	Methods	Resources
1.	Root stalk development and evaluation	1 Screening of the local germplasm (for adaptability to our environment.) 2. Molecular characterization.	-Conventional breeding techniques. -Molecular approaches -molecular laboratory facilities
2.	Evaluation of suitable genotypes	1. Screening for disease resistance and pest 2.Screening for abiotic stresses.	-Field experimentation -Green house research -Plant tissue culture laboratory facilities
3.	Development of new varieties	1. Selection of the adoptable varieties and generation of variation.	-Cold rooms -Plant growth rooms
4.	Identification of new crops/introduction of indigenous fruit crops	1. Characterization of the germplasm 2. Evaluation of the germplasm.	-Microbial tissue culture facilities -Plant physiology facilities

Adapted from: PharmEng Technology Inc. 2005

Technology dissemination priorities: APPSA will support the dissemination of improved technologies by providing resources for RCoLs to engage with a range of partners in scaling up the use of promising innovations of relevance to Horticulture (fruits and vegetables) and other targeted commodities in APPSA participating countries. APPSA will help to strengthen the links between researchers, extension agents, input distributors, and farmers and other end users, but lead responsibility for technology dissemination will remain with the national extension system.

Technology dissemination activities supported by APPSA will be designed to encourage participation by diverse partners, in line with principles of pluralism. The pluralistic and inclusive “innovation systems” approach is expected to focus on:

- Improving the content and accessibility of technology messages and knowledge products around maize, rice, and food legumes technologies, including the use of information and communication technologies;
- Improving the capacity of advisory service providers through technical training of Lead Farmers, extension agents, and other actors in private sector or civil society;
- Strengthening the capacity of dissemination officers or technology transfer specialists in research institutes, to enable them to engage more effectively with farmers, extension agents, and advisory service providers;
- Establishing or improving platforms for dialogue and consultation around technology priorities with farmers, private sector, and civil society;
- Improving farmer-research-extension feedback mechanisms to obtain a better analysis of farmer preferences;
- Exchanging information and experiences with other participating countries;
- Conducting research on technology dissemination methods or tools, including those targeting gender specific issues such as household nutrition and food safety.

APPSA will support the expansion of seed multiplication capacity within RCoLs, with the goal of increasing the availability of seed for further multiplication (by farmer-producers, farmer associations, Non-Governmental Organisations (NGOs), or private firms). APPSA will also support the production of farm implements and simple farm machinery, as well as the testing of farm implements and farm machinery in pilot schemes.

Component 2: Strengthening the Institutional and Enabling Environment for Technology Adoption

This Component will finance: (i) upgrading of research infrastructure including rehabilitation and construction of physical infrastructure; farm, laboratory, and office equipment; and information technology and knowledge management systems; (ii) upgrading of infrastructure for sanitary and

phytosanitary (SPS) management; (iii) improving institutional administration and performance management systems within RCoLs or SPS systems; (iv) developing human capital, with special focus on promoting women scientists, by providing scientific or technical training at the post graduate level; by upgrading skills through short courses or targeted training, and scientific exchanges; and (iv) strengthening seed production capacity, seed regulatory functions, and related services.

This component will also finance regional policy analysis and harmonization through analytical work, needs assessments, and policy dialogue or policy harmonization activities in key areas that affect R&D at national and regional level. Work will focus on analysis of relevant policies and legislation for intellectual property rights, operationalization of the SADC harmonized seed regulatory system, implementation of biosafety regulations, and similar topics. Discussions will take place during implementation to determine whether Project resources could be used productively to advance the regional seed agenda. If the participating countries agree that APPSA could play a useful role by supporting key players other than the RCoLs, support for these key players could be channelled through CCARDESA.

The proposed research priorities, objectives and expected results for horticulture under APPSA Lesotho are described in Table 2-2 below.

Table 2-2: Horticultural Research Priorities in Lesotho

Priority	Objective	Activity	Expected Output
Crop genetic diversity improvement (collection; characterization; conservation and germplasm exchange).	To characterise and evaluate potato, tomato and fruit crops germplasm to preserve distinctive plant genetic resources integrity/identity and promote their management for continuous use.	1. Collect fruit crop, potato and vegetable germplasm, profile and compare the descriptive of these lines (passport data). 2. Conduct morphological characterization of collected Germplasm. 3. Conduct biochemical characterization of collected germplasm. 4. Conduct molecular characterization and develop genetic markers of lines collected and varieties released regionally.	1. Horticulture Germplasm collected and profiled. 2. Morphological characterization of horticulture documented. 3. Biochemical characterization of horticulture crops documented. 4. Genetic makers for horticulture crops developed and varieties released for regional use.
	To enhance genetic diversity of adaptable species.	1. Exchange the genetic material with desirable traits. 2. Establish national on-farm conservation sites in areas with high diversity.	1. Regional genetic materials exchange kick started. 2. National on-farm conservation sites established.
Crop breeding and improvement for adaptability, economic and spill over effect.	To develop and promote quality seeds and seedlings for tomato, potato and fruit crops.	1. Develop sustainable system for production of certified seed of tomato, potato and fruit tree seedling. 2. Characterize and evaluate the root stalks of tomato and fruit trees for adaptability 3. Develop protocols for disease free potato seed production. 4. Identification of crafted trees???	1. Sustainable production system developed for tomato, potato and fruit tree. 2. Tomato, potato and fruit tree root stalks characterized and evaluated. 3. Potato seed disease free protocols developed.
	To enhance development of new horticultural crop varieties and cultivars.	1. Conduct varietal/cultivar adaptability studies for specific agro-zones. 2. Conduct molecular and mutation breeding using biotechnology applications. 3. Assess standardized propagation techniques. 4. Develop varieties/cultivars with high nutritional value (e.g. Beta-carotene) and desired cooking qualities for the local and regional markets. 5. Identify and promote suitable other non-traditional horticultural crops of high value and cash generation potential. 6. Determine appropriate varieties and other inputs as well as optimum planting dates for various horticultural crops. 7. Introduce apiculture into fruit trees to study bee-tree productivity interaction.	1. Horticultural crops' adaptability/suitability mapped to agro-zones. 2. Propagation techniques assessed. 3. High nutritional varieties/cultivars developed. 4. Horticultural crops of high values and cash generation potential identified and promoted. 5. Appropriate varieties and inputs for horticultural crops. 6. Bee-tree productivity interaction studies undertaken.

Integrated pest and disease management development.	To develop IPDM for cost effective crop management and protection techniques.	<ol style="list-style-type: none"> 1. Identify and promote botanical /natural pest management techniques for vegetable and fruit production. 2. Develop and promote traditional organic methods for pest and disease control. 3. Identification of semio-chemicals for pest management. 4. Develop economic and environmental friendly use of chemicals for pest and disease control. 	<ol style="list-style-type: none"> 1. Natural pest management techniques identified and promoted. 2. Traditional pest and disease organic methods developed and promoted. 3. Semio-chemicals for pest management identified. 4. Economically and environmentally friendly use of chemicals developed.
Development of postharvest technology and innovation techniques.	To develop postharvest technologies for improved utilization of horticulture commodities.	<ol style="list-style-type: none"> 1. Add value to horticultural crops for introduction of new food products. 2. To assess viable technologies for reducing postharvest losses. 3. Processing, marketing and development of labour saving technologies. 4. Develop appropriate systems for handling, cleaning, sorting, grading and packaging of horticultural crops. 5. Determine the appropriate storage facilities (locally available materials). 6. Develop cost effective storage facilities. 	<ol style="list-style-type: none"> 1. Value added horticultural commodities available. 2. Viable technologies assessed. 3. Labour saving technologies developed and used. 4. Appropriate systems for postharvest management developed. 5. Appropriate storage facilities using locally available materials developed. 6. Cost effective storage facilities developed and in use.
Irrigation technologies/innovations development.	Develop and test appropriate machineries, irrigation and agricultural implements to support the different activities of the horticulture production cycle.	<ul style="list-style-type: none"> -Machineries and agricultural tools of different technology levels for pre-harvest operations developed and tested; -Machineries and agricultural tools of different technology levels for post-harvest operations developed and tested; -Develop technologies that reduce evaporation losses and optimize the use of soil moisture. -Develop and test different irrigation designs for water application in vegetables, fruit trees and potatoes. -Select water harvesting techniques suitable for both small holder irrigation and commercial purposes. -Design of efficient technologies for gravity fed and drip irrigation. 	
Production systems and management technologies integration (e.g. planting dates, soil fertility improvement).	To evaluate land (soil) suitability for potato, fruits and vegetables production in Lesotho	<ol style="list-style-type: none"> 1. Soil survey and classification. 2. Standardize soil suitability evaluation procedure. 3. Identify and discuss issues on sustainable land management in Lesotho. 4. To evaluate land use planning as a prerequisite for sustainable use of soils. 5. To make recommendations on how to sustain Lesotho soil resources. 6. Develop sustainable system for production of certified seed of tomato, potato and fruit tree seedlings. 	<ol style="list-style-type: none"> 1. Lesotho soils classified. 2. Soil suitability procedure standardized. 3. Land management issues identified and reviewed. 4. Land use planning evaluated. 5. Recommendations on how to sustain soil resource developed. 6. Sustainable production systems of certified seed (tomato, potato and fruit crops) developed.
	To improve husbandry practices and management techniques.	<ol style="list-style-type: none"> 1. Study soil fertility management practices for production of tomato potato and fruit trees (peaches, berries, grapes and apples). 2. Organic fertilizers development for production of tomato, potato and fruit trees (peaches, berries, grapes and apples). 3. Improve Soil health for production of tomato potato and fruit trees (peaches, berries, grapes and apples). 4. Develop and promote hydroponics and organic farming techniques. 5. Improve and promote Good Agricultural Practices (GAP) under protected agriculture. 6. Identify and test cost effective crop management practices and technology 	<ol style="list-style-type: none"> 1. Soil fertility management practices studied. 2. Organic fertilizers developed for production of tomato, potato and fruit trees. 3. Soil health improved for production of tomato, potato and fruit crops. 4. Hydroponics and organic farming techniques developed. 5. GAP under protected agriculture improved and promoted. 6. Crop management practices and other technology options that are cost effective identified and tested. 7. Sustainable farming systems developed and their use recommended.

		options that are ecologically sustainable and climate smart. 7. Develop and recommend use of sustainable farming systems (e.g. agroforestry and intercropping) to farmers. 8. Develop and promote appropriate storage facilities.	8. Appropriate storage facilities developed and promoted.
Dissemination and technology transfer.	To empower and enhance capacity of Farmers for enhanced productivity, supporting livelihoods and household economic growth.	1. Establish nurseries and demonstration trial sites. 2. Establishment of Research and Training Centre 3. Conduct hands on training workshops for Extension staff and farmers in innovative vegetable production techniques and entrepreneurship related skills. 4. Develop manuals, guidelines and publications to enhance technical capacity. 5. Develop sustainable and easy adoption technological packages for different horticultural crops. 6. Undertake market studies to map demand. 7. Improve information flow among various value chain actors and the market. 8. Identify marketing channels. 9. Establish sustainable specific commodity-based platforms. 10. Assess the economic viability of commercial deciduous fruit, potato and vegetable production in Lesotho.	1. Nurseries and demonstration sites established.

Source: WB, Agricultural Productivity Program for Southern Africa - Angola & Lesotho (P164486), Project Appraisal Document, May 2018

Component 3: Contingency Emergency Response Component.

The CERC would be available should the need arise to redirect some project resources to contribute with other projects in the participating countries portfolio to respond to an eligible emergency or crisis. Resources would be made available to finance emergency response activities and to address crisis and emergency needs. If such a crisis develops, the government may request the World Bank to reallocate project funds to cover some costs of emergency response and recovery.

This component is designed to provide swift response in the event of an Eligible Crisis or Emergency, through a project specific Contingency Emergency Response Component (CERC), The detailed operational guidelines for implementing the project CERC at national level are presented in section 5.3.

All expenditures under the CERC will be in accordance with paragraphs 11, 12, and 13 of World Bank OP10.00 (Investment Project Financing). The operational guidelines and expenditures will be appraised and reviewed to determine if they are acceptable to the World Bank before any disbursement is made. Disbursements will be made against an approved list of goods, works, and services required for crisis mitigation, response, recovery, and reconstruction. In case this component is to be used, the project will be restructured to re-allocate financing.

Component 4: Project Management, Monitoring and Evaluation, and Regional Coordination

This Component will finance: (i) national coordination; (ii) regional facilitation; and (iii) monitoring for results.

National level research coordination and management: At national level, APPSA will finance project coordination activities, including planning and budgeting, management and administration, monitoring and evaluation, safeguards compliance, and regional engagement. If necessary, APPSA could finance consultants to ensure that all essential project coordination activities are carried out effectively. Government counterpart resources will be used to pay staff-related costs not eligible for IDA funding.

Regional facilitation by CCARDESA: At the regional level, APPSA will finance regional facilitation activities including:

- (i) planning, monitoring and evaluation activities related to regional collaboration;
- (ii) regional exchange of information, knowledge and technologies; and
- (iii) technical assistance and capacity building. Many of these activities will be carried out by CCARDESA, which will play an important role in facilitating the development of R&D projects, including organizing the peer review process and providing quality control.

The regional facilitation activities to be performed by CCARDESA will be supported using funds from a subsidiary agreement between the APPSA participating countries. CCARDESA will also support all participating countries in implementation of the regional monitoring and evaluation framework through setting up a joint Management Information System (MIS) between countries implementing the ongoing APPSA – Malawi, Mozambique and Zambia – as well as the new countries joining APPSA – Angola and Lesotho.

R&D policy analysis and dialogue: APPSA financing will support analytical work, needs assessments, and policy dialogue or policy harmonization activities in key areas that affect R&D at national and regional level. Work will focus on analysis of relevant policies and legislation for intellectual property rights, operationalization of the SADC harmonized seed regulatory system, implementation of biosafety regulations, and similar topics.

2.2 Research and Development Priorities for the Horticultural RCoL

Selected crops for a tentative RCoL include fruit trees (peaches and apples) and vegetables (e.g., potato). Varietal selection, the use of wild plants and wild relatives of plants, irrigation techniques, planting methods, cropping patterns and fertilization are some of the practices that have been, and are being used to improve crop production (FAO, 2013). Major Challenges to horticultural production and productivity in Lesotho include production practices and management techniques. These problems still exist and are seen as priority areas for agricultural research and development. Focus areas for potential research and development towards enhancing horticultural production and productivity are discussed below.

2.2.1 Proposed Research Priorities

At present the proposed research priorities are expected to involve:

- I. Crop genetic diversity improvement (collection; characterization; conservation and germplasm exchange).
- II. Crop breeding and improvement for adaptability, economic and spill-over effect.
- III. Integrated pest and disease management development.
- IV. Development of postharvest technologies.
 - I. Irrigation technologies/innovations development.
 - II. Production systems and management technologies integration (e.g. planting dates, soil fertility improvement).
- III. Dissemination and technology transfer.

These are described in more detail below.

I. Crop Genetic Diversity

Objective: To enhance genetic diversity of adaptable species.

Major Activities

- a) Exchange the genetic material with desirable traits.
- b) Collection and gene banking of germplasm for major fruit trees and horticultural crops.
- c) Conduct germplasm characterization trials and patenting of genetic strains.
- d) Identify and document the most relevant attributes for horticultural crops.
- e) Establish national on-farm conservation sites in areas with high diversity.

II. Crop Breeding and Improvement

Objective: To enhance development of new Horticultural crop varieties and cultivars

Major Activities:

- a) Conduct varietal/cultivar adaptability studies for specific agro-zones.
- b) Conduct molecular and mutation breeding using biotechnology applications.
- c) Conduct bio-fortification studies on micro elements to address nutrition issues (sorghum and beans).
- d) Assess standardized propagation techniques.
- e) Develop nurseries and demonstration trial sites.
- f) Develop varieties/cultivars with high nutritional value (e.g. Beta-carotene) and desired cooking qualities for the local and regional market.
- g) Identify suitable other non-traditional horticultural crops of high value and cash generation potential.
- h) Determine appropriate varieties and other inputs as well as optimum planting dates for various horticultural crops.
- i) Introduce apiculture into fruit trees to study bee-tree productivity interactions.

III. Pest and Disease Management

Objective: To develop Integrated Pest and Disease Management (IPDM) for cost effective crop management and protection techniques.

Major Activities:

- a) Identify and promote botanical /natural pest management techniques for vegetable and fruit production.
- b) Develop and promote traditional organic methods for pest and disease control.
- c) Identification of semi-chemical for pest management.
- d) Develop of economic and environmentally friendly use of chemicals for pest and disease control.

IV. Postharvest Technologies

Objective: To develop postharvest technologies for improved utilization of horticulture commodities.

Major Activities:

- a) Add value to horticultural crops for introduction of new food products.
- b) To assess viable technologies for reducing postharvest losses.
- c) Processing, marketing and development of labour saving technologies.

V. Irrigation and Mechanization technologies/innovations development.

Objective: Develop and test appropriate machineries, irrigation and agricultural implements to support the different activities of the horticulture production cycle.

Major Activities:

- a) Machineries and agricultural tools of different technology levels for pre-harvest operations developed and tested;
- b) Machineries and agricultural tools of different technology levels for post-harvest operations developed and tested;
- c) Develop technologies that reduce evaporation losses and optimize the use of soil moisture.
- d) Develop and test different irrigation designs for water application in vegetables, fruit trees and potatoes.
- e) Select water harvesting techniques suitable for both small holder irrigation and commercial purposes.
- f) Design of efficient technologies for gravity fed and drip irrigation.
- g) Integrated soil fertility and water management for different agro-ecological zones under irrigation and rain-fed conditions.

VI. Production systems and management technologies.

Objective: To improve husbandry practices and management techniques.

Major Activities:

- a) Develop and test Agriculture practices and mechanisms that allow for increased capacity of adaptation to climatic variability and changes.
- b) Characterization and mapping of suitable soils for intensive vegetable, fruit tree and potato production
- c) Soil fertility management for production of tomato potato and fruit trees (peaches, berries, grapes and apples).
- d) Organic fertilizers development for production of tomato, potato and fruit trees (peaches, berries, grapes and apples).
- e) Soil health for production of tomato potato and fruit trees (peaches, berries, grapes and apples).
- f) Develop and promote hydroponics and organic farming techniques.
- g) Improve and promote Good Agricultural Practices (GAP) under protected agriculture.
- h) Identify and test cost effective crop management practices and technology options that are ecologically sustainable and climate smart.
- i) Develop and recommend use of sustainable farming systems (e.g. agroforestry and intercropping) to farmers.
- j) Develop and promote appropriate storage facilities.

VII. Dissemination and technology transfer.

Objectives: To empower and enhance capacity of Farmers for enhanced productivity, supporting livelihoods and household economic growth.

Major Activities:

- a) Promote commodity-oriented Farmer Interest Groups (FIGs) at village level and federated at constituency/district level to make the technology generation/dissemination farmer driven and farmer accountable.
- b) Conduct hands on training workshops for Extension staff and farmers in innovative vegetable production techniques and entrepreneurship related skills.
- c) To undertake technology, transfer activities through demonstrations and field days.
- d) Develop manuals, guidelines and publications to enhance technical capacity.

- e) Develop sustainable and easy adoption technological packages for different horticultural crops.
- f) Undertake market studies to map demand.
- g) Improve information flow among various value chain actors and the market.
- h) Identify marketing channels.

2.2.2 Proposed Developmental (Capacity and Knowledge Transfer) Activities

It is worth noting that all the afore-mentioned priority areas will need establishment of service facilities and well-coordinated legal arrangements. Therefore, the following proposed developmental priorities need to be recognized:

- I. Strengthening planting material systems;
- II. Research technologies exchange with other regional research institutions;
- III. Capacitating farmers on horticulture-based farming system;
- IV. Improving laboratories for research and community service;
- V. Setting up legal framework to facilitate R&D.

In order to address the aforementioned R&D priorities a number of objectives have been designed and categorized according to horticultural production and productivity major challenges. The main objective of the RCoL is to develop plant materials of high economic value which will exhibit desirable traits (in terms of yield; pest and disease resistance; drought tolerance and market value) and also promote technology transfer through strengthening of institutional linkages both locally and regionally. To address the main objective, the following specific objectives and their outputs for horticulture-based farming system have been developed for improved production and productivity of fruit trees, potatoes and vegetables.

I. Strengthening planting material systems.

Objective: To produce parent stock of various planting material for access by private nursery farms within the country.

Major Activities:

- a) Carry out rapid and mass production of disease free plant material in the biotechnology laboratories and on-station nurseries.
- b) Multiply developed varieties and supply private nursery firms to enhance commercial crop production.
- c) Increased access to seed of superior varieties by the farmers in the country and the region as a whole.

II. Research technologies exchange with other regional research institutions.

Objective: To disseminate and exchange information through various dissemination platforms and publications

Major Activities are:

- a) Prepare manuscripts for publication in peer-review articles
- b) Prepare papers for oral presentations in organised conferences
- c) Engage actively with the Consultative Groups for International Agricultural Research (CGIAR) and other international research systems to strengthen and add value to the National Agricultural Research System (NARS).

III. Capacitating farmers on horticulture-based farming system.

Objectives: Engage relevant national farmers and farmers' groups' contribution towards research.

Major Activities are:

- a) Conduct on-farm trials and demonstration trials using farmers' land.

- b) Co-opt research into daily farmers' activities on potato, fruit trees and vegetables.
- c) Conduct a study on farmers' needs as well as inventory of different levels/status of farmers.

IV. *Improving laboratories for research and community service.*

Objective: To enhance and maintain efficiency of laboratories.

Major Activities are:

- a) Acquisition of relevant and high throughput laboratory equipment and consumables.
- b) Quality control measures put in place (accreditation of laboratories etc.).
- c) Ensure that safety precautions are known and observed at all times.
- d) Establish inter-laboratory network for efficient utilization of resources.

V. *Setting up legal framework to facilitate R&D.*

Objective: Strengthen legal framework on horticulture-based farming system for improved production and productivity.

- a) Complement work done under FAO-TCP on development of Research and Extension Policy.
- b) Establish research and extension coordinating body for a better R&D and technology dissemination.
- c) Develop and facilitate implementation of relevant policy strategies and bills.

2.3 Infrastructure Requirements

The infrastructure that will be required at the RCoL, research stations and field trial stations will include:

- General laboratory facilities;
- Plant tissue culture facilities;
- Plant growth facilities
 - greenhouses
 - shade nets
 - growth chambers;
- Gene banks - seed storage facility
 - seed treatment reagents storage
 - walk-in-seed drying room
 - seed treating facility
 - cold seed storage room.

The following are the possible activities that impact on the environment that will emanate from each of the above-mentioned facilities:









2.3.1 General Laboratory Facilities


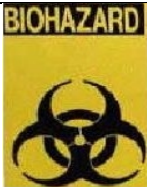



Laboratory facilities will have a whole host of equipment and will be using a whole host of reagents and in the process will generate a lot of potentially hazardous waste.

The laboratories and growth chambers will have to be free of all contamination, and thus may be a need for the laboratories to have HEPA filters or some sort of air filtration system to ensure the lab air is not contaminated with pollen, spores, or other air-borne contaminants.

All potential waste streams that arise as part of laboratory operations need to be assessed and an appropriate disposal route selected prior to it actually being generated. Waste should be collected in a suitable container and labelled accordingly (University of Wollongong, 2005). The Table 2-3, below provides a summary of possible containers and label types that can be used for waste handling:

Table 2-3: Laboratory Waste Containers and Labels

Waste Type	Waste Container	Typical container
Hazardous Materials		
Chemical solvents and liquids	5L HDPE residue container (approved)	
Contaminated material which has hazardous material adhered such as filter paper, gloves, tissues, glass, etc.	Laboratory contaminated material bin Waste contractor contaminated waste bin	 
Sample vials containing less than 2g hazardous material	Hazardous sample vial waste container	
Old or unlabelled chemicals in supplier bottles	These bottles can be taken directly to waste pick up, ensuring that a waste tracking log is completed. Special collections of high risk or unlabelled material can be arranged.	
Glass		
Broken glass (chemically clean, including domestic glass)	Half-size yellow or grey SULO bins Small bin with lid, temporary storage	
Winchesters 	Winchester recycling bin. If contained acid – rinse with water before disposal. If contained solvent – vent in fume-hood before disposal.	

Waste Type	Waste Container	Typical container
	Dispose of lids in normal bin	
Solid		
Spent silica	5L HDPE residue container (approved) or bagged in contaminated waste bag	
Sharps	Yellow sharps containers	
Contaminated sharps	In a sharps container and bagged according to the type of contamination (biohazardous, radioactive, cytotoxic)	
Other types of Waste		
Biohazardous	Yellow bags or containers labelled with black biohazard symbol.	
Radioactive	Red bags or container labelled with radioactive symbol.	
 Cytotoxic	Purple bag or container labelled with white cytotoxic symbol.	

Adapted from: University of Wollongong, 2005

2.3.2 Plant Tissue Culture Facilities

Plant tissue culture is a series of culture techniques used to produce plants in-vitro. In plant tissue culture, plants are produced in a culture room on specific media to provide nutrients to the plants. A small tissue section of a plant is used for culturing. It can be a shoot, root or leaf of the plant. Artificial illumination system is used for such plants to facilitate growth (Gamborg O. L. and Phillips G. C, 1995).

Plants growing in tissue culture laboratories require specific light and temperature conditions. Basic facilities required at a culture plant tissue laboratory include; (i) Washing room, for glass ware washing, storage and autoclaving (ii) Media room, for media preparation (iii) Sterile area, for aseptic manipulation and (iv) Growth/Culture room, to maintain cultures under suitable environmental conditions.

The overall design and traffic patterns must focus on maintaining aseptic conditions. Order and cleanliness need to be maintained continuously throughout the facility, because all operations require aseptic conditions. The design should provide a system analogous to a production line, with the units and the activities being arranged to make operational steps possible with the least amount of cross-traffic.

For a plant tissue culture facility, absolute *cleanliness* is essential. Dust and microbial spores from work surfaces and the air can result in contamination, which in turn means losses of cultures. Thus, a plan for a tissue culture facility must be a design that allows for excluding dust and easy

effective cleaning. The air brought from the outside should be passed through a high efficiency particulate *air filter*, such as a high-efficiency particulate air (HEPA) filter. The installation of the capability for positive air pressure can be an advantage but is not essential. The other critical aspect of the facility is the need for *temperature control*, especially for the culturing room and laboratory areas where heat is emitted from the autoclave and burners in sterile transfer hoods.

A plant tissue culture facility should be serviced with adequate electrical power. A *back-up power generator* would be highly advisable for ensuring continued operation in case of power failure. Failures of power supply and controls can be disastrous. Safety cut-off devices, warning lights, and electronic *warning systems* are needed to safeguard against disasters. Consideration should also be given to have compressed air, and either natural gas or bottled gas for gas burners.

Generally, the products produced by tissue culture labs are Banana, Sweet potatoes, potatoes, fig, lemon, pineapple, tindora etc. Organic manure and micronutrient are also produced. Tissue culture offers uniform yields, good selection of right varieties, resistance against disease and faster, larger yield compared to conventional planting material.

The waste streams from tissue culture laboratories include the following:

- **Waste water.**
Water used in plant tissue culture room is only in washing, hence there is no harmful chemical or any other material found in this waste water. The **waste water generated can be reused in irrigation of greenhouse and nurseries, thus**, almost zero water will be discharged directly to the environment.
- **Plastic bags used in culturing.**
A large number of plastic bags will be used in the laboratory. **Plastic bags used in culturing can be reused at least once resulting in a** huge saving per year and thus avoiding large volumes of waste.
- **Aluminum foil used for incubation of media**
A lot of aluminium foil will be used **for incubation of media. Although aluminium foil is recyclable, a substantial amount of aluminium foil** waste will be generated, with a considerable potential of polluting the environment. The aluminium foil can be replaced by stainless steel plates, which will reduce the waste that will be generated, since the steel plates can be utilized again and again.
- **Waste of chemicals/culture media.**
Culture media can be wasted if it gets contaminated by dust and microbial spores from work surfaces and the air. Large amount of waste from chemicals and media can also be generated due to production of different plants over a short period. The wastage of chemicals/media per year can be as much as 6% of total raw materials. This can be drastically reduced by adopting an approach of producing the same plants over a period of not less than six months.

2.3.3 Plant Growth Facility

Plant growth facilities will comprise of greenhouses, shade nets and growth chambers. Very strict sanitary conditions will be maintained at the plant growth facilities to protect the plants and avoid general infestations and pollution. Therefore:

- All new plant materials will be inspected for infestation before being introduced into the greenhouse. Infected plants will be treated before being placed in the facility or may be denied placement in the facility based on current level of infestation.
- Wash hands before working with plants. This is especially important when working with propagation materials or one smokes tobacco products. Smoking is forbidden in the greenhouse.
- Media and herbicides will be stored in the containers in a separated pesticide store. spilled soil or soil that accumulates on the floor should not be re-used but should be placed in the compost cart.

Figure 2-1: Example of a Growth Chamber



Source: Linington S and Manger K, 2000

Plant Waste Disposal

Non-hazardous Waste: If non-hazardous waste is generated, it will be composted: after removal of all labels/stakes/containers.

Potentially Hazardous Waste: If the waste is potentially hazardous waste (chemically-contaminated, infected with a pathogen, or transgenic, as well as potentially contaminated material such as soil, labels, containers, or adjacent plant material), the plants, soil, labels, and containers will be disposed of in the appropriate waste stream for hazardous waste.

Bio-hazardous Waste: For bio hazardous waste, including transgenic plants and plants infected by pathogens, the following standard procedure can be used:

- An infectious waste box must be lined with two infectious waste bags;
- The box should be clearly labelled with the facility/laboratory name;
- When three quarters full, box is sealed and labelled with facility/laboratory name and date on top (The Box should not be overfilled).
- The sealed plastic autoclave bags must then be transported to the autoclave.

It will be the responsibility of the greenhouse user to coordinate the disposal of their plant material in a timely manner after project completion. In general;

- Potting media is to be placed into the used potting media bins.

- Plant material and labels are to be thrown away in the trash cans.
- Trays and pots are to be placed on the used pot shelves.
- Large amounts of plant waste can be placed in plastic bags and put in the trash cans.
- Any pots or plants that have been exposed to herbicides, must be labelled with tape, "Herbicide Pots" and placed in a separate holding area.

2.3.3.1 Gene Banks

Basically, four structures are required for a functional gene bank, i.e. i) Seed treatment reagents storage, ii) walk-in-seed drying room, iii) Seed treating facility and iv) Cold seed storage room.

i) Seed Treatment Reagent Storage

This is the area where the materials for treating seed will be stored and it will have the following characteristics:

- Floor - floors should be impervious to products stored and have a smooth finish with no floor drains. Floor drains can be used if they discharge to a separate containment system.
- Spill Containment - seed treatment storage area should have a 4-5" retaining curb around its perimeter to prevent spills or leaks from entering the outside environment. This is not required if only granular treatments are used.
- Liquid Tanks - should be stored inside the facility within a dike large enough to hold 110% of the largest tank.
- Granular Bulk Tanks - should be hopper bottom bins located on concrete surface. Tanks should be sealed to prevent contamination. Spilled materials must be clean up immediately. Tanks should be fitted with overflow protection.
- Ventilation - ventilation should be provided in accordance with occupational health & safety requirements.
- Wall Construction - walls of storage area shall meet appropriate fire and building code requirements.
- Heating System - open flame heaters should not be used to heat storage area. Ceiling furnaces must meet fire and building code requirements.
- Spill Cleanup – Spills should be cleaned up immediately and thoroughly and disposed of in an approved manner.

ii) Walk-In-Seed Drying Room

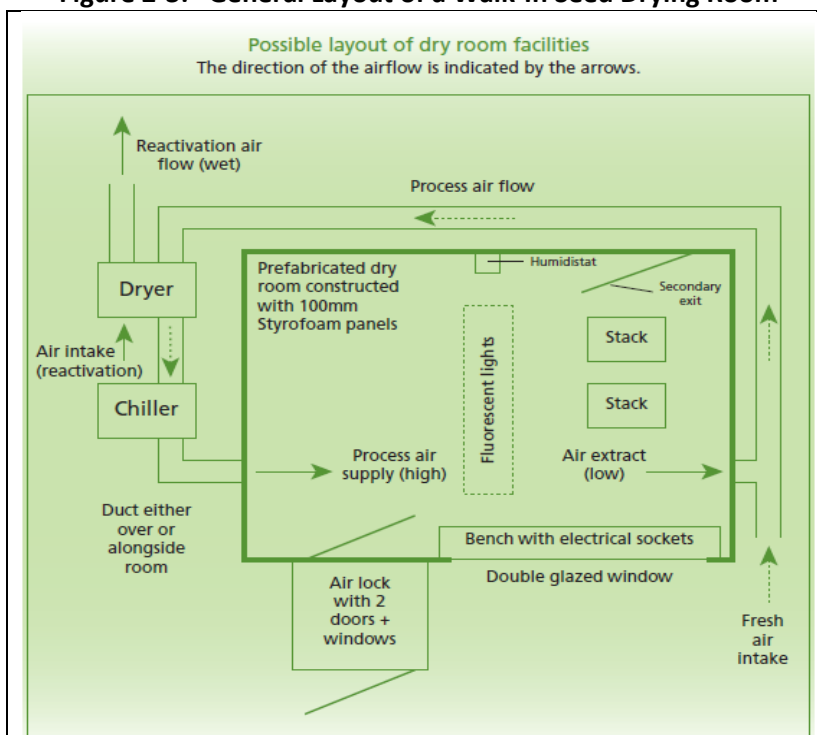
Figure 2-2: A Walk-In Seed Drying Room



Source: Linington S and Manger K, 2000

The effective drying of seeds prior to cold storage is the key to successful seed banking. Drying prolongs storage life, allows seeds to tolerate extreme temperatures, prevents germination, and reduces attack by predators and pathogens. For long-term conservation, the aim is to reduce seed moisture status to 15% equilibrium relative humidity (eRH) at 15°C. This is about 3-7% moisture content (on a fresh weight basis), depending on the oil content of the seeds. A dry room is the most appropriate drying method when you need to dry large quantities of seed at the same time. Dry rooms also provide safe storage prior to seed cleaning and a suitable location to package samples for storage or to warm up frozen samples that have been removed from the cold room (Linington S and Manger K, 2000).

Figure 2-3: General Layout of a Walk-In Seed Drying Room



Source: Linington S and Manger K, 2000

iii) Seed Treating Facility

This is the area where the seed is treated and it will have the following characteristics:

- Floor - floors should be impervious to products used and have a smooth finish with no floor drains. Floor drains can be used if they discharge to a separate containment system.
- Separation - seed treating area should be separated from seed treatment storage area.
- In-Process Liquid Storage - should be stored within a dike large enough to hold 110% of the largest tank/container.
- Ventilation - ventilation should be provided in accordance with occupational health & safety requirements.
- Wall Construction - walls of processing area shall meet appropriate fire and building code requirements.
- Heating System - open flame heaters should not be used to heat storage area. Ceiling furnaces must meet mandatory fire and building code requirements.
- Electrical Code - all installations should conform to the appropriate electrical code and/or supplement. If flammable products are used in the process, explosion proof wiring will be required by electrical code.

- Spill Cleanup – Spills should be cleaned up immediately and thoroughly and disposed of in an approved manner.

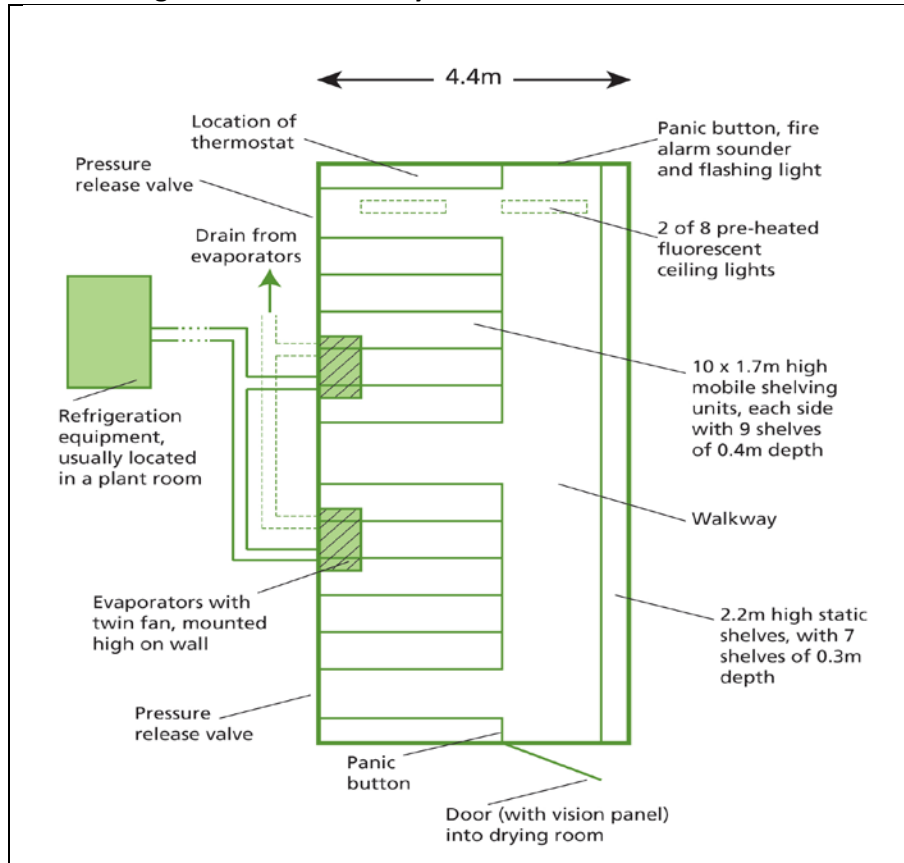
iv) Cold Seed Storage Room

Seed storage is the preservation of seeds under controlled environmental conditions that maintain seed viability for long periods. Two types of seed stores are used for conservation of genetic resources: those holding seed samples for long-term security—referred to as *base collections*—and those holding seed samples for immediate use—referred to as *active collections*. The temperature, relative humidity (RH), seed moisture content, containers and distribution arrangements of these stores vary.

Cold seed storage rooms will have the following characteristics:

- Floor - floors should be impervious to products stored and have a smooth finish with no floor drains. Floor drains can be used if they discharge to a separate containment system.
- Separation - treated seed storage area should be separated from seed treatment storage area.
- Ventilation - ventilation should be provided in accordance with occupational health & safety requirements.
- Wall Construction - walls of storage area shall meet appropriate fire and building code requirements.
- Heating System - open flame heaters should not be used to heat storage area. Ceiling furnaces must meet fire and building code requirements.
- Spill Cleanup - Spills should be cleaned up immediately and thoroughly and disposed of in an approved manner.

Figure 2-4: General Layout of a Seed Bank Cold Room



Source: Linington S and Manger K, 2000

The two commonly available options for seed storage are *walk-in cold stores* and *freezers*. The choice depends on the number of accessions to be stored, seed size and storage temperatures selected. When collections are small and sub-zero temperatures are required, chest or upright freezers are a cheaper option for seed storage.

Walk-In Cold Storage: If the gene bank has a walk-in cold store, the best option is to use moveable racks that maximize storage space. Each rack is divided into a number of shelves. The distance between each shelf will depend of the size of containers. Small containers or aluminium foil bags can be held in boxes or trays and placed on the shelves. A coding system can help gene bank staff to locate accessions readily for sample retrieval; coding can be computerized in a database or stock inventory system.

Chest or upright freezers: For gene banks using chest or upright freezers, containers that fit onto shelves or boxes holding individual small containers can be used to store accessions. As for cold storage, a coding system to help locating accession can be established, including freezer number, row number and box number.

Storage Organisation

The organization of storage space depends on the type of storage facility and the type of containers used in the gene bank. In view of the cost of maintaining cold storage, the space should be optimized so that a maximum number of seed accessions can be stored.

Figure 2-5: Seed Collections Double Packed in Cold Room



Source: Linington S and Manger K, 2000

Handling Waste Seed

The following are some of the ways of handling treated seed with active ingredients that is destined for disposal:

Planting and Desiccation: This method of disposing of treated seed is very effective in reducing inventories of non-saleable seed. This option can be completed with regular farming implements by seeding the waste at a rate of up to 3 times the regular seeding rate. The green matter is then ploughed under prior to maturity. Environmental liability remains with the waste generator if the land use is restricted because of insecticide residues. This method cannot be used to dispose of seed blended with granular insecticide.

Burial at an Approved Landfill (Approved for Solid Hazardous Waste): Landfilling is a very common method of waste disposal and is closely monitored and regulated. Landfilling lowers the risk to the generator as each landfill must meet specific regulations to operate these facilities. The waste generator is responsible for waste treated seed once in the landfill as per the “Cradle to Grave” philosophy. Since waste is not destroyed, environmental liability remains with the generator forever.

Incineration: Environmental liability is virtually eliminated because waste is burned into a non-toxic ash. Incineration is a very easy method of disposal as waste is picked up and incinerated in its current form, but it can be very expensive.

Composting: This option involves placing seed in piles and allowing microbes to break down the treated seed into organic product (also theoretically reduces lindane content). This method is not acceptable for seed treated with insecticide (hazardous waste considerations), but for it has been accepted for disposal for seed treated with fungicides only.

2.4 Biosafety Considerations

The following section on biosafety levels is sourced from:

- a. <https://rgw.arizona.edu/compliance/rlss/biosafety-program/biosafety-containment-levels/plant-and-animal-biosafety-levels>, and
- b. Adair D and Irwin R (2008) A Practical Guide to Containment: Plant Biosafety in Research Greenhouses, Information Systems for Biotechnology, Virginia Tech, USA.

Plant research generally, but not always, does not pose a human health hazard; but they may pose a threat to plants and the environment. Plants pathogens can be spread by: direct contact between plants, arthropods, soil borne nematodes, plant damage, and pollinators. Biosafety principles are designed to protect the natural and agricultural environment.

Plant biosafety levels are designated with a “P” after the containment level. The principal purpose of plant containment is to avoid the unintentional transmission of a recombinant or synthetic nucleic acid molecule-containing plant genome, including nuclear or organelle hereditary material or release of recombinant or synthetic nucleic acid molecule-derived organisms associated with plants.

In order to determine the appropriate biosafety levels for specified RCoLs, a risk assessment will be done which will consider:

- Source and nature of the introduced DNA:
 - exotic infectious agent or pathogenic organism
 - fragment of DNA or complete genome
- Recipient organism
 - mode and ease of dissemination
 - invasiveness
 - noxious weed or capable of interbreeding with noxious weeds
 - potential for outcrossing between recipient organisms and related species
 - potential for detrimental impact on natural or managed ecosystems
- Nature of expressed protein
 - vertebrate toxin or potential or known allergen
 - toxic to other organisms in local environment
- Local environment
 - nature and importance of nearby crops
 - presence of sexually compatible wild or weedy species
- Experimental procedures
 - transport to or from greenhouse
 - necessary containment measures

The table below provides a guideline for assigning biosafety levels for plant research. The table shows that as the potential risk to the environment increases, increasingly stringent requirements for containment are indicated. When applicable, physical containment requirements may be eased with the addition of biological containment measures, indicated by the “+” sign.

Table 2-4: Suggested Criteria for Assigning Biosafety Levels

CRITERIA	TRANSGENIC PLANTS	TRANSGENIC MICROBES		TRANSGENIC ARTHROPODS AND THEIR MICROBES
		Exotic	Non-Exotic	
Not a noxious weed or cannot outcross with one	BL1-P			
Not easily disseminated			BL1-P	
No detriment to environment		BL2-P or BL1-P +	BL1-P	BL2-P or BL1-P +
Noxious weed or can interbreed with weeds	BL2-P or BL1-P +			
Contains complete genome of non-EIA	BL2-P or BL1-P +			
Contains genome of EIA	BL3-P or BL2-P +			
Treated with an EIA	BL3-P or BL2-P +			
Detriment to environment			BL2-P or BL1-P+	BL3-P or BL2-P +
EIA with detriment to environment	BL3-P or BL2-P +			
May reconstitute genome of infectious agent <i>in planta</i>	BL3-P or BL2-P +			
Contains vertebrate toxin	BL3-P	BL3-P	BL3-P	
PMP & PMI	BL3-P			
Select Agent plant pathogens	BL3-P	BL3-P	BL3-P	BL3-P+ or BL4-P

*EIA – Exotic Infectious Agent

Source: Adair and Irwin (2008)

Based on the above and descriptions of the types of research activities to be undertaken by the RCoLs and the capacity of the PIUs, the biosafety levels of the research facilities will be assigned to Biosafety Level BSL-1P or BSL-2P. However, at a later stage if the RCoLs decide to carry out higher level research, then a risk assessment will have to be undertaken to ascertain the biosafety level where:

- The accidental release of transgenic plants, plant pathogens or other organisms may have a recognized potential for significant detrimental impact on the environment;
- Non-genetically engineered plant research will involve exotic infectious agents capable of causing serious environmental harm;
- Experiments are being carried out using transgenic plants or organisms that contain genes coding for vertebrate toxins;

- experiments using transgenic microbial pathogens of insects or small animals that associate with plants, if the pathogen has the potential to cause harm to the local environment;
- Experiments are being carried out involving certain exotic, readily transmissible infectious agents that are potentially serious pathogens of major southern African crops.

For the above types of research, and for activities where the risks are unknown, the RCoL facilities would be assigned to BSL-3P or BSL-4P.

Requirements for BSL-1P and BSL-2P are summarised below:

Plant Biosafety Level 1 (BSL-1P)

BSL-P1 is recommended for all experiments with transgenic plants and associated agents that have no or limited threat potential. These would include, for example, transgenic plants that are not noxious weeds or agents that have no recognized potential for rapid dissemination. Examples of agents worked with at BSL-1P include *Agrobacterium tumefaciens* and *Rhizobium* spp.

Requirements at BSL-1P include:

- Access to the laboratory and greenhouse is limited or restricted when experiments are in progress.
- Prior to entering the greenhouse, personnel are required to read and follow instructions on BSL-1P greenhouse practices and procedures.
- All procedures must be performed in accordance with accepted greenhouse practices appropriate to the experimental organism.
- Records will be kept of experiments currently in progress in the greenhouse facility.
- Rendered experimental organisms biologically inactive by appropriate methods before disposal.
- A program shall be implemented to control undesired species (e.g., weed, rodent, or arthropod pests and pathogens) by methods appropriate to the organisms and in accordance with applicable state and federal laws.
- House arthropods and other motile macro-organisms in appropriate cages. If acro-organisms (e.g. flying arthropods or nematodes) are released within the greenhouse, precautions must be taken to minimize escape from the greenhouse facility.
- The greenhouse floor may be composed of gravel or other porous material. Impervious (e.g. concrete) walkways are recommended.
- Windows and other openings in the walls and roof of the laboratory and greenhouse facility may be open for ventilation as needed for proper operation and do not require any special barrier to contain or exclude pollen, microorganisms, or small flying animals (e.g. arthropods and birds). Screens are recommended.
- Laboratories and greenhouses must be locked when unoccupied. All agents must be secured against accidental exposure, unauthorized use, and theft. All recombinant nucleic acids must be stored in locked containers.

Plant Biosafety Level 2 (BSL-2P)

Recommended for transgenic plants that are noxious weeds, plants in which the introduced DNA represents the complete genome of a non-exotic infectious agent, plants associated with transgenic non-exotic microbe that has a recognized potential for serious detrimental impact on managed or natural ecosystems, or plant pathogens that have a recognized potential for serious

detrimental impact on managed or natural ecosystems. Examples of agents worked with at BSL-2P include: *Meliodogyne* spp (root-knot nematode), and *Pseudomonas syringae*.

The following are required when working at BSL-2P:

- A program to control undesired species (e.g., weed, rodent, or arthropod pests and pathogens) by methods appropriate to the organisms and in accordance with applicable state and Federal laws.
- A greenhouse floor composed of an impervious material. Concrete is recommended, but gravel or other porous material under benches is acceptable unless propagates of experimental organisms are readily disseminated through soil. Soil beds are acceptable unless propagates of experimental organisms are readily disseminated through soil.
- Materials containing experimental microorganisms must be transferred in a closed, leak proof container.
- An autoclave must be available for the treatment of contaminated plant material including soil.
- If intake fans are used, measures shall be taken to minimize the ingress of arthropods. Louvers or fans shall be constructed such that they can only be opened when the fan is in operation.
- Greenhouse containment requirements may be satisfied by using a growth chamber or growth room within a building provided that the external physical structure limits access and escape of microorganisms and macro-organisms in a manner that satisfies the intent of the foregoing clauses
- Laboratories and greenhouses must be locked when unoccupied.
- All agents must be secured against accidental exposure, unauthorized use, and theft.
- All recombinant nucleic acids and BSL-2P agents must be stored in locked containers.
- All material in the open bay or common use areas must be secured when not in use.

2.5 Implementation Arrangements

The following is an outline of the Implementation Arrangements for APPSA – Lesotho with an elaboration of the organizational requirements for safeguards compliance;

The implementing agency will be the Department for Agricultural Research (DAR) under the Ministry of Agriculture and Food Safety (MAFS), which will establish a project implementation unit (PIU) for the day to day running of the project. The implementation arrangement will consist of 6 tiers:

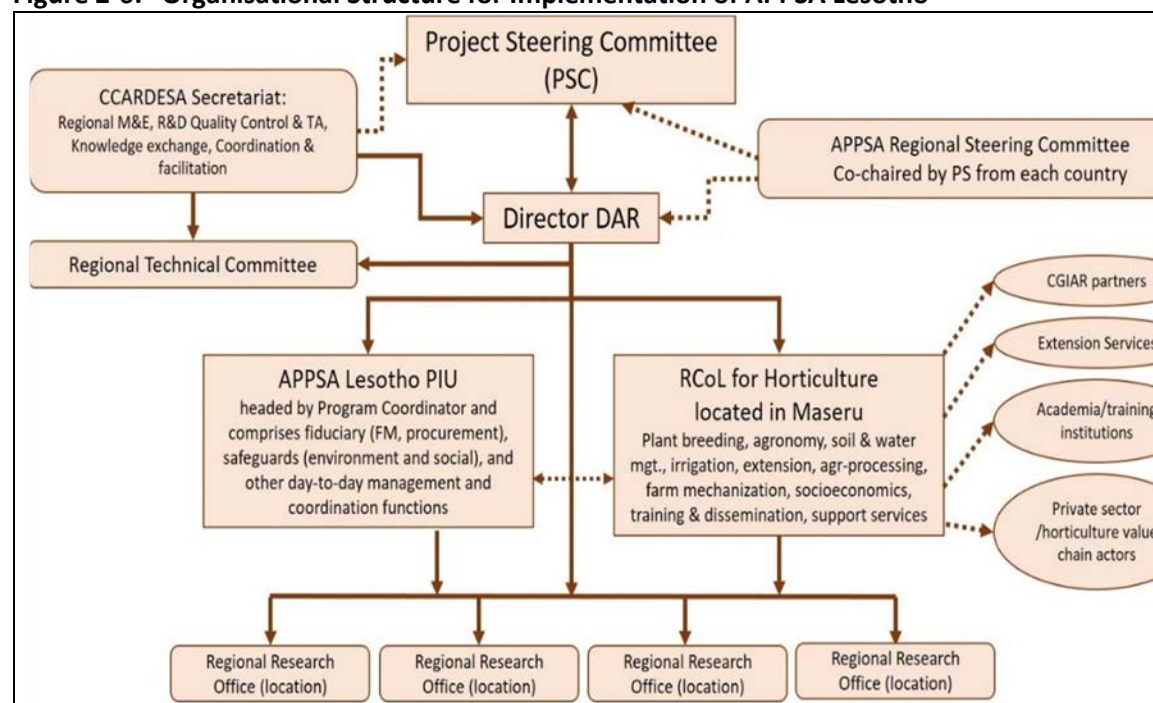
- i. Project Steering Committee (PSC) providing oversight and policy guidance,
- ii. Research Technical Committee (RTC) ensuring that the programmes are technically sound and adhere to standards for scientific studies,
- iii. Project Implementation Unit (PIU) providing day-to-day management, coordination, fiduciary and safeguards compliance,
- iv. Regional Centre for Leadership (RCoL) for horticulture crop farming system for technical implementation of R&D subprojects,
- v. Regional Research Offices (RROs) for implementation and access to farmers at district level in Lesotho, and
- vi. the Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) for regional coordination and harmonization at SADC level.

The organogram for APPSA Lesotho is shown in Figure 2-6 below.

2.5.1 Project Implementation Unit (PIU)

The PIU will be established at the DAR Head office in Maseru with 4 Regional Research Offices (RROs) in Mokhotlong, Mahobong, Siloe and Nyakosoba. Under the APPSA financing, Lesotho will establish the RCoL for Horticulture at its Maseru main station. The RROs will comprise of district research and extension officers and additional support staff. The RCoL will also coordinate with the external agricultural stakeholders including extension services, private sector/horticulture value chain stakeholders, CGIAR institutions, and academia and other research organizations.

Figure 2-6: Organisational Structure for Implementation of APPSA Lesotho



2.5.2 Safeguards Capacity of APPSA Lesotho PIU

To provide initial support and on boarding for the newly recruited PIU staff, the existing Project Management Unit (PMU) under the World Bank financed Smallholder Agriculture Development Project (SADP) will be used for initial planning and fiduciary aspects. This arrangement is an additional support to ensure APPSA Lesotho implementation starts on a stronger footing and initial delays in setting up financial management and procurement planning activities comply with World Bank policies. The financial management (FM) and procurement staff of the APPSA Lesotho PIU will work closely under the mentorship of SADP PMU for an initial duration of 6 months after on boarding of APPSA financial management (FM) and Procurement Staff. Thereafter, the support from SADP will be rolled back. Currently, there are no Environmental and Social Safeguards Specialists attached to SADP.

The proposed structure for the PIU (Figure2-6) has a provision for an Environmental and Social Safeguards Specialist who will make sure that the project is complying with all the safeguards issues. It is recommended that two specialists – an Environmental Safeguards Specialist and a Social Safeguards Specialist - be engaged since SADP has no safeguards specialists working on the project. This will ensure that the various environmental and social requirements are catered for adequately. The safeguards team can be strengthened by incorporating the District Agricultural Officers, who can be trained in the requirements of the ESMF and then assist in its implementation in their districts. The safeguards specialists will be responsible for the implementation of the

requirements of this ESMF, ESMP and IPMP. Their specific responsibilities and tasks include the following:

- Ensuring and enforcing safeguards due diligence during all phases of implementation of the project.
- Streamlining the requirements of the ESMF and the IPMP (or PMP) into all the activities of the PIU;
- Creating safeguards awareness and needed training, monitoring indicators and reporting on implementation of safeguards instruments and actions.
- Training District agricultural officers as trainers on environmental and social requirements of APPSA Lesotho, and then assisting them to further propagate the issues in their districts;
- Training all stakeholders in environmental and social safeguards requirements of APPSA Lesotho and encouraging them to comply from project inception;
- Ensuring that all subprojects are screened for environmental and social impacts prior to implementation, using the procedure outlined in Chapter 11 and Figure 11-1;
- Assist in the development of site specific ESMPs for sub-projects;
- Carry out regular inspections, monitoring and reviews to ensure compliance;

3 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 Introduction

Over the last ten years, the Government of Lesotho has adopted a new republican constitution, and a number of new policies and legislation with the ultimate aim of promoting and consolidating sustainable socio-economic development in the country through the mainstreaming of environmental and social considerations in project planning and implementation. These include: The National Environmental Action Plan, the National Environmental Policy, the Lesotho Poverty Reduction Strategy (PRS) Paper, the Decentralization Policy, the Environmental Act, and Local Government Act among others. The following paragraphs highlight some selected policies and laws which are applicable in the planning and implementation of public sector projects, more especially those in the agricultural and irrigation sector:

3.2 Review of Relevant Policy Framework

3.2.1 *Poverty Reduction Strategy - National Strategic Development Plan (2012)*

The National Strategic Development Plan (NSDP), was to be implemented from the fiscal year 2012/13 to 2016/17, succeeded the Poverty Reduction Strategy Paper (PRSP) and the Interim National Development Framework (INDF). Like the PRSP and the INDF, it served as an implementation strategy for the National Vision 2020. The Strategy included the following; employment creation and income generation, Agriculture and Food security, infrastructure development - roads, water, electricity and communication, deepening democracy, governance, Safety and Security, improving quality of and access to essential health care and social welfare service, improving quality and access to education, managing and conserving the environment and improving public service delivery. The crosscutting issues are scaling up the fight against HIV/AIDS and gender, youth and children.

Agriculture and food security are a major pillar in the strategy and the APPSA is set to address the same issue.

3.2.2 *Agricultural Sector Strategy (2003)*

The Agricultural Sector Strategy (2003) formulates its own policies with goals, objectives and outputs for 19 subsectors which fall into three groups: i) The production sub-sectors, which are crops, livestock and subsistence production; ii) Cross cutting issues (food and nutrition, forestry, conservation and range management, land use, land tenure, rural finance and investment); and iii) Government services (extensions, training and research).

The strategy put emphasis on development of productive capacities of households/farmers to tap into agribusiness. Implementation has however fallen short as Lesotho still has very low agricultural productivity despite huge government subsidies particularly for cereals production under the Block Farming Project for grain farming. There has generally been limited policy direction towards support of diversified commercial agriculture.

3.2.3 *Other National Agricultural Strategies*

The National Action Plan for Food Security 2007-2017, the Comprehensive Africa Agriculture Development Programme (CAADP), and the National Agricultural Investment Programme (NAIP) are

some of Lesotho government's statements of policy and strategy in the agricultural sector development. They indicate how the Ministry of Agriculture and Food Security (MAFS) aims to achieve the national goals as set in the National Vision 2020.

3.2.4 Agriculture and Food Security Policy of Lesotho (2006)

Lesotho's agriculture and food security policy signifies that agriculture is critically dependent on environmental resources such as land, water, forest, and air (GoL, 2005). Within the policy, replenishing soil fertility and increasing the use of high yielding crop varieties and improved livestock breeds are priorities. The policy shows that climate change has serious impacts on agriculture and livestock sectors and that Climate Smart Agriculture (CSA) could reduce the impacts of climate change. The tenets of CSA such as increasing agricultural productivity, conservation agriculture, block farming, homestead gardening, improved livestock production, land conservation and improvement and crop diversification are all highlighted below:

Pillar 1: Promotion of Conservation Agriculture (CA)

- i) This will be done with aid of development partners through:
- ii) Conducting and adopting technologies suitable to the local conditions;
- iii) Offering specialized CA training modules to Extension staff and farmer groups; and
- iv) Introducing subsidies for input for innovative approaches to CA.

Pillar 2: Promotion of block farming to increase food production

- i) Facilitating (not directly involved in operations) the promotion of block farming throughout the country;
- ii) Supporting agriculture extension system;
- iii) Offering incentives through subsidies for innovative approaches preferable for innovative investments (irrigation equipment, tractors etc. in line with agricultural subsidy policy);
- iv) Reforming the land tenure.

Pillar 3: Promotion of homestead garden production

This includes keyhole gardens, trench gardens, and bag gardens that use organic fertilizers.

Pillar 4: Promotion of livestock production and improvements in range management

- i) Supporting the combating of livestock theft Supporting rangeland productivity;
- ii) Promoting small stock production for poor vulnerable households
- iii) Promoting intensive livestock and milk production in peri-urbans

3.2.5 National Biosafety Policy (2005)

The goal of Lesotho's National Biosafety Policy is to ensure safe use of biotechnology in order to protect human health and ensure the well-being of the environment, while maximizing the benefits from biotechnology.

The main objectives of the national policy are to guide the judicious use of modern biotechnology in Lesotho for sustainable development, in ways which do not in any way jeopardize human and environmental health including Lesotho's biodiversity and genetic resources and ensure the effective control of trans-boundary movements of genetically modified organisms or products thereof resulting from modern biotechnology.

This will be achieved through:

- The exchange of information and a scientifically based, transparent system of Advance Informed Agreement.
- Development of human resource and institutions that can assist to make informed decision.

- The formulation of structures and laws to manage biotechnology and biosafety issues in the country.
- Creating public awareness and understanding of biotechnology and biosafety for stakeholder buy-in.
- Enhancing research and development in order to develop country specific products and applications that would enhance the socio-economic and environmental well-being of Lesotho.

Lesotho's National Biosafety Policy covers all GMOs (Genetically Modified Organisms) and their products or derivatives; this coverage includes all living organisms, germplasm, and all elements of genetic manipulation. It then gives detail on the following issues:

- Laboratory and field applications of biotechnology.
- Such fields as agriculture, human and veterinary medicine, food/beverage production, and environment management.
- The whole regulatory framework encompassing biosafety including the safe handling, disposal; and monitoring of potentially hazardous biotechnology materials.
- The research and development processes.
- Occupational health and safety issues around biotechnology procedures or commodities, including public health and environmental safety.

This policy attempts to strike a balance between protection and promotion, which will embrace benefits of biotechnology without compromising safety of the people of Lesotho and harming the environment as well as protecting biological diversity. It states that Lesotho will not allow herself to be used to test, purchase or dispose of products or technologies which are banned elsewhere, or which fail the safety standards of other nations.

3.2.6 National Environmental Policy (1998)

The overall goal of the National Environmental Policy (NEP) is to achieve sustainable livelihoods and development for Lesotho. The Policy relates directly to Lesotho's national development priorities. It focuses on the social and economic dimensions, the management and conservation of natural resources, and the promotion of community participation. The objectives of the policy are:

- i) To secure for all Basotho a high quality of environment to enhance their health and well-being.
- ii) To raise public awareness and promote understanding of essential causal linkages between development and environment, and to ensure that environmental awareness is treated as an integral part of education at all levels.
- iii) To use and conserve the environment and natural resources for the benefit of present and future generations, considering the rate of population growth and productivity of the available resources.
- iv) To conserve the Basotho cultural heritage and utilize it for the benefit of the present and future generations.
- v) To encourage and facilitate individual, NGO, community, religious organizations, and business community participation in environmental management.
- vi) To halt environmental degradation, and to restore, maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere and to preserve biological diversity.
- vii) To implement the principle of optimum sustainable yield in the use of natural resources and ecosystems.
- viii) To foster community management and revenue sharing from sustainable utilization of natural resources on customary and public land.

- ix) To put in place comprehensive environmental regulatory measures to stimulate sustainable economic and social development. Such development will be complemented by social and economic incentives to influence positive behaviour towards environment.
- x) To set up comprehensive programmes of resource inventorying and accounting, complemented by regular and accurate environmental assessment, monitoring, and dissemination of information to all sectors of society.
- xi) To ensure that the true and total costs of environmental use and abuse are borne by the user, i.e. the "polluter pays" principle.
- xii) To enact and implement a land tenure policy which enhances sustainable natural resource management.
- xiii) To empower women to play a key role in natural resource use and management activities.
- xiv) To cooperate in good faith with other countries in the Southern Africa Development Community (SADC) region, in Africa, and with international organisations and agencies to achieve optimal use of trans-boundary shared natural resources and effective prevention or abatement of trans-boundary environmental impacts.

3.2.7 Lesotho Science and Technology Policy 2006-2011 (2006)

The Science and Technology Policy recognises that technical and scientific aspects are critical to the Agriculture sector making it essential to have trained, qualified, competent and highly motivated personnel to operate effectively; well-serviced, modern equipment and technologies. It highlights the MAF's roles in training, community education, research and extension.

Its provisions are directly linked with the objectives of the APPSA Project which seeks to improve the Agricultural Technologies and Approaches.

3.2.8 ICT Policy for Lesotho (2005)

The Ministry of Communications, Science and Technology is the custodian of the information and communications technologies (ICT) policy. The Policy provides the nation with a vision and strategy for becoming a fully integrated member of the Information Society. It is intended to unite Government, industry, civil society and the general public in the achievement of its national development goals and endeavours to reduce the digital divide between the "haves" and the "have nots," to promote gender equality, protect the environment and to improve food security and the standard of living of all Basotho. It further strives to promote a food secure society capable of exploiting the full potential of ICTs.

The vision of the ICT Policy is "To create a knowledge-based society fully integrated in the global economy by 2020." While its mission is "To fully integrate information and communications technologies throughout all sectors of the economy in order to realise rapid, sustainable socio-economic development."

The policy has nine overall objectives but the most relevant for the Agriculture sector is to "Promote usage of ICTs throughout all sectors of society including disadvantaged groups." The policy then outlines the role of each sector in implementing it.

It then highlights Agriculture as one of the ten (10) cross cutting catalysts that provide the strategic framework needed to guide the successful implementation of the ICT policy and to realise national development goals. ICTs have the potential to revolutionize the management of the agricultural sector and improve food security. ICTs may significantly improve information flows between farmers, consumers, and agriculturalists and thus lead to higher crop yields, production that is more responsive to consumer needs and greater market access. ICTs can be used to improve crop planning, monitoring and forecasting. Livestock Registration, Marking and Information Systems

(LRMIS) can be used to prevent stock theft as well as to control diseases. It can also be used to track and locate livestock throughout the country.

The Lesotho Vision 2020 has identified increased agricultural productivity and sustainable food security as one of the country's primary challenges. Government believes that ICTs can be used to improve the food security of the nation by improving communications among producers and consumers as well as providing greater access to information.

The objectives of using ICT in agriculture and food security are to:

- Improve agriculture productivity, in order to attain food security for the country.
- Protect the investment of livestock farmers and prevent the spread of disease.
- Increase access to agro-related information for farmers and other stakeholders through appropriate, scalable ICTs in order to benefit from a wide range of information services.
- Link rural agricultural producers to markets.
- Monitor the sustainable utilization of natural resources in agricultural production.

3.2.9 World Bank Safeguards Policies and Guidelines

3.2.9.1 World Bank Operational Policies

The World Bank has ten (10) environmental and social safeguard policies that it uses to examine potential environmental and social risks and benefits associated with Bank lending operations. Appendix 5 gives a detailed description of the World Bank environmental and social safeguard policies. The environmental and social safeguard policies are designed to avoid, mitigate or minimise adverse environmental and social impacts of projects supported by the bank. The following is a summary of the Safeguard Policies that will be triggered by the APPSA:

- OP/BP 4.01: Environmental Assessment as a result of potential negative impacts
- OP/PB 4.09: Pest Management due to anticipated increase in use of fertilizers and chemicals by farmers.
- OP/BP 4.11: Physical Cultural Resources. The policy is not directly triggered by the project, but only as a precautionary measure. Lessons learned from other projects in Lesotho have shown that in some districts, such as Leribe and Butha Buthe artefacts from historical cultural resources have been found at some construction sites. The RCoLs will be on existing sites. However, during field trials or dissemination to farmers, this could be triggered (if not archaeological resources, then perhaps graves). The Project will prepare a Cultural Resources Management Plan in readiness for chance finds that might occur during the implementation of the project (Appendix 8 presents a guideline Chance Finds Procedure).
- OP/BP 4.37: Safety of Dams. Due to the anticipated inclusion of small-scale earth dams to harvest and store water for research stations under the RCoLs.

Table 3-1: Key Safeguard Policies Triggered for Lesotho APPSA.

Safeguard Policies Triggered by the Project	yes	No
Environmental Assessment (OP/BP/GP 4.01)	[X]	[]
Natural Habitats (OP/BP 4.04)	[]	[X]
Pest Management (OP 4.09)	[X]	[]
Physical Cultural Resources (OP 4.11)	[X]	[]
Involuntary Resettlement (OP/BP 4.12)	[]	[X]
Indigenous Peoples (OP 4.10)	[]	[X]
Forests (OP/BP 4.36)	[]	[X]
Safety of Dams (OP/BP 4.37)	[X]	[]
Projects in Disputed Areas (OP/BP 7.60)	[]	[X]
Projects on International Waterways (OP/BP 7.50)	[]	[X]

NOTE: Involuntary Resettlement (OP/BP 4.12) was not triggered for Lesotho.
Physical Cultural Resources (OP 4.11) was triggered as a precautionary measure.

A detailed explanation of why the safeguards were triggered is offered in Appendix 5 as section APP 5.2.

3.2.9.2 World Bank Group Environmental Health and Safety Guidelines (EHS)

The World Bank Group Environmental Health and Safety Guidelines (EHS) are also relevant for this program and these include i) General EHS Guidelines; ii) Perennial crop production EHS Guidelines; iii) Annual crop production EHS Guidelines.

WB EHS General Guidelines:

https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

Specific Guidelines: Annual crop production

https://www.ifc.org/wps/wcm/connect/c6f002804c3c4596bb44bfd8bd2c3114/Annual+Crop+Production+EHS+Guidelines_2016+FINAL.pdf?MOD=AJPERES

Specific Guideline: Perennial crop production

https://www.ifc.org/wps/wcm/connect/ef0d4b804c3c5ad9bcb9bed8bd2c3114/English_2016_Perennial+Crop+Production_EHS.pdf?MOD=AJPERES

(i) General EHS Guidelines

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). They are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors e.g. the Agricultural sector (IFC, 2007).

The General EHS Guidelines contain information on cross-cutting environmental, health, and safety issues potentially applicable to all industry sectors and covers the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are considered. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent or protective of human health and the environment.

The General EHS Guidelines cover issues on are organized as follows; Environmental Safety, Occupational Health and Safety, Community Health and Safety and Construction and Decommissioning. Effective management of environmental, health, and safety (EHS) issues will entail the inclusion of these EHS considerations into the operations of the Lesotho APPSA programme.

(ii) Perennial crop production EHS Guidelines

This document includes information relevant to large-scale plantation crops and out grower systems and focuses on the primary production and harvesting through farming and plantation forestry of major multi-year food, fiber, energy, ornamental, and pharmaceutical

crops, located in both temperate and tropical regions. It includes tree crops (such as olives, citrus, coffee, rubber, eucalypts, and cacao) as well as banana, sugarcane, and palm oil (WB 2016 b).

However, the guideline does not include the processing of raw materials into semi-finished and finished products.

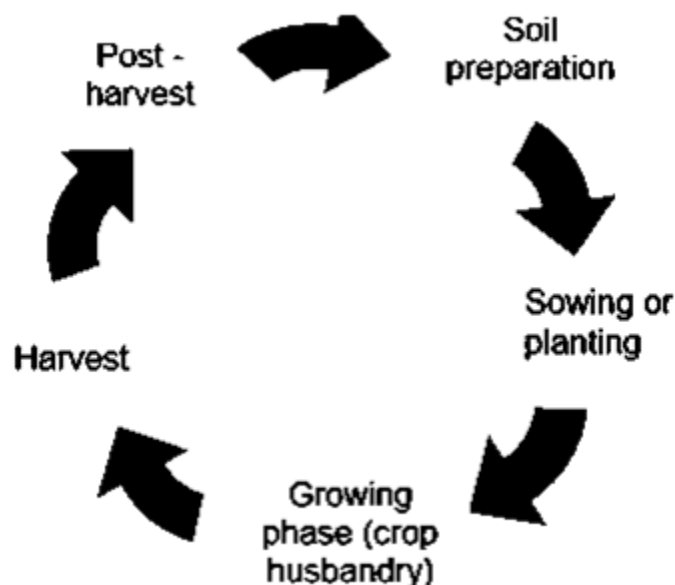
The Specific Perennial crop production EHS Guideline covers the following issues:

- Industry - Specific Impacts and Management
- Performance Indicators and Monitoring
- References and Additional Sources and
- General Description of Industry Activities

(iii) Annual crop production EHS Guidelines.

This document includes information relevant to large-scale production, harvesting, post harvesting processing and storage of major annual crops, including cereals, pulses, roots and tubers, oil-bearing crops, fiber crops, vegetables, and fodder crops, located in both temperate and tropical regions.

Figure 3-1 Crop Production Cycle



The Guideline covers all the activities within the lifetime of an annual crop, which is normally within one growing season that falls within one year. More than one crop may be produced on the area during one year and annual crops are often grown in rotation across years, alternating with other crops and fallow periods.

The Guideline does not include the processing of raw materials into semi-finished and finished products. The Specific Annual crop production EHS Guideline covers the following issues:

- Industry - Specific Impacts and Management
- Performance Indicators and Monitoring

- References and Additional Sources and
- General Description of Industry Activities

3.3 Review of Relevant Legal Framework

3.3.1 *Constitution of Lesotho – Fifth Amendment (2004)*

Section 36: Stipulates Lesotho will adopt policies designed to protect and enhance the natural and cultural environment of Lesotho for the benefit of both present and future generations and shall endeavour to ensure all citizens a sound and safe environment adequate for their health and well-being. APPSA activities have a potential to disrupt the wellbeing of the environment, thus affecting people in the process. So, in implementing APPSA Lesotho must adopt approaches that will conform to the requirement of the Constitution.

3.3.2 *Environment Act No 10 of 2008*

Environment Act makes provision for the protection and management of the environment and conservation and sustainable utilization of natural resources of Lesotho. It provides for the protection of the land base against the negative impacts of development that cause excessive land disturbance and soil erosion. Among others, the act is based on the following principles of environmental management:

- To ensure every person living in Lesotho the fundamental right to a clean and healthy environment.
- To ensure that sustainable development is achieved through the sound management of the environment.
- To use and conserve the environment and natural resources of the Basotho nation for the benefit of both present and future generations, considering the rate of population growth and the productivity of available resources.
- To maintain stable and functional relation between the living and non-living parts of the environment through preserving biological diversity and respecting the principle of optimum sustainable yields in the use of natural resources.
- To reclaim lost ecosystems where possible and reverse the degradation of natural resources.
- To require prior environmental impact assessment of proposed projects or activities which are likely to have adverse effects on the environment or natural resources.
- To ensure that appropriate measures are taken to prevent soil erosion.

The proposed agricultural activities will have various effects on the environment and the relevant clauses that cover the protection and management of the environment include the following:

Part V: Environmental Impact Assessment, Audits and Monitoring: This clause provides for undertaking environmental impact assessment of the project developments. It makes provision for the type of projects for which an environmental impact assessment is required and specified in the Schedule to the Act. It stipulates submission of the project brief and guide to its preparation. The project brief preparation includes preparation of the environmental management plan for guiding development for prevention of environmental impact on natural resources by undertaking mitigation measures. Environmental impact studies and statements preparation and guide are made for projects that have serious environmental impacts on natural resources. It makes provision for review of environmental impact statements, environmental monitoring, environmental audit and issuance of the license for implementing the project.

Part VI: Environmental Quality Standards: Makes provision for soil, water, air, waste, noise, ionization, and other radiation, control of noxious smells, guidelines for environmental disasters and other standards.

Part VII: Pollution Control: Makes provision for prohibition of discharge of hazardous substances, chemicals and materials or oil into the environment and spiller's liability.

Part VIII: Environmental Management: Makes provision for the notifications of any spill, including the measures to be taken, like clean-ups, recovery of expenses and spill liabilities.

Part IX: Environmental Restoration Order: Identification and protection of areas which are at risk of degradation which among others include:

- Reforestation and afforestation
- Protection of rivers, river banks and wetlands
- Protection of forests
- Conservation of energy and planting of trees or woodlots
- Conservation of biological diversity
- Conservation of biological resources in-situ
- Conservation of biological resources ex-situ
- Access to genetic resources of Lesotho
- Management of rangelands
- Land use planning
- Protection of natural environmental areas
- Management of dangerous materials
- Management of hazardous waste

Part X: Environmental Restoration Notices: Makes provision for issuance of environmental restoration notices and orders.

Part XI: Inspections, Analysis and Records. Provides for the appointment of inspectors, their powers and duties. Also, the designation of laboratories and what they should analyse.

Part XII: International Environmental Conventions: Covers environmental conventions or agreements to which Lesotho is a party.

Several regulations have been enacted to support the implementation of the main Act and the include the following:

3.3.2.1 Guidelines for EIA in Lesotho, (2008)

In 2008, Lesotho promulgated an Environment Act which provides for the EIA process. Following the enactment of the Act, the final guidelines for EIAs were issued.

The Guidelines for EIA are aimed at facilitating participation in and compliance with Lesotho's EIA requirements by the developers. They are also aimed at "integrating environmental concerns and economic development from the earliest stages of the project development. According to the Guidelines, the objectives of an EIA in Lesotho are to:

- a) Integrate environmental considerations into development planning, thereby promoting sustainable livelihoods;
- b) Ensure that the environmental and socio-economic costs and benefits of economic development projects are properly accounted for;
- c) Ensure that unwarranted negative impacts are avoided or mitigated at an early stage in the planning process;
- d) Ensure that potential benefits are identified and enhanced;
- e) Carry out environmental and socio-economic studies of projects in parallel with analysis of engineering and economic feasibility;
- f) Ensure that decision-makers are provided with information on environmental costs and benefits to complement information on its technical and economic feasibility at key decision points in the development of a project;
- g) Ensure that all the affected and interested groups (local communities, government authorities, developers, NGOs, CBOs, etc.) Participate in the process;
- h) Set up a system to carry out mitigation, monitoring, auditing, and enforcement.

3.3.2.2 *Need for Pesticides and Toxic Substances Legislation*

Lesotho does not have a specific legislation dealing with the management of chemicals and pesticides, specifically persistent organic pollutants substances. There are however, a few pieces of legislation, which generally touch on dangerous substances and hazardous substances. The laws that exist are fragmented and not specific to chemicals. The country is further incapacitated in terms of financial requirements to meet the infrastructural developments and human resource base to undertake some of the requirements of managing the toxic substances.

3.3.3 *Managed Resources Areas Order (1993)*

Section 12: makes provision for prohibition on activities in Managed Resource Areas other than for grazing purposes including prohibition of burning that causes land degradation. This provision will come handy in rangeland management subprojects which will need to protect the lands for grazing stock.

3.3.4 *Local Government Act (1997)*

The Act is in the process of being enforced and in the last six months, the government has been decentralizing its services to the districts. Under the Act, the government has established the Local Government Service and the interest of the Central Government at district level will be represented by the District Administrator, who coordinates the duties and functions of all public officers in the district. Indeed, all public officers in the district function under the direct supervision of the District Administrator. It should be noted that the district technical staff report administratively to the DA but functionally to the line ministries. The District Administrator reports to the Minister of Local Government. Thus, the project implementation will be coordinated by the DA who will be the chair of the Programme Implementation Committee.

The Act also impacts on the APPSA in that all the local governance issues will be dealt with through this act.

3.3.5 *Land Act (2010)*

The Act bill makes provision for ensuring sustainable use of agricultural land and stipulates that the lessee shall use and take steps to ensure that land used for arable purposes is farmed in accordance with the practices of good husbandry customarily used in the area and that land used for pastoral purposes is used in a sustainable manner in accordance with the best principles of pastoralism practiced in the area.

3.3.6 *The Forestry Act (1998)*

This law makes provision that land should be made available for forestry activities, including fuel wood production for purposes of domestic supply seen as a means to preserve indigenous shrubs and trees that protect land from soil erosion. It also provides for the protection and preservation of these forests. APPSA activities may induce vegetation clearing for working space and for firewood. The provisions of this act will thus be used to protect the forests from over exploitation.

3.3.7 *Weeds Eradication Act (1969)*

Weeds Eradication Act (1969) deals with alien invasive plants and control of their encroachment into the climax vegetation. Expansion of agricultural activities poses the danger of introducing alien invasive plants and this act will help curb this problem.

3.3.8 Liremo Control Act (1970)

The act makes provision for the protection of Liremo through controlling their use. This has since been revised by King Moshoeshoe II and declared all indigenous trees and shrubs Liremo that are plants of economic value which, though not cultivated, are community owned resources, the use of which is controlled directly by the chief or appointed headmen. This act will thus protect the indigenous trees from being indiscriminately cut as the project will be implemented.

3.3.9 The Public Health Order (1970)

The Order sets out the functions of the Ministry of Health shall, as to promote the personal health and environmental health within Lesotho; to prevent and guard against the introduction of disease from outside; to prevent or control communicable disease; to advise and assist district administrations and local authorities in regard to matters affecting public health; to promote or carry out researches and investigations in connection with the prevention and treatment of human diseases; to prepare and publish reports and statistics or other information relative to the public health; to report on the work of the Ministry to the Minister who may submit such report to the Council of Ministers each year; to provide for the appointment of advisers, advisory bodies or councils to assist the Minister in all matters concerning public health; and generally to administer the provisions of this Order.

It stresses the notification of Communicable diseases and non-Communicable diseases, the inspection of premises where a person suffering from such a disease may have entered and the cleansing thereof.

The Order also specifies that the Minister may make regulations applicable to all communicable diseases or only to such communicable diseases as may be specified therein regarding the following matters:

- The imposition and enforcement of isolation or of medical observation and surveillance in respect of persons suffering from communicable disease;
- The duties, in respect of the prevention of communicable disease and in respect of persons suffering or suspected to be suffering there from, of occupiers of land on which persons reside;
- The measures to be taken for preventing the spread of or eradicating smallpox, typhus fever, typhoid fever, cholera, yellow fever, plague, poliomyelitis, tuberculosis or any other communicable disease requiring to be dealt with in a special manner;
- The conveyance of persons suffering from or the bodies of persons who have died of a communicable disease.

Generally, the Order makes provisions for all matters concerning public health in Lesotho.

3.3.10 Water Act (2008)

The Water Act 2008 provides for the prevention of pollution of water resources through measures such as the control of processes causing pollution, the control or prevention of movement of pollutants, compliance with prescribed standards or management of waste, and the elimination of any sources or potential sources of pollution. It sets up the Water and Sewage Authority (WASA). These provisions have direct relevance to the activities of the National TB/HIV project as a potential source of pollution if not properly handled.

3.4 International Conventions and Treaties

Lesotho is a signatory and party to more than twenty-one international, conventions, treaties and protocols. Of the many treaties, the following will be triggered by the APPSA project: -

The Convention of Biological Diversity (1992)

The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

Agricultural activities will impact on biodiversity as the ecosystems are converted for agricultural use, e.g. natural forests turned into managed range lands, wetlands drained for arable land, thus interfering with the natural state.

The Cartagena Protocol on Biosafety (2003)

The Cartagena Protocol on Biosafety is a legally binding global protocol to the Convention on Biological Diversity (CBD). It was named in honour of Cartagena, Colombia, where negotiations were expected to conclude in February 1999. One year later, on January 29, 2000, the Protocol was finalized and adopted in Montreal, Canada by unanimous consent with 135 countries present. The Protocol entered into force on 11 September 2003

The Protocol seeks to contribute to ensuring the safe transfer, handling and use of living modified organisms (LMOs) created through modern biotechnology. Article 1 of the Protocol states that it aims to “contribute to ensuring an adequate level of protection in the field of the safe transfer, handling and use of living modified organisms resulting from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health, and specifically focusing on transboundary movements”. In short, it seeks to protect biodiversity from the potential risks of living modified organisms (LMOs) resulting from modern biotechnology.

The Protocol covers the “transboundary movement, transit, handling and use of all living modified organisms that may have adverse effects on the conservation and sustainable use of biological diversity, taking into account risks to human health”. It also assists developing countries in building their capacity for managing modern biotechnology:

- It creates an advanced informed agreement (AIA) procedure that requires exporters to seek consent from importing countries before the first shipment of LMOs meant to be introduced into the environment (e.g. seeds for planting, fish for release, and microorganisms for bioremediation)
- It establishes an internet-based “Biosafety Clearing-House” to help countries exchange scientific, technical, environmental and legal information about LMOs.
- It requires bulk shipments of LMO commodities, such as corn or soybeans that are intended to be used as food, feed or for processing, to be accompanied by documentation stating that such shipments “may contain” LMOs and are “not intended for intentional introduction into the environment”.

The Protocol includes a clause that makes clear the Parties’ intent that the agreement does not alter the rights and obligations of governments under the World Trade Organization (WTO) or other existing international agreements. However, the Biosafety Protocol does not:

- Cover products derived from LMOs (e.g. Paper from GM trees) and LMOs, which are pharmaceuticals for humans that are addressed by other relevant international agreements or organizations;

- Address food safety issues. This is addressed by experts in other international fora.
- Require segregation of bulk shipments of commodities that may contain living modified organisms;
- Require consumer product labelling;
- Subject shipments of bulk commodities to the Protocol's AIA procedure.

Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (2010)

This is a 2010 supplementary agreement to the 1992 Convention on Biological Diversity. The Protocol sets out core obligations for its contracting Parties to take measures in relation to access to genetic resources, benefit-sharing and compliance. Domestic-level access measures are intended to: create legal certainty, clarity and transparency; provide fair and non-arbitrary rules and procedures; establish clear rules and procedures for prior informed consent and mutually agreed terms; provide for issuance of a permit or equivalent when access is granted; create conditions to promote and encourage research contributing to biodiversity conservation and sustainable use; pay due regard to cases of present or imminent emergencies that threaten human, animal or plant health; consider the importance of genetic resources for food and agriculture for food security. Domestic-level benefit-sharing measures are to provide for the fair and equitable sharing of benefits arising from the utilization of genetic resources with the contracting party providing genetic resources. Utilization includes research and development on the genetic or biochemical composition of genetic resources, as well as subsequent applications and commercialization. Sharing is subject to mutually agreed terms. Benefits may be monetary or non-monetary such as royalties and the sharing of research results. Specific obligations to support compliance with the domestic legislation or regulatory requirements of the contracting party providing genetic resources, and contractual obligations reflected in mutually agreed terms, are a significant innovation of the Nagoya Protocol. The increased agricultural activities that will be triggered by APPSA will necessitate the implementation of this convention as farmers will be wanting to access plant material.

The Convention on International Plant Protection (1951)

The International Plant Protection Convention (IPPC) is a 1951 multilateral treaty overseen by the Food and Agriculture Organization that aims to secure coordinated aims to secure coordinated, effective action to prevent and to control the introduction and spread of pests of plants and plant products. Its primary focus is on plants and plant products moving in international trade and also covers research materials, biological control organisms, germplasm banks, containment facilities and anything else that can act as a vector for the spread of plant pests — for example, containers, packaging materials, soil, vehicles, vessels and machinery.

The APPSA will involve potential plant and plant product movement as the agricultural activities are being scaled up to commercial levels. Thus, the requirements of this convention have to be taken into consideration.

Convention on Wetlands of International Importance (1971)

The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The project area has a number of wetlands and these may be encroached on by the agricultural activities due to the constraints of land availability. The requirements of the Ramsar Convention will need to be applied in order to protect the wetlands from degradation.

The Convention on Conservation of Migratory Species of Wild Animals (1983)

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their

range. The Convention was signed in 1979 in Bad Godesberg, a suburb of Bonn (hence the name), and entered into force in 1983. The project may interfere with migratory routes of wildlife as the requisite structures for the agricultural activities are established. The usual nesting grounds for avian migratory species may be affected as lands, vleis and wetlands will be acquired for agricultural purposes.

The Convention Concerning the Protection of World and Natural Heritage

The World Heritage Convention aims for the preservation of the cultural and natural heritage sites of outstanding universal value. Each State, party to this Convention recognizes that the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage and situated on its territory, belongs primarily to that State. The project area is endowed with a lot of natural and cultural heritage sites. Any excavations may encounter artefacts, fossils and other items of cultural importance. Thus, the project triggers this convention.

The Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification

The aim of the Convention, which was signed in 1994, is to combat desertification and mitigate the effects of drought in those countries experiencing serious drought, particularly in Africa, through international cooperation and effective action at all levels. Desertification is due primarily to human activity and climatic variations. It does not mean the advance of current areas of desert. It is the result of the extreme vulnerability of the ecosystems in arid areas to over-exploitation and inappropriate use of land. Poverty, political instability, deforestation, overgrazing and bad irrigation practices are all factors which have a deleterious impact on the productivity of the land. Under APPSA the agricultural activities have a potential to degrade the environment and the Convention encourages implementation of measures to combat desertification.

African Convention on Conservation of Nature and Natural Resources

This Convention focuses on living resources, calling for the creation of protected areas and for the specific conservation measures for listed species. It also provides the grounds for the conservation of other natural resources such as soil and water, for the consideration of environmental concerns in development plans, and for research and education. The agricultural activities will have a direct impact on the natural resources by clearing of vegetation, loosening soils, draining wetlands, degrading marginal lands. Thus, the requirements of this convention have to be considered in the implementation of APPSA.

Stockholm Convention on Persistent Organic Pollutants

The Stockholm Convention on Persistent Organic Pollutants is a global treaty to protect human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of humans and wildlife, and have adverse effects to human health or to the environment. Exposure to Persistent Organic Pollutants (POPs) can lead to serious health effects including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and even diminished intelligence. APPSA activities will promote increased use of biocides, some of which are listed as POPs. Some illegal trade in these will also be fuelled by the increased activities, thus this convention has to be effected in the implementation of APPSA.

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal

The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. Its scope of application covers a wide range of wastes defined as “hazardous wastes” based on their origin and/or composition and their

characteristics, as well as two types of wastes defined as “other wastes” - household waste and incinerator ash. The provisions of the Convention centre around the following principal aims:

- The reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes, wherever the place of disposal;
- The restriction of transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management; and
- A regulatory system applying to cases where transboundary movements are permissible.

APPSA Lesotho may generate hazardous waste for which there are no disposal or treatment facilities in the country. These wastes would then have to be transported across the border to South Africa for disposal, and APPSA would have to acquire the necessary permits and consents to do this.

The International Treaty on Plant Genetic Resources for Food and Agriculture

This is popularly known as the International Seed Treaty, is a comprehensive international agreement in harmony with Convention on Biological Diversity, which aims at guaranteeing food security through the conservation, exchange and sustainable use of the world's plant genetic resources for food and agriculture, as well as the fair and equitable benefit sharing arising from its use. It also recognizes farmers' rights: to freely access genetic resources, unrestricted by intellectual property rights; to be involved in relevant policy discussions and decision making; and to use, save, sell and exchange seeds, subject to national laws.

International Convention for Protection of New Varieties of Plants

Known as the UPOV, this Convention provides and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society.

3.5 Intellectual Property Rights and Indigenous Knowledge Systems for Lesotho

3.5.1 Intellectual Property Rights

There is a strong need to strengthen the research on horticultural crops as well as protection of intellectual property. Without this protection, industry would be reluctant to invest in agriculture.

Intellectual Property Rights (IPRs) can also bring the food and nutritional security and use of evolved agricultural practices. It may be helpful in maintaining the biological diversity and ecological balance and the livelihood of the poor within the country. Thus, a better understanding of intellectual property by research scientists is needed to increase the pace of research for technological development in horticulture.

Lesotho respects international intellectual property laws, and is a member of several IP bodies which include:

- The African Regional Intellectual Property Organisation (ARIPO)
- The World Intellectual Property Organization (WIPO)
- The African Intellectual Property Organization (AIPO).

The International Convention for Protection of New Varieties of Plants (UPOV) created the *sui generis* system for protection of new varieties of plants. The *sui generis* system is a milder/diluted form of a patent and it accords the legislation of plant variety protection through which breeders, researchers and farmers rights are protected. Lesotho has initiated the procedure for acceding to the UPOV Convention through ARIPO.

Legal structures to protect intellectual property rights are relatively strong in Lesotho. The main IP laws include the Industrial Property Order 1989 (Order No. 5 of 1989) and the Copyright Order 1989 (Order No. 13 of 1989), which, through WIPO, conform to the standards set out in the Paris Convention for the protection of industrial property and Berne Convention for the Protection of literary, scientific and artistic works. However, enforcement is somewhat weak, although infringements and theft are not common.

The local law endeavours to protect patents, industrial designs, trademarks, and grant of copyright, but does not protect trade secrets. Intellectual Property (IP) protection in horticulture can take the form of patents, trademarks, geographical indications, copyrights, plant variety protection, and trade secrets. Each of these different types of statutory IP protection protects a different type of intellectual property and grants different rights to the owner. By using statutory IP protection strategically organizations can make the most of their own IP assets.

The patent regime in Lesotho does not offer very good chances to the horticulture sector. Generally, horticulture development fails to fulfil any of the criteria essential to get patent i.e. novelty, non-obviousness and commercial application. But, if Lesotho would increasingly embrace the patent route in the horticulture sector, the novel ideas and their implementation will attract many of the domestic and foreign companies to invest in this sector.

Development of a new plant cultivar or variety, either by "traditional" breeding methods or by "modern" molecular modification, requires a lot of time and effort. To recover the costs of this research and development, the breeder may seek to obtain exclusive marketing rights for the new variety. Keeping it a trade secret is one way to do this, as well as obtaining a plant patent, utility patent, or plant variety protection. The method chosen depends on the specific benefits and limitations of the protection, and the costs involved. Plant variety protection is a good choice for many breeders. Plant Variety Protection (PVP) is a patent on a sexually propagated plant variety.

3.5.2 Indigenous Knowledge

There are potential risks to livelihoods of resource poor farmers relating to their potential reduced capacity to access and use of locally available genetic resources and indigenous knowledge, and avoiding a dependence on commercial seeds and chemicals and. Locally available genetic resources and indigenous knowledge could be crowded out by the introduction of dominant new varieties or through contamination of the gene pool by uncontrolled release of genetically modified organisms. Another issue is the capacity of resource poor farmers to deal with such risks.

3.5.3 Management Approach

The management of risks related to IP and indigenous knowledge can be achieved through creating a local "IP and Indigenous Knowledge Systems" body or association which will lay down requirements for protection, have screening process with risk assessment guidelines addressing the IP or the indigenous knowledge systems, operational policies, standard operating procedures, training, preventative maintenance, integrated confinement systems, improved public relations and communications. Compliance can be assured through regular audits and reviews, overseen by a Steering Committee that includes stakeholder members.

"IP and Indigenous knowledge systems" council can be an affiliate of the Ministry of Justice or the ministry of The Ministry of Tourism, Sports and Culture. This is because the Law Office is responsible for enforcement of the Industrial Property Order, while the Ministry of Tourism, Sports and Culture is responsible for enforcement of copyright, whilst the Deeds Registry carries out registration.

3.6 Institutional Framework

3.6.1 Department of Environment

In 1994, the National Environmental Secretariat (NES) was established to advise the Government on all matters relating to environment management. It spearheaded the development of Lesotho's Agenda 21 action Plan adopted in 1995. In 1998 the Department of the Environment, which was then part of the Ministry of Natural resources, was merged with NES and the new institution became the lead institution in environmental management. The Department of the Environment then appointed Environmental Units in line Ministries in order to strengthen the coordination of environmental activities. The units received some training in different aspects of environmental management but they are not fully effective because of under staffing.

The Department of Environment's principal responsibility is coordination, monitoring and supervision of environmental conservation activities. It also has a cross-sectoral mandate to oversee the conduct of EIAs through issuance of guidelines, regulations and registration of practitioners. It reviews and approves environmental impact statements in consultation with any relevant lead agencies.

3.6.2 Ministry of Agriculture and Food Security (MAFS)

Ministry of Agriculture and Food Security (MAFS) is responsible for all the agricultural activities in the country. It will be the lead implementing agent for the APPSA through its various departments at Head Office and its District structures. The responsible directorates at head office will be the Directorate of Planning and Policy Analysis (DPPA) and the Directorate of Agricultural Research (DAR) and at district level each District Agricultural officer (DAO) and his team will be responsible.

A Project Implementation Unit (PIU) will be established which will be responsible for overall coordination, supervision and monitoring, while programme activities would be implemented by the private sector, NGOs and Government Agencies on the basis of performance-based contracts.

3.6.3 Other Participating Ministries

The following Ministries have responsibilities that cover areas relevant to the APPSA programme implementation:

Ministry of Finance and Development Planning (MFDP)

The Ministry of Finance and Development Planning is a central coordinating Ministry in charge of reducing poverty levels through increased national and household incomes, economic growth, domestic production, employment, wealth and investment. These are to be attained through formulation of effective development, macroeconomic and fiscal policies and their implementation through best plans and programmes. Thus, it will be the lead agency in charge of the financing mechanism.

Ministry of Forestry and Land Reclamation (MFLR)

Soil and water conservation form the primary responsibility of the Ministry of Forestry and Land Reclamation which has four main departments of Soil and Water Conservation, of Forestry, of Range Management and of National Parks. The Ministry works in close collaboration with the Ministry of Agriculture and Food security, which in addition to sharing responsibility of the broad agricultural sector, links most directly with crop production in the sense that this takes place in soils that need conservation, and to the livestock sub-sector since extensive production takes place in range lands. Thus, it will be important in the agricultural support programmes like catchment conservation and curbing soil erosion.

Ministry of Trade & Industry, Cooperatives and Marketing (MTCIM)

The Ministry of Trade's mandate is to create and maintain a more equitable and enabling environment for industrial, agri-business and commercial development" by formulating and monitoring the implementation of appropriate commercial, marketing and industrial development policies and enforcing supporting legislation amongst other things.

Ministry of Local Government and Chieftainship (MLGC)

The Ministry of Local Government is responsible for creating conditions for sustainable local government, poverty reduction and overall human development in Lesotho. These efforts are anchored on the synergy of policies and programmes for citizens' empowerment and participation, improved management of land and its development, decentralisation of government functions and the pursuit of appropriate rural development technologies. Agricultural activities and conservation works hinge on adequate land use planning, thus the Ministry will be very important in the area of land allocations and reallocations for project purposes at all its various levels of local government down to the villages.

3.7 Gap Analysis Between World Bank Safeguards Policies and Lesotho Legislation

The key world bank Policies of interest are:

- Environmental Assessment OP/BP 4.01
- Pest Management OP 4.09
- Physical Cultural Resources OP/BP 4.11
- Involuntary Resettlement OP/BP 4.12

The following is a discussion of pertinent issues in these key world bank policies compared with the Lesotho Legislation:

3.7.1 Project Classification

The Lesotho legislation classifies projects and activities into three categories, i.e. Category 1 to Category 3 as outlined in table 3-2 below. On the other hand, the World Bank classifies projects into four categories, i.e. category "A" to "C" and the Category "FI". These are outlined in table 3-2 below:

Table 3-2 Comparison of Lesotho and World Bank Project Classification

No.	Lesotho Classification	World Bank Classification
	<p>Category 1: projects under this category are not listed in the Schedule and are unlikely to cause any significant environmental impact and thus do not require any additional environmental assessment.</p> <p>Category 2: projects under this category are listed in the Schedule and are likely to cause environmental impacts, some of which may be significant unless mitigation actions are taken. Such projects cause impacts which are relatively well known and easy to predict. Also, the mitigation actions to prevent or reduce the impacts are well known. From the assessment of the Project Brief the projects are classified as not requiring a full EIS.</p> <p>Category 3: projects under this category are listed in the Schedule and are likely to have significant adverse environmental impacts whose scale,</p>	<p>Category A: A proposed project is classified as Category A, if it is likely to have significant adverse environmental and social impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.</p> <p>Category B: A proposed project is classified as Category 'B', if its potential adverse environmental and social impacts on human populations or environmentally important areas – including wetlands, forests, grasslands and other natural habitats – are less adverse than those of category 'A' projects. These impacts are site – specific, few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for category 'A' projects.</p>

	extent and significance cannot be determined without in-depth study. Appropriate mitigation measures can only be identified after such study. From the assessment of the Project Brief the projects are classified as requiring a full EIS.	<p>Category C: A proposed project is classified as Category C, if it is likely to have minimal or no adverse environmental and social impacts.</p> <p>Category FI: If it involves investment of Bank funds through a financial intermediary in subprojects that result in adverse environmental and social impacts.</p>
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3.7.2 Environmental and Social Assessment Procedures

While Lesotho's EA procedures are generally consistent with the Bank's policies, there are some gaps regarding the screening of subprojects where the sites and potential adverse localized impacts cannot be identified prior to the appraisal of the project. Therefore, under the APPSA the environmental and social screening processes as described in this report will be used. Table 3-3 describes the gap analysis and comparison of World Bank and Lesotho environmental and social assessment procedures.

Independent Reviews of EA work is not specifically provided for under EIA Regulations of Lesotho and as a result the review of ESIA's is commonly reviewed by government agencies, whereas the OP 4.01 provides for a Panel of Experts for Category A type projects;

Table 3-3: Comparison between Bank and Lesotho ESA Procedures

Subject/Issue	World Bank Policy	Lesotho Policy	Solution/mitigation
EIA process	EA is initiated as early as possible in project processing and is integrated closely with the economic, financial, institutional, social, & technical analyses of all proposed projects.	Only projects classified as category 3 require EIS.	EIA should be initiated as early as possible in project processing to inform design of all projects
Independent reviews	OP 4.01 provides for a Panel of Experts for Category A type projects	not specifically provided for under EIA Regulations of Lesotho.	The provisions of OP 4.01 for independent reviews will be applied.

3.7.3 Screening Criteria

The World Bank requires that all projects financed by the Bank are screened for their potential environmental and social impacts to determine the appropriate extent and type of environmental and social work.

To ensure that future small-scale subprojects are implemented in an environmentally and socially sustainable manner the bank has developed an environmental and social screening process for small scale subprojects consistent with OP 4.01.

Table 3-4: Comparison of Screening Criteria Requirements

Subject/Issue	World Bank Policy	Lesotho Policy	Solution/mitigation
Screening Criteria	The Bank's project screening criteria group projects into three categories depending on the severity of impacts: Category A – Detailed Environmental Assessment; Category B – Initial Environmental Examination. Category C – Environmentally friendly.	Only projects classified as category 3 require full EIS	APPSA is classified at Category B under World Bank's screening criteria and is required to prepare an overall ESMF and subproject specific ESMPs.

	ESMF used for screening of subprojects where the sites and potential adverse localized impacts cannot be identified prior to the appraisal of the project.	No Provision for screening of subprojects where the sites and potential adverse localized impacts cannot be identified prior to the appraisal of the project.	APPSA Lesotho will use the environmental and social screening process as described in this ESMF.
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3.7.4 Disclosure Requirements,

Table 3-5, below gives a comparison of the disclosure requirements:

Table 3-5: Comparison of disclosure Requirements

Subject/Issue	World Bank Policy	Lesotho Policy	Solution/mitigation
Disclosure	World Bank requires ESA reports to be: <ul style="list-style-type: none"> disclosed for written comments from the various agencies and government agencies notify the public of the place and time for its review and solicit oral or written comments from those affected 	EIS reports are available for public consumption at EAD upon completion but are not circulated for written comments from the various agencies and public	Upon completion of ESA reports, these must be: <ul style="list-style-type: none"> circulated for written comments from the various agencies and government agencies; notify the public of the place and time for its review; and solicit oral or written comments from those affected.

3.7.5 The Framework Approach

The Lesotho Laws do not provide for the Framework Approach (ESMF and RPF) but rather only, specific instruments (ESIA, ESMP, Environmental Audits). This ESMF prepared for APPSA in line with OP 4.01 will guide the preparation of the specific instruments;

Table 3-6: Comparison of the Framework Approach Requirements

Subject/Issue	World Bank Policy	Lesotho Policy	Solution/mitigation
the Framework Approach	World Bank requires an ESMF, RPF, etc. for projects whose location and design of the Program activities and subprojects, and the magnitude of their impacts are not precisely known at project appraisal stage	Lesotho Legislation does not provide for the Framework Approach but rather only, specific instruments (ESIA, ESMP, Environmental Audits)	This ESMF prepared for APPSA in line with OP 4.01 will guide the preparation of the specific instruments for the sub-projects as and when deemed necessary.

3.7.6 specific instruments

Specific instruments include ESIAs ESMPs, etc. The table below gives a comparison of the requirements for specific instruments:

Table 3-7: Comparison of specific Instruments Requirements

Subject/Issue	World Bank Policy	Lesotho Policy	Solution/mitigation
Specific Instruments: egg Environmental and Social Management Plans (ESMPs)	ESMPs are required for each set of activities (e.g. subprojects) that may require specific mitigation, monitoring and institutional measures to be taken during implementation	In addition to EIS for category 3 projects, no other plans are prepared	ESMPs will be prepared for each subproject to be financed under APPSA and will include specific mitigation, monitoring and institutional measures to be taken during implementation

3.7.7 public consultation requirement,

Table 3-8: Comparison of public consultation Requirements

Subject/Issue	World Bank Policy	Lesotho Policy	Solution/mitigation
<i>Public Consultation</i>	<i>Consultation and Public Notification:</i> Affected persons/communities are provided timely and relevant information, and informed about their options and rights. Consultation with customary landowners and affected persons is essential, and may require their participation in a Social Assessment.	Lesotho Legislations requires Public Consultation but does not emphasis the need for participation and consultation with vulnerable groups.	Consultation Process in this ESMF will guide the consultations for the project. Identification of affected persons must consider vulnerable persons (disabled, women, youth, etc.). Notification periods should allow adequate time to salvage property being removed for the project (i.e. two weeks prior to any construction activity).

3.7.8 health and labour safety requirements,

Issues of occupational health and safety are spelt out clearly in related Acts such as the *Lesotho Labour Code (Amendment)* Act No 3 of 2000, and the Public Health Order No. 12 of 1970, including all issues related to labour influx and sexual harassment. The same issues are explicitly included in the OP/BP 4.01, as part of the environmental and social management. The specific references are included in the Environmental, Health and Safety Guidelines (ESHSG) of WBG Guidelines containing the performance levels and measures that are normally acceptable and that are generally considered to be achievable in new facilities at reasonable costs by existing technology

Table 3-9: Comparison of health and labour safety requirements Requirements

Subject/Issue	World Bank Policy	Lesotho Policy	Solution/mitigation
health and labour safety	OP/BP 4.01 provides for Environmental Health and Safety, including all issues related to labour influx and sexual harassment.	Lesotho Legislation adequately deals with issues of Environmental Health and Safety, labour influx and sexual harassment in such pieces of legislation as the The Public Health Order No. 12 of 1970 The Lesotho Labour Code (Amendment) Act No 3 of 2000	Lesotho Legislation will be applied as far as is possible. Where there are gaps the provisions of OP/BP 4.01 and the Environmental, Health and Safety Guidelines (ESHSG) of WBG

3.7.9 Physical Cultural Resources OP/BP 4.11

Although the chances of affecting any Physical Cultural Resources is small, since the refurbishments will be within the foot print of the existing research centres, the policy was triggered as a precautionary measure for any chance finds of antic relicts. Thus, an Archaeological Chance Finds Procedure is included in the ESMF to address that possibility of archaeological deposits, finds and features becoming exposed during refurbishments.

Table 3-10: Comparison of Physical Cultural Resources Requirements.

Subject/Issue	World Bank Policy	Lesotho Policy	Solution/mitigation
Physical Cultural Resources and chance finds procedures	Physical Cultural Resources (or Heritage): Avoid and mitigate adverse impacts from Bank-assisted projects on physical cultural resources (archaeological, paleontological, historical, architectural, religious, aesthetic or other cultural significance).	Prevent the export of, or damage to, sites of important national historical and cultural heritage.	Chance Finds Procedures (CFP) is included in Appendix 8 and will be included in each site-specific Environmental Management Plan (EMP).

3.7.10 Involuntary Resettlement OP/BP 4.12

under OP 4.12 (Involuntary Resettlement), Lesotho's Land Act is restricted to fair, adequate and prompt compensation (cash), while the World Bank policy requires the need to provide alternative land, resettling the Project Affected Persons (PAPs) to levels or standards of livelihood similar to or better than before compensation. The Lesotho legislation also does not provide for restoration of livelihoods, resettlement assistance and compensation at replacement value. Under circumstances like these regarding short-comings in the Lesotho law on compensation process, the provisions of OP 4.12 shall be applied.

Table 3-11: Comparison of Involuntary Resettlement Requirements.

Subject/Issue	World Bank Policy	Lesotho Policy	Solution/mitigation
Involuntary Resettlement	Involuntary resettlement should be avoided wherever feasible, or minimized, exploring all viable alternative project designs.	Lesotho legislation does not emphasis avoiding involuntary resettlements, but that when this happens, it must be done	The project design will seek to avoid physical and economic displacement. Where such impacts cannot be avoided, best efforts will

		with as little damage as possible.	be made to minimize impacts through design review. Acquisition of land will only be pursued once all viable alternatives have been considered.
	Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.	Lesotho legislation provides for public notification of the intention to take land and allows for objections to be lodged.	Affected persons will be meaningfully consulted throughout the preparation of implementation of resettlement plans. Any severely affected persons will be consulted on the development of mitigation measures for relocation or livelihood restoration.
	Affected land and non-land property is required to be compensated at full replacement cost.	Lesotho legislation provides for 'full and just' compensation for all affected people as the basis for determining the offered value of the affected land.	Compensation will be provided at full replacement cost. For land, compensation will be based on market value plus transaction costs. For structures, compensation will be sufficient to replace the affected structure without depreciation plus the cost of any transaction costs such as registration fees. For non-land property that can be feasibly moved, assistance will be provided to restore the affected property.
	WHO IS ELIGIBLE: WB requires compensation/ assistance to informal land users & occupants ("squatters and encroachers")	Lesotho Legislation does not recognize illegal settlers.	The provisions of OP 4.12 shall be applied where there are short comings in the Lesotho legislation.
	VALUATION: WB requires compensation equal to replacement value of land/assets	The Lesotho legislation also does not provide for compensation at replacement value	The provisions of OP 4.12 shall be applied where there are short comings in the Lesotho legislation.
	BEYOND COMPENSATION: WB requires assistance for restoration of livelihoods (not worse off as result of project	The Lesotho legislation also does not provide for restoration of livelihoods as such.	The provisions of OP 4.12 shall be applied where there are short comings in the Lesotho legislation.
	TIMING: WB requires compensation/assistance provided in full prior to beginning implementation of works	The Lesotho legislation also does not provide for compensation/assistance provided in full prior to beginning implementation of works	The provisions of OP 4.12 shall be applied where there are short comings in the Lesotho legislation.

4 BASELINE ENVIRONMENTAL AND SOCIAL REVIEW

4.1 Introduction

Lesotho is endowed with diverse natural resources, which include some of the most fertile soils, forest and water resources which accommodate diverse species of flora, fauna and fish resources. However, these resources are currently challenged by a complex interaction of several factors which include the rapid rate of population growth of about 21% per annum. This imposes ever intensive pressure on the natural resources utilisation, leading to unsustainable land use, depletion of forest resources, and loss of biodiversity, heavy soil erosion and water pollution.

The following paragraphs review some of the key country's natural resources such as land resources, atmospheric resources, biological resources and water resources as well as the agricultural activities.

4.2 Context

Lesotho is a land locked state in Southern Africa which is completely surrounded by the Republic of South Africa. It is situated approximately between 28° S and 31°S latitudes and longitude 27° E and 30° E. Lesotho is a predominantly mountainous country, with an average altitude of more than 1600 metres above sea level. It covers approximately 30 350 square kilometres and has limited natural resource endowments (GoL, 2006). One quarter of the land is lowlands and the remainder is highlands.

The arable land area is about 9% of the total area and this poses a challenge to expansion of agricultural activities. However, the arable land is susceptible to severe soil erosion. The country has over the years experienced severe deterioration of agricultural land due to a set of natural and manmade factors among which may be pointed out: heavy summer rainfalls usually on bare ground following the vegetation-less winter months, overgrazing on steep slopes in the mountains and foothills. Soil loss through erosion is currently estimated at about 13.2 tonnes per hectare totalling 40,000 tonnes per annum. This loss of topsoil with its higher organic content is also accompanied by loss of nutrients leading to overall impoverishment of land and reduction in the soil horizon.

A mid-1980s study indicated that rangelands comprise about 60% of the land area. Increase in population and poor land husbandry, unsustainable grazing patterns combine with a communal land tenure system to aggravate the problem of soil erosion and loss of fertility. It is estimated that degraded grassland consists of 12% *chrysoma* and 5% shallow rock outcrops and that since the above study degradation is estimated to be increasing at about 2% per annum.

Vegetation is predominantly grassland with less than 1% forest cover of indigenous forests consisting of patches of evergreen trees and shrubs. Firewood supplies over 64% of energy demand in the rural household economy. The resulting shortage of firewood leads to a majority of the population resorting to the use of animal waste and plant residues as alternatives to fuel wood.

Lesotho's economy is based on exports of water and (excess electricity, when available) to South Africa, some manufacturing—in particular textiles and leather goods, agriculture, livestock, and to some extent the earnings—currently declining—of its labourers employed in South Africa. Its people have developed a strong culture of wage employment. According to International Labour Organization (ILO), approximately half of the country's population lives below poverty levels.

Despite the fact that over 85% of the country's year 2005 population of 2,022,331¹, in one way or the other, is dependent upon agriculture and livestock, arable land continues to decline due to soil erosion and rapid encroachment of towns, villages and roads. Lesotho is a persistent net food importer. For instance, during the last five years, up to 65 percent of Lesotho's annual maize requirements and 80 percent of its annual wheat requirements were met through imports. The scope for increasing food production through higher productivity is also extremely limited due to technical and climatic reasons. Given the country's topography, accessibility to many rural locales at best is difficult.

Subsistence farming based on mixed farming of crops and livestock is the most common form of farming on small landholding. There are no farms in Lesotho but rather fields whose average sizes range from 3-4 ha or less. Lately, however, some (small-scale) commercial farming has gathered some momentum. The commercial farmers lease land from these small holders on seasonal/annual or long-term basis. Individual households grow fruit trees such as apples; most fruits however are imported from South Africa. Lesotho's soils are generally of poor quality, and given poor agronomic and management practices, yields of the main staple crops—maize, sorghum and wheat—are declining. Transition to horticulture and high value crops is an important shift to achieve optimal agricultural productivity in Lesotho. The non-arable mountain areas are also rapidly deteriorating because of overgrazing and erosion. The land in Lesotho is the property of the nation in the custody of the king and is allocated free to any adult male. However, this situation is under current review.

Lesotho faces land degradation and environmental and social crisis of massive proportions. This crisis has four major dimensions²:

- Declining self-sufficiency in food;
- Rapid erosion, estimated to total 40 million tons of soil annually. At this rate all topsoil is projected to be lost by the year 2040;
- Acute shortage of wood fuels, significantly continuing deforestation; and
- Expanding populations, current growth annual rate of 2.6% is considered high, and under current trends, Lesotho's population will pass 3.1 million – the maximum that can be fed from Lesotho's lands with high inputs, and assuming no erosion – by the year 2013-2015 AD.

Given the above situation, the existence of the rural population is precarious at the best of times. It has been made even more vulnerable by the increasing frequency of dry spells (and spread of HIV/AIDS). Government sees agricultural research and development as key avenues for increasing agricultural production and household food security. A successfully implemented approach would enable farmers to intensify and diversify their crop production base. Crops identified for diversification include vegetables and fruits such as potatoes, tomatoes, apples, peaches, apricot, plums, cherries and pears and some dry land crops as sorghum. Some international donors are providing technical and funding assistance to mitigate soil erosion, develop water resources and improve livelihoods. However, according to FAO³, externally funded development projects in the past, at best, had very poor outcomes for various reasons.

¹ As of July 2006; See: <http://worldfacts.us/Lesotho.htm>

² Adapted from: S.D. Turner, CARE, April 2003

³ SEE: <http://www.fao.org/docrep/007/ae365e/ae365e00.htm>

4.2.1 Program Locations and Sites

4.2.1.1 Location, Size and Extent of Lesotho

Lesotho is a land locked state in Southern Africa which is completely surrounded by the Republic of South Africa. It is situated approximately between 28° S and 31°S latitudes and longitude 27° E and 30° E. Lesotho is a predominantly mountainous country, with an average altitude of more than 1600 metres above sea level. It covers approximately 30 350 square kilometres and has limited natural resource endowments (GoL, 2006). Lesotho's highlands constitute two-thirds of territory; less than 10% of which is suitable for cultivation.

Lesotho has a population of 2.2 million growing at an average rate of 21% per annum, mainly with a literate but largely unskilled labour force.

4.2.1.2 Possible District Profiles

The possible project areas will be in three (3) of the major agro-ecological zones of Lesotho: (i) highlands, (ii) foothills and (iii) lowlands (southern and northern, and central lowlands). These areas are characterised by a mixture of sandstone hills with extensive basaltic outcrops dominated by pillow lavas. The sandstone hills are flanked by deeply incised valleys with erosion encroaching arable land. flat portions of the valleys are suitable for agriculture. The valleys are typically of the rich black soils from the weathering of the basalts and some perennial streams flow down the hills.

Soil and water conservation measures and range management characterise these districts which are the driest in the country and have the greatest need for soil and water conservation. Soil erosion is a major problem especially in the lowland zones. Lateral expansion of gullies (dongas) is reducing the area of cultivable land while sheet erosion is reducing the productivity of the land. It is estimated that the percentage of arable land suffering from severe erosion is in the region of 46% (BIPP, 2004).

4.2.1.3 Potential Project Sites

In Lesotho, the project is being proposed to be implemented at the Department for Agricultural Research's (DAR) research stations. DAR falls under the Ministry of Agriculture and Food Safety (MAFS). DAR has a total of 13 research stations and field trial stations across the country (see Table 4-1).

Table 4-1: Research and Field Trial Stations Across all Agro-Ecological Zones

No	Station	District	Agro-ecological zones	Crops
1	Maseru	Maseru	Main RCoL station- central lowlands	Fruits Tree ⁴ , Vegetables, Potato
2	Nyakosoba	Maseru	Field Trial Station- foothills	Fruits Tree, Vegetables, Potato
3	Mahobong	Leribe	Regional Station - Northern lowlands	Beans, Fruits Trees, Potato
4	Mokhotlong	Mokhotlong	Regional-station- mountains	Seed Potato, Fruit trees
5	Sakoane	Berea	Field trial -Lowlands	Sorghum, Beans, Vegetables
6	Machache	Maseru	Field trial - foothills	Fruits Tree, Vegetables, Potato
7	Siloe	Mohales'Hoek	Regional Station – Southern lowlands	Sorghum, Beans, Fruits Tree

⁴ Fruits tree (Apples, Peaches, Apricot, Plums, cherries and Pears)

No	Station	District	Agro-ecological zones	Crops
8	Tsifa-li-mali	Leribe	Field trial station - lowlands	Beans, Fruits Tree, Sorghum
9	Thaba Tseka	Thaba Tseka	Field Trial Station - Mountains	Fruits Tree ⁵ , Potato
10	Molumong	Mokhotlong	Field Trial Station- Mountains	Fruits Tree ⁶ , Potato
11	National University of Lesotho (NUL)	Maseru	Field Trial Station - Central lowlands	Vegetables, Potato, Beans, Sorghum
12	Lesotho Agricultural College (LAC)	Leribe	Field Trial Station – Northern lowlands	Beans, Fruits Tree, Potato
13	District Agricultural Office (DAO)	Mafeteng	Field Trial Station – Southern Lowlands	Sorghum, Beans, Fruits Tree ⁷

Out of the total of 13 locations, APPSA will provide financing for rehabilitation and upgrading of 8 regional and field trial stations to prioritize the limited resources available under APPSA. Table 4-2 and Figure 4-1 below provides the list of stations that will be covered under APPSA.

Table 4-2: Research and Field Trial Station to be supported by APPSA

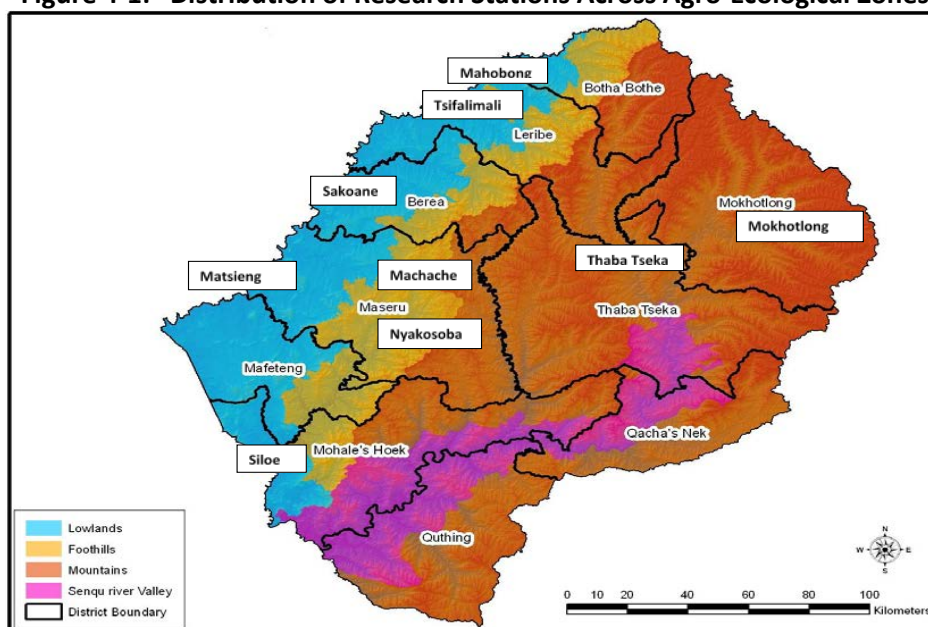
No	Station	District	Agro-ecological zones	Crops
1	Maseru	Maseru	Main RCoL station- Central lowlands	Fruits Tree, Vegetables, Potato
2	Nyakosoba	Maseru	Regional Station- Foothills	Fruits Tree, Vegetables, Potato
3	Mahobong	Leribe	Regional Station - Northern lowlands	Beans, Fruits Trees, Potato
4	Mokhotlong	Mokhotlong	Regional-station- mountains	Seed Potato, Fruit trees
5	Siloe	Mohales'Hoek	Regional Station – Southern lowlands	Sorghum, Beans, Fruits Tree
6	Sakoane	Berea	Field trial -Lowlands	Sorghum, Beans, Vegetables
7	Machache	Maseru	Field trial - Foothills	Fruits Tree, Vegetables, Potato
8	National University of Lesotho (NUL)	Maseru	Field Trial Station - Central lowlands	Vegetables, Potato, Beans, Sorghum
9	Lesotho Agricultural College (LAC)	Leribe	Field Trial Station – Northern lowlands	Beans, Fruits Tree, Potato
10	District Agricultural Office (DAO)	Mafeteng	Field Trial Station – Southern Lowlands	Sorghum, Beans, Fruits Tree

⁵ Fruits tree (Apples, Peaches, Apricot, Plums, cherries and Pears)

⁶ Fruits tree (Apples, Peaches, Apricot, Plums, cherries and Pears)

⁷ Fruits tree (Apples, Peaches, Apricot, Plums, cherries and Pears)

Figure 4-1: Distribution of Research Stations Across Agro-Ecological Zones



4.3 Biophysical Baseline

The following paragraphs review some of the key country's background information on environmental and social issues as regards the agriculture system.

4.3.1 Topographical Features

Three distinct geographical regions, demarcated by ascending altitude, extend approximately north-south across Lesotho. The western quarter of the country is a plateau averaging 1,500–1,850 m (4,900–6,100 ft). The soil of this zone is derived from sandstone and, particularly in the westernmost region, is poor and badly eroded. The remainder of the country is highland. A zone of rolling foothills, ranging from 1,800–2,200 m (5,900–7,200 ft), forms the border between the lowlands and the mountains in the east.

The Drakensberg Range forms the entire eastern and south-eastern border. A spur of this range, the Maluti Mountains, runs north and south. Where it joins the Drakensberg Range there is a high plateau ranging from 2,700–3,200 m (8,900–10,500 ft) in elevation. The highest point is Thabana Ntlenyana, 3,482 m (11,425 ft), in the east. The rich volcanic soils of the foothills and mountains are some of the best in the country.

The sources of two of the principal rivers of South Africa, the Orange and the Tugela, are in these mountains. Tributaries of the Caledon River, which forms the country's western border, also rise here. The Orange and Caledon rivers, together with their tributaries, drain more than 90% of the country.

The mountain zone in Lesotho covers approximately 65% of the total land area at elevations ranging between 2 300 and 3 480 metres above sea level. This land is mostly characterised by steep slopes with fragile soil formations which are extensively degraded. The most notable feature of Lesotho's environmental degradation is the extensive soil erosion, with gullies (or dongas) and surface sheet erosion being widespread. This is not only attributable to natural factors such as the rugged mountainous terrain, erodible soils and erratic rainfall, but also to anthropogenic activities like overstocking and overgrazing of rangelands, poor agricultural practices and biomass removal.

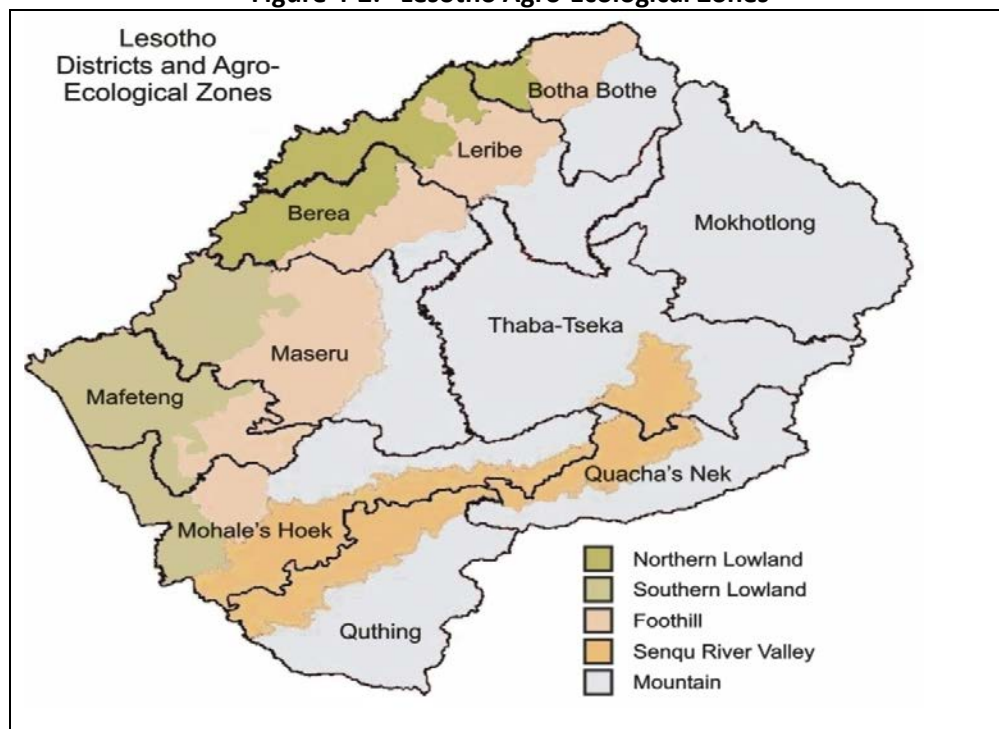
Most of the rural inhabitants keep livestock which graze freely on communal land. This system does not encourage environmentally friendly grazing like rotation, but results in overgrazing and total removal of bio-mass leaving bare and vulnerable terrain.

Only 10% of Lesotho's land is arable and over 80% of this is found in the lowlands, where it is not used for agriculture but for other purposes such as housing. Most of the poor rural folks are forced to plough on marginal steep slopes which have resulted in soil erosion that has seen Lesotho lose 40 million tonnes of top soil per year. This has resulted in the formation of deep gullies.

4.3.2 Agro-Ecological Zones

Lesotho has 4 agro-ecological zones namely Northern and Southern Lowlands; Foothills; Highlands (Mountains) and Senqu River Valley (Figure 4-2). DAR maintains its headquarters in Maseru as the RCoL station with regional research stations representing 3 of the major agro-ecological zones of Lesotho: (i) highlands, (ii) foothills and (iii) lowlands (southern and northern, and central lowlands) together with 6 sub-stations or otherwise referred to as field trial stations. APPSA Lesotho will cover all agro-ecological zones.

Figure 4-2: Lesotho Agro-Ecological Zones



- i) **The Northern Lowlands** The northern and central lowlands are characterized by large deposits of rich volcanic soils and cover the western part of the country and occupy about 2,500 km² which is 8% of the total surface area. This region is a narrow strip of land extending at some places just 10km from the border to 60 km at some places and it lies between 1400 m and 1,800 m above sea level.

The Southern Lowlands The southern or lowlands are characterized by poor soils and low rainfall and cover the western part of the country, occupying about 2,700 km² which is 9% of the total surface area.

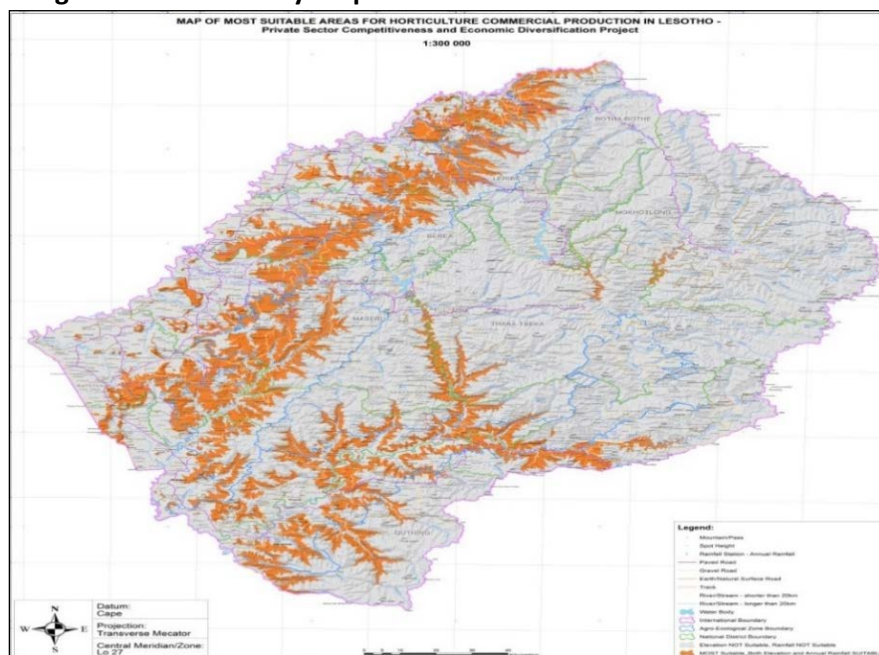
In general, the lowland soils are the duplex type which are prone to erosion, and have poor moisture retention capacity. They are thus liable to rapid loss of fertility.

- ii) **The Foothills**, on the other hand, consist of very fertile land that is associated with high agricultural productivity. The foothills are defined as the area between the lowlands and the highlands and occupy an estimated area of about 4,600 km² which lies between 1,800 m and 2,000 m above sea level and forms 15% of the total land area. The foothills enjoy cooler temperatures, making them suitable for growing fruit trees. They also have a higher rainfall than the lowlands, and springs feed into perennial rivers giving opportunity for simple technologies for irrigation.
- iii) **The Senqu River valley** forms a narrow strip of land that flanks the banks of the Senqu River and penetrates deep into the highlands, reaching lower parts of the main tributaries of this river. This region covers 9% of the total surface area. The soils of the Senqu River valley vary from rich especially in the alluvial bottom zones, to very poor along the slopes of the valley. Being in the rain shadow of the Drakensberg makes this the most unproductive region in the country.
- iv) **The Mountains** constitute the largest ecological area which covers an area of 18,047 km². This region has been extensively dissected by the headwaters of the Senqu River and its tributaries which drain in a north-south direction, and, which together with an extensive network of mountain wetlands, today forms an important segment of the Southern African region's water resources. The drainage pattern of the highlands or Mountain region has produced deep river valleys, gorges, and gullies that, in general, make human life very difficult.

The region forms the main livestock grazing area in the country. Although the soils are much less susceptible to erosion compared with the low lands, inadequate cover teams up with the steep slopes, to create torrential rains that result in massive erosion in this zone. The importance of proper range management can therefore not be overstated.

Figure 4-3 below depicts the areas that are suitable for Commercial Horticultural Production in Lesotho.

Figure 4-3: Suitability Map for Commercial Horticultural Production



Source: World Bank PSCDP

Table 4-3: Agro-Ecological Characteristics and Production Opportunities

Description	Lowlands	Foothills	Mountains	Senqu river valley
CHARACTERISTICS				
Area - sq. km. *1	5,200 (17%)	4,588 (15%)	18,047 (59%)	2753 (9%)
Altitude range (m)	< 1,800	1,800-2,000	2,000-3,250	1,000-2,000
Topography	Flat to gentle rolling	Steeply rolling	Very steep bare rock, outcrops and gentle rolling valleys	Steeply sloping
Soils	North: Sandy, textured, red to brown South: Clayey	Rich, alluvial along valleys, thin and thick rock on slopes	Fragile, thin horizon of rich black loam except in valley bottoms	Calcareous clayey, red soils with poor penetration by rainfall
Climate	North: Moist South: Moderately dry	Moist, sheltered	Cold & moist	Higher rainfall Dry
Risks	Parching sun; strong winter winds; hail; droughts; High soil erodibility.	Flooding; high soil erodibility	Long period of frost, snow, hail, high soil erodibility	Severe drought, moderate soil erodibility
Vegetation	Crop stubble, reforestation on some hills fruit trees ear homesteads	Poplar and willow trees along streams and gullies, crop stubble fruit trees near homestead	Denuded grassland, indigenous shrubs in some river valleys, stunted peach trees near homesteads	Denuded & dry, shrubs, brush, few fruit trees in valleys

Source: GoL, 2010

Table 4-4: Agro-Ecological Characteristics and Production Opportunities

Description	Lowlands	Foothills	Mountains	Senqu river valley
CHARACTERISTICS				
Area - sq. km. *1	5,200 (17%)	4,588 (15%)	18,047 (59%)	2753 (9%)
Altitude range (m)	< 1,800	1,800-2,000	2,000-3,250	1,000-2,000
Topography	Flat to gentle rolling	Steeply rolling	Very steep bare rock, outcrops and gentle rolling valleys	Steeply sloping
Soils	North: Sandy, textured, red to brown South: Clayey	Rich, alluvial along valleys, thin and thick rock on slopes	Fragile, thin horizon of rich black loam except in valley bottoms	Calcareous clayey, red soils with poor penetration by rainfall
Climate	North: Moist South: Moderately dry	Moist, sheltered	Cold & moist	Higher rainfall Dry
Risks	Parching sun; strong winter winds; hail; droughts; High soil erodibility.	Flooding; high soil erodibility	Long period of frost, snow, hail, high soil erodibility	Severe drought, moderate soil erodibility
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Source: GoL, 2010

4.3.3 Vegetation Types and Associated Habitats

Grass is the natural vegetation in this virtually treeless country, with less than 1% forest cover of indigenous forests consisting of patches of evergreen trees and shrubs. The high plateau is covered with montane or subalpine grassland. Red oat grass forms a dry carpet in much of the Drakensberg foothill region.

Even with less than 1% forest cover, firewood supplies over 64% of energy demand in the rural household economy. The resulting shortage of firewood leads to a majority of the population resorting to the use of animal waste and plant residues as alternatives to fuel wood.

The possible project area, in the lowlands and the foothills, have large areas of shrub lands, in particular rangelands, and a very modest area of plantation forests (mostly based on *Eucalyptus* and *Pinus*). In a few almost inaccessible areas, very small patches of Afromontane Forest are preserved. During the 1990s the number of conservation areas increased from two to seven, but only an exceedingly small percentage of land area (0.4 %) remains protected. Lesotho also has “sustainable use” areas which occupy 6.9% of the land area mainly in the rangelands (UNDP, 2007). However, many forest areas have been cleared for agricultural use, exacerbating the problem of soil erosion.

Lesotho, as a country, however has a high degree of botanical diversity. As many as 2,000 species of plants have been recorded in Lesotho, including such as the unique *Peridophytes* as *lycophyte* with secondary growth *Isoetes welwitschii* and two species of *Ophioglossum*, *O. vulgatum* and *O. polyphyllum*. Among the flowering plants these are: *Euphorbia clavarioides*, *Euphorbia pulvinata* (known only from Quthing area), *Aloe polyphylla* (endemic to Lesotho), *Guthreia capensis* (endemic to Lesotho), *Dais cotonifolia* (known from Berea district only), *Aponogeton ranunculiflorus*, *Salix mucronata* (indigenous willow), *Leucosidea sericea* (important species), *Helichrysum palustre* (endemic to Lesotho), and *Helichrysum quthlambanum* (only in Butha-Buthe district).

There is limited information relating to trends in biodiversity in Lesotho. However, it is assumed that the number of threatened species may have increased over time (UNDP, 2007). The threatened species have been estimated at 94, with eight of them being critically endangered; four endangered; fourteen vulnerable while the remaining sixty are not sufficient (UNDP, 2007). The Government has responded by initiating a number of conservation projects like the Maloti-Drakensburg Trans-Frontier Conservation and Development Project which focus on biodiversity conservation and nature-based tourism.

The list of protected flora under the Historical Monuments, Relics, Flora and fauna Act (1967) has been increased from thirteen in 1969 to thirty-one in 2004. The new list covers all species that are already threatened or are being used by individuals for economic gains.

Some groups like algae and fungi have not received adequate attention. In addition, there are other plant species of concern, which are not physically protected even though they are protected by law. Lack of law enforcement and low fines has led to declining populations of these (and other important) species. *Aloe Polyphylla*, spiral aloe is an endemic plant that is also facing extinction. The exploiters are selling it to tourists and the public.

The country is full of mountains, and mountains are known centres for endemism. For example, with the altitudes ranging from 2,300 and 3,400 m, Drakensberg⁸ Mountains forms an important centre for endemism as well as speciation. The Drakensbergs are thought to be some of the oldest mountains in the world and are in the centre of a continent rather than at continental edges. The Mountains are an international 'hot-spot' of plant biodiversity, not only of vascular plants (over 2200 species in an area of about 40,000 km², but also of bryophytes.

The government's policy towards biodiversity is very emphatic in protecting wild genetic resources although the means of implementation are very limited because of the communal use of land resource in the country. The high risk of losing valuable indigenous plant resources due to forest clearance, collecting of firewood and medicinal plants is a serious problem in Lesotho. Furthermore, there is rapid replacement of traditional varieties by the high yielding hybrid varieties. Cropland races and threatened plant Species should be the priority for future collecting missions in Lesotho.

4.3.4 Fauna

The country's small size, high elevation, and limited range of habitats restrict the variety of fauna. The African lammergeier, a bird common in the mountains of Ethiopia but nowhere else in Africa, and the bald ibis, both of which are near extinction, are found in small numbers in the Drakensberg Range. As of 2002, there were at least 33 species of mammals, 123 species of birds, and over 1,500 species of plants throughout the country.

4.3.5 Water Resources

Lesotho is known to have abundant water, some of which is being sold to neighbouring South Africa through the Lesotho Highlands Water Project (LHWP). However, the distribution of water in the country is disproportionate owing to rainfall and other physical factors. The highlands receive more rainfall than the lowlands where most of the people reside. A FAO study estimates surface water resources at 4.73 km³ /year—far in excess of the country's requirements, and the groundwater resources estimated at 0.5 km³ /year. Aquifer yields are low, usually less than 1 litre/second.⁹

Surface water occurs in dams, springs, rivers and wetlands. Groundwater is also an important source of water particularly for rural populations where the supply system is typically hand pumps or small-piped systems using water from springs or boreholes.

Wetlands are also very important as they are important groundwater recharge points and also control flooding, erosion and water quality. A variety of medicinal plants and grass for thatching grow in these wetlands.

In general, the provision of clean water rose from 52% to 63% in the 1990s (GoL, 2006) on a national scale, but the situation has been steadily deteriorating in the peri-urban areas, especially with number of people per collection point. So, there is a critical shortage of water supply to potential development sites like industries and factories. This is hampering production and has ripple effects to primary sectors like agriculture, which then can't produce.

⁸ The Drakensberg Mountains (28°30' – 31°20'S, 27°00' – 29°40'E) form a 300-km border between the landlocked mountain kingdom of Lesotho (formerly Basutoland; = Mountain Kingdom) and South Africa. The area was called Drakensberg ('Dragon Mountain') by the early Dutch settlers (Voortrekkers) because of its resemblance to the ridges of a dragon's back. The steep ridges of its dragon-like back are formed by headwater erosion of rivers that separate the Highveld Plateau from the coastal lowlands of southern Africa.

⁹ FAO, 1995. *Aquastat: FAO's information system on water and agriculture: Lesotho*: <http://www.fao.org/ag/agl/aglw/quastat/countries/Lesotho/index.stm>

In the context of the farming, water resources can be viewed from three perspectives: the precipitation that feeds crops; groundwater that supplies domestic needs from springs, and reticulated water supplies; and rivers that feed some larger reticulation schemes and provide the potential for irrigation. Taking the water balance into account, the overall water output for Lesotho is estimated at 159.53 m³ per second¹⁰. Ironically, in spite of the abundance of water, from the people's perspective, the domestic dimension of water resources is still a constraining feature of their livelihood context; the population has cited scarce, undependable, and unclean water as significant problems, according to the studies done by Water and Sewage Authority (WASA) and others in Lesotho.

The overall potential for irrigation in Lesotho is generally considered to be modest, because of topography and soil distribution relative to the position of suitable rivers. However, micro-irrigation and water conservation techniques at the scale of the individual field or homestead garden offer good potential. The government is also proposing major interventions to improve irrigation technologies for improving agriculture production.

4.3.6 Geology

Table 4-5 below provides a summary of the geological formations of Lesotho, while Figure 4-4 depicts the country's geology.

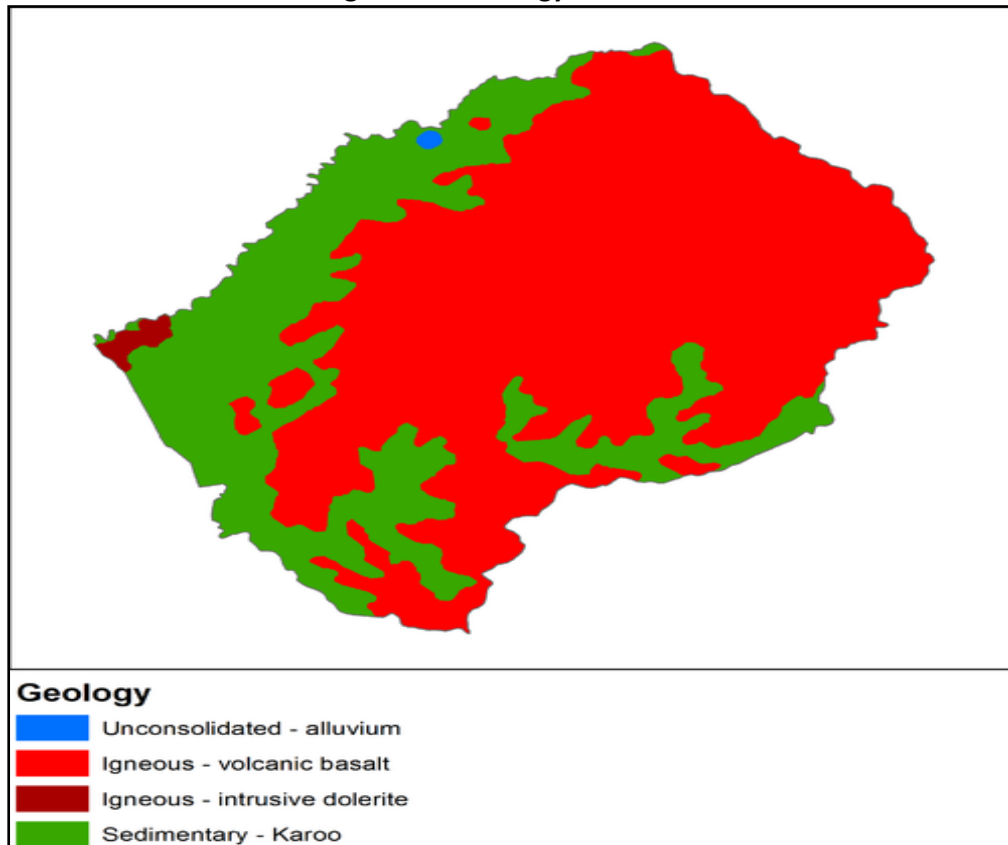
Table 4-5: Geological Formations of Lesotho

Key Formations	Period	Lithology	Structure
Igneous - volcanic			
Lesotho Formation (Drakensberg Group)	Jurassic	Massive basalts which overlie the sedimentary rocks of the Karoo Group.	Reaches thickness of 1600m at Mount-aux-Sources in the north of Lesotho (Schmitz and Rooyani 1987).
Igneous - intrusive			
Dolerite intrusions	Jurassic	Numerous dykes cross the country in two dominant directions: NW-SE and NNE-SSW. Most dykes are near vertical, plate-like bodies, but some dip as shallowly as 60° (Schmitz and Rooyani 1987). Some dykes cut across all geological formations and others die out within the basalts. Sills (plate-like, near-horizontal intrusions) occur in older Karoo sedimentary strata, especially in the southwest of Lesotho.	
Sedimentary – Karoo			

¹⁰ TAMS Consultants and Associates. 1996. Water Resources Management: Policy and Strategies Study: Executive Summary, Final And All Annexes Reports For Lesotho Government.. Maseru, Lesotho: Ministry of Natural Resources.

Clarens Formation (Cave Sandstone) (Stormberg Group)	Late Triassic to Early Jurassic	<p>This is the youngest sedimentary formation underlying the basalts of the Jurassic Lesotho Formation. It occurs across the central and eastern parts of Lesotho but crops out only in central Lesotho and in major valleys within the Lesotho Formation. The sandstones are of aeolian origin. Generally pale white and cream coloured, although darker beds occur. The formation can be subdivided into three zones:</p> <ul style="list-style-type: none"> Zone I: thickly to very thickly bedded, light brown and light red, very fine-grained sandstone, silty sandstone and sandy siltstone. Zone II: alternating beds of massive and cross-bedded sandstone. Zone III: massive to very thickly bedded, very fine-grained sandstone to massive silty sandstone, sandy siltstone and siltstone. 	Thickness from 15 to 250m. Outcrops in the form of plateaux in the lower foothills and as cliffs overlooking the lowlands.
Elliot Formation (Red Beds) (Stormberg Group)	Late Triassic to Early Jurassic	<p>Underlies the Clarens Formation and characterised dominantly by red and purple mudstones and shales and medium to fine grained sandstones.</p> <p>The strong red and purplish coloration differentiates it from the underlying Molteno Formation and from the white and cream coloured overlying Clarens Formation. The transition from the underlying Molteno Formation to the Elliot Formation is gradual, indicating continuous sedimentation.</p>	Thins from a maximum of 250m in the south to 15m in the north.
Molteno Formation (Stormberg Group)	Late Triassic to Early Jurassic	White arkosic grits and gritty sandstones, mainly pebbly, with occasional thin shaly sandstones and bluish mudstone (Schmitz and Rooyani 1987). The Molteno Formation underlies the whole of Lesotho and outcrops in the lowlands, where it comprises up to 50m of massive, coarse sandstone.	Thins out northwards (Schmitz 1984): from 35m in the north to 150m in the south.
Burgersdorp Formation (Beaufort Group)	Mid Permian to Lower Triassic	Green, purple and red shales and mudstones with some buff sandstone; occasional carbonaceous shales with thin coal seams; some ferruginous concretion beds. Only the uppermost part of this formation is exposed in Lesotho, with its maximum exposed thickness in the Mohokare (Caledon) River Valley in the extreme western part of Lesotho (UNDP 1984).	Maximum exposed thickness of 200 to 250m

Figure 4-4: Geology of Lesotho



4.3.7 Soils

Most of the program area's soils are derived from sandstone or shale. Soils, with both management and inherent fertility problems, influence the productivity of both arable land and rangelands. In the project areas, maize dominates cropping. However, yields (per hectare) are low due to poor soil fertility and poor management, leading to a declining trend over the years. As across Lesotho, soil erosion and land degradation is also a major concern in the project area. Even to a casual observer, many areas in each of the project districts, look eroded and worn out. Gullies scar the landscape, and in many places the surface of the soils is crusted and hard.

Lesotho soils are mostly of alluvial, colluvial or eolian of either sedimentary or basaltic origin. Those derived from sedimentary rocks are more common in the lowlands and those from basalt and dolerite are predominant in the mountains. However, mixtures and variations occur throughout the country. Most soils in the flatter and gently sloping areas tend to be moderately deep to deep, and well drained, whilst those of the mountain slopes tend to be more shallow and stony. The principal arable soils of the lowlands and foothills are yellowish red to yellowish brown loams with sandy loam topsoil. They are moderately fertile and slightly acidic and are prone to wind and water erosion.

Most Lesotho soils are classified as belonging to *Oxisols*¹¹. These are characterized by soil erosion,¹² low pH, and extreme deficiency of Phosphorus, physical problems such as difficult land topography, and the impacts of the environmentally degrading soil degradation. Soil degradation is a two-stage process. Initially, organic matter-rich surface horizons are removed leading to diminished nutrient supplying capabilities, water holding capacity, biodiversity, and aggregation. In the more deeply eroded phases, such as in many areas of Lesotho, soil water storage capacity is a limiting factor due to shallow soil depth.

Soil conservation touches many rural households since it provides major employment: Over grazing, and bad farming practices have significantly contributed to soil deterioration, and the traditional agricultural system lacks many soil-conserving elements—broadcast of grains, dispersed rotational grazing, grassland surrounded agricultural fields.

4.3.8 Climatic Conditions

The climate is harsh, with temperatures varying from -10 degrees Celsius (in winter) to 30 degrees Celsius (in summer) in the lowlands. In the highlands winters are more severe, with heavy snowfalls that often cut off access to most of the mountain settlement. The climate can be classified as continental and temperate, with four distinct seasons: spring, summer, autumn and winter. The summers often have high temperatures and precipitation due to the position of the Inter-tropical Convergence Zone (ITCZ) i.e. being south of the equator. In winter, the presence of high-pressure results in clear skies, dry air, and warm temperature during the day, but becomes colder after sunset.

The highlands areas experience severe winters, with ground frost in few areas up to 200 days a year. The winter's severity along with the area's topography, limit the scope of crop production and its diversity. The mountainous regions receive snow during the unusually cold winters. In Lesotho January is normally the hottest month of the year with average temperatures in excess of 30°C being recorded in the lowlands. The coldest period is between June and July with an average of 8°C. Temperatures in excess of 35°C have been recorded particularly during droughts. For example, 39.4°C was recorded in Maseru in January 1973. Low temperatures in the highlands are indicative of the effect of altitude on temperature e.g. a rare lowest of -20.4°C was recorded in the highlands in 1967.

As the table shows, the temperature in Lesotho varies from place to place according to altitude and decreases with increasing elevation. The country exhibits marked seasonality, where even the lowlands fluctuate around 30 to 5°C. The country can be divided into four ecological regions. Table 4-6. provides key climate characteristics for the regions. On the whole, Lesotho's climatic conditions are optimal for the annual cultivation of most temperate zone crops, including maize, sorghum, wheat, beans, peas, vegetables and fruits.

Table 4-6: Key Climatic Characteristics for the Four Regions

¹¹ *Oxisols* are very highly weathered soils that are found primarily in the intertropical regions of the world. These soils contain few weatherable minerals and are often rich in Fe and Al oxide minerals. Most of these soils are characterized by extremely low native fertility, resulting from very low nutrient reserves, and high phosphorus retention by oxide minerals, and low cation exchange capacity (CEC). Most nutrients in Oxisol ecosystems are contained in the standing vegetation and decomposing plant material. Despite low fertility, Oxisols can be quite productive with inputs of lime and fertilizers.

¹² A 1979 study argued, "ten of the 25 soil series described for Lesotho are classified as highly erodible, but most of the gully erosion (dongas) actually occurs in the duplex or clay pan soils. Also, much of [the crop land] is so highly eroded that it should be returned to permanent cover with only very limited grazing permitted. See Turner, 2003 op cit

DESCRIPTION	LOWLAND	SENQU RIVER VALLEY	FOOTHILLS	MOUNTAINS
Annual rainfall (mm)	600 - 900	450 - 600	900 – 1,000	1,000 – 1,300
Temperature (°C)	-11 - 38	-5 - 36	-8 - 30	-8 - 30
Average Temperature (°C)	17	16	14	13

Rainfall

In Lesotho, precipitation is characterized by fluctuating trends, with high variability from year to year. The reliability of rainfall (and distribution of water) is a serious constraint on agricultural production. Rainfall, the bulk of which, as much as 85% of the total, falls between October and April—but there is normally no month that has less than 12 mm—varies from about 700 mm to 1,000 mm depending on location. Rainfall is also (highly) variable both between years and locations. Droughts are common. Key characteristics related to rainfall in Lesotho are:

- The seasonal distribution of precipitation varies considerably and thus the danger of rain falling at the wrong time, or falling too hard, or not falling at all when it is needed, is always present even if total rainfall has been adequate;
- Extreme weather conditions occur periodically; droughts are said to occur three years out of every ten, heavy frosts are frequent and heavy unseasonable rains also occur from time to time; and
- Not just the geographical distribution of precipitation, but also the fact that water does not always collect in places where it is immediately accessible for agriculture constitutes a problem; this makes it necessary to build, for example, conveyance infrastructures.

The spatial and temporal distribution of rainfall in each growing season is highly variable, and its value for crop production is further degraded by various factors. These include heavy storms that limit infiltration and increase runoff and erosion, and hail that damages or destroys crops. Out of season frosts can damage crops anywhere in the country, they are a particular hazard in the mountains, where the growing season is short, and frost can occur in mid-summer. Heavy snowfalls in the mountains often limits grazing, sometimes leading to widespread livestock mortality. However, it is the variable character of the rainfall regime, and the destructive nature of some precipitation events, that are more significant for livelihoods than the long-term average rainfall figures, which of themselves are adequate for a variety of dry land crops.

The river discharge statistics shows that most of the rainfall is lost in the form of run-off. Taken as a whole, rainfall in Lesotho is at a level that is adequate to sustain healthy agricultural activity; however, the erratic nature of its distribution, unpredictable droughts and poor management are major constraints for food production. The country has two cropping seasons, the summer season (September – April) and the winter season (May – July) in the past few years, rainfall has been erratic in both cropping seasons causing rain fed crops to yield less and less. The following table indicates the rainfall over the past ten years.

Table 4-7: Rainfall

Year	Berea	Botha-Bothe	Leribe	Mafeteng
2000	845	1188.4	879.9	887.4
2001	710.48	805.9	771.8	1159.9
2002	716.1	773.4	859.2	894.4
2003	450.8	588.7	591.8	507.2
2004	590.9	755.4	700	471
2005	806	781	842.5	595.6
2006	986.1	1147.3	992.3	937.3
2007	643.2	758.6	738.4	544.2
2008	534.3	791.8	581.6	627.4
Normal	706.1	846.6	784.8	701.6

Source: Lesotho Meteorology Services

4.4 Socio-Economic Baseline

4.4.1 Political and Civil Administration

Lesotho is a constitutional monarchy, with the King as Head of State, the Prime Minister as Head of Government and a dual legal system – consisting of traditional customary law and the common Law. The legislative branch is bicameral with a 120-seat member Parliament and a 55-seat Senate of which 22 are permanently held by principal chiefs and 11 other senators who are appointed to represent the wider interests of society. The judiciary, which is the arm of Government headed by a Chief Justice, consists of the Court of Appeal, as the highest court, the High Court, Magistrates' Courts, and the local courts. While the country's nascent democratic institutions are gradually evolving, its political stability and tolerance have been frequently tested. Although political stability has been achieved through the adoption of a relatively more inclusive electoral system as of 2003, strengthening the democratic institutions and culture remains a challenge to the country.

4.4.2 Population and Demographic Conditions

The population of Lesotho in 2017 was estimated at 1,958,042¹³. The population is currently at 2.2 million growing at an average rate of 0.28% per annum. Approximately 5% of the population was over 65 years of age, with another 19.5% of the population under 15 years of age. Approximately 28% of the population live in the urban areas, some 70% of the total population lives in the fertile lowlands, where the land can be most readily cultivated; the rest are scattered in the foothills and the mountains. The population density in the western half of the nation is relatively higher, with the capital of Maseru, and the smaller cities of Mafeteng, Teyateyaneng, and Leribe attracting the most people. About 35% of the youth are unemployed.

The prevalence of HIV/AIDS has had a significant impact on the population of Lesotho, and the prevalence rate in 2016 was estimated at 25%. The AIDS epidemic causes higher death and infant mortality rates and lowers life expectancy, which is estimated at 53 years (2017).

Literacy rate for the total was estimated at 79.4% in 2015 (70.1% for males and 88.3% for females).

4.4.3 Land Tenure and Land Use

4.4.3.1 Land Tenure

Most land in Lesotho is allocated and held under customary tenure. Traditionally, use rights for residential and crop lands were allocated by a hierarchy of traditional authorities to household heads who then passed this on mainly to their male heirs. Grazing lands and forests and other communal resource areas were used and managed under the administration of traditional authorities on behalf of the king. However, over the past three decades there has been a gradual introduction of new land administration and management institutions that have sometimes resulted in ambiguities and contestations between different administration and management authorities.

With regard to the administration and management of residential and crop lands, the 1973 Land Administration Act introduced a "Form C" which regulated and documented the granting of land by the chiefs to individuals. The 1979 Land Act abolished Form Cs and provided for their conversion to leasehold. Legislation in the early and mid-1980s transferred responsibility for allocation of residential and crop lands in rural areas from the chiefs, first to Village Development Committees (VDCs), then to District Development Committees (DDCs). In addition to leasehold a new set of Certificates were introduced. Records of these were to be kept by VDCs and then DDCs. Leasehold

¹³ <https://www.cia.gov/library/publications/the-world-factbook/geos/lt.html>

records are meant to be kept in the national cadastre although Districts also keep records. Under the 1979 Land Act, Chiefs were made the chairmen of VDCs but the 1994 Development Councils (Amendment) Act required that VDC chairs be elected. Subsequently, the GoL found itself unable to maintain the $\pm 1,600$ VDCs which were replaced by ± 210 larger, initially interim, Community Councils under the 2001 Local Government Act. The first CC elections were held in 2005. The CCs were subsequently reduced to 128 in 2007. In twelve gazetted urban areas, Urban Land Committees became responsible for land administration under the 1979 Land Act. Community Council Land Allocation Committees are meant to allocate both residential and crop land but, in practice, chiefs continue to exercise significant influence in land allocation in both rural and urban areas. Many remain the chairs of Community Councils, Form Cs continue to be issued illegally by chiefs (backdated prior to their abolition), records of certificates are kept by both CCs and Chiefs, few Community Councils or Urban Land Committees issue leases and some abolished interim Community Councils continued to operate and issue certificates.

Since the late 1990s, new efforts have been made to reform land administration, initially mainly with World Bank, German Technical Cooperation Agency (GTZ) and the Department for International Development (UK) (DFID) support but recently with support from the Millennium Challenge Corporation (MCC). A National Land Commission was established in 1999 with the support of the World Bank and GTZ, which recommended, among other things: (a) the abolition of all customary responsibility for land administration; (b) a generalization of leasehold tenure; and (c) the systematic registration and titling of land. Subsequently, a draft Land Policy and Land Bill were produced with the support of the World Bank, GTZ and DFID from 2001 to 2003 and a draft Land Act was produced in 2006. Several concerns were raised regarding various proposed leasehold categories in the 2006 draft Land Act, in particular the wholesale conversion of various customary and informal (often considered illegal) tenure arrangements to "primary leaseholds".

Recent reforms in land administration for residential and crop lands

In July 2007, MCC and the GoL signed a USD 362 million Compact covering water, health and private sector development. Implementation started in September 2008. A USD 20.5 million land administration reform activity was included under the Agricultural Productivity Programme in Southern Africa (APPSA). The activity includes: (a) policy and legal reform; (b) systematic regularization of land in urban areas and improvement of rural land allocation processes; (c) modernization and improvement of land administration services; and (d) public outreach and awareness activities. The expected outcome of the land administration reform activity is that the use of land as an economic asset for collateral will be increased. Under the policy and legal reform sub-activity, assistance is to be provided to the Government to revise various legislations associated with land reform currently in draft form and to develop its land policy. Gender analysis was to be done to ensure that the Land Act is congruent with the Legal Capacity of Married Persons Act and other gender equality reforms and principles. The systematic regularization of land in urban areas and improvement of rural land allocation processes sub-activity is supposed to include the regularization of $\pm 55,000$ urban/peri-urban residential parcels and the improvement of rural land allocation processes in 40 Community Councils (CCs). The modernization and improvement of land administration services sub-activity will mainly involve the simplification of land administration procedures and the establishment of a new Land Administration Authority (LAA) as an autonomous parastatal body, modelled after the Lesotho Revenue Authority (requiring the promulgation of the Land Administration Authority Act. These reforms are not likely to have any implication on the APPSA subprojects which do not require any land acquisition.

4.4.3.2 Land Use

Most communal land is allocated for grazing. It is estimated that about two thirds to three quarters of all land in Lesotho is used for grazing. Historically communities in the lowlands (Zone C) and foothills/lower mountain slopes (Zone B) were granted access to mountain areas (Zone A) for summer grazing but over time the system has broken down in many areas. The 1969 Land

Husbandry Act repealed the provisions of the Laws of Lerotholi (a codification of customary law), empowering the Minister of Agriculture to make regulations for grazing and rangelands.

In many cases communities in the foothills and lowlands have lost access to grazing land or are grazing illegally in the mountain areas. There are frequent reports of conflicts between communities over grazing, including illegal burning of grazing areas and stock theft.

The percentage of land use for the different uses is as follows (2015 estimates):

- agricultural land: 76.1%
 - arable land 10.1%;
 - permanent crops 0.1%;
 - permanent pasture 65.9%
- forest: 1.5%
- other: 22.4%.

Approximately 40% of the agricultural land is still under traditional agriculture most of which is in the highlands and foothills. Generally, with improved technologies the farmers are getting some income from agriculture as opposed to those still practicing the traditional approaches. Income generation has been realized from protected agriculture (shade nets etc.), conservation agriculture, and seed multiplication (of the improved crop varieties).

4.4.4 Agriculture

Lesotho's agricultural sector is characterized by a basic paradox. The country is land poor; only 10% of its area is at all suitable for crop farming, only 0.4% is classified as good land, and yet more and more land is being put to fallow. Rather than intensifying agriculture, 100,000 ha. were taken out of production between 1973-74 and 1977-78 - a drop of nearly 30%. The total area in production has continued to drop, despite a continuing increase in the resident rural population. This has traditionally been ascribed to labour shortage, but the relative unattractiveness of returns from farming would seem to be the main cause. The Basotho agriculturalist faces an unhappy combination of steep slopes, erosion, degraded soils and chancy climate that makes much of Lesotho a marginal area for cultivating its traditional crops of maize, sorghum, wheat and beans.

The returns to labour are better in the RSA. In any one-year agriculture can provide as much as 17% of rural household incomes, domestic off-farm sources provide 12%, and remittances 71%. The yearly gross cash margin from an average 2 ha holding in maize and beans is less than R50 -- compared to mine incomes of R1200 or better. Thus, remittances from mine workers have been a major source of rural livelihoods, providing cash to purchase agricultural inputs or invest in household assets and housing. However, remittances have been declining steadily over the past decade.

Lesotho's economic performance is reliant on agriculture, livestock, manufacturing and mining. Agriculture contributes approximately 7.4% to GDP, industry 34.5% and services 58.2%. Significant natural resources include diamonds and water. Agriculture is still the country's most important generator of employment. With roughly 70% of the population living in rural areas, farming provides as much as 45% of employment. Although little more than 10% of land is arable, crop farming is the mainstay of income for rural residents – mostly traditional low-input, low-output rain fed cereal production and extensive animal grazing. However, Lesotho cannot produce enough food to feed its growing population (Imani, 2017)

Over the longer run, it is anticipated that population growth and the shrinking of the South African labour market will increase the relative attractiveness of more land and labour-intensive agriculture. Although the Government has proposed some key policies and programs (including implementation of a recently-passed Land Act which will allow present land holders, in effect, to

acquire title), it does not lay out a sufficiently well-articulated strategy for Lesotho's future agricultural development. Such a strategy should comprise: (i) a careful selection of priorities for development under the current constraints of low interest in farming, overstocking, and a not-yet-equipped set of Government services; and (ii) preparations for the longer-term when cumulative changes in Lesotho's wage employment and land tenure situation and the capacity of Government services would be likely to have a major impact on agriculture.

The Government through various projects like the Smallholder Agricultural Development Programme (SADP) has begun preparing for a longer-term shift to more intensive farming. As the number of persons depending on agriculture for their livelihood rises, cultivation presumably will have to shift away from present-day low-value crops to such crops as nuts and fruits, vegetables, perennial herbs for essential oils, and fodder for intensified livestock production. Specific ecologically suitable crops and varieties will have to be identified and tested and their market potential explored. Investigations of some (e.g. lucerne, irrigated vegetables and asparagus introduced by the IDA-assisted Thaba Bosiu project) already have been initiated, though the areas suitable for their cultivation are quite limited. Others, such as apples, peaches and vines are grown at present, and seem to offer large potential for improvement. Introducing these more intensive crops also should offer opportunities for further employment in drying, processing, canning and other agro-related industries.

Thus, the government is supporting the efforts of smallholder farmers to ensure food security for their families, raise their incomes and improve overall nutrition. Increased productivity is a key to achieving these aims and reducing poverty in rural areas. The major thrust of the programmes and projects is to encourage rural people's participation in planning and developing income-generating activities, including microenterprises, focusing on three main opportunities for reducing rural poverty:

- diversifying and intensifying agriculture and livestock production;
- rehabilitating and reclaiming degraded lands, including rangelands;
- developing rural financial services to support improved agricultural production and creating income-generating activities.

4.4.4.1 Horticulture in Lesotho

Horticulture is growing in Lesotho and is getting an increasing focus after the implementation of the World Bank-supported Private Sector Competitiveness and Economic Diversification Project (PSCEDP) Project. The project had two sub-components: the production of vegetables and the production of fruit trees. The horticulture projects majored in plums, cherries, apples, apricots and peaches which were supplied to retailers such as Shoprite, Pick n Pay, Game Fruit and Veg in Lesotho.

While low-yield cereal production, primarily for own-consumption, is by far the most widespread cropping activity, the most recent data available (for 2006-2008) indicate that vegetable production accounts for about 13.5% of land planted to crops, with fruit adding a further 1.5%. Potatoes, beans and peas – all essentially land extensive, rain-fed crops for own-consumption and local sale – dominate vegetable output (Imani, 2017). Peaches, apples and cherries, also mainly for own-consumption and local sale, are the most widely grown fruit crops. Almost all rural households with access to land are involved in some form of vegetable and/or fruit production, resulting in a solid indigenous skills base in horticultural techniques.

Due to the country's elevation, good soil, and abundance of water, the quality of the produce is good, and the fruits ripen earlier than in other countries in the southern hemisphere, offering an opportunity to supply the regional market early in the season. The Government's thrust is to take advantage of its competitive advantage over its neighbors.

The PSCEDP undertook research to study areas in Lesotho with the potential to support a viable horticulture industry. They drew a map that identifies areas with the elements necessary to support the business such as high altitude, excellent soils and access to water due to high annual rainfalls (Figure 4-2). The map shows the massive potential for Lesotho to engage in commercial horticulture which will give Lesotho an advantage of reaping harvests much earlier than South African counterparts.

Where there is even a minimal supply of irrigation water, substantial potential exists in the lower-lying foothills and lowlands for higher value fruit and vegetable production, without encroaching significantly on scarce rain-fed crop production land. The increased production of high value crops is identified as a high policy priority of government, as outlined in the Lesotho National Development Plan, primarily to increase rural incomes and food security, but also to enter export markets.

There are however significant shortcomings in respect of funding, physical capacity (particularly relating to storage/packaging/marketing facilities), appointment of staff to fill critical posts (especially in the Ministry of Agriculture and Forestry), technical competence, trade facilitation (notably in regard to meeting phyto-sanitary export requirements and the timely passage of perishable goods at borders), the business-friendliness of the legislative and public institutional environment, inter- and intra-ministry coordination, data collection, monitoring and evaluation/quality assurance and reporting (Imani, 2017). Thus, Lesotho currently does not have processing and packing facilities for these products, thus there is a need to look at incorporating such value-added processing facilities as canning, juicing and drying facilities.

4.4.4.2 Implications for Agricultural Productivity

The reforms in land use and land use planning do not have direct implications on the APPSA subprojects which will mainly be at DAR's research and trial stations. However, some trials may involve some individual farmers who may then be affected by these legal requirements. Future roll out and dissemination of the APPSA developed technologies may also have to take cognisance of these requirements.

Access to land and sustainable land and natural resource use is essential for improving agricultural productivity and for increasing the commercialization of agriculture. While there appears to be a demand for land allocation certificates and perhaps to a lesser extent, lease titles for residential and commercial purposes in small rural towns and villages, there seems to be less of a demand for these in relation to crop land, where people generally feel that their rights are clear and undisputed. However, there could be a sporadic demand for certificates for ventures in commercial agriculture.

The strengthening of land use and settlement planning is important for reducing the encroachment of settlements on crop lands. For this, finalizing legislation that provides for gazetted and hence enforceable land use plans is essential. So is improving land allocation procedures and the collection of ground rents in existing residential areas as a basis for encouraging the use of unutilized residential land.

4.4.4.3 Status of Agricultural Research in Lesotho

Agricultural research in Lesotho is predominantly supported by government through the Ministry of Agriculture and Food Security. The responsibility to generate and/or adapt and transfer appropriate technologies and scientific knowledge and usable information, and to provide necessary laboratory services to farmers and other stakeholder institutions for sustainable agricultural development is entrusted with the Department of Agricultural Research (DAR). In view of its mandate to conduct applied/adaptive research and disseminate new technologies, research is conducted both on station at DAR main station and at the research substations representing all

the agro-ecological zones. Research is also conducted on farm in collaboration with farmers and the model seems to be working fairly well for both the farmers and the Department.

The basis for DAR's research is guided by policy and government priorities in various commodities ranging from crops and livestock related areas. Also, in pursuit of its mandate, DAR carries out research in collaboration with other public institutions including the academia through the National University of Lesotho and the Lesotho Agricultural College and private sectors such as the Non-Governmental organisations. The National University of Lesotho on the other hand does undertake agricultural research on its own but mainly that is for academic purposes. The University also offers some specialised services although unlike the Department it is not a national service but purely for generation of revenue to sustain the University.

There is currently minimal binding joint planning between DAR and research partners in the absence of a formal national agricultural research system (*NARS*) and the Agricultural Research Policy in Lesotho. But in some situations, DAR does initiate joint planning to facilitate implementation of research work especially where there is direct funding that comes directly to DAR from the external collaborators. DAR therefore arranges meetings with stakeholders comprising public and private Institutions, farmers associations and entrepreneurs for joint planning. It is in these meetings that DAR leads the process to identify research projects and required support for allocating roles and responsibilities in conducting, promoting research and disseminating technologies, though in most cases stakeholders are not keen to accept the responsibility.

At the departmental/institutional level, planning starts before the government financial year where sectional activities and budgets are drawn, presented and approved by DAR management. This process involves prioritization of activities against the Department budget ceiling. In cases where the department experiences further budget cuts, further prioritization is undertaken by a smaller group/ budget team comprising Heads of Divisions, Accounts and Human resource office assigned by the Director to advise her office and re-submitted to Headquarters through the office of Policy and Planning. The latter facilitates for approval through a presentation to Management of the Ministry which includes the Principal Secretary as the chief accounting office.

The implementation process usually involves trials and demonstrations of different crops and Livestock done at different locations. For all types of research, the lead researcher takes all the responsibilities, as well as for on farm research, the responsible officer liaises with the Extension Division who coordinates with the Ministerial Extension Department to identify committed farmers and provide the necessary inputs. In cases where research is conducted jointly with an NGO the same procedure is followed.

The placement of DAR within the Ministry has not seen the Department progressing much beyond the period of constant funding and support of expatriates in the early 1980s. At the Ministry it has been allocated a relatively low level of articulation within the structure of the Ministry ranging from an experimental station upon its establishment in 1952 to being a department in 2000. As a result of this and the low level of remuneration the Department experiences the highest loss of professional staff thus making its impact very minimal.

The Lesotho Agricultural College was established in 1954 with the main mandate of teaching agriculture courses to enhance agriculture. The establishment of the Faculty of Agriculture at the National University of Lesotho (NUL) was approved in 1977. However, the actual machinery for its creation was put in place in July 1990, with the first intake of students for undergraduate programmes taking place in August 1991. It has also struggled with funding and specialist researchers and has therefore not achieved much in technology dissemination. The same challenge

of low funding applies to both the university and the Agricultural College hence emphasis tends to be towards teaching compared to research.

4.4.4.4 Available Agricultural Technology

The available technologies include among others those targeting to address the climate change challenges such as:

- Conservation agriculture,
- Drought and pest tolerance crop varieties and fodder species,
- Early maturing crop varieties,
- Gravity fed and drip irrigation,
- Protected agriculture for fruits and vegetables,
- Resilient animal breeds,
- Home gardens (e.g. Keyholes),
- Bio fortification,
- Value addition on products (food processing techniques).

Additional desirable technology includes:

- Advanced pest control methods such as chemical ecology,
- Breeding especially for unique agro-climates of Lesotho on various crops,
- Value addition on livestock products and indigenous crops and other indigenous livestock,
- Technologies on water harvesting as well as various irrigation techniques.

4.4.4.5 Gender in Agriculture

Gender is a critical factor in understanding vulnerability to food security as gender based inequitable use and access to land and resources, and decision-making structures based on customary laws constrain women's ability to take part in agriculture (Gwimbi et al, 2014).

While there was previously a clear division of labour by sex for agricultural tasks, absences of males have forced women to take over or assist with many male tasks. Women even assist with ploughing and planting, which were the main agricultural tasks traditionally carried out by males. Hand labour operations like weeding and harvesting - traditionally women's responsibility - make up over 80% of total labour inputs during the growing season. Residential gardens are also women's responsibility.

The traditional kitchen gardens are poorly maintained, fertilizer is seldom used, seeds are generally of poor quality, and most labour is not mechanized. At the household level, women are also engaged in raising poultry and pigs. Gardens and rural poultry have considerable potential for improving the availability of food and for generating household income. Much of the needed advice and assistance for these agricultural activities that may emanate from the research programmes has to be directed, therefore, at women. It is envisaged that APPSA will ensure that R&D subprojects will be sensitive to gender-differentiated priorities as these relate to household food security and nutritional sufficiency. Recognizing that research and extension programs in the participating countries in the past have attracted mainly men as participants, the project will ensure that at least 30 percent of the farmers and other end users who participate in project-supported activities will be women. To achieve this, focused awareness campaigns will be organized to encourage women's participation as potential Lead Farmers.

Women make up the majority of the agricultural labour force in Lesotho. The Agricultural Census of 1999/2000 confirmed that there were more women than men in agricultural work in all districts, with the exception of Butha-Buthe district, where males were in the majority (52%), (AfDB, 2005). Thus, in terms of gender parity, Lesotho agriculture is almost attaining it, with more women than men in most districts.

Lesotho has a high rate of literacy among women, which facilitates their training in agriculture. In reality, there is a reverse gender gap that favours girls and women when it comes to education. Women are more literate compared to men, while girls and women also enjoy higher net primary, and secondary and tertiary enrolment rates. However, the relatively higher female educational attainment has not automatically translated into higher income for women because of cultural and social norms that prevent them from having access and control to productive resources and the type of skills that they acquire (AfDB, 2005).

In the informal education sectors, the available programs include those offered by the Lesotho Distance Training Centre (LDTC). It offers many programs of interest to women, related to household as well as income-earning skills. Some of the relevant programmes include:

- Me and My Community
- Me and My Environment
- Communication and Transport
- Decision Making
- Know Your Business
- Development Studies
- Business Education
- Integrated Science
- Commerce

Within the formal education system, women are well represented at the Lesotho Agricultural College, although some concentrate on "rural domestic economy" rather than on agriculture (Lesotho CCA, 2017). Rural Domestic economy covers the following disciplines:

- Socio-economic development of rural areas.
- Employment in rural areas.
- The rural family.
- Rural household income.
- The role of rural women and the role of farm household socio-economic development of the rural community and country.
- Agro-tourism and rural family.
- vocational training in agriculture.

A large number of women are also being trained as agricultural extension agents and women already occupy many positions among headquarters and field staff of the Ministry of Agriculture. This is also an entry point for narrowing the gender gap in agricultural research, policy and decision-making, using the platform of strengthening institutions and investing in human resources with a focus on gender balance in agricultural researchers as a driver for meaningful change in addressing the preferences and constraints of female farmers.

Among the initiatives which the GoL has taken to recognize and support the substantial contributions women have been making to agriculture and rural development is the establishment of a national organization for women; the Women's Bureau. It will coordinate women's activities in rural areas and assist in directing services to them. Its priority tasks are to address the various factors limiting women's role in agriculture as well as their broader role in rural areas. The effectiveness of Women's Bureau and its impact on women in Lesotho is yet to be fully determined. Under the APPSA, linkages with Women's Bureau would be explored to identify potential women Lead Farmers and creating a network of women farmers for knowledge and technology adoption.

The Government of Lesotho has taken major strides in securing the rights of women through enacting various pieces of legislation, like the National Gender and Development Policy of Lesotho

of 2003. This policy draws its mandate from Chapter II of the national constitution and states that every citizen has fundamental human rights and freedoms (GoL, 2003). Relevant policy objectives include achieving equal access to education, training and health services. Crucially, the policy calls for equal access to and control over resources such as land and credit.

The policy advocates the allocation of land in accordance with availability, not in terms of gender. The country, however, faces challenges in trying to translate its gender policy into reality for a variety of reasons.

- First, while the constitution of Lesotho prohibits discrimination of any kind, it gives priority to customary law which relegates women to being legal minors; under their fathers, husbands and sons or male relatives.

The 2000 Land Commission Report (GoL, 2001), The Legal Capacity of Married Persons Act (2006) and Land Act of 2010 all provide for the removal of this minority status of women and girls in the constitution, but it remains in place today disadvantaging women on paper in terms of access, use and ownership of resources that enable them to actively participate in agriculture.

- Second, the Land Act of 2010 ensures that all Basotho regardless of gender can own land. The main challenge however is that this law is in conflict with national constitution which gives customary law more power over all other laws. Consequently, in rural areas where majority of women live cultural attitudes dictate that a family is headed by a man and that he has control over family property. As a consequence, a woman's access to land (and associated livestock and implements) is mainly through her husband. Women are not able to inherit land once their husbands are deceased as according to common and customary law "heir" only refers to a male and excludes women.

Although we have more women than men in the sector they are still disadvantaged in many ways. The agricultural sector should take advantage of the APPSA project and initiate the mainstreaming of gender in its policies and programmes, accelerate the land reform process to ensure women's access to and control over land resources, increasing women's access to productive technologies, credit, new crops and markets.

Gender-based violence (GBV) is pervasive in Lesotho and by all indications seems to be on the increase. Approximately 86% of women experience GBV perpetrated by men in their lifetime. 62% of these violations relate to intimate partner violence (IPV) and 16% of women in their lifetime experience rape perpetrated by strangers (AfDB, 2005; LCCA, 2017). There are different types of gender-based violence:

- The first category is those that are classified under harmful traditional or cultural practices including beliefs, norms and social institutions that legitimize and thus perpetuate gender-based violence range from early marriage, abduction, *lobola* (bride wealth payment) and wife inheritance.
- The second category is domestic violence committed by husbands and other partners. Although it is believed to be wide spread, it is difficult to obtain reliable estimates of the prevalence and frequency of such forms of violence throughout the country.
- The third category is the prevalence of wide spread cases of rape including child abuse. Child abuse also includes forced and early marriages and other harmful cultural rites and practices (AfDB, 2005).

4.4.5 Socio-Economic Conditions

Gross domestic product (GDP) growth at 4.6%, in 2017, and was being driven primarily by mining production, construction and government services.

Unemployment stood at 27.25% in 2017 and is unlikely to have changed much, even as underemployment and low productivity employment is widespread, especially in rural areas. Preliminary government estimates based on the 2010/11 Household Budget Survey show that the national poverty head count rate stood at 57.1% and the Gini Coefficient based on consumption stood at about 0.53. Poverty has decreased in urban areas, while poverty has increased in rural areas.

With so many men working away from home, many women in Lesotho are left to take care of the family and tend their fields alone. When the men do not send enough money home, women have to find alternative ways to make ends meet, such as selling handcrafts, brewing beer or working on neighbor's farms. Thus, the majority of the workforce that will be available for APPSA is expected to be women.

Most rural families live in villages of between 20 and 1,000 people. A wide range of cereals, vegetables and fruits are grown but most of these are exported, while Lesotho also imports food for those who can afford it. Maize or wheat is used to make a stiff porridge that is eaten with the fingers, and sorghum is used for local beer brewing. However, droughts cause severe food shortages and the introduction of improved technologies will go a long way in alleviating these food shortages.

4.4.6 Livelihood Conditions

Under the APPSA, it is expected that technologies generated to boost agricultural productivity would directly support rural population, especially women and youth, by addressing nutritional aspects as well as increased potential for employment in horticulture corps. APPSA will also complement the investments under the Smallholder Agriculture Development Project (SADP) that promotes rural-based small-scale agro-processing interventions that focus on women and youth. APPSA will have special focus on providing training and capacity building opportunities to affirmatively intake female scientists, as well as increase women farmers' access to agricultural technologies. APPSA will introduce mechanisms that address women's specific constraints in accessing technology and advisory services to ensure effective outreach to women farmers and include women's preferences within the R&D subproject cycle.

In general, the livelihoods in Lesotho include agriculture, wage employment, Government dependency syndrome, and the small enterprise sector (Acidri. J, 2012; Lesotho CCA, 2017).

Agriculture is a major livelihood for the rural folk although it is a long time since agriculture was truly the backbone of Lesotho. But it still plays an important role in the livelihoods of the poor.

The second livelihood revolves around **wage employment**. The Basotho believe that a livelihood without wages is unfulfilled, and that poverty can only be addressed through wage employment. wage employment has been engrained into the lives of the Basotho by the system of migrant work in the mines in South Africa.

The third livelihood is the **Government dependency syndrome**. This dependence syndrome that is characterized by the Basotho's assertion that government must solve all their problems. They therefore call on government to give them jobs, to give them housing, and to give them whatever more.

The fourth livelihood is the burgeoning **small enterprise sector** in Lesotho operates on the margins of legality and/or morality. In addition to street vending, small workshops and other such enterprises, Basotho are exploiting the cash economy vigorously through the brewing and sale of

alcohol, the widespread production and marketing of dagga (marijuana) and casual and professional sex work. But although these are some of the ways in which Basotho have managed to keep their livelihoods afloat, they also contribute directly to the weakening of the national social fabric and to the steady rise in violent crime and the abuse of women and children.

The Foot Hills Livelihood Zone is one of the highly productive areas of the country and cuts across a number of districts from the north to southern parts of Lesotho. The main crops grown in the area include maize, sorghum and some beans. Although the zone is dependent on crops, there is also communal grazing of livestock such as cattle, goats and sheep.

The main sources of household cash income include crop and livestock sales, supplemented with self-employment in the form of petty trade among others.

The Mountains livelihoods zone is mainly in the Maluti Mountains and located in various parts of Mokhotlong, Botha-Bothe, Leribe, Berea, Maseru, Mohale's Hoek, Quthing, Qacha's Nek, and Thaba Tseka.

Overall the local people's livelihoods are dependent on mixed agriculture comprised of both crop and livestock production. The main crops produced in the area include cereals such as wheat, maize, sorghum and pulses such as beans and lentils supplemented with potatoes. The livestock kept by the in the area include cattle, sheep, goats, pigs and donkey, horses for transport purposes. These livelihood options have a number of implications for the local people's survival.

The Northern Lowlands livelihood zone is comprised of various parts of the three districts of Butha-Buthe, Leribe and Berea. The Zone occupies the most fertile and productive arable land in the country, as such it is regarded as the food basket of Lesotho.

The livelihoods of the people in the Northern Lowland livelihood zone is mainly dependent on mixed agriculture as a result of the productive soils and adequate rainfall in the area. The main crops grown in the area are maize, sorghum and beans. Wheat is not produced on commercial scale due to limited access to crop finance and agricultural machinery. This is complemented by good road networks which have facilitated the effective marketing of agricultural produce in the area. The livestock sector also has a significant number of livestock particularly among the wealthier households. These livelihood options have a number of implications for the local people living in the area.

The Southern Lowlands livelihood zone covers an extensive area from Maseru, Mafeteng and Mohale's Hoek. The livelihood of the area is based on mixed agriculture comprised of crop and livestock production. The main livestock reared include cattle, goats, sheep and pigs and crops produced by the local population include maize, sorghum and beans. Overall winter season is not fully utilised due to limited access to agricultural inputs and machinery. These livelihood options have a number of implications for the local people's living in the area, (Acidri. J, 2012; Lesotho CCA, 2017).

4.4.7 Archaeological, Historical and Cultural Heritage

Lesotho has rich cultural heritage resources. The archaeological record comprises of a number of Middle Stone Age (MSA), Late Stone Age (LSA) and Iron Age sites as well as rock art. The custodian of all the cultural heritage is the Department of Culture (DoC). It is responsible for protecting and promoting Lesotho's national cultural heritage. Indigenous arts and culture are promoted through the cultural Policy Framework and supporting centers and activities of excellence, while support is also being given to initiatives already taken by local communities.

Lesotho boasts a number of must see tourist attractions such as;

- Habaroana Rock Art Interpretation Centre;
- the Morija Museum and Archives;
- Thaba-Bosiu; and
- The Basotho Cultural Village

The research and technology dissemination activities will thus be on the look out for any Archaeological, Historical or Cultural features that may be affected by the agricultural activities.

4.4.8 Social Services and Facilities relevant to APPSA Lesotho

In the past, many social welfare programs were organized on the local level or by missions. But the need for concerted action to alleviate hardships brought about by the severe droughts led to the creation in 1965 of a Social Welfare Department under the Ministry of Health (later the Ministry of Health and Social Welfare). Community development teams stimulate local initiative by conducting courses and forming voluntary community development committees. The Homemakers' Association, an organization long active in social welfare, has given family-management courses in remote areas under a grant from the Oxford Committee for Famine Relief (Oxfam).

4.4.8.1 Education

Officially, almost all children enrol at school but only half complete their final primary year. There are no government secondary schools; so many families cannot afford secondary education, even for successful students.

In contrast to some other countries, some girls in Lesotho are able to continue their education further than boys because they are not forced to leave home early to find employment. Other parents prefer to see their daughters married young. Estimates of adult literacy vary widely, but there are significant numbers of adults who cannot read and write.

The levels of adult literacy may be a challenge to the assimilation of the developed technologies, but this may be offset by the young and vibrant generation that is sufficiently literate.

4.4.8.2 Health

The available labour force for agriculture has been decreasing mainly due to the TB and HIV/AIDS scourge (24% of the population). The scourge was exacerbated by the system of labour migration, which generally exposed people to high-risk behaviour and made migrants more vulnerable to infection. The migrants imported the diseases back to their families, infecting a large number of people who never migrated. Then the additional consequence is that rural people's scarce resources are used in caring for the sick ones, covering funeral expenses and supporting orphans. With an HIV prevalence of 24%, Lesotho ranks as the second country most impacted by HIV/AIDS in the world.

Thus, the available workforce will constitute a large number of women, many whose husbands are former mineworkers or who no longer work due to disease (especially tuberculosis and HIV/AIDS) or disability (18 percent)

The government of Lesotho is working to rehabilitate some hospitals and is making an overall effort to strengthen health care services. However, it is facing an acute human resource for health (HRH) crisis.

In terms of protecting the workforce from work related illnesses, the Government enacted "The Labour Code Order 1992" under the Ministry of Employment and Labour. The order, among other

things emphasizes the Health and safety of employees, making it the responsibility of the employer to take care of any work-related illnesses that may affect its workforce. It also sets out that every employer shall, so far as is reasonably practicable, ensure the safety, health and welfare at work of all of his or her employees, by providing and maintaining plant, systems of work, and a working environment for his or her employees that is clean, safe, without risks to health and adequate as regards sanitary facilities and arrangements for their welfare at work.

The order also provides for the notification of industrial diseases, where a medical practitioner suspects or finds that any person is suffering from any industrial disease specified in the First Schedule to the Workmen's Compensation Act 1977, shall notify the employer of that person and the employer shall further notify the Labour Commissioner of the same

In addition, the Ministry of Agriculture is collaborating with the Aids Council to continue HIV/AIDS awareness campaigns as part of their planned national activities. The Ministry of Agriculture is participating in various training activities and will continue to include these as part of APPSA.

4.4.8.3 Roads and Communication

In 2002 there were 4,995 km (3,104 mi) of roadway in Lesotho, 887 km (551 mi) of which were paved. A 2.6-km (1.6-mi) South African railway connects Maseru's industrial park to the Bloemfontein-Natal line, providing a valuable freight link to South Africa.

In 2004, there were an estimated 28 airports, of which only 3 had paved runways as of 2005. Lesotho Airways and South African Airways maintain scheduled passenger service between Johannesburg and Moshoeshe International, the new international airport 19 km (12 mi) outside of Maseru. Lesotho Airways also has regular service to Swaziland, Zimbabwe, and Mozambique, and to 28 domestic airstrips. In 1997 (the latest year for which data was available), about 29,000 passengers were carried on scheduled domestic and international airline flights. Air taxis and chartered planes serve airstrips at Maseru and other centers.

Thus, the country is well connected internally and externally for the ease of dissemination of the developed technologies both within Lesotho and the rest of the region.

4.4.8.4 Energy Resources

Energy resources can be classified into three categories: non-renewable (coal, gas, paraffin etc.); potentially renewable (biomass) and renewable (hydro-electricity, solar and wind energy). The capability of the country's potentially renewable natural resources to meet household energy demands has been drastically reduced through human and animal pressure forcing households to rely more on dung and crop residues and imported fossil fuels like paraffin. Domestic energy needs are largely being met from sources that lead to further deforestation and environmental degradation especially in rural areas.

In terms of renewable energy, only about 14% of the household have access to electricity. However solar and wind energy haven't been widely adopted. APPSA will have to employ renewable sources of energy like electricity, solar and wind. The project will not encourage the utilization of any energy sources that are detrimental to the environment.

4.4.9 Labour and Migration

The economically active population was estimated at 959,047 in 2017, with an unemployment rate of 29.2%.

Approximately 86% of the resident population engages in subsistence farming, and as many as 35% of male wage-earners work in South Africa According to *Migration Information Source*, Lesotho led

the world's nations with the highest total remittances received as a percentage of GDP in 2001, with remittances at 26.2% of GDP, equivalent to \$112.80 per capita. In 2003 remittances were \$2.17 million but these figures have been declining and stood at 16.5% in 2015 and 15% in 2016 (see Figure 4-5 below).

Figure 4-5: Remittance Inflows to GDP for Lesotho (World Bank, 2016)



The proportion of rural households with a migrant is 60% and the average male who migrates spends 15 years, or 35% of his working life, away from home. This way of life has strained personal and other domestic relationships in households and has led to an agricultural labour force which is predominantly female.

More recent data shows that in Lesotho, agriculture contributes around 6 per cent to the GDP, employs almost 60 per cent of the labour force (on subsistence farms) and provides livelihood sustenance for 90 per cent of the rural population. More than half the country's population – 57 percent – lives below the poverty line, many of who rely on agricultural activities for basic sustenance.

Migration has given many rural households a relatively high income, but at a high social cost in terms of the quality of family life. As much as the country has been receiving handsome remittances, the trade-off in disease burden has been immense. The mine workers who go to South Africa are exposed to such diseases as TB and once they are ill they return home and become the Government of Lesotho's problem.

In the past few years mine labour has dramatically decreased with a resultant decrease of migrant labourers. However cross-border movement (legal and illegal) between Lesotho and South Africa has remained high. There has been a shift in migration flows and composition, as the migration slowly became feminized. While in the past, women would only seldom follow men in migration flows, during the past decade more and more women became primary income earners in Lesotho and as such, started to be increasingly present in migration flows and substituted men in migration towards South Africa, thus shifting the labour ratios available for agriculture.

The wives of migrant labourers left behind are heavily dependent on remittances received from their migrant husbands. The study done by Gwimbi et al (2014) finds that women who are reliant on remittances as the main source of household income, express concerns about the amount they receive, the uncertainty of timely arrival of remittances, and with their limited control over how much can be spent on agriculture. Further the traditional crop land tenure arrangements deny them decision-making authority over land use.

5 ENVIRONMENTL AND SOCIAL IMPACTS AND MEASURES

5.1 Potential Environmental and Social Risks and Impacts

The following is a detailed outline of the potential risks and impacts that the rehabilitation and upgrading of research stations and field trial stations will exhibit. The risk and impact identification cover the following:

- i. Construction/refurbishments of research facilities;
- ii. Research activities at the improved research facilities;
- iii. Dissemination of horticulture technology.

It will be noted that since specific details of refurbishment requirements at selected research centres are not known at this stage, nor have the specific types of research activities been defined, the impacts and mitigation can only be described in a generic manner.

The first stage of impact assessment was the identification of the project activities that have the potential to generate impacts at the RCoLs as a result of potential activities due to the construction, refurbishment/rehabilitation of existing buildings to create the following:

- Seed storage facilities;
- Greenhouses;
- Laboratories;
- Chemical stores;
- Growth chambers; and
- Plant tissue facilities.

The improvements will then be followed by the use of the improved research centres, when issues such as the handling of chemical reagents, disposal of obsolete chemicals and the discharge of laboratory effluents will be important.

The rehabilitation and upgrading of Regional Centres of leadership will enhance technology development. The intention is that research developed will be disseminated to farmers who will be involved in field trials.

Table 5-1 below is a matrix outlining the environment and social aspects that project activities will typically affect, positively and/or negatively, during construction/refurbishment of the research centres, and the dissemination of research and field trials.

Table 5-1: Positively Affected Environmental and Social Components of APPSA Lesotho

ENVIRONMENTAL AND SOCIAL COMPONENTS PROJECT ACTIVITIES	Soils	Air quality	Water quality	Water resources	Noise	Solid waste	Hazardous materials	Flora and fauna	Health and safety	Land use	Livelihoods	Local economy	Archaeology/Cultural heritage	Aesthetic	Disturbance/Anxiety
PLANNING PHASE ACTIVITIES															
Site identification											X				
Project consultations											X				
IMPLEMENTATION/OPERATION PHASE ACTIVITIES															
Construction/refurbishments of buildings such as greenhouses, laboratories, seed storage facilities, growth chambers, plant tissue facilities															
Procurement of building materials											X	X			
Demolition of structures											X	X			
Erection of partitioning											X			X	
New fittings; plumbing, wiring, air conditioning, etc.		X							X					X	
Fixing/fitting roofs/ceilings											X	X			
Fixing/rehabilitating floors											X	X			
Proper Management of waste		X	X			X	X	X	X		X	X		X	
Erection of new facilities for: greenhouses, laboratories, seed storage, tissue culture											X	X		X	
RESEARCH ACTIVITIES AT THE IMPROVED RESEARCH FACILITIES															
Seed storage facilities		X							X		X	X		X	
Greenhouses											X	X			
Laboratories											X	X			
Chemical stores											X	X			
Disposal of obsolete chemicals											X	X			
Growth chambers											X	X			
Plant tissue facilities											X	X			
DISSEMINATION OF HORTICULTURE TECHNOLOGY															
Application of improved Horticulture Technologies											X	X			
Land clearing activities											X	X			
Land Tilling/levelling											X	X			
Planting of crops											X	X			
Pest control											X	X			
Processing of produce											X	X			
Marketing of produce											X	X			
Operation of water pumps, boreholes											X	X			

Table 5-2: Negatively Affected Environmental and Social Components of APPSA Lesotho.

ENVIRONMENTAL AND SOCIAL COMPONENTS PROJECT ACTIVITIES																	
	Soils	Air quality	Water quality	Water resources	Noise	Solid waste	Hazardous materials	Flora and fauna	Health and safety	Land use	Livelihoods	Local economy	Archaeology/Cultural heritage	Aesthetic	Disturbance/Anxiety		
	PLANNING PHASE ACTIVITIES																
	Site identification															X	
	Project consultations															X	
	Designing of refurbishments															X	
	IMPLEMENTATION/OPERATION PHASE ACTIVITIES																
	Construction/refurbishments of buildings such as greenhouses, laboratories, seed storage facilities, growth chambers, plant tissue facilities																
	Procurement of building materials																X
	Demolition of structures	X	X	X	X	X	X	X	X	X	X					X	X
	Erection of partitioning		X			X	X	X		X							
	Disruption of utilities		X	X	X	X	X		X	X			X			X	X
	New fittings; plumbing, wiring, air conditioning, etc.				X	X	X	X									X
	Fixing/fitting roofs/ceilings		X			X	X	X	X	X							X
	Fixing/rehabilitating floors		X			X	X			X							X
Poor Management of waste		X	X		X	X	X	X	X	X	X				X	X	
Erection of new facilities for: greenhouses, laboratories, seed storage, tissue culture	X	X		X	X	X	X	X	X	X			X		X	X	
RESEARCH ACTIVITIES AT THE IMPROVED RESEARCH FACILITIES																	
Seed storage facilities		X				X			X								
Greenhouses	X	X	X	X		X		X	X						X		
Laboratories		X	X	X		X	X		X								
Chemical stores		X	X	X		X	X		X								
Disposal of obsolete chemicals		X	X	X		X	X	X	X								
Discharge of laboratory effluents and waste		X	X	X		X	X	X	X								
Growth chambers		X	X	X		X			X								
Plant tissue facilities		X	X	X		X	X		X								
DISSEMINATION OF HORTICULTURE TECHNOLOGY																	
Application of improved Horticulture Technologies	X		X	X		X	X	X	X	X			X			X	
Land clearing activities	X	X	X		X	X		X	X	X			X			X	
Land Tilling/levelling	X	X	X		X			X	X	X			X			X	
Planting of crops	X			X					X	X						X	
Pest control	X	X	X	X		X	X	X	X								
Processing of produce			X	X	X	X			X								

ENVIRONMENTAL AND SOCIAL COMPONENTS PROJECT ACTIVITIES	Soils	Air quality	Water quality	Water resources	Noise	Solid waste	Hazardous materials	Flora and fauna	Health and safety	Land use	Livelihoods	Local economy	Archaeology/Cultural heritage	Aesthetic	Disturbance/Anxiety
Operation of water pumps, boreholes	X	X	X	X	X			X	X						X

5.1.1 Significant Negative Impacts.

5.1.1.1 Potential Impacts during Refurbishment of Research Stations

5.1.1.1.1 Construction Impacts

The construction phase has environmental and social impacts due to the concentrated but temporary nature of the activities and the criticality of ensuring the correct installation of services and utilities. During the construction period, the major activities will include relocation (i.e. moving personnel and equipment from one room to another in order to facilitate the refurbishment or demolition of walls and rooms), demolition, construction and decommissioning.

The key to preventing adverse environmental and social impacts resulting from construction is to include the requirements for mitigation measures and good construction practice into the contract brief of the contractors and then to monitor implementation.

There will be need for quarry stone and other building materials. These will be supplied by commercial suppliers whose operations are already licenced. No materials will be sourced from illegal dealers whose operations will affect the environment.

(i) Physical Restrictions on Building Space

The size of the existing structures may not be in line with the intended use for the improved research station. This may entail extensive demolitions or construction of new structures altogether.

(ii) Demolition

The majority of materials demolished will consist of inert building materials. Most of these materials can be disposed in a routine manner i.e. disposed of at proper landfill sites, with minimal impact to the environment.

Materials of environmental concern that may be found in the research centres to be refurbished could include:

- Asbestos - from boiler rooms' piping, duct and wiring insulation' flooring and ceiling tiles; fire proofing materials, electrical panels, laboratory counter materials, acoustical plaster and cement pipes (flue);
- Chlorofluorocarbons (CFCs) – from fire extinguishers, air conditioners, refrigerators and freezers, chillers and heat pumps;
- Lead – from paint, lead acid batteries, lead pipes, solder;

- Mercury – from batteries, lighting, HVAC and boilers, electrical systems;
- Poly-Chlorinated Biphenyls (PCBs) – from electrical transformers, transistors, capacitors and light ballasts

(iii) *Construction*

Impacts to the bio-physical and social environment during the construction period include, but are not limited to:

- Airborne construction dust;
- Elevated noise levels given the proximity of residential areas;
- Generation of construction waste or debris (e.g. excavated soils, cement bags, paint drums, brick and concrete rubble, scrap metal, broken glass, timber waste and other debris);
- Spills (oils, lubricants, etc.) from vehicles and equipment that may result in soil and water contamination
- Public health and occupational safety;
- Traffic safety;
- General risks and hazards;

(iv) *Impacts of Construction Activities on Staff and Other Stakeholders*

Refurbishment work undertaken in the same buildings and having staff has potential to cause injuries to the occupants. At all sites, renovation works will have the following potential hazards to staff:

- Exposure to hazardous materials such as asbestos containing materials (e.g. old buildings with asbestos roofs);
- Falling and tripping on building materials;
- Noise and vibrations during demolition;
- Injury from falling or flying debris when demolishing walls;
- Cracking of existing structures from vibrations;
- Spillages and dust during transportation of materials;
- Traffic safety.

The safety of the local population may be at risk during construction activities. Pollutants such as dust and noise could also have negative implications for the health of the near-by communities.

(v) *Temporary Visual Intrusion*

Construction activities will require material, equipment and cordons at the RCoLs. Since facilities under renovation would not be closed from access by the public, these activities and materials thereof will cause temporary visual intrusion at all sites. This may be exacerbated by the contractor setting up camp on site.

Table 5-3: Possible Treatment of Different Construction Waste Streams

TYPE OF WASTE GENERATED	SOURCE	RECOMMENDED TREATMENT
Solid toxic/hazardous chemical waste	Demolitions of old buildings	Segregated and out sourced to licensed abatement professional for disposing at designated landfill sites.
Inert construction waste or debris	Demolitions of old buildings	Disposed of at general municipal landfill sites

TYPE OF WASTE GENERATED	SOURCE	RECOMMENDED TREATMENT
Toxic Chemical waste products including Chlorofluorocarbons (CFCs) –; Lead – Mercury Poly-Chlorinated Biphenyls (PCBs)	Demolitions of old buildings	Segregated and out sourced to licensed abatement professional for specialised disposal at designated landfill sites.
Spills (oils, lubricants, etc.)	Construction equipment and vehicles.	All refill areas should have banding to contain any spills. Avoid using old and defective equipment and machinery that may leak out oil or fuel. Contain any spillages and outsource to licensed abatement professional for specialised handling.

5.1.1.2 Physical and Natural Resources Impacts

(i) Soil and Land Degradation

The risk of accidental discharge of hazardous products like leakage of hydrocarbons, oils or grease from construction machinery constitutes potential sources of soils and land pollution.

(ii) Ambient Air Quality

The key impact will be from dust and emissions. Air Quality will be impacted by emissions from vehicles, building equipment and released particulate matters. Demolition to modify the built environment will lead to considerable levels of cement dust which can affect workers, researchers and staff. Deteriorated indoor air quality will be of critical effect to especially asthmatic construction workers, and staff, with either minor or severe health impact depending on level and duration of exposure.

(iii) Water Quality

Water quality will be impacted by wastewater discharges from the refurbishment activities. These will include mainly rainwater run-off from the regional Centres of leadership (RCoLs) site. The discharge of this wastewater into surface waters will impact water quality by causing changes to its physical, chemical and biological properties.

Given the high anticipated volume of waste/spoil that will be generated from the Demolitions, during the refurbishments, it is likely that the waste will be stockpiled on road sides. If it is not properly contained, rains could carry it along with runoff into surface waters, leading to increased turbidity and siltation. This could affect aquatic resources such as fisheries and aquatic invertebrates.

(iv) Noise

Noise and vibration caused by machines, site vehicles, pneumatic drills etc. will be commonplace during the refurbishment activities. These impacts can affect the quietness of the communities and provoke irritation and anger.

5.1.1.3 Socio-Economic Impacts

(i) Anxiety and Anticipation

The planning stage brings a lot of anxiety and anticipation as both staff and management do not know exactly what will happen and when it will happen. The anticipation causes management to

stop other programmes whilst waiting for the promised rehabilitation. They can't do patch work when extension and refurbishments have been promised.

The small-scale farmers neighbouring the research institutions grow maize, beans, potatoes and vegetables mainly for subsistence. They view the developments at the stations with suspicion as they feel that if there are any accidental releases of experimental plants, they will have negative impacts on local crop production.

The apparent lack of a dialogue and communication system with research stations has led to speculation about the adequacy of containment measures and handling procedures for research specimens.

Regular consultation with local communities and other project stakeholders will be crucial to address anxiety and anticipation. All interventions under APPSA, will ensure that consultation remains foremost in addressing community concerns.

(ii) Labour Influx

While most workers may originate from the local community where they have families, there might be others from distant places and working away from their families. Contractors might be viewed as being wealthy by local people. With some disposable income to spend, this might induce illicit sexual relationships, with attendant risk for spread of HIV/AIDS. Criminal activities may increase at the facilities due to the high population. Gender-based violence (GBV) may also increase at the facilities. These may include domestic violence, and rape, including child abuse.

(iii) Gender-based Violence (GBV) and Violence Against Children (VAC)

GBV and VAC related impacts are potential issues during the construction phase. Labor mobilization associated with project construction often transplant workers, especially foreigners, in unfamiliar cultural and social settings. Contractor offices and workers camps also attract men and women from surrounding communities looking for employment, as well as local vendors and sellers (including children). This inevitably creates opportunities for social interactions. Some of these interactions may lead to culturally insensitive behaviour and relationships, including some that are disrespectful of local customs, and others fostering and or directly resulting in gender-based violence (GBV), violence against children (VAC), sexual harassment etc.

Avoiding such adverse social impacts is a shared responsibility with the Contractor having the onus of ensuring employees are sensitive to and respectful of local cultures and upholding an acceptable standard of behaviour when interacting with outsiders and local communities. with enforceable measures for ensuring accountability for non-compliance agreed to.

APPSA will address GBV and VAC issues through the mainstreaming of GBV and VAC codes of conduct and training to increase the protection of women and children.

5.1.1.4 Health and Safety

(i) Occupational Hazards

The movement of trucks to and from the site, the operation of various equipment and machinery and the actual refurbishment activities will expose the workers to work-related accidents and injuries. Pollutants such as dust and noise could also have negative implications for the health of workers and other populations.

(ii) Disruption of Utility Services

The demolitions and refurbishment activities may cause temporary disruptions of utility services such as electricity, communication and water. Such disruptions may upset the communities in the vicinity of the centres.

(iii) Vehicular Traffic

Construction works will result in a high volume of traffic around the RCoLs and within the communities. The transportation of raw materials will introduce a number of heavy trucks accessing the RCoLs and this could increase the risk of vehicular accidents. Communities around the rehabilitation sites will experience heavier human and vehicular traffic. Construction related activities will be a nuisance to road users e.g. storage of construction stones by the roadside.

5.1.1.5 Potential Impacts of Research Activities at the Improved Research Facilities

5.1.1.5.1 Waste Management

Activities in the various laboratories will generate different kinds of waste which will require different approaches of handling and management. The research stations will implement a waste management plan that will incorporate identification and separation of several different waste streams. This will include office waste, non-biohazardous laboratory waste, biohazardous laboratory waste, glassware (broken or intact) and chemical wastes.

(i) Hazardous Waste Management

Hazardous waste generated from the research stations will include the following:

- Chemical waste
- Radioactive waste
- Glass and sharps waste

Chemical waste: Chemical wastes will arise from biochemical and chemical activities which will include waste from molecular biology, protein and cell biology studies, analytical services, and expired chemicals. Hazardous chemical waste as well as all expired chemicals will be segregated and collected in a central collection area prior to transportation offsite for incineration by an accredited contractor, in accordance with national waste management regulations.

Radioactive waste: Radioactivity will be used for research purposes at the research centres. The research will include transgenic plant research. Radioactive wastes may arise from immunology and molecular studies where biomolecules are tagged for monitoring purposes. Radioactive waste will be separated based on whether it is liquid or solid and whether it is a low or high energy emitter of radioactivity. Low energy liquid wastes are to be poured down the drain or directly into the oxidation tanks after decay. Low energy solid waste is to be incinerated. High energy radioactive liquid and solid waste are to be allowed to decay prior to disposal.

Glass and sharps waste: Hazardous Sharps (such as needled syringes) will be collected in labelled plastic jars with screw lids and autoclaved when full and discarded into the waste pit.

(ii) Non-Hazardous Solid Waste Management

This includes all general waste like office wastes and laboratory non-hazardous waste.

(iii) Non-Hazardous Liquid Waste Management

The liquid effluent from the research stations will consist of general and research waste. The general waste originates from lavatories, kitchens and general sanitation processes. The research waste originates from all the sinks and floor drains in the laboratory areas. The liquid effluent waste stream from the research stations can be consolidated and directed to some form of treatment plant like oxidation ponds.

Table 5-4 shows the possible different waste streams likely to be generated from the RCoLs, and possible treatment methods.

Table 5-4: Possible Treatment of Different Waste Streams

TYPE OF WASTE GENERATED	SOURCE	RECOMMENDED TREATMENT
Solid hazardous chemical waste	Laboratories	Segregated and out sourced for incineration
Liquid hazardous chemical waste	Laboratories	Out sourced for incineration
Solid biological hazardous waste	Laboratories	Sterilization followed by incineration
Liquid biological hazardous waste	Laboratories	Sterilization by autoclaving or chemical disinfection (bleach) followed by discharge into sewage treatment
Solid biological hazardous waste	Laboratory	Sterilization by autoclaving within primary containment barrier followed by incineration
Liquid biological waste	Laboratory	Sterilization by autoclave within containment barrier or discharge into dedicated effluent sterilization system
Solid transgenic plant waste	Greenhouse	Double bagging of waste before transportation to autoclave followed by incineration
Runoff liquid waste	Greenhouse	Chemical treatment or evaporation
Radioactive waste	Laboratories	Decay followed by discard into regular waste stream
General solid non-hazardous waste	Offices, cafeteria, laboratories,	Incineration
General liquid non-hazard waste	Offices, cafeteria, laboratories	Sewage treatment systems

Source: PharmEng Technology Inc, 2005

5.1.1.5.2 Impacts on Physical and Natural Resources

(i) Soil and Land Degradation

The risk of accidental discharge of hazardous products like leakage of hydrocarbons, oils or grease from farm machinery constitutes potential sources of soils, water and land pollution.

(iii) Water Quality

Water quality will be impacted by wastewater discharges from the laboratories and research activities. The waste water discharges will include effluent discharged down the sinks in the laboratories and other hazardous waste which may need special treatment before being discharged. The discharge of this wastewater into surface waters will impact water quality by causing changes to its physical, chemical and biological properties. Ideally all the waste water must be channelled to treatment plants.

5.1.1.5.3 Socio-Economic Impacts

(i) *Anxiety and Anticipation*

The operations stage brings a lot of anxiety and anticipation as staff wait for the new research facilities and improved operations.

5.1.1.6 Health and safety

(i) *Occupational Hazards*

Research facilities are a potential source of various occupational health and safety risks. Health issues emanate from the working environment, which if not conducive can generate hazards. These could pose unsafe conditions for staff. The safety issues arise from the working conditions, the fittings and equipment which the researchers will be using. Safety measures should be put in place at all times.

(ii) *Chemical Safety*

The activities at the research stations will use and generate hazardous chemicals. However, the volumes of these reagents used for each study will be relatively small (0.5 - 10 ml) and generally used as diluted preparation from stocks or master solutions.

The potential chemical hazards will include reagents and gases that are flammable, hazardous to health, very reactive, or display some unique hazards. These reagents will pose varying risks to the research station personnel, the environment and to surrounding communities depending upon the levels of containment and safe practice in use.

The human health risks of exposure to hazardous chemicals include caustic effects, suffocation, irritation and damage to eyes, injury from explosion, sensitization, teratogenicity and carcinogenicity. Risks to the surrounding environment include potential contamination of water sources and resulting adverse effects on animals and plants.

(iii) *Radiation Safety*

Radioactive isotopes (radioisotopes) are primarily used in laboratories for either labelling cells to measure their rates of metabolism or for labelling biochemicals (proteins and nucleic acids) for detection purposes.

The severity of the effects of radiation exposure in an individual is proportional to the dose delivered: the higher the dose, the greater the severity. Examples of effects range from erythema (reddening of the skin), epilation (loss of hair) and cataracts, to mutagenesis, carcinogenesis and teratogenesis. These effects display a threshold: such that below a certain dose, no effects are observed. In bioscience laboratories the intention is to keep the exposure to each radioisotope below the threshold levels. The risks and handling procedures for each radioisotope are described extensively in the Radiation Safety Data Sheets which are generally provided by the vendors and which accompany all shipments of radioisotopes (PharmEng Technology Inc, 2005).

(iv) *Fire Safety*

Fire Extinguishers are either not serviced or non-existent at the current research stations. Without adequate provisions for fire safety, an outbreak could result in endangering life and/or financial loss. Fires can start from ignitable materials in training rooms, store rooms, cigarette smoking in non-designated places or old electrical connections and even from the adjacent buildings which house a lot of ignitable materials.

(v) *Misuse or Inability to Use Installed Equipment*

The operation of new equipment together with attendant the chemical reagents will initially expose the workers to work-related accidents and injuries as they get used to the new environment.

The Regional Centres of leadership (RCoLs) must have the requisite training and skill to use installed equipment for improved service delivery. Lack of this training will have a significant, negative medium-term but reversible impact.

(vi) Biosafety

The two possible sources of hazards during the operations of greenhouses and growth facilities are the risks associated with accidental release of transgenic plants, and accidental escape of experimental insects and microorganisms from contained greenhouses. The impact of both hazards is on the environment and food supply to humans and livestock. The table below summarizes the key impacts and assigns a risk level to each impact.

Table 5-5: Biosafety Risks and Mitigation

IMPACT	NATURE	RISK	MITIGATION
Accidental escape of GM plants	Potential negative impact on human health through contamination of food supply and impacts on endogenous flora and crops in the environment	Low-Medium	Incorporate primary and secondary containment measures and operational procedures as described by the National Institute of Health (NIH) guidelines Additional mitigation measures are recommended in the sections below
Accidental escape of insects and microorganisms from contained greenhouses.	Potential negative impact on the environment and food supply to humans and livestock	Medium	Incorporate primary and secondary containment measures and operational procedures as described by the National Institute of Health (NIH) guidelines Additional mitigation measures are recommended in the sections below

Source: PharmEng Technology Inc, 2005

5.1.1.7 Potential Impacts of Technology Dissemination

5.1.1.7.1 Waste Management

(i) Effluent and Solid Waste

Most horticulture (fruits and vegetables) production, agro-industries, packaging and marketing operations produce solid waste. Waste is generated in settling ponds and dust filtration systems:

- Steam and hot water boilers produce ash;
- Fresh food and processed food markets;
- Washing and packaging vegetables (potatoes) produce polluted waste water.

The effluent pollutes soil and water resources. Littering and indiscriminate dumping of solid waste pollutes the land and ultimately the water resources.

5.1.1.7.2 Physical and Natural Resources Impacts

(i) Physical Restrictions on Project Space

The terrain of Lesotho is generally mountainous and very little arable land available. Siting of projects on steep terrain will have an impact of erosion of the mountain tops and sides. Siting the projects in the valleys also has the problem of gully erosion which is encroaching on arable land.

(ii) Soil and Land Degradation

The roll out programme/ Dissemination of Horticulture Technology activities could result in intensive land preparations which may involve clearing and depletion of vegetation (this will be limited), compaction of soil, exposure of topsoil and possibility for erosion, weakening and degradation of soils, break down the soil structure which will potentially decrease the drainage of the areas, disturbance of the natural landscape and disfiguring of the natural morphology.

Furthermore, the risk of accidental discharge of hazardous products, leakage of hydrocarbons, oils or grease from farm machinery also constitute potential sources of soils and water pollution.

(iii) Disturbance of Marginal Areas

Because of the general terrain of the country, many marginal lands exist and establishing the projects in such areas can pose serious threats to further degradation of the marginal lands.

(iv) Loss of Fragile Ecosystems

Establishment of agricultural activities in some areas may impact on fragile ecosystems like wetlands and mountain tops. The farmers may drain the wetlands to create arable land, unsustainably cultivate in these wetlands, and also cultivate on steep slopes and mountain tops without adequate conservation measures. This will result in the fast degradation of the wetlands, erosion of the mountain tops and sides and subsequent loss of the natural purpose of these systems (systems failure)

(v) Ambient Air Quality

Air quality will be impacted by dust from intensive land preparations, emissions from processing and packaging plants. Some horticulture processing operations using steam boilers, heating systems or food processors, will produce smoke.

All drying processes of agricultural products produce dust. All these require smoke and dust control and air filtration to bring air quality both inside and outside the plant within the WHO recommended guideline levels. These include fruit drying plants, seed processing and packaging, agro-industries involving dry powder plants.

These operations result in the Pollution of air, increases in bronchial disorders, Impaired visibility on the roads, disturbs normal developments of vegetation and can cause acid rain.

(vi) Water Quality

Wet processes for food and beverage production require liquid waste water treatment to meet national standards. These include fruit processing, pickles and juices; potato washing plants; starch mills and agro-industries involving wet processing or chemical cleaning of the process. These operations result in the pollution of water resources, death of aquatic animals and general loss of the ordinary use of water. The polluted water affects plant growth and treatment costs of that water can be very high.

(vii) Noise

All processing and services equipment produce various levels of noise and vibration. These impacts can affect the quietness of the communities and provoke irritation and anger. Other negative health effects may include hearing impairments due to prolonged working under noisy conditions.

(viii) Visual Intrusion

Establishment of Orchards, irrigation systems for the plots, greenhouses, warehouses, processing plants and other possible facilities will change the aesthetics of the project areas and leave marred landscapes, e.g. hail nets stick out in the bare landscape. Also, the clearing of vegetation that may be required for the fields and establishment of irrigation and buildings will impact on the visual amenity of the existing structures.

5.1.1.7.3 Socio-Economic Impacts

(i) Anxiety and Anticipation

The technology dissemination stage brings a lot of anxiety and anticipation as most stakeholders will not be knowing what exactly will be happening and when it will happen. They then hold the whole process with suspicion and do not want the planning phase to drag for too long. If it drags for too long, it results in the stakeholders not fully cooperating with the project preparation team and not disclosing all the relevant information during consultations.

(ii) Poor Stakeholder Participation

The level of participation of all relevant stakeholders during project planning and designing is of paramount importance as a buy-in process. Communities are used to top down approaches where projects are just handed over to them without their initial consent. This poor stakeholder participation will result in the lack of ownership of the project by the locals, poor participation in project implementation and low chances of sustainability of the project.

(iii) Loss of Natural and Cultural Heritage

The roll-out programme activities may affect some natural features, antics and relics in the project area. The excavations for terracing and contour ridging the fields will cause destruction of the natural features, antics and relics.

(iv) Intellectual Property Rights (IPR)

The intellectual property (IP) of developing new fruit and vegetable species may have to be protected using patents etc. This has implications (risks and opportunities) on the developers and help in ensuring food security in the country. The intellectual property rights (IPRs) will be for the state since this will be a government run project.

(v) Indigenous Knowledge Systems

There are potential risks to livelihoods of resource poor farmers relating to their potential reduced capacity to access and use locally available genetic resources and indigenous knowledge, and avoid a dependence on commercial seeds and chemicals. Locally available genetic resources and indigenous knowledge could be crowded out by the introduction of dominant new varieties or through contamination of the gene pool by uncontrolled release of genetically modified organisms.

5.1.1.7.4 Health and Safety

(i) Occupational Hazards

The safety of staff and the local population may be at risk during the roll-out programme activities which may entail intensive land preparations and employing new technics. The operation of various equipment and machinery will expose the workers to work-related accidents and injuries. Pollutants such as dust and noise could also have negative implications for the health of workers and near-by communities such as bronchial diseases from dust and hearing impairments due to prolonged working under noisy conditions.

(ii) Exposure to Agrochemicals

Replication and up-scaling of horticulture growing activities may result in the use of agro-chemicals to realise better yields and control pests and diseases. However, the farmers have limited knowledge of the poisonous nature of the chemicals, may employ poor disposal methods, wash empty containers and equipment in rivers and apply the agro-chemicals wrongly. This poor handling of the chemicals, exacerbated by potential accidental spillages, can then expose the farmers to these toxic chemicals resulting in the poisoning of farmers, aquatic animals and soils.

(iii) Impacts of Roll-out Activities on Farmers and Other Stakeholders

Various works at the agricultural plots have potential to cause inconveniences or even injuries to the farmers as they continue with their day to day duties. At all sites, these works may have potential hazards to staff and farmers for example, farm plant and equipment, dust, spillages.

(iv) Misuse or Inability to Use Installed Equipment

Use of the improved facilities will be impaired if the farmers are not fully trained. This may result in the underutilisation and damage of equipment and may also result in the injury of the farmers.

5.1.2 Significant Positive Impacts.

5.1.2.1 Potential Positive Benefits during Refurbishment of Research Stations

5.1.2.1.1 Socio-Economic Impacts

(i) Employment Opportunities

These opportunities arise during and after the refurbishment processes. During the refurbishment process jobs may become available for construction workers. Once the centres are up and running, more jobs may be created to run the expanded facilities ranging from the technical staff to train and run the machinery to non-technical job opportunities for cleaners, security guards, etc. APPSA will ensure that all opportunities for training and employment generation include gender sensitivity and encourage women's participation. The APPSA results framework will measure gender disaggregated results for all beneficiary groups.

(ii) Income to Material/ Equipment Suppliers and Contractors

The proposed refurbishments of the RCoLs will necessitate the procurement of equipment, construction materials and services, providing income to suppliers and contractors. This is a positive but short-term impact. Considering that construction labour would be local or national but some building materials will be procured internationally. This impact has local, national and international spatial extent.

(iii) Improvement in Livelihoods and Local Economies

The availability of work for locals during the refurbishment period will increase household incomes leading to the benefit of improved local economies.

5.1.2.2 Potential Positive Benefits of Research Activities at the Improved Research Facilities

5.1.2.2.1 Impacts on Physical and Natural Resources

(i) Ambient Air Quality

Some laboratories will require purified air and generally the environment must be neat. This will thus result in improved air quality in the laboratories.

(ii) Aesthetics

Renovation will improve aesthetics of the RCoLs which, in their present state, are dilapidated. Some buildings currently being used are unfit for occupation. Renovation will also give these buildings and equipment an extended life.

5.1.2.2.2 Socio-Economic Impacts

(i) Employment Opportunities

These opportunities will arise from the expanded research opportunities brought about by the upgraded research stations. Once the centres are up and running, jobs may be created to run the expanded facilities ranging from the technical staff to train and run the machinery to non-technical job opportunities for cleaners, security guards, etc.

(ii) Research at the RCoLs

The project will positively impact on the technology development programmes through improved quality and diversity of research that will be offered. Renovation of the centres and installation of equipment will enable currently unsustainable centres to provide new or improved research and production activities leading to sustainability of the centres.

(iii) Impacts on Livelihoods and Local Economies

An improved working environment will improve labour productivity and household incomes leading to the long-term benefit of improved local economies.

5.1.2.3 Potential Positive Benefits of Technology Dissemination

5.1.2.3.1 Physical and Natural Resources Impacts

(i) Improved Aesthetics and Life of Agricultural Facilities

Renovations and up-scaling of agricultural activities will improve their aesthetics and this should be maintained.

5.1.2.3.2 Socio-Economic Impacts

(i) Income to Material/ Equipment Suppliers and Contractors

The proposed roll-out of horticulture research activities will necessitate the procurement of equipment, consumable materials and services, providing income to suppliers and contractors. This is a positive but short-term and reversible impact where the income levels for the suppliers and contractors will be raised.

(ii) Employment Opportunities

Expanded agricultural activities and programmes as a result of technology uptake will result in the creation of more long-term job opportunities for locals as extension and change agents, community facilitators, etc.

(iii) Improvement in Livelihoods and Local Economies

Improved agricultural outputs will enhance the livelihoods of the communities, raising their incomes and hence further improve productivity and lifestyles. However social conflicts may arise due to increased wealth differentials among the population.

5.1.3 Summary of Key Positive and Negative Impacts

Table 5-5 below presents a summary of the key potential risks and impacts that may occur during each of the project phases.

Table 5-6: Summary of Key Risks and Impacts

No.	PROJECT PHASE	KEY NEGATIVE IMPACTS	KEY POSITIVE IMPACTS
1.	CONSTRUCTION PHASE	Dust, Noise, Occupational health and safety (OHS) risks, Public safety from refurbishment works (construction traffic, etc.), Spillage of oil/lubricant wastes and Construction debris/waste. Disposal of potentially toxic materials eg asbestos, electric fittings with mercury, etc. Spread of diseases. Breaking of social fabric	Improved aesthetics Creation of jobs Income to material suppliers Improvement in livelihoods and local economies
2.	OPERATIONS PHASE	Impacts on water quality from laboratory chemicals, Waste management (hazardous waste, chemical waste, sharps, contaminated waste, and possibly radioactive waste depending on what type of equipment and instruments may be used); Biosafety (depending on level of research anticipated) Soil and land degradation	Creation of jobs after refurbishment period Creation of more long-term jobs New technology developed and on offer Diversification of productivity possible Enhancement of livelihoods of communities Raising of income levels Improvement of productivity and lifestyles
3.	TECHNOLOGY DISSEMINATION PHASE	Water resources (e.g. abstraction of water for irrigation) Pollution of water sources and soil due to agro-chemical inputs OHS risks to farmers Health risks to communities due to contamination from agrochemicals Land degradation Risks of IP being stolen or patented by other parties Overcrowding of indigenous varieties by GMO Erosion of indigenous knowledge systems Risk to resource poor farmers of potentially reduced capacities	Improved aesthetics Income levels for suppliers and contractors raised. Creation of more long-term jobs Enhancement of livelihoods of communities Raising of income levels Improvement of productivity and lifestyles. Food and nutritional security Use of evolved agricultural practices Global recognition of research innovations Maintaining the biological diversity and ecological balance Maintaining the livelihood of the poor

5.2 Significance Rating

The significance of adverse impacts from project actions is rated on the basis of the combination of the likelihood and consequence of the impact and scales of rating are High, Moderate and Low as shown in the matrix in Table 5-7 below. Where an aspect is affected by more than one impact, the highest rating is taken as the applicable significance of the impact.

Table 5-7: Significance Rating Matrix

Likelihood \ Consequence	Consequence				
	Negligible	Minor	Moderate	Major	Severe
Certain	L	M	M	H	H
Likely	L	M	M	H	H
Possible	L	L	M	H	H
Unlikely	L	L	L	M	H
Rare	L	L	L	M	M

Tables 5-7, 5-8 and 5-9 below show the significance of impacts for the three project phases before and after mitigation is applied.

Table 5-8: Significance of Potential Impacts during Refurbishment of Research Stations

Table 5.6: Significance of Potential Impacts during Rehabilitation of Research Stations					
Aspect	Risks and Impacts	Consequence	Likelihood	Significance	
				Before Mitigation	After Mitigation
Construction Impact					
Physical restrictions on building space.	Can't expand the centres outwards. Size of existing structures small May call for new structures. Renovations restricted to internal alterations.	Moderate	Certain	M	M
Demolitions	Creation of demolition debris, including potentially hazardous material. Building rubble obstructs movement, affects the aesthetics of the centres. Dust. Noise. Worker and public safety	Moderate	Certain	M	M
Constructions	Construction waste, obstruction of movement, health and safety hazards. Dust affecting air quality. Noise. Public safety	Moderate	Certain	M	M
Temporary Disruption of Research Work	Shortages of working space. Moving equipment around to make way for renovations Temporary disruptions to on-going research	Moderate	Certain	M	M
Impacts of Construction activities on, staff or other stakeholders	Inconvenience or injuries to staff or other stakeholders. Cracking of existing structures from vibrations.	Moderate	Possible	M	L
Temporary Visual Intrusion	Unsightly, messy construction sites	Moderate	Certain	M	L
Physical and Natural Resources					
Soil and Land degradation.	Soil and land pollution, erosion, spoil heaps, excavations defacing countryside.	Major	Likely	H	M
Air Quality	Pollution of air – dust.	Major	Certain	H	M
Water Quality	Pollution of water resources. Impact on aquatic animals. Loss of ordinary use of water. Polluted water affects plant growth.	Moderate	Possible	M	M

	Treatment cost of the water become high.				
Noise	Irritation and anger. Impairment of hearing.	Minor	Likely	M	L
Socio-Economic Impacts					
Anxiety and anticipation	Suspicion. Lack of cooperation. Hiding of information	Moderate	Possible	M	L
Labour Influx	Spread of diseases. Disintegration of social fabric. Social conflicts	Major	Likely	H	M
Health and Safety					
Occupational hazards	Work related accidents and injuries. Bronchial diseases from dust. Hearing impairments due to prolonged working in noisy areas.	Major	Possible	H	M
Disruption of Utilities Services	Affect operations of neighbours. Disrupt internal operations. Temporary closure of the RCoLS	Major	Possible	H	M
Vehicular traffic	Nuisance to other road users. Heavy human presence. Vehicular accidents.	Major	Possible	H	L

Table 5-9: Significance of Potential Impacts During Research Activities at the Improved Research Facilities

Aspect	Risks and Impacts	Consequence	Likelihood	Significance	
				Before Mitigation	After Mitigation
Waste Management					
General waste	Effluent pollutes soil and water resources.	Major	Certain	H	M
Hazardous waste	Pollution of water sources, land contamination. Risks to human and animal health	Severe	Certain	H	H
Non-Hazardous solid waste	Littering, spread of disease by vermin.	Major	Certain	H	M
Non-Hazardous Liquid Waste	Pollution of water sources, land contamination	Major	Certain	H	M
Physical and Natural Resources					
Soil and land degradation.	Soil and land contamination.	Minor	Possible	L	L
Air quality	Contaminated air in laboratories	Major	Possible	H	M
Water quality	Pollution of water resources by laboratory effluents. Impact on aquatic animals. Loss of ordinary use	Major	Certain	H	M

	of water. Polluted water affects plant growth. High treatment cost.				
Socio Economic Impacts					
Anxiety and anticipation	Anxiety. Lack of cooperation. Hiding of information	Moderate	Likely	M	L
Poor stakeholder participation	Lack of ownership of the project, poor uptake of research innovations by farmers. Low chances of sustainability of the project.	Major	Possible	H	L
Health and Safety					
Occupational health and safety	Work related illnesses from infectious waste. Accidents or injuries.	Major	Possible	H	M
Chemical safety	Unsafe working conditions. Fire hazard. Contamination of the environment. Contamination of the water resources. Poisoning of staff	Severe	Possible	H	M
Radiation safety	Illnesses such as Erythema, epilation, cataracts, mutagenesis, carcinogenesis, teratogenesis	Severe	Possible	H	H
Fire safety	Fires from ignitable materials, electrical faults.	Severe	Possible	H	M
Misuse or inability to use installed equipment	Impairment of use of equipment. Damage to equipment. Injury of workers.	Major	Possible	H	L
Biosafety	Accidental release/escape, Contamination of crops, and indigenous and other plant species. effect on food supply. Negative effects on human health	Severe	Unlikely	H	M

Table 5-10: Significance of Potential Impacts during Dissemination of Horticulture Technology

Aspect	Risks and Impacts	Consequence	Likelihood	Significance	
				Before Mitigation	After Mitigation
Waste Management					
Effluent and solid waste	Effluent /agrochemicals pollute soil and water resources. Littering and indiscriminate dumping of solid waste pollutes land and water.	Major	Certain	H	M
Physical and Natural Resources					
Physical restrictions on project space -trial farms	Erosion of steep mountain sides. Gully formations in the valleys.	Major	Likely	H	M
Soil and land degradation.	Soil compaction. Exposure of top soil. Breakdown of soil structure. Decrease in drainage. Dust. Noise. Defacing of countryside. Soil and water pollution.	Major	Likely	H	M
Air quality	Increases in pollen, emissions from agro-processing plants, causing bronchial disorders.	Moderate	Possible	M	L
Water quality	Pollution of water resources by agrochemicals. Impacts on aquatic animals. Loss of ordinary use of water. Polluted water affects plant growth. High treatment cost.	Major	Likely	H	M
Noise	Irritation and anger. Impairment of hearing.	Moderate	Possible	M	L
Visual intrusion	changes in landscape from new irrigation systems, agro-processing plants	Moderate	Likely	M	M
Socio Economic Impacts					
Anxiety and anticipation	Suspicion. Lack of cooperation. Hiding of information	Moderate	Likely	M	L
Poor stakeholder participation	Lack of ownership of the project by the locals. Poor participation in project implementation. Low chances of sustainability of the project.	Major	Possible	H	L
Loss of natural and cultural heritage.	Destruction of cultural, traditional or archaeological artefacts and sites	Major	Unlikely	M	L
Intellectual Property Rights (IPRs)	Theft of IPR	Major	Possible	H	M

Indigenous Knowledge Systems	Overcrowding of indigenous varieties by GMO. Risk to resource poor farmers of potentially reduced capacities.	Major	Possible	H	M
Health and Safety					
Occupational safety and health	Work related accidents and injuries. Bronchial diseases from dust. Hearing impairments due to prolonged working in noisy areas.	Major	Possible	H	M
Exposure to agro-chemicals	Poisoning of farmers by chemicals. Poisoning of aquatic animals by the chemicals. Poisoning of the soil by the chemicals.	Major	Likely	H	M
Impacts of roll-out activities on farmers or other stakeholders	Inconvenience or injuries to farmers.	Moderate	Possible	M	L
Misuse or inability to use installed equipment.	Impairment of use of equipment. Damage to equipment. Injury of farmers.	Major	Possible	H	L

It can be seen that in almost all cases, mitigation will lower the significance of the impact. The only residual impacts of high significance are related to hazardous waste and radiation safety.

5.3 Environmental and Social Management Plans

The proposed environmental and social management plans (ESMPs) for the proposed refurbishments of research facilities (Table 6-1), the research activities at the improved research facilities (Table 6-2), and dissemination of horticulture technology (Table 6-3) provide guidelines for the management of potential environmental and social aspects at the possible project sites. In each case, the EMSP identifies parties responsible for implementing and monitoring actions, and any training or capacity building needs.

Mitigation measures have been proposed to reduce both existing and potential impacts associated with both the existing and proposed refurbishments at the RCoLs and the horticulture research and dissemination roll-out programmes. In addition, mitigation measures are identified as either social or bio-physical measures. Social mitigation includes the measures used to mitigate effects such as noise, land use, and other effects to the human environment. Bio-physical mitigation includes measures that address impacts to the bio-physical environment, such as biological communities, vegetation, air quality, and others.

It is also important to note that appropriate facility designs are key to mitigating environmental and social risks and impacts. Hence reference must also be made to design recommendations in Chapter 2.

5.3.1 ESMPs For Negative Impacts

Tables 5-11 to 5-13 are outlining the ESMP for the addressing the negative impacts of the refurbishments, research and dissemination of the proposed horticulture approaches.

Table 5-11: ESMP for Addressing Impacts During Refurbishment of Research Facilities

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES (\$)	RESPONSIBILITY	CAPACITY BUILDING
Construction Impacts				
Physical Restrictions on Building Space				
The size of construction sites is generally small.	Does not apply for refurbishing existing buildings but may entail the erection of high rise buildings for any lateral expansion. The proposal is to restrict all activities within the existing research station premises. Thus, all planning has to deal with internal refurbishments and use of available land.		Lesotho APPSA and Contractor	
Demolition				
Demolition of buildings and walls to make way for new partitions will generate a lot of debris, dust and noise. Activities at construction sites will produce construction wastes whose disposal will pose a threat to the environment. Demolition may also cause occupational health and safety issue such as accidents, injuries (and deaths) from falls from heights, slips and tripping, electrocution, vehicular traffic, etc.	Construction debris must be disposed of properly and not allowed to accumulate at the construction sites. Use dust suppression measures to reduce dust emissions. Use less noisy equipment and work during normal working hours to avoid disturbing the rest of the community. Recycling of these materials will reduce the amount sent to the landfill. Concrete or stone can be crushed and used as aggregate for concrete. The wood can be reused for construction on projects other than the laboratory projects or used as a fuel source. Seek guidance of local environmental officers to identify acceptable disposal sites. Contractors should undertake waste segregation at source to separate hazardous from non-hazardous waste. Take measures to identify any residual impacts from traces of hazardous waste in the construction debris.	00.00	Lesotho APPSA Contractor; Regional Centres of Leadership (RCoLs) Administrator Local Environmental Officer.	For disposal of hazardous and non-hazardous construction waste

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES (\$)	RESPONSIBILITY	CAPACITY BUILDING
	<p>Demolition debris can be recycled. Concrete or stone can be crushed and used as aggregate for concrete. Wood can be reused for construction on projects other than the refurbishments at the laboratories or used as a fuel source. Recycling of these materials will reduce the amount sent to the landfill.</p> <p>Building debris found with hazardous elements must be handled as hazardous material and disposed of appropriately at an approved disposal site.</p> <p>Provide PPEs and ensure that they are worn when workers are working</p> <p>Carry out morning tool box sessions and provide appropriate training to workers who may be engaged in dangerous activities such as working from heights or with electric cables.</p> <p>Switch off electricity when work is done around electric cables and switches</p>			
Construction				
<p>Construction activities including restocking of building materials, etc. will generate construction debris, dust, noise and constitute public nuisance.</p> <p>Construction may also cause occupational health and safety issue such as accidents, injuries (and deaths) from falls from heights, slips and tripping, electrocution, vehicular traffic, etc.</p>	<p>Construction measures during construction will include the following:</p> <p>Construction debris must be disposed of properly and not allowed to accumulate at the construction sites.</p> <p>Employ dust suppression measures to reduce dust emissions.</p> <p>Use less noisy equipment and work during normal working hours to avoid disturbing the rest of the community</p> <p>Develop a Health and Safety Plan (HASP);</p> <p>Develop a Construction Operations Plan;</p> <p>Restrict construction to designated areas and times;</p> <p>Development of various management plans, including construction-related environmental and social management plan;</p> <p>occupational health and safety plan; community health and safety plan;</p> <p>traffic management plan;</p> <p>waste management plan,</p> <p>emergency response plan;</p> <p>labour force management plan;</p>	0.00	tho APPSA Contractor; Regional Centres of Leadership (RCoLs) Administrator	

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES (\$)	RESPONSIBILITY	CAPACITY BUILDING
	<p>Ensure proper working conditions for construction workers, including provision of sanitary facilities, potable water, rest areas, induction training, provision of PPE, work schedules (stipulating work hours per week).</p> <p>Provide PPEs and ensure that they are worn when workers are working</p> <p>Carry out morning tool box sessions and provide appropriate training to workers who may be engaged in dangerous activities such as working from heights or with electric cables.</p> <p>Switch off electricity when work is done around electric cables and switches</p>			
Temporary Disruption of Training Services				
Since the Regional Centres of Leadership (RCoLs) under renovation will not be closed, they will experience limitation of working space.	<p>Plan pre-construction activities early to identify suitable rooms or adjoining buildings into which to relocate equipment and researchers with minimal inconvenience.</p> <p>Refurbishment should be in phases so that the whole facility is not disrupted at once.</p>	Included as part of project investment.	LESOTHO APPSA Contractor; Regional Centres of leadership (RCoLs) Administrator	
Impacts of Construction Activities on Researchers, Staff or other Stakeholders				
Refurbishment work undertaken in the same buildings having students has potential to cause inconvenience or even injuries to the students.	<p>Contractors should cordon off areas under construction</p> <p>Ensure good housekeeping and clean operations always immediately removing rubble strewn outside construction areas.</p> <p>Construction workers should limit verbal noise or other forms of noise during the renovation works inside the buildings</p> <p>Contractors should use screens or nets to avoid flying debris and dust.</p>	Included as part of project investment	Lesotho APPSA and Contractor	Good construction practices
Temporary Visual Intrusions				
Construction materials and contractor camps will cause temporary visual blight at sites.	Contractor should ensure minimum footprint of construction activities and provide decent accommodation for workers.	Included as part of project investment	Contractor and Regional Centres of leadership (RCoLs) management.	
Physical and Natural Resources				
Soil and Land Degradation				

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES (\$)	RESPONSIBILITY	CAPACITY BUILDING
Point source contamination from spilled paints, diesel, lubricants etc. around workshop areas.	Appropriate containment measures for all operational areas and proper disposal of used lubricants. Take measures to identify any residual impacts from traces of pollutants accidentally discharged into the environment.	Included as part of project investment	Lesotho APPSA and contractor	Environmental awareness training
Air Quality				
Air quality will be impacted by emissions from vehicles, equipment and released particulate matters. Demolition to modify the built environment will lead to considerable levels of cement dust and asbestos dust which can affect the health of the workers and the public.	Contractors should use dust screens or nets in windows, doorways and ventilators of rooms where demolition or other dusty construction activities are occurring Processing waste must be handled properly to avoid contamination and smells. Dust suppression measures such as watering of dusty surfaces must be instituted at all sites. Accredited firms must be contracted to manage hazardous materials such as asbestos	Included as part of project investment and 9,000.00	Lesotho APPSA and contractor	e
Water Quality				
Water quality will be impacted by wastewater discharges from construction activities including onsite sewage and rainwater run-off.	Contractor to employ proper sanitary facilities Pollution from lubricants and other wastes to be avoided.	Included as part of project investment	Lesotho APPSA and Contractor	e
Noise				
Noise and vibration caused by machines, site vehicles, pneumatic drills etc.	Contractor to avoid old and faulty equipment. Heavy duty equipment to be minimized. Noisy operations to be limited to certain times. Noise levels to be limited to within acceptable levels.	Included as part of project investment	Lesotho APPSA and contractor	e
<i>Socio-Economic Impacts</i>				
Anxiety and Anticipation				
Project planning to be more transparent and should not take long.	The planning stage must be shortened and on commencement the implementation must be within schedule. There should be continuous consultations with staff and the local communities so that everybody is always on the same page of the developments.		Lesotho APPSA and contractor	e
Labour Influx				

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES (\$)	RESPONSIBILITY	CAPACITY BUILDING
<p>acts associated with the contractor's camp include:</p> <p>Disposal of liquid and solid wastes.</p> <p>Theft, alcoholism and sexually transmitted diseases (especially HIV/AIDS).</p> <p>Gender Based Violence (GBV) and Sexual Exploitation and Abuse (SEA)</p> <p>Child abuse including rape</p> <p>Conflicts and disputes</p>	<p>As a contractual obligation, contractors should be required to have an HIV/AIDS policy and a framework (responsible staff, action plan, etc.) to implement it during project execution.</p> <p>Contractor will be responsible for all work-related illnesses as required by the Labour Code.</p> <p>Contractor to curb thefts and misbehaviour as spelt out in a code of conduct (CoC) as part of the works contract.</p> <p>Contractor to manage any of its waste properly.</p> <p>Contractor to sign code of conduct (CoC) and ensures that workers abide by the CoC</p> <p>Contractor should be responsible to curb gender-based violence and child abuse as specified in the code of conduct.</p> <p>Safeguards officer should ensure that community engagement on gender-based violence and child abuse</p> <p>Establish a functional grievance redress mechanism/system (GRM)</p>	Included as part of project investment	Lesotho APPSA safeguards officer and contractor	
Health and safety				
Occupational Health Safety Risks to Construction Workers and other Stakeholders				
<p>The movement of trucks to and from the site, the operation of various equipment and machinery and the actual refurbishment activities will expose the workers to work-related accidents and injuries.</p> <p>Pollutants such as dust and noise could also have negative implications on the health of workers.</p>	<p>All safety precautions, including working at heights, around electric cables, etc. must be enforced</p> <p>Provide PPE to all workers</p> <p>Carry out training, inductions and tool box for workers on work safety</p>	Included as part of project investment	Lesotho APPSA and contractor	Application of various types of PPE and their proper use.
Disruption of Utilities Services				
<p>The demolition and excavations during refurbishments may cause temporary disruptions of utility services such as electricity communication and water.</p>	<p>Any service disruption must be reconnected as soon as possible</p> <p>Alternative means of providing the service must also be used.</p> <p>Work closely with utility companies/agencies to ensure that danger that could come from electric power cables, switches, etc. are curtailed</p>		Lesotho APPSA, contractor, RCoLs), Administrator	None
Vehicular Traffic				

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES (\$)	RESPONSIBILITY	CAPACITY BUILDING
<p>Communities around the rehabilitation sites will experience heavier human and vehicular traffic.</p> <p>High traffic volume around the RCoLs and within the communities resulting in accidents.</p>	<p>Implement traffic management plan</p> <p>Traffic safety procedures, including signage and warnings to be observed by construction workers.</p> <p>Put in place speed limiting structures such as bumps</p> <p>Ensure drivers respect speed limits through built areas and urban centres.</p> <p>Employ safe traffic control measures, including temporary road signs and flag persons to warn of dangerous conditions.</p>		<p>Lesotho APPSA and contractor</p>	<p>Contractor needs speed awareness through built areas and urban areas</p>

Table 5-12: ESMP for Addressing Impacts During Research Activities at the Improved Research Facilities

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES	RESPONSIBILITY	CAPACITY BUILDING
Waste Management				
Research Waste Generation				
The research activities will generate different kinds of waste requiring different kinds of handling (see Chapter 2). The generated effluent has potential to pollute the soil and water resources, but also contaminate gene pools and affect human and animal health.	<p>All waste streams should be handled appropriately and effluents channelled to waste stabilisation/treatment ponds. (See Chapter 2)</p> <p>Waste should be segregated: there is need for accurate and complete labelling and safe storage, transport, treatment and disposal of wastes. Wastes should be segregated and mixing avoided where possible, as unexpected reactions may occur. minimize waste generation where possible. Waste chemicals and solvents will be stored in suitable areas whilst awaiting collection and must not be accumulated. Regular disposal from the laboratories must be part of the laboratory OHS program. designate a separate residue container for any one particular type of waste which will be generated in large amounts. The container must be leak proof and there should be no spillage on the exterior of the container.</p> <p>provide Personal Protective Equipment (PPE) for normal laboratory operations and for handling any chemical waste</p>	30,000.00	Research stations, Lesotho APPSA	Environmental and social awareness training
Hazardous Waste Management				
Generation of waste from laboratories which includes chemical waste, radioactive waste, glass and sharp waste which has a potential to pollute the environment and harm humans.	<p>All hazardous waste must be collected and transported to appropriate treatment facilities like incinerators, etc. Measures should be taken to identify any residual impacts from traces of hazardous waste that might have escaped.</p>	15,000.00	Research stations, Lesotho APPSA	Environmental and social awareness training
Non-Hazardous Solid Waste Management				
Generation of general waste from offices and laboratories with a potential of littering the environment	All non-hazardous solid waste generated at the research facilities must be collected and disposed of at appropriate landfill sites or incinerated	Included as part of project investment	Research stations, Lesotho APPSA	Environmental and social awareness training
Non-Hazardous Liquid Waste Management				
Discharge of poor quality non-hazardous liquid waste from the research facilities	<p>All such effluents must be directed to stabilisation ponds before finally being discharged into the environment.</p> <p>Measures should be taken to identify any residual impacts from traces of waste effluents that might have escaped.</p>	Included as part of project investment	Research stations, Lesotho APPSA	Environmental and social awareness training

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES	RESPONSIBILITY	CAPACITY BUILDING
Physical and Natural Resources Impacts				
Soil and Land Degradation				
Point source contamination from diesel, lubricants, etc. around working areas. Increased soil erosion due to vegetation clearing, soil trampling and compaction. Some trial station sites are on steep terrain and erosion is impacting on arable land Increased rapid runoff due to vegetation clearing and soil compaction diminishing infiltration capacity. Deterioration of soil characteristics due to increased erosion.	Appropriate containment measures for all operational areas and proper disposal of used lubricants. Institute soil erosion control measures to reduce erosion potential like contouring, stabilising slopes, re-vegetation, reseeding of grasses, land preparation, terracing, use of gabions, stabilization of banks of canals, etc.) Institute catchment conservation measures. Restoration of borrow pits, sand and quarry stone abstraction sites and brick moulding sites.	7,000.00	MAFS, MFLR, Lesotho APPSA and contractor	Environmental and social awareness training
Water Quality				
Water quality will be impacted by wastewater discharges from construction activities including onsite sewage and rainwater run-off. Soil and water pollution resulting from the accumulation of solid and liquid waste. Soil and water pollution from chemicals & fertilizers meant for production. Water quality may be impacted by waste streams from processing plants.	Contractors to erect proper sanitary facilities. Pollution from lubricants and other wastes to be avoided. Controlled disposal of wastes and effluent by use of appropriate disposal facilities, use of appropriate drainage structures, use of cleaner technologies, proper storage of materials, awareness campaigns Waste must be recycled and reused to avoid dumping in waterways.	5,000.00	Lesotho APPSA and contractor, District Agric. Officer	Environmental and social awareness training
Socio-Economic Impacts				
Anxiety and Anticipation				
Project planning not be (or perceived to be) transparent and may take long. Stakeholders anxious as they do not know exactly what will happen and when it will happen	The planning stage must be shortened and on commencement the implementation must be within schedule. There should be continuous consultations with staff and the local communities so that everybody is always on the same page of the developments.	N/A	MAFS, Lesotho APPSA and contractor	Environmental and social awareness training
Health and Safety				
Occupational Health Safety Risks				
The movement of trucks to and from the site, the operation of various equipment and machinery and the actual agricultural activities will expose the workers to work-related accidents and injuries.	All safety precautions must be enforced. Provide PPE to all workers. Institute dust and noise suppression measures.	Included as part of project investment	MAFS, Lesotho APPSA and contractor	Application of various types of PPE and their proper use.

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES	RESPONSIBILITY	CAPACITY BUILDING
Pollutants such as dust and noise could also have negative implications for the health of workers.				
Chemical Safety				
<p>Unsafe working conditions can be created by chemicals that will be stored and used at the research stations which will then pose hazard due to:</p> <ul style="list-style-type: none"> • General chemical hazards • Flammable chemicals • Reactive chemicals • Poor storage facilities • Accidental discharge into the environment 	<p>All chemicals should be stored appropriately in accordance with their characteristics preferably in a separate chemical store room from the rest of the laboratory.</p> <p>Obsolete chemicals should be returned to suppliers</p> <p>Measures should be taken to identify any residual impacts from traces of chemicals stored or being used at the research facilities.</p>	6,000.00	Laboratories Lesotho APPSA	Safe chemical storage practices.
Radiation Safety				
Radioactivity from equipment and radioactive reagents causing radiation exposure exceeding the threshold for safe working environments	<p>Ensure exposures are well below the threshold levels for each particular reagent.</p> <p>Employ appropriate safety measures to reduce exposure</p> <p>Measures should be taken to identify any residual impacts from traces of radioactive materials stored or being used at the research facilities.</p>	8,000.00	Laboratories Lesotho APPSA	Safe radioactive substances use and storage practices.
Fire Safety				
Fire extinguishers are either not serviced or non-existent in most of the facilities posing a high a risk of fire outbreak at the RCoLs with disastrous life and financial impact	de fire extinguishers to RCoLs staff on fire management	Included as part of project investment	Lesotho APPSA	Basic firefighting skills
Misuse or Inability to Use Installed Equipment				
Use of the improved facilities will be impaired if the staff are not fully trained.	de requisite training during equipment installation	Included in Training budget	Lesotho APPSA	Training on use of all new gadgets.
Biosafety				
Accidental release of transgenic plants and accidental escape of experimental insects and microorganisms from greenhouses, ending up affecting the environment, the food supply and human health.	<p>adherence to biosafety regulations.</p> <p>Measures should be taken to identify any residual impacts from transgenic plants which would have accidentally escaped into the environment.</p>	8,000.00	Lesotho APPSA, Research Stations	Training on biosafety.

Table 5-13: ESMP for Addressing Impacts During Dissemination of Horticulture Technologies

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES (\$)	RESPONSIBILITY	CAPACITY BUILDING
Waste Management				
Effluent and Solid Waste				
Most agricultural, agro-industries, packaging and marketing operations produce solid waste. Steam and hot water boilers produce ash Fresh food and processed food markets, waste from canning Waste generated from agricultural activities. Waste from agricultural produce processing. Waste from market places.	Seek guidance of local environmental officers to identify acceptable disposal sites. Waste from agricultural activities can be further processed into other uses, e.g. organic manure, composting, bio-digesting into biogas energy, etc. Reuse and recycling must be preferred over disposal of the waste.	7,000.00	Lesotho APPSA, local environmental officer.	Management/handling of hazardous and non-hazardous construction waste
Physical and Natural Resources Impacts				
Physical Restrictions on Project Space				
Some project sites are on steep terrain and erosion is impacting on arable land	Institute measures to reduce erosion potential like contouring, stabilising slopes and planting vegetation. Institute catchment conservation measures. Avoid unnecessary excavations and restore and protect any disturbed ground.	Included as part of project investment	MAFS, MFLR, Lesotho APPSA and contractor	None
Soil and Land Degradation				
Point source contamination from diesel, lubricants, etc. around working areas. Increased soil erosion due to vegetation clearing, soil trampling and compaction. Increased rapid runoff due to vegetation clearing and soil compaction diminishing infiltration capacity. Deterioration of soil characteristics due to increased erosion.	Appropriate containment measures for all operational areas and proper disposal of used lubricants. Soil erosion control measures (e.g. re-vegetation, reseeding of grasses, land preparation, terracing, use of gabions, stabilization of banks of canals etc.) Restoration of borrow pits, sand and quarry stone abstraction sites and brick moulding sites.	Included as part of project investment	MAFS, Lesotho APPSA and contractor	Environmental and social awareness training
Disturbance of Marginal Areas				
Establishing the projects in such areas poses serious threats to their further degradation.	Avoid extraction of raw materials from marginal areas, No construction of structures in marginal areas.	Included as part of project investment	Lesotho APPSA, NGOs and beneficiaries	Awareness creation
Loss of Fragile Ecosystems				
Fragile ecosystems like wetlands, quickly degrade and lose their functionality if misused.	Conduct feasibility studies before construction, Use expert knowledge of ecologists, Introduction of ecosystem conservation projects, Fencing out some sensitive sites. Harvesting of resources in wetlands must be controlled.	6.000.00	Contractors, Lesotho APPSA, District Forestry Department,	Awareness creation

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES (\$)	RESPONSIBILITY	CAPACITY BUILDING
	Agricultural activities in wetlands must be under controlled conditions – sustainable use of wetlands. Invasive alien species must not be introduced into sensitive ecosystem.			
Ambient Air Quality				
Air quality will be impacted by emission waste from processing, canning, etc. Air quality will be impacted by emissions from vehicles, equipment and released particulate matters in the process of the roll out activities.	Processing waste must be handled properly to avoid contamination and smells. Dust suppression measures such as watering of dusty surfaces must be instituted at all sites.	5,000.00	Lesotho APPSA and contractor	Training in good handling of hazardous materials
Water Quality				
Water quality will be impacted by wastewater discharges from construction activities including onsite sewage and rainwater run-off. Soil and water pollution resulting from the accumulation of solid and liquid waste. Soil and water pollution from chemicals & fertilizers meant for production. Water quality may be impacted by waste streams from processing plants.	Contractors to erect proper sanitary facilities. Pollution from lubricants and other wastes to be avoided. Controlled disposal of wastes and effluent by use of appropriate disposal facilities, use of appropriate drainage structures, use of cleaner technologies, proper storage of materials, awareness campaigns Waste must be recycled and reused to avoid dumping in waterways.	10,000.00	Lesotho APPSA, contractor, District Agric. Officer	Training in water quality monitoring
Noise				
Noise and vibration caused by machines, site vehicles, pneumatic drills etc. Noise from the processing of agricultural produce.	Contractor to avoid old and faulty equipment. Heavy duty equipment to be minimized. Noisy operations to be limited to certain hours of the day. Noise levels to be limited to within acceptable levels. Processing plants should be sited away from residential areas.	Included as part of project investment	MAFS, Lesotho APPSA and contractor	None
Visual Intrusions				
Rehabilitation and upgrading of agricultural facilities like warehouses, processing plants and other possible facilities will change the characteristics of the area and leave a marred landscape.	Contractor should ensure minimum footprint of construction activities and provide decent accommodation for workers. All altered landscapes (Sand pits, borrow pits, brick moulding sites etc.) should be rehabilitated by the contractor.	N/A	Contractor and DAO.	none
Socio-Economic Impacts				
Anxiety and Anticipation				

MPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES (\$)	RESPONSIBILITY	CAPACITY BUILDING
Planning of the dissemination of developed technology not very transparency and may take long. Stakeholders anxious as they do not know exactly what will happen and when it will happen	The planning stage must be shortened and on commencement the implementation must be within schedule. There should be continuous consultations with staff and the local communities so that everybody is always on the same page of the developments.		MAFS, LESOTHO APPSA and contractor	None
Poor Stakeholder Participation				
Poor participation of communities, staff members and other stakeholders in the planning and designing of the project.	evant stakeholders should be continuously involved and attend meetings from planning to construction	Included as part of project investment	MAFS, Lesotho APPSA and contractor	None
Loss of Natural and Cultural Heritage				
Natural features, antics and relics destroyed in the project area e.g. during excavations.	Conduct feasibility studies, fencing, introduce proper antiquity education programmes. Come up with a physical cultural resources management plan Establish procedure for chance finds.	10,000.00	MAFS, Lesotho APPSA, District Agric. Officer, NGOs	Requirement of the National Monuments Act.
Intellectual Property Rights (IPRs)				
Protection of intellectual property, to effect food and nutrition security, maintenance of the biological diversity and ecological balance and safeguarding the livelihood of the poor.	Institute a patent programme	7,000.00	MAFS, Lesotho APPSA, Research stations	Patent processing
Indigenous Knowledge Systems				
Overcrowding of indigenous varieties by GMO Risk to resource poor farmers of potentially reduced capacities	Establishing a project screening process with risk assessment guidelines addressing the indigenous knowledge systems, operational policies, standard operating procedures, training, preventative maintenance, integrated confinement systems, improved public relations and communications. Regular audits and reviews, overseen by a steering committee that includes stakeholder members.	Included as part of project investment	MAFS, Lesotho APPSA, Research stations	Indigenous knowledge systems
Health and Safety				
Occupational Health Safety Risks				
Research facilities are a potential source of various occupational health and safety risks. Poor working environments could pose unsafe conditions for staff.	All safety precautions must be enforced. Provide PPE to all workers. Institute dust and noise suppression measures.		MAFS, Lesotho APPSA and contractor	Application of various types of PPE and their proper use.
Exposure to Agro-chemicals				
Use of agro-chemicals may increase due to the roll out programme and the need to realise better yields by controlling pests and diseases. This can then expose the farmers to these toxic chemicals	Encourage organic farming and limit the use of agro-chemicals like inorganic fertilizers.	Included as part of project investment and training budget.	MAFS, Lesotho APPSA,	Conduct awareness training & workshops on

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES (\$)	RESPONSIBILITY	CAPACITY BUILDING
	<p>Apply integrated pest management approaches to minimize pesticide use.</p> <p>Conduct awareness training & workshops on safe handling of chemicals.</p> <p>Take measures to identify any residual impacts from traces of chemicals stored or being used at the research facilities.</p>		Sub-Project Management Committee	safe handling of chemicals.
Impacts of Roll-out Activities on Farmers and other Stakeholders				
Inconvenience or injuries to farmers due to the roll out processes. The potential hazards to staff and farmers will be from new farm plant and equipment introduced to implement the new farming approaches, and also from dust and spillages.	Minimise the inconveniences as much as possible	N/A	MAFS, Lesotho APPSA Sub-Project Management Committee	Awareness creation
Labour influx				
<p>Impacts associated with the contractor's camp include:</p> <p>Disposal of liquid and solid wastes.</p> <p>Theft, alcoholism and sexually transmitted diseases (especially HIV/AIDS).</p> <p>Gender Based Violence/SEA</p> <p>Child abuse including rape</p>	<p>As a contractual obligation, APPSA Lesotho PIU / Research Centre Administration should be required to have an HIV/AIDS policy and a framework (responsible staff, action plan, etc.) to implement it during project execution.</p> <p>Research Centre Administration to curb thefts and misbehaviour through a code of conduct.</p> <p>APPSA Lesotho PIU / Research Centre Administration will be responsible for all work-related illnesses as required by the Labour Code.</p> <p>APPSA Lesotho PIU / Research Centre Administration should be responsible to curb GBV/SEA and child abuse.</p> <p>APPSA safeguards officer should ensure that community engagement on gender based violence and child abuse</p>	Included as part of project investment and AIDS awareness campaigns	MAFS, APPSA Lesotho PIU and contractor	Awareness and sensitization

5.3.2 ESMPs for Positive Impacts

Tables 5-14 to 5-16 are outlining the ESMP for the addressing the positive impacts of the refurbishments, research and dissemination of the proposed horticulture approaches.

Table 5-14: ESMP for Addressing Impacts During Refurbishment of Research Facilities

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES	RESPONSIBILITY	CAPACITY BUILDING
Construction Impacts				
Improved Aesthetics of the (RCoLs)				
Renovation of the RCoLs will improve their aesthetics and this should be maintained.	Maintenance teams to be stationed at the Regional Centres of leadership (RCoLs). Planned maintenance of machines and buildings to be instituted	Included as part of project investment	Lesotho APPSA and facility management	Maintenance Staff training in the maintenance of newly installed equipment
Economic Impacts				
Employment Opportunities				
During refurbishment jobs may become available for construction workers. The refurbished centres will offer more long-term technical and non-technical job opportunities.	Offer appropriate training for staff to manage the improved facilities. Ensure equity in the recruitment and training processes to ensure equal opportunities between men and women	Included in training Budget	Lesotho APPSA and suppliers	Staff training in operation of improved facilities
Income to Equipment and Material Suppliers				
Project will promote local procurement where technically or commercially reasonable and feasible.	For earth materials, procure from legitimate sources to avoid encouraging environmental degradation	N/A	Lesotho APPSA and contractor	None
Improvement in Livelihoods and Local Economies				
Improved training delivery will improve labour productivity and household incomes and hence improve the local economy.	Leadership should promote viable economic activities. Employing local labour through consultations with the community leaders and chiefs. Employment creation initiatives such as labor based rural feeder roads and other infrastructural development.	N/A	Lesotho APPSA and local leadership	Stake holder training in entrepreneurship.

Table 5-15: ESMP for Addressing Impacts During Research Activities at the Improved Research Facilities

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES	RESPONSIBILITY	CAPACITY BUILDING
<i>Physical and Natural Resources Impacts</i>				
Ambient Air Quality				
Ambient air quality will be positively affected by the requirement for clean environment in the laboratories which will require purified air. This will thus result in improved air quality in the laboratories.	Air purification systems should be maintained at all times.	Included as part of project investment	Lesotho APPSA and contractor	Environmental and social awareness training
<i>Socio-Economic Impacts</i>				
Employment Opportunities				
Expanded Agricultural facilities and programmes will result in the creation of more long-term job opportunities with the resultant training of staff.	Offer appropriate training for staff to manage the improved facilities. Ensure equity in the recruitment and training processes to ensure equal opportunities between men and women	Included in training budget.	MAFS, Lesotho APPSA and scheme managers	Staff training in operation of improved facilities
Improved research at the RCOLs				
Improved technology developed allowing diversification of productivity and improved production potentials using newly installed equipment.	Renovation of Regional Centres of leadership (RCOLs) should be matched with commensurate staffing with technical staff adequately trained in the use of newly installed equipment	N/A	Lesotho APPSA and suppliers	Staff training in operation of newly installed equipment
Improvement in livelihoods and local economies				
Improved agricultural outputs will enhance the livelihoods of the communities, raising their incomes and hence further improve productivity and lifestyles. Social conflicts may arise due to increased wealth differentials among the population.	Leadership should promote viable economic activities. Awareness on replication by others should be a continuous process Monitoring the drought conditions ensuring the promotion of crop diversification through the introduction of early maturity and drought resistant varieties	Included as part of project investment	MAFS and local leadership	Stake holder training in entrepreneurship.

Table 5-16: ESMP for Addressing Impacts During Dissemination of Horticulture Technologies

IMPACT	MITIGATION MEASURES	ESTIMATED COST OF MEASURES	RESPONSIBILITY	CAPACITY BUILDING
<i>Physical and Natural Resources Impacts</i>				
Improved aesthetics and life of agricultural facilities				
The roll-out programmes will result in up-scaling of agricultural activities to commercial levels entailing Improved terracing and contour ridging of fields, and renovations and erection of modern processing plants. This will improve their aesthetics and this should be maintained.	Maintenance teams to be stationed at readily accessible places for the agricultural facilities. Planned maintenance of machines and buildings to be instituted.	Included as part of project investment	MAFS, Lesotho APPSA and Agricultural facility management	Maintenance Staff training in the maintenance of newly installed agricultural equipment

The following table is summary of the estimated costs for implementing the mitigation measures of the impacts that were identified for the APPSA project extracted from tables 5-11 to 5-16.

Table 5-17

No.	MEASURES CONSIDERED	ESTIMATED COST
1.	Demolition	15,000.00
2.	Construction	7,000.00
3.	Air Quality – demolition toxins like asbestos and from processing	14,000.00
4.	Research Waste Generation	30,000.00
5.	Hazardous Waste Management	15,000.00
6.	Soil and Land Degradation	7,000.00
7.	Water Quality – waste water discharges	15,000.00
8.	Chemical Safety	6,000.00
9.	Radiation Safety	8,000.00
10.	Biosafety	6,000.00
11.	Effluent and Solid Waste	7,000.00
12.	Loss of Fragile Ecosystems	6,000.00
13.	Loss of Natural and Cultural Heritage	10,000.00
14.	Intellectual Property Rights (IPRs)	7,000.00
	TOTAL	153,000.00

5.4 Contingency Emergency Response Component (CERC)

Lesotho is prone to a variety of natural disasters, in particular floods, droughts, pest and diseases, frost, hail storms, and Thunderstorms. These phenomena cause damages to properties, infrastructure, and livelihoods; they impede and set back development efforts, divert development funds and above all loss of lives. Agriculture is one of the most affected sectors by all disasters. Agricultural production and livelihoods, particularly of the majority of smallholder farmers in the country are recurrently affected by these natural hazards.

The Contingent Emergency Response Component (CERC) enables the project to provide a swift response in the event of an Eligible Crisis or Emergency¹⁴. This is done by redirecting a portion of the undisbursed project resources, from other components of the project to address immediate post-crisis and emergency financing needs (World Bank, 2017). The implementing agency for the CERC will be the Lesotho APPSA Project Implementation Unit (PIU).

In the event of an emergency, it is not anticipated that a reallocation of project funds will cause serious disruption to project implementation. The CERC is activated without needing to first restructure the Original Project, thus facilitating rapid implementation. Once the requirements for activating the CERC are met, uncommitted funds from the project are reallocated to the CERC and made available for crisis or emergency response. To facilitate a rapid response, formal restructuring is deferred to within three months after the CERC is activated.

¹⁴ This is an event that has caused, or is likely to imminently cause, a major adverse economic and/or social impact associated with natural or man-made crises or disasters, (OP/BP 8.00, *Rapid Response to Crises and Emergencies*.)

Activities under this Component will be governed by the World Bank Directive *Contingent Emergency Response Components (CERC)* (October 2017) (World bank, 2017). Disbursement of emergency financing under the CERC will be contingent upon:

- a) the recipient establishing a nexus between the disaster event and the need to access funds to support recovery and reconstruction activities (an “eligible event”); and
- b) submission to and no objection granted by the World Bank of an Emergency Action Plan (EAP). The EAP will include a list of activities, procurement methodology and safeguards procedures.

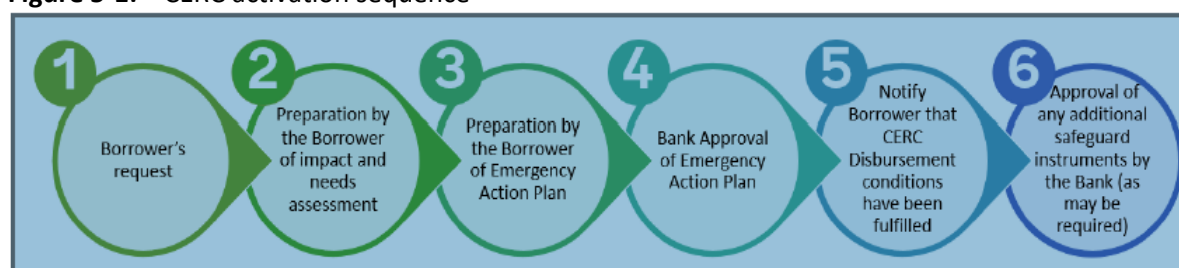
The preparation of the Emergency Action Plan (EAP) will have to take into consideration the current ESMF and any additional safeguard instruments. The additional safeguard instruments will require World Bank approval prior to commencement of activities. Importantly, the EAP will need to include procedures for:

- Consultation and disclosure;
- Integration of mitigation measures and performance standards into contracts; and
- Supervision/monitoring and reporting measures to ensure compliance.

5.4.1 Activating the CERC.

The sequence for activation of the CERC includes the following steps as outlined in the figure below:

Figure 5-1: CERC activation sequence



The Formal restructuring of the Original Project is not a pre-requisite for activating a CERC (World Bank, 2017).

5.4.2 Safeguards.

All activities financed through the CERC are subject to World Bank safeguards policies. The CERC will rely as much as possible on the Original Project’s social and environmental assessments and safeguard instruments, ensuring that as much as possible is known regarding risks and management measures in anticipation of an emergency response.

The EAP will require consideration of **safeguard** implications for any proposed emergency supplies procurement or reconstruction activities. The World Bank, through the no objection process, will closely examine the nature of the proposed activities, particularly those involving civil works, to ensure that:

- i. they are not prohibited under the negative list and

- ii. the recipient is aware of the required safeguard compliance documentation before initiating the process by which the proposed works will be prepared and implemented.

Emergency activities financed under the CERC will involve financing provision of critical goods or emergency recovery and reconstruction works and it is likely these will fall into Category B or C. Activities that fall under Category C could involve procurement of emergency supplies such as medicine and water and do not require the application of safeguard instruments, post-screening or assessment. Other emergency supplies, such as fuel products, will require safeguard instruments (such as Environmental Codes of Practice or EMPs) to ensure procurement, storage and dispensing procedures are adequate.

The implementing agency, ie the APPSA PIU will have to consider the following safeguards elements of the CERC before commencement of implementation:

- a) Confirming which activities can proceed on the basis of the provisions of the CERCE-ESMF, with no additional environmental or social assessment, and which ones require assessment (and at what level) prior to being initiated.
- b) Rapidly assessing the environmental and social baseline of the planned CERC activities and locations based on readily available information.
- c) Determining the sequencing and implementation plan for:
 - Mobilizing technical assistance and funding to prepare any additional safeguard instruments, e.g. Environmental and Social Management Plan, Resettlement Action Plan, etc.
 - Preparing the safeguards instruments and carrying out their Bank review, revisions, clearance, and approval.
 - Consultations and disclosure.
 - Establishing roles and responsibilities for safeguards implementation, and monitoring.
 - Estimating the costs for safeguards preparation and implementation.

In order to ensure that CERC sub-project activities comply with the requirements of the Bank's Safeguard Policies, a positive and negative list has been developed to provide guidance on critical supplies and/or for emergency works, goods or services which may be eligible for financing.

5.4.3 CERC Negative List

Sub-projects with the following potential impacts will not be eligible for financing under the CERC component or the parent project:

- cause, or have the potential to result in, permanent and/or significant damage to nonreplicable cultural property, irreplaceable cultural relics, historical buildings and/or archaeological sites;
- will negatively affect rare or endangered species;
- do not meet minimum design standards with poor design or construction quality, particularly if located in the research institutions;
- Require or involve the purchase, application or storage of pesticides or other hazardous materials such as asbestos;
- Involve sand mining or land reclamation;

- Require a higher proportion of funding than is available.
- Require acquisition of land and physical or economic displacement of people.
- Block the access to or use of land, water points and other livelihood resources used by others
- Encroach onto fragile ecosystems, marginal lands or important natural habitats (e.g. ecologically-sensitive ecosystems; protected areas; natural habitat areas, forests and forest reserves, wetlands, national parks or game reserve; any other environmentally sensitive areas)
- Have risks assessed as requiring biosafety levels BSL-3P and BSL-4P containment

5.4.4 CERC Positive List

The purpose of the positive list is to indicate the types of critical supplies and emergency works following a loss and needs assessment that would be acceptable to the Bank to be financed under this CERC. Project funds allocated to the CERC Disbursement Category may be used to finance any expenditure that is consistent with the Framework Agreement (FA) provisions.

The following sub-projects or activities will be deemed eligible under the CERC:

a) Critical Supplies:

Eligible expenditures on critical supplies required by the public/private sectors under the CERC include:

- Construction materials, equipment and industrial machinery.
- Water, air, land transport equipment, including spare parts.
- Purchase of petroleum and other fuel products.
- Any other item agreed to between the World Bank and the Recipient (as documented in an Aide-Memoire or other appropriate Project document).

b) Emergency Sub-projects:

Eligible expenditures for emergency sub-projects initiated following the Declaration of a National Emergency/Disaster in response to damage, losses and needs caused by an event are as follows:

- Repair or reconstruction of streets, roads, bridges, transportation and other infrastructure;
- Reestablishment of communications infrastructure;
- Reestablishment of drainage systems;
- Removal and disposal of debris associated with any eligible activity;
- Stabilisation of heavy erosion or unstable embankments and slopes;
- Replacement of vegetation destroyed by the event using native (not invasive) species;
- repair/mitigate damage caused by the event to a protected area or buffer zone (such as mangroves).

5.5 Monitoring and Evaluation.

In crisis/emergency response projects, effective monitoring is essential for providing performance feedback during implementation, and data on results are vital for learning and managing post-disaster recovery and reconstruction efforts. However, in such a situation, monitoring and evaluation is often severely constrained by many factors. The following monitoring modalities will be applicable for this project:

i. ***Data for M&E.***

As CERCs are event-driven and rapidly mobilized, M&E rely mainly on secondary data and qualitative information that is easily obtainable, such as from social assessments. Thus, Lesotho APPSA will target the collection of secondary data. Primary data collection may be used in selected situations when resources and time permit.

ii. ***Implementation monitoring***

This will focus on planned vs. actual types, numbers, locations, costs, and starting/completion times of activities undertaken.

iii. ***Performance monitoring***

Performance monitoring will rely on:

- field visits by the staff of the implementing agency,
- reports from supervision consultants,
- meetings with beneficiaries and local communities, and,
- where deemed necessary, technical inspections by third parties of selected CERC-financed activities.

6 GUIDELINES FOR THE PREPARATION OF AN ESIA AND AN ESMP

6.1 Introduction

Environmental and Social Impact Assessment (ESIA) is one of the methods and tools that are used to assess a project's potential social and environmental consequences and to develop appropriate measures to avoid and manage risks and impacts. The **Environmental and Social Impact Assessment (ESIA)** identifies and assesses the potential social and environmental impacts of a proposed project and its area of influence, evaluates alternatives, and designs appropriate avoidance, mitigation, management, and monitoring measures. An ESIA addresses all relevant issues related to the relevant Environmental and Social Safeguards Policies for the particular project. A key output of an ESIA is an Environmental and Social Management Plan (ESMP). Appendix 10 outlines an indicative outline of an ESIA whilst Appendix 11 provides the outline for an ESMP.

6.2 Key Steps for Conducting an ESIA

The following are the key steps that should be taken to conduct an ESIA.

6.2.1 Stage 1: Screening

Proposed projects must undergo Environmental and Social Screening Procedure (ESSP). The objectives of the ESSP are to:

- integrate the ESS Overarching Principles (i.e. human rights, gender equality and women's empowerment, environmental sustainability) to strengthen social and environmental sustainability
- identify potential social and environmental risks and their significance
- determine a project's risk category (A, B, C or FI), and
- determine the level of social and environmental assessment and management required to address potential risks and impacts.

Projects categorized as "C" require limited or focused forms of social and environmental assessment while High Risk Projects "A" require comprehensive forms of assessment (ESIA, SESA). (See table 3-3 for project categorisation.)

6.2.2 Stage 2: Scoping

Scoping parameters of ESIA. Where initial studies and analysis have not been conducted, it is important to undertake a scoping exercise early in the assessment process (i) to identify and focus the environmental and social assessment on key issues, and (ii) to establish a logical roadmap for the assessment process. The scoping exercise will vary depending on the range and complexity of potential social and environmental impacts. Scoping typically builds on the results of the screening and involves the following tasks/components:

- o An *initial* identification of significant environmental and social issues and potential adverse risks and impacts to be assessed.
- o Identification of data availability and gaps for conducting the assessment.

- o Identification of national/local project planning requirements as well as relevant safeguard requirements that must be addressed.
- o Identification of feasible project alternatives that will be considered in the assessment.
- o Scoping meetings with stakeholders to establish focus areas and potential issues of concern.
- o Identification of types and qualifications of specialists needed to undertake the assessment and required studies.
- o A summary scoping report

6.2.3 Stage 3: Conducting an ESIA Study

Step 1: Further Detail and Define the Proposed Project.

The assessment must be based on a well-defined project. Based on the Draft Project Document, the project should be further detailed to include, where relevant:

- The geographic, ecological, social and temporal context of the proposed project, including any offsite investments (i.e. associated facilities) that may be required (e.g. dedicated pipelines, access roads, power plants, water supply, housing, and raw material and product storage facilities);
- Project location, site, and design (e.g. technology/process, facilities design, construction, operation and maintenance, and decommissioning or closure); and
- Map showing the project site, project's area of influence (as determined during the scoping phase) and sensitive environmental and social features.

Step 2: Develop Baseline Information.

The current and projected environmental and social, and physical/cultural baseline data must be presented for the project's area of influence. This should include:

- Descriptions of the relevant existing physical, biological, gender, and socio-economic conditions;
- Evaluation of any changes anticipated in these conditions before the project commences, as well as any trends in or projections of data over time after the project commences that are anticipated independently of the project, including current and proposed development activities located in the project area but not directly connected to the project; and,
- Estimation of the reliability of the information sources used and the quality of the information available, including its accuracy, precision, completeness, representativeness, etc.

The baseline data should reflect the objectives and indicators identified in the 'scoping report.' For spatial plans, the baseline can usefully include the stock of natural assets including sensitive areas, critical habitats, and valued ecosystem components. For sector plans, the baseline will depend on the main type of environmental and social impacts anticipated, and appropriate indicators can be selected (e.g. emissions-based air quality indicators for energy and transport strategies).

Step 3: Review Policy, Legal/Regulatory and Institutional Framework

Review the legal and permitting requirements as well as applicable social and environmental standards from:

- Applicable laws and regulations of the local and national jurisdictions in which the proposed project will operate.
- Applicable international obligations and agreements (e.g. Multilateral Environmental Agreements) that must be complied with.
- Applicable World Bank Environmental and Social Safeguard Policies

Assess the adequacy of the identified applicable policy, legal/regulatory and institutional

framework relative to implementing and sustaining the proposed project, especially the proposed mitigation, monitoring and institutional responsibilities. Compare local standards with Bank policies, and where standards differ, adhere to the higher standard.

This discussion provides the legal and regulatory context for the project and helps to ensure that all relevant planning approvals are identified.

6.2.4 Step 4: Examine Project Alternatives and Revise Project Design.

Systematically review and compare feasible project alternatives identified during scoping and initial public consultation and select the preferred or most socially and environmentally sound and benign option(s) for achieving the objectives of the proposed project. Potential type and scale of likely social and environmental impacts associated with different alternatives should be considered. Consider all types of alternatives related to overall approach and project design, including the “no action” alternative. Factors to consider include:

- Project site locations.
- Timing.
- Scales.
- Partners.
- Intensities.
- Technologies/processes.
- Facilities designs.
- Construction.
- Operation and maintenance.
- Organizational and management setups.
- Ways of dealing with impacts

Based on the alternatives analysis conducted above, determine what, if any, modifications will be made to the project design to improve the social and environmental sustainability of the proposed project.

Step 5: Analyze and Evaluate Risks and Impacts.

Review and refine the list of potential risks and impacts identified during the scoping process.

This step of the assessment should consider the type, location, sensitivity and scale of the proposed project, analyze all of the likely and relevant social, environmental and related effects, including where relevant potential impacts on the following features:

- Physical: surface and ground water, air, soil, land use, landform/topography, noise, vibration, geology, seismicity and other natural hazards, resource use, waste, greenhouse gases, etc.
- Biological: terrestrial and aquatic flora and fauna, habitat and ecosystems, endangered species, protected areas, etc.
- Social and socioeconomic: impacts on socioeconomic conditions, human rights, livelihoods, indigenous peoples, vulnerable or marginalized groups, gender dimensions, risks of physical and/or economic displacement, occupational health and safety, cultural heritage, community health and safety. Examine if individuals or groups may be differentially or disproportionately affected because of their disadvantaged or marginalized status, and if so, ensure adverse impacts do not affect them disproportionately.

This step should also review and refine the project’s spatial and temporal area of influence established during the scoping phase. Impacts and risks must be analyzed in the context of the area of influence.

The spatial scope of potential impacts (i.e. area of influence) will encompass:

- The primary project site(s) and related facilities that the WORLD BANK and its Implementing Partners develop or control, such as buildings and facilities, protected areas, agricultural areas, fisheries, transportation, construction areas (e.g. seawalls, solar

- installations, roads);
- Associated facilities that are not funded or financed as part of the proposed project (funding or financing may be provided separately by the Implementing Partners or by third parties including multilateral financing institutions), and whose viability and existence depend on the project;
- Areas potentially impacted by cumulative impacts from the incremental adverse impacts of the project when added to other past, existing, planned or reasonably predictable future projects and developments (e.g. incremental contribution to pollutant emissions, forest depletion due to multiple logging concessions). Assessing potential cumulative impacts enlarges the scale and timeframe for assessing combined effects of multiple activities and impacts;
- Areas potentially affected by impacts from unplanned but predictable developments (indirect and induced impacts) caused by the project that may occur later or at a different location (e.g. facilitation of settlements or illegal logging in intact forest areas through expansion of adjacent agricultural activities);¹⁸
- Transboundary impacts, such as pollution of international waterways or transboundary river basins, air-sheds and ecosystems; migration of populations; international relations;
- Global environmental and social impacts, e.g. greenhouse gas emissions, ozone depletion, loss of biodiversity and desertification; loss of cultural diversity and heritage.

The temporal scope of potential impacts will encompass:

- Future anticipated or projected short-term impacts, e.g. increases in consumption, waste, pollution, capacity needs, and health problems resulting from the proposed project;
- Future anticipated or projected long-term impacts, e.g. indirect or secondary effects of induced unplanned development and changes in socio-economic conditions;
- Present or baseline pollution of the proposed project site or facilities, e.g. soil and ground water pollution originating from past disposal of or contamination with hazardous substances or wastes.

Impacts must also be analyzed for the key phases of a proposed project's lifecycle.

The organizational/management scope of potential impacts will include WORLD BANK and the Implementing Partner as well as the:

- Role and capacity of third party organizations, e.g. governments, construction contractors and suppliers (with whom the proposed project or Implementing Partner has a substantial involvement), or an operator of an associated facility (to the extent of the Project Developer's control or influence over these organizations);
- Supply chain organizations (where the resource utilized by the proposed project is ecologically sensitive, or where low labor cost is a factor in the competitiveness of the item supplied).

Use the following parameters to further characterize and quantify the potential environmental and social impacts: positive and negative, direct and indirect (primary and secondary), cumulative and synergistic, and reversible and irreversible.

Determine whether the proposed project will meet applicable social and environmental requirements (e.g. national laws and regulations, international obligations, World Bank Safeguard Policies) and determine what reasonable period of time will be needed. For impacts that cannot be fully mitigated, determine the relative importance and acceptability of the residual impact (e.g., additional resources needed).

The purpose is to identify 'win-win' solutions where multiple, mutually reinforcing gains can

strengthen the economic base, provide equitable conditions for all, and protect and enhance social and environmental sustainability.

Step 6: Prepare an ESIA Report

An ESIA Report will be prepared to provide an adequate, accurate and impartial evaluation and presentation of the issues and conclusions of the assessment. This report, which is usually technical, must be presented in an understandable format and in an appropriate language(s). Draft assessments and reports, including any draft management plans, should be disclosed before project appraisal; however, if the assessment is conducted as part of project implementation, then draft assessments need to be disclosed and consulted on prior to initiation of any activities that may lead to adverse social and environmental impacts. Short summaries and graphic presentations will often be required to facilitate reading and understanding. Moreover, a non-technical summary – that can be understood by different stakeholders – should be included to facilitate and encourage comments. Where appropriate, independent expertise should be used to assist in the preparation of ESIA reports.

6.2.5 Stage 4: Preparing an Environmental and Social Management Plan

Taking into account the relevant findings of the ESIA and the results of consultation with the project stakeholders, an Environmental and Social Management Plan (ESMP) needs to be prepared. The ESMP will be integrated into the overall project design, including the Project Monitoring Framework and Monitoring Plan.

The ESMP consists of a set of mitigation, monitoring and institutional measures, including policies, procedures and practices – as well as the actions needed to implement these measures – to achieve the desired environmental and social sustainability outcomes.

The ESMP may range from a brief description of routine mitigation and monitoring measures (e.g. for Category “B” and “C” projects with limited, readily identifiable potential impacts) to a series of specific plans as may be required by the WORLD BANK’s Environmental and Social Safeguards Policies (refer to specific requirements of applicable Policies), including, for example, Resettlement Action Plans/Livelihood Action Plans, Indigenous Peoples Plans, Biodiversity Action Plans, Cultural Heritage Management Plans, Emergency Preparedness and Response Plans. The level of detail and complexity of an ESMP and priority of the identified measures and actions will be commensurate with the proposed project’s risks and impacts. All plans will contain specific monitoring measures.

The ESMP will define desired social and environmental management outcomes and specify social and environmental indicators, targets, or acceptance (threshold) criteria to track ESMP implementation and effectiveness. It will also provide estimates of the human and financial resources required for implementation and identify organizational structure and processes for implementation.

Recognizing the dynamic nature of the project development and implementation process, the implementation of an ESMP will be responsive to changes in project circumstances, unforeseen events, and the results of monitoring.

An ESMP will consist of separate sections on:

1. Environmental and Social impact mitigation;
2. monitoring Plan;
3. Capacity development;
4. Stakeholder engagement;

6.3 Summary of The Key Stages of The ESIA Process

The key stages of an ESIA process are summarized in Table 6-1 below:

Table 6-1: Summary of the ESIA Process

Stages	Steps/main tasks within each stage
Stage 1: Screening Key components: Complete WORLD BANK Social and Environmental and Social Screening Procedure (ESSP)	Conduct Social and Environmental Screening to identify potential risks and their significance, identify relevant requirements of WORLD BANK's ESS, and determine risk category of project and nature of further assessment that may be required
Stage 2: Scoping (for Moderate or High-Risk Projects) Key components: Where initial studies and analysis have not been conducted, it is important to undertake a scoping exercise early in the assessment process (i) to identify and focus the social and environmental assessment on key issues, and (ii) to establish a logical roadmap for the assessment process.	Determine the social and environmental issues to be addressed, spatial and temporal focus, data and information needed and level of analysis required to assess the impacts Determine data availability Consultations with stakeholders, partners, and project-affected communities and development of stakeholder engagement plan Prepare ToR for the ESIA
Stage 3: Conducting an ESIA (for High Risk Projects) Key components: Based on a clearer definition of the project to be implemented, collect necessary data/information and assess full range of impacts and examine project alternatives. Report the results of the assessment and make a draft available publicly for consultation.	Further detail and define the proposed project Develop baseline environmental and social information Review policy, legal/regulatory and institutional framework Examine project alternatives and revise project design Analyze and evaluate impacts Prepare ESIA Report
Stage 4: Preparing an environmental and social management plan (for High Risk Projects) Key components: Based on relevant findings of the assessment and the results of consultations with the project stakeholders, define measures that will be needed to, <i>inter alia</i> : avoid, and if avoidance is not possible, minimize, mitigate and manage expected adverse impacts of the project (per the mitigation hierarchy); monitor impacts and mitigation options/measures; build capacities, and communicate results of the environmental and social management plan (ESMP).	Define social and environmental impact mitigation actions/measures per the mitigation hierarchy. Detail social and environmental monitoring to be conducted during project implementation. Develop a plan to assess and build capacity to implement the environmental and social management plan and other project environmental and social components Disclose draft ESIA and ESMP and develop a plan to communicate progress with implementation and effectiveness of the environmental and social management plan

7 PUBLIC CONSULTATION AND GRIEVANCE REDRESS MECHANISM

7.1 Public Consultation Plan

The implementing agency of the Agricultural Productivity Programme in Southern Africa (APPSA) has the responsibility to effectively engage stakeholders in achieving the project objectives for the benefit of all. This public consultation plan (PCP) forms part of the ESMF and is the same for all categories of refurbishments and agricultural projects. It is for use during public consultation in the screening processes for every World Bank funded project and sub-projects.

7.2 Objectives of the Plan

The PCP provides a framework for achieving effective stakeholder involvement and promoting greater awareness and understanding of issues so that the project is carried out effectively within budget and on-time to the satisfaction of all concerned. To ensure the effective implementation of this plan, APPSA Lesotho shall be committed to the following principles:

- Promoting openness and communication;
- Ensuring effective stakeholder involvement;
- Evaluating the effectiveness of the engagement plan in accordance with the expected outcomes.

The key elements of a Public Consultation Plan are:

- i. Stakeholder identification and analysis
- ii. Information disclosure
- iii. Stakeholder consultation
- iv. Grievance management
- v. Stakeholder involvement in project monitoring
- vi. Reporting to stakeholders
- vii. Management functions.

7.3 Key Stakeholders

Stakeholders of this project shall be defined as all those people and institutions that have an interest in the successful planning and execution of the project. This includes those likely to be positively and negatively affected by the project.

The key stakeholders to be continuously engaged could include:

1. Lesotho Government Departments:
 - Ministry of Agriculture and Food Security, mainly the following Departments: Agricultural Research; Field Services; Crops Services; Agricultural Extension Services; Crops; Agricultural of Planning and Policy Analysis; Nutrition and Food Technology;
 - Other ministries, such as:
 - Ministry of Trade, Industry, Cooperatives and Marketing;
 - Ministry of Health;
 - Ministry of Finance;
 - Department of Environment; and
 - Department of Culture.
2. CCARDESA;

3. World Bank;
4. Researchers;
5. National and regional research institutions;
6. Farmers/farmers groups or associations;
7. Communities neighbouring RCoLs and trial fields;
8. Lesotho National Farmers Union (LENAFU);
9. Serumula Development Association;
10. Other agricultural NGOs;
11. Multinational companies involved in agrochemical and agricultural biotechnology, such as Monsanto, Syngenta, Bayer, DowDupont, and BASF.

The above list is not exhaustive. As the Programme gets underway, the PIU will develop a detailed PCP identifying all possible stakeholders, their specific information needs and the appropriate modes of consultation as well as feedback mechanisms. Information Disclosure and Consultation

The type of information to be disclosed to the various stakeholders depends on their interests and how they will be affected by the Programme – or how APPSA activities may be affected by them. Thereafter various communication tools can be utilized for the engagement process, such as:

- Project notices published in local newspapers;
- Radio advertisements;
- Direct mailings to communities;
- Presentations with or without focus group sessions);
- Targeted e-mails;
- One-on-one meetings, presentations, seminars, workshops, e-mails and phone conversations with stakeholders;
- Site tours; and
- The use of social media.

Table 7-1 below gives a general overview of the types of information needs for various stakeholder groups.

Table 7-1: Summary Overview of a Public Consultation Plan (PCP) for APPSA Lesotho

Stakeholders	Information to be disclosed	Consultation means
APPSA community, neighbouring communities, general public	Current and new activities and how these relate to them in terms of opportunities and threats	Local leaders i.e. Chief's or district offices, Churches, national media, social media, DAR/MAFS website etc.
	Forum to express community / health fears and get feedback e.g. accidental release/escape; contamination; emergencies (fire)	Public consultations, focal group discussions, social media Training specific members of the communities, awareness, education
Staff / workers at existing facilities	How refurbished facilities will affect their work environments including Occupational Health & Safety rules	Staff newsletters, bulletin boards, signs in labs; email, website, meetings with management, staff sensitization & training program in lab safety
Researchers, CGIARs	Existence of the RCoL facility; capabilities of the facilities; what sort of research can be done at RCoLs; scope of research programme	DAR website, newsletter, brochures, e-mail, national media
	Setting the research agenda	Sensitization meetings

	Procedures for conducting research	Research journals; briefs; standard operating procedures, website, emails
	Adulteration of IKs & linked activities; Bio-piracy; Intentional release; accidents / escape / contamination	Training, awareness, education
Regional agricultural research institutions, CGIAR, academia	Proposed RCoLs activities and how these relate to them i.e. opportunities and threats	electronic mail, website, lab meetings, meetings
Farmers Groups, Agricultural NGOs Farmer Union Agrochemical companies	Consultation on research needs / food safety	Researchers, District Extension services, Baseline surveys / subsequent surveys to monitor impacts, emails, bulletins
	Research findings on new GMO crops for improved yield	Seminars; District Extension services, sales agents
Intergovernmental Institutions; CCARDESA; World Bank	Setting research agenda for participating countries (under country-specific regulatory framework)	Intergovernmental meetings and consultations
	Capacity building for participating countries with inadequate regulatory frameworks	Build partnerships through meetings, seminars, workshops
University Graduates	Internship opportunities	Website, public media, bulletin boards
Youths	Opportunities for employment during construction, sponsorships for education	District Agricultural Offices, public consultations

7.4 Current Public Consultation

In the process of developing the current ESMF the local stakeholders were consulted to solicit their views and concerns as regards the proposed intensification of agricultural activities resulting from the research and implementation of the research findings. Two approaches were employed, i.e. the administration of a questionnaire and direct interviews with targeted stakeholders. The consultations also took a two-pronged approach, i.e.;

- (i) Consultations with the designated implementing or major organizations through stakeholder workshops
- (ii) consultations with the public concerning the implementation of the project in the selected research stations

7.4.1 Consultations with the major organizations.

The consultations for the designated implementing or major organisations include the following:

- a) **Workshop held for LENAFAU by CCARDESA at Maseru on January 6, 2016**
- b) **National Stakeholder Consultative Workshop on APPSA, held on October 11, 2017 at Berea.**

The workshop was attended by

- National Agriculture Research System
- the Lesotho National Farmers union,
- NGOs,

- government agencies, and
 - the Deputy Principal Secretary of the Ministry of Agriculture and Food Security.
- c) **Faculty of Agriculture (FoA), National University of Lesotho and the Department of Agriculture (DAR), Consultative Forum held on October 25, 2017 at the National University of Lesotho**

In general, the aims of the consultations included (i) introducing the project to the Stakeholder, (ii) identifying together the crops of importance that can be included in the project, (iii) identifying any possible challenges and how they should be addressed or mitigated, (iv) bringing on board some of the major agricultural research players like the university Agriculture research department.

According to these stakeholders, joining the regional APPSA program would bring the following benefits to the Kingdom of Lesotho:

- i. Strengthen its research system, infrastructure, planning, and the execution of its activities
- ii. Mobilize science in a way that improves the lives of citizens
- iii. Scale up investments that will provide the needed catalyst for sustainable development
- iv. Diversify food security and crops and rebrand strategy on agriculture as a business

The stakeholders also assisted in the:

- i. Selection of a main crop for the development of a center of leadership based on economic importance to Lesotho.
- ii. Identification of major skills to boost the research and development activities around this crop.
- iii. Mapping of Collaboration linkages.
- iv. Selection of an APPSA project team to lead the development of the proposal and other talks as necessary.

7.4.2 consultations with the public.

The public consultations were done to raise awareness of the project by informing the public in the concerned areas through their chiefs and some public gatherings about the upcoming project in their areas. The public was also interviewed to gather their opinions regarding the project and the environmental and social consequences that may result from its implementation.

The stakeholders who were consulted are listed in appendix 6 together with a sample of the record of the public consultations.

7.4.3 Analysis of the responses on the questionnaires

The following is a summary of the responses from the public consultations.

7.4.3.1 Environment and Social Concerns

The envisaged **Positive** Environmental and social impacts include the following:

- Job creation for the locals especially skilled pp
- Research centre will be active as a result motivate community
- Fencing of the site and electrification
- Access to public road thus easy access to services
- Development to the area

- Rural Community livelihoods improved.
- Job creation for locals (temporary)
- Acquisition of skills
- Easy access to services

The envisaged **Negative** Environmental and social impacts include the following:

- Main water line that service the community may be affected
- There may be loss of natural plants during road site
- Fencing will restrict movement of people
- Animals will have no access to crazing land
- Compete on scarce water resource
- Effects of dust, falling rocks

7.4.3.2 Research Activities

The envisaged Negative impacts from Waste generation include the following:

- reduced jobs where pesticides are used (e.g. manual weeding)
- chemicals affect plant/pp/animal health
- contamination of water reservoirs and environment.

The Mitigation measures for envisaged impacts include the following:

- Waste can be recycled
- Awareness campaigns and training
- Warning signs where chemicals have been used
- Safety measures in place for people working with chemicals
- Use less hazardous chemicals
- Use of less destructive machinery
- Dispose chemicals in a safe manner
- Use alternative less hazardous pest control measures
- Good security by fencing and night watch
- Invite health sectors for routine check
- Provision of brochures and hand-outs to the public

7.4.3.3 Preservation and Indigenous Knowledge on Horticulture and Vegetable Production

The following Indigenous Knowledge on Horticulture and Vegetable Production was highlighted:

- Use of keyhole gardens to preserve indigenous vegetables
- There are existing fruit gardens and traditional gardens for preserving indigenous vegetables.
- Use of sunlight to dry vegetables and fruits
- Move natural plants to safe place for conservation and document the indigenous knowledge.
- More training on handling trees

7.4.3.4 Dissemination of Horticulture

The following environmental and Social Impacts were Envisaged for the technology dissemination period:

- There will be a need for training so that they can apply technologies
- Dissemination of user/environmentally friendly practices
- Improved varieties will improve the natural base (soil, water and plants)
- Best technologies will be learnt for management and production of vegetables and trees.
- People will learn by doing
- Increased orchards
- Increased production will in turn improve the landscape of the country
- Information for type of crops and planting dates
- People's lives will be improved
- Soil improvement
- People will be able to produce for markets and generate income
- Production will be increased thus enhance income
- Nutritional status of the households will be improved
- Farmer to farmer transfer of technology

The Mitigation measures for the technology dissemination impacts include the following:

- Lead farmers should encourage other farmers
- Training of farmers on all aspects of production including soil management
- Women to take part in Agricultural activities
- Surrounding community should be given free planting material to motivate them
- Protecting through fencing and guards
- Installation of the irrigation system
- Regular trainings to answer day-to-day needs especially on climate change
- Good follow up after trainings
- Awareness and public gatherings
- Incorporate water storage/harvesting methods and moisture conservation practices

In summary, the consultations show that the public perceive the project to be of great potential to bring improvement to the livelihoods of the concerned communities through the likelihood of bringing information that will assist with increased production and productivity as well as the possibility of job creation. The project is seen as a platform through which advanced information would be generated and disseminated to the communities as well as also provision of regular training to refresh and to give new information. There were some negative impacts anticipated but the communities were also able to suggest mitigation activities that should be included in the project. Some of these were centering around possible side effects due to increased use of pesticides but communities believe with proper training on use and management of such these side effects could be minimized.

In General the following comments were made by the stakeholders:

- Surrounding village will gain a lot of knowledge with regard to Agriculture
- Communities should always be informed of any developmental activities that will take place in their areas.

- Strong fencing and security at the project site
- Project should help with development of the road, electricity and water installation for the village.
- The project will be very helpful to our community if it will be well implemented
- There will be introduction of resilient, tolerant varieties hence improved Agricultural production and nutrition within the community
- People within the implementing stations should be given free trees for food security
- There is a need for water installation in the village for improved vegetable production
- Fencing, water and electricity are the main issues for success of this project in our area

7.5 Grievance Redress Mechanism

As part of the continuous consultation process, there will be a grievance redress mechanism in place. The grievance redress mechanism (GRM) will be a system by which queries or clarifications about the project will be responded to, problems with implementation will be resolved, and complaints and grievances will be addressed efficiently and effectively. The Grievance Redress Mechanism is detailed in Appendix 9. The purpose of the grievance redress mechanism will be:

- To be responsive to the needs of beneficiaries and to address and resolve their grievances;
- To serve as a conduit for soliciting inquiries, inviting suggestions, and increasing community participation;
- To collect information that can be used to improve operational performance;
- To enhance the project's legitimacy among stakeholders;
- To promote transparency and accountability;
- To deter fraud and corruption and mitigate project risks.

Besides the proposed project GRM, aggrieved persons can also employ additional channels to air their complaints. These include the World Bank Grievance Redress System (GRS) and the inspection Panel.

The World Bank's **Grievance Redress System (GRS)** provides an additional, accessible way for individuals and communities to complain directly to the World Bank if they believe that a World Bank-financed project has or is likely to have adverse effects on them or their community. The GRS enhances the World Bank's responsiveness and accountability by ensuring that grievances are promptly reviewed and responded to, and problems and solutions are identified by working together. The objective is to make the Bank more accessible for project affected communities and to help ensure faster and better resolution of project-related complaints. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), affected should visit <http://www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-service>

The **Inspection Panel** is an independent accountability mechanism of the World Bank. The Panel provides a forum for people who believe that they may be adversely affected by Bank-financed operations to bring their concerns to the highest decision-making levels of the World Bank. The Panel determines whether the Bank is complying with its own policies and procedures, which are designed to ensure that Bank-financed operations provide social and environmental benefits and avoid harm to people and the environment. For information on how to submit complaints to the

World Bank Inspection Panel, affected persons should visit www.inspectionpanel.org.

7.6 Feedback and Monitoring

As part of the PCP a mechanism for providing feedback to the stakeholders on their particular information needs will be set up. In addition, the PCP will include means for monitoring the effectiveness of the public consultation processes and outcomes from consultations, and for determining where further action may be necessary in regard to engagement.

The environmental and social safeguards specialists in the PIU will be responsible to ensure that the PCP is implemented throughout the life of the Program. They will also be responsible for communicating and reporting on all stakeholder matters to the PIU Coordinator.

8 ENVIRONMENTAL AND SOCIAL MONITORING PLAN

8.1 Introduction

The PIU with the help of relevant authorities will monitor the environmental and social effects of project implementation and the success of mitigation measures. Monitoring is an important part of managing the impacts of the project. The environmental and social monitoring will be the responsibility of the PIU Environmental Safeguards Specialist and Social Safeguards Specialist who will be coordinating all safeguards issues.

8.2 Environmental and Social Monitoring Plan

Screening will ensure that no activities in the Exclusion List (Table 11-1) will be accommodated under APPSA Lesotho. Thus, the first action by the Environmental Safeguards Specialist and Social Safeguard Specialist will be to monitor whether any subprojects:

- i) Require acquisition of land and displacement of people.
- ii) Block the access to or use of land, water points and other livelihood resources used by others
- iii) Encroach onto fragile ecosystems, marginal lands or important natural habitats (e.g. ecologically-sensitive ecosystems; protected areas; natural habitat areas, forests and forest reserves, wetlands, national parks or game reserve; any other environmentally sensitive areas)
- iv) Impact on physical cultural resources of national or international importance and conservation value
- v) Have risks assessed as requiring biosafety levels BSL-3P and BSL-4P containment.

Screening will also determine the subproject category. Any Category B subprojects will have to prepare an ESIA, the complexity of which will depend on the screening outcome and potential risks anticipated. The ESMPs prepared as part of the ESIA's will have subproject specific environmental and social monitoring plans covering potential anticipated impacts.

8.3 Program E&S Performance Monitoring

In addition to monitoring the implementation of mitigation measures proposed to address environmental and social impacts during construction/refurbishments of research facilities, research activities at the improved research facilities and dissemination of horticulture technology, the overall performance and effectiveness of the Program can be assessed through monitoring the following indicators:

- Number of infrastructure rehabilitated.
- Quality of construction materials for the refurbishments.
- Reports on quality of water discharged from the establishments.
- Number of employment opportunities for locals.
- Number of new employees engaged by the project.
- Ratio of men to women employed by the project (ensure equity in the recruitment processes).
- Number of safeguards training courses conducted for staff.

- Ratio of men to women trained (ensure equity in the training processes).
- Establishment of a waste segregation system with well-established handling and treatment method for each waste stream, including hazardous waste.
- Implementation of the public consultation plan.
- Number of new and resistant crop varieties introduced.
- Number of farmers involved in new technology trials segregated by gender.
- Institution of planned maintenance of machines and buildings.
- Biosafety management systems in place.
- Patenting programme in place.

8.4 The Monitoring Plan.

XXX

The following monitoring plan (Table 8-1) will be used during the refurbishments of the research facilities, the research and technology dissemination period of the APPSA project:

Table 8-1: Impact Monitoring Plan

No.	ENVIRONMENTAL AND SOCIAL IMPACT	MONITORING PARAMETER	AREAS OF CONCERN	HOW IS PARAMETER TO BE MONITORED/TYPE OF MONITORING EQUIPMENT?	MONITORING FREQUENCY AND POSITIVE INDICATORS	ESTIMATED MONITORING BUDGET (\$)	RESPONSIBLE AUTHORITY
1.0	NEGATIVE IMPACTS						
1.1	Ground water pollution due to increased use of agrochemicals including fertilizers and pesticides which may seep into ground water resources	Pesticide active ingredient, Chlorides, Nitrogen and phosphates	Borehole, water well or soil in target fields as appropriate	<ul style="list-style-type: none"> Water resources should be managed well The water quality of the rivers and wells in the area should be monitored to ascertain the suitability for irrigation and human consumption. Sampling and lab analysis 	Frequency: Semi-annually effective year after use of project procured agrochemicals Indicator: <ul style="list-style-type: none"> Water made available for social concerns. Pollution of water resources monitored/detected early and remedial measures taken on time 	5,000	<ul style="list-style-type: none"> Health ministry Lesotho APPSA (Safeguards Officer) Ministry of Health Department of Environment Research Centre Administrator (Research officers)
1.2	Surface water pollution due to increased use of agrochemicals which may be washed into surface water bodies	Pesticide active ingredient, Chlorides, Nitrogen and phosphates	Runoff receiving water body	Sampling and lab analysis	Frequency: Semi-annually effective year after use of project procured agrochemicals	5,000	<ul style="list-style-type: none"> Health ministry Lesotho APPSA (Safeguards Officer) Ministry of Health Department of Environment Research Centre Administrator

No.	ENVIRONMENTAL AND SOCIAL IMPACT	MONITORING PARAMETER	AREAS OF CONCERN	HOW IS PARAMETER TO BE MONITORED/TYPE OF MONITORING EQUIPMENT?	MONITORING FREQUENCY AND POSITIVE INDICATORS	ESTIMATED MONITORING BUDGET (\$)	RESPONSIBLE AUTHORITY
					<ul style="list-style-type: none"> Water made available for environmental and social concerns. Pollution of water resources monitored/detected early and remedial measures taken on time 		(Research officers)
1.3	Soil contamination/land degradation due to increased use of agrochemicals and improper disposal of agrochemical containers	Pesticide active ingredient, Nitrogen and phosphates	<ul style="list-style-type: none"> Accidental discharges of oil and chemicals Soil erosion soil in target fields 	<ul style="list-style-type: none"> During the Demolitions and construction stages the Developer should make a daily inspection of all earth works and ensure that no adverse impacts are occurring. During the operations phase APPSA should ensure that the chances of chemical or oil discharges are minimized. Sampling and lab analysis 	Frequency: Semi-annually effective year after use of project procured agrochemicals Indicator: <ul style="list-style-type: none"> absence of pollution 	4,000	<ul style="list-style-type: none"> Ministry of Forestry and land Reclamation (MFLR) Ministry of Agriculture and Food Security Department of Environment Lesotho APPSA (Safeguards Officer) Research Centre Administrator (Research officers)
1.4	Soil erosion and loss of soil fertility due to intensified land use	Erosion characteristics (gully formation, sheet removal, soil transportation, turbidity of runoff, soil collection along runoff channels) NPK, CEC, Organic content, Acidity	<ul style="list-style-type: none"> Field and field surroundings Soil in field Soil erosion 	Observation Sampling and lab analysis	Frequency: Annually effective year after use of sponsored farming activities Indicator: absence of rills, gullies or other erosion features occurs	Included in field management costs	<ul style="list-style-type: none"> participating farmers, Extension Officers Ministry of Forestry and land Reclamation (MFLR) Ministry of Agriculture and Food Security Department of Environment Lesotho APPSA (Safeguards Officer) Research Centre Administrator (Research officers)
1.5	Loss of biodiversity arising from pest control activities and increased area under	Species count	Field and surrounding areas	Species and population inventories	Frequency: Biannually effective	4000	<ul style="list-style-type: none"> Consultant Research Centre Administrator (Research officers)

No.	ENVIRONMENTAL AND SOCIAL IMPACT	MONITORING PARAMETER	AREAS OF CONCERN	HOW IS PARAMETER TO BE MONITORED/TYPE OF MONITORING EQUIPMENT?	MONITORING FREQUENCY AND POSITIVE INDICATORS	ESTIMATED MONITORING BUDGET (\$)	RESPONSIBLE AUTHORITY
	cultivation				Indicator: Constant population inventories.		
1.6	Biosafety concerns arising from improperly management breeding activities	Off traits and genetic contamination	Field and lab specimens	Crop seed/germplasm analysis	Frequency: Annually effective commencement of breeding activities Indicator: Samples not genetically contaminated.	4000	<ul style="list-style-type: none"> • Consultant • Research Centre Administrator (Research officers)
1.7	Noise	Noise Levels	<ul style="list-style-type: none"> • nearest sensitive receiver. • Surrounding neighbourhood 	Noise monitoring should be carried out on an ad-hoc basis by the Environmental and social Monitor or the APPSA to establish noise levels in the work areas.	Frequency: Regularly and ongoing as project is implemented. Indicator: Noise levels at the nearest sensitive receiver would be kept to a minimum.	4000	<ul style="list-style-type: none"> • Health ministry • Lesotho APPSA (Safeguards Officer) • Ministry of Health • Department of Environment • Research Centre Administrator (Research officers)
1.8	Land and water contamination due to poor disposal of wastes	Presence/quantity of litter in undesignated places Presence of waste specific pollutant in soil or water	<ul style="list-style-type: none"> • Around waste stockpiles • Waste collection sites • Availability of Segregation. • Methods of treating hazardous wastes. • Condition of the disposal sites 	<ul style="list-style-type: none"> • Visual Observation • Sampling and analysis • Observations should be made on the regime of waste collection, transportation and how the waste is disposed of. 	Frequency: Weekly Annually Indicator: <ul style="list-style-type: none"> • Absence of waste accumulations • Waste Segregation available. • Disposal sites well managed 	4,000	<ul style="list-style-type: none"> • Ministry of Agriculture and Food Security • Department of Environment • Lesotho APPSA (Safeguards Officer) • Research Centre Administrator (Research officers)
1.9	Archaeology -Loss of natural and cultural heritage	Archaeological Findings	<ul style="list-style-type: none"> • Construction sites 	Provision should be made to allow archaeologists to be present on site during any excavation (e.g. during	Frequency: Regularly and ongoing as project is implemented	3000	<ul style="list-style-type: none"> • Archaeology • Department of Environment

No.	ENVIRONMENTAL AND SOCIAL IMPACT	MONITORING PARAMETER	AREAS OF CONCERN	HOW IS PARAMETER TO BE MONITORED/TYPE OF MONITORING EQUIPMENT?	MONITORING FREQUENCY AND POSITIVE INDICATORS	ESTIMATED MONITORING BUDGET (\$)	RESPONSIBLE AUTHORITY
				plumbing) periods if they so wish. The APPSA should inspect all excavations, and where archaeological remains are found work must stop until the APPSA has given the all clear to proceed. The APPSA should contact the Museums Authorities in the event of a significant archaeological find.	Indicator: <ul style="list-style-type: none"> • Reports of any findings • Chance finds Procedure followed properly • Archaeological remains not excavated, disturbed or destroyed 		<ul style="list-style-type: none"> • Lesotho APPSA (Safeguards Officer) • Research Centre Administrator (Research officers)
1.10	Marginal lands/fragile ecosystems	Agricultural activities in Marginal lands	<ul style="list-style-type: none"> • Fields • Participation in farmers Fields • surrounding lands 	Marginal lands and fragile ecosystems must be protected against abuse. During the trial runs such areas must be avoided altogether.	Frequency: Regularly and ongoing as project is implemented Indicator: <ul style="list-style-type: none"> • Marginal lands and fragile ecosystems protected against abuse • Marginal lands and fragile ecosystems avoided. • No sub-projects allowed on marginal lands and fragile ecosystems 	2000	<ul style="list-style-type: none"> • Ministry of Forestry and land Reclamation (MFLR) • Ministry of Agriculture and Food Security • Department of Environment • Lesotho APPSA (Safeguards Officer) • Research Centre Administrator
1.11	Public and occupational health and safety concerns.	<p>Incidences of poisoning or illness associated with pesticide use</p> <p>Incidences of injury/disability or illness associated with working conditions</p>	<p>Workers and surrounding community</p> <p>poisoning due to misuse or improper handling of pesticides</p> <p>poor working conditions</p>	<p>Incidence reports/surveys</p> <p>Regular health checks should be conducted on all staff working at the stations to screen for any work related diseases</p> <p>The APPSA must ensure that education and awareness campaigns are implemented. The Ministry of Agriculture, local authority should carry out awareness campaigns on, water-</p>	Frequency: <ul style="list-style-type: none"> • Regularly and ongoing as project is implemented • Each time incidence is reported • Annual surveys in surrounding communities Indicator:	6,000	<ul style="list-style-type: none"> • Farmers, • Extension Officers • Consultant • Officer in charge of Research Station • Agriculture ministry • Lesotho APPSA (Safeguards Officer) • MTICM

No.	ENVIRONMENTAL AND SOCIAL IMPACT	MONITORING PARAMETER	AREAS OF CONCERN	HOW IS PARAMETER TO BE MONITORED/TYPE OF MONITORING EQUIPMENT?	MONITORING FREQUENCY AND POSITIVE INDICATORS	ESTIMATED MONITORING BUDGET (\$)	RESPONSIBLE AUTHORITY
				borne diseases and carry out vector control methods such as regular spraying of potential breeding sites (ponds) The safety of the workplace must also be monitored especially during the construction stages	<ul style="list-style-type: none"> Reduction in number of work related diseases. Reduction in number of cases of such diseases as Avian flu, foot and mouth, AIDS/STD related diseases recorded at hospital and medical clinic Reduction in number of diseases such as malaria and cholera 		
2.0	POSITIVE IMPACTS						
2.1	Ready availability of improved varieties of Fruits and vegetables	Improved Varieties availability	Seed and seedling outlets	Social survey	Frequency: Annually effective year of release Indicator: improved varieties of Fruits and vegetables available on the market	6,000	<ul style="list-style-type: none"> Consultant APPSA PIU Ministry of Agriculture and Food Security Department of Environment Lesotho APPSA (Safeguards Officer) Research Centre Administrator (Research officers)
2.2	Ready availability of improved agronomic practices	Dissemination materials and program	Farmers reached with improved agronomic packages	Farmer Interviews, availability, review of dissemination materials and attendance sheets for sensitization programs	Frequency: Annually effective year of release Indicator: improved agronomic practices implemented	4,000	<ul style="list-style-type: none"> Consultant APPSA PIU Ministry of Agriculture and Food Security Department of Environment Lesotho APPSA (Safeguards Officer) Research Centre Administrator (Research officers)
2.3	Improved fruit and vegetable Productivity	Farmer unit Yield increase	Farmers who have Adopted improved	Farmer interviews/Yield analysis	Frequency: Annually effective year of	3,000	<ul style="list-style-type: none"> Extension Officers

No.	ENVIRONMENTAL AND SOCIAL IMPACT	MONITORING PARAMETER	AREAS OF CONCERN	HOW IS PARAMETER TO BE MONITORED/TYPE OF MONITORING EQUIPMENT?	MONITORING FREQUENCY AND POSITIVE INDICATORS	ESTIMATED MONITORING BUDGET (\$)	RESPONSIBLE AUTHORITY
	arising from farmer adoption of improved seed and agronomic practices generated		seed and agronomic practices		adoption Indicator: Improved yields of fruit and vegetables.		<ul style="list-style-type: none"> Ministry of Agriculture and Food Security Department of Environment Lesotho APPSA (Safeguards Officer) Research Centre Administrator (Research officers)
2.4	Improved nutrition and food security due to readily available fruit and vegetables including fruit and vegetable processing technology on the market	Consumption of fruit and vegetable based food products	Consumers, Farmers	Social survey/interviews	Frequency: Annually effective year following release Indicator: Improved nutrition levels of the communities.	7,000	<ul style="list-style-type: none"> Consultant APPSA PIU Health ministry Lesotho APPSA (Safeguards Officer) Ministry of Health Department of Environment Research Centre Administrator (Research officers)
2.5	Enhanced national and regional capacity for Conducting research and development in food legumes	No. of research programs successfully completed	Research institutions	Review of Annual reports	Frequency: Annually effective 2 nd year of program commencement Indicator: No. of research programs successfully completed	Included in coordination costs	<ul style="list-style-type: none"> CCDERSA Ministry of Agriculture and Food Security Department of Environment Lesotho APPSA (Safeguards Officer) Research Centre Administrator (Research officers)
2.6	Improved local, national and regional economy arising from APPSA investments through procurement of goods and services	Cost of procurements at local, national and, regional level	Program cost centers Local suppliers	Expenditure analysis/program burning rate	Frequency: Effective program implementation phase Indicator: Local costs of procurement competitive.	Included in coordination costs	<ul style="list-style-type: none"> CCADERSA Administrator (Research officers)
	TOTAL					61,000.00	

9 TRAINING AND CAPACITY BUILDING

9.1 Capacity Building Needs

The successful implementation and monitoring of the environmental and social management framework, environmental and social management plans (ESMPs) and pest management plan (PMP) will require that target groups and stakeholders who play a role in the implementation of the ESMF be provided with appropriate training and awareness. This is necessary because the implementation of the activities will require inputs, expertise and resources which will be adequately taken care of if the concerned parties are well trained. These groups are described below.

As noted in Section 2.5.2, currently there is little capacity within the DAR to implement environmental and social requirements necessary to manage the potential environmental and social risks and impacts resulting from the construction/refurbishment of research facilities, research activities at the improved research facilities and dissemination of horticulture technology.

9.1.1 *National Level*

The APPSA Lesotho PIU will be responsible for completing the Environmental and Social Screening Form (Appendix 1) to be able to identify and mitigate the potential environmental and social impacts of rolling out the horticulture R&D activities. In the event that a project activity under the Lesotho APPSA falls under the listed projects in the Environmental Act, APPSA and MAFS will review the recommendations from the District and undertake the process of seeking the approval of the EIA through the Environmental Department. In addition, strategic decisions on the direction of research will be undertaken at this level, and therefore those decision makers must be aware of potential risks and impacts. The groups that will need training will include:

- PIU coordinator and management
- RCoL management
- DAR Regional Technical Committee
- APPSA Regional Steering Committee
- Other collaborating institutions.

9.1.2 *Area and District (Local) Level*

At local level the groups that will receive environmental and social training in various topics including research facility management, pest management, pesticide management, HIV/AIDS awareness, water management, crop management:

- District Agricultural Office Team
- District Environment Units
- Extension workers in project impact areas district environmental officers
- District agricultural officers (DAO)
- DAR Research Officers
- Area Agricultural Extension Officers (AEO)
- Farmers
- Trial farm management committee
- RCoL staff and researchers
- Trial farmers
- Farmers associations
- Store keepers

- Pesticide transporters
- Pesticide users
- Research scientists
- Research technicians
- Waste management firms
- Research facility administrative and general centre staff.

9.2 Training Requirements

The proposed Agricultural Productivity Programme in Southern Africa (APPSA) activities will be numerous and challenging. Successful implementation of the project activities will require dynamic and multi-disciplinary professionals. Therefore, regular short and tailor-made training courses and seminars will be required to reinforce the capacity and skills of the stakeholders and farmers during the entire project period. Training activities and target groups are presented in Table 9-1 below.

The stakeholders have different training needs as follows:

- Awareness raising will cause the participants to acknowledge the significance or relevance of the issues, but without in-depth knowledge of the issues;
- Sensitization will cause the participants to be familiar with the issues to the extent of demanding precise requirements for further technical assistance;
- Comprehensive training will raise the participants to a level of being able to train others and to competently take action on environmental and social issues in their areas.

Training and seminars will also be required for building capacity and awareness in social and environmental issues including effects of deforestation and soil erosion. Table 9-1 below provides costs estimates for the identified capacity building activities. The basis of the estimates is on some of the following:

- Prevailing costs of goods and services offered in typical urban or rural areas.
- An average number of 30 people for District Agricultural Office team
- An average number of 30 people for a local level team.
- The length of training sessions will depend on the course and will vary from 1 day to about 2 weeks.
- The estimated costs include training costs/fees, hire of rooms, food for participants, per diems, and transport costs. Training subsistence allowances have been estimated at R 100.00 per participant per day while a lump sum of R 25 000.00 has been included for each training session to cover the costs of the trainer.

Table 9-1: Environmental and Social Training

No.	TRAINING ACTIVITY	TARGET GROUP / TRAINER	MEANS OF VERIFICATION	COST ESTIMATES
1.	Environmental and Social Risks and Impacts of APPSA Lesotho <ul style="list-style-type: none"> - Typical issues - Mitigation requirements - Management plans - Monitoring requirements - Management review - Budgeting for E&S risk management 	<ul style="list-style-type: none"> • PIU coordinator and management • RCoL management • DAR Regional Technical Committee • APPSA Regional Steering Committee • Other collaborating institutions. <p>TRAINER: Dept. of Environment OR PRIVATE CONSULTANT</p>	<ul style="list-style-type: none"> • 30 high level decision makers, managers, coordinators trained 	<p>\$ 2,600.00 (one session during the entire project period)</p> <p>Length: 1 day</p>

No.	TRAINING ACTIVITY	TARGET GROUP / TRAINER	MEANS OF VERIFICATION	COST ESTIMATES
2.	Environmental and Social Impact Assessment of the Projects: <ul style="list-style-type: none"> - Screening process. - Use of checklists - Preparation of terms of reference. - Identification of Impacts - ESIA report preparation and processing - Policies and laws in Lesotho - World Bank safeguard policies 	<ul style="list-style-type: none"> • District Agricultural Office Team • District Environment Units • Extension workers in project impact areas. TRAINER: Dept. of Environment OR PRIVATE CONSULTANT	<ul style="list-style-type: none"> • 10 members of District Agricultural Office Team are trained. • 10 District Environment Units members are trained. • 10 Extension workers in project impact areas trained. 	(Three sessions during the entire project period) Length: 5 days per session Total cost: \$ 10,200.00
3.	Integrated Pest Management <ul style="list-style-type: none"> - Types of pests - Identification of pests - Biological control of pests - Physical control of pests - Chemical (pesticide) control - Environmental control 	<ul style="list-style-type: none"> • Farmers • Trial farm management committee TRAINER: MINISTRY OF AGRICULTURE	<ul style="list-style-type: none"> • 10 members of trial farm management committee • 10 Extension Workers • 30 Farmers from various trial farms trained 	(Four sessions during the entire project period) Venue: Farms Length: 5 days per session Total cost: \$15,800.00
4.	Facilitate HIV/AIDS awareness <ul style="list-style-type: none"> - Impacts of HIV/AIDS on social wellbeing, livelihood and projects - Mitigation measures - Care of victims 	<ul style="list-style-type: none"> • Extension workers in project impact areas • Farmers. TRAINER: NAC, MAFS	<ul style="list-style-type: none"> • 10 Extension workers in project impact areas trained. • 30 Farmers from various trial farms trained 	TO USE NAC RESOURCES (Two sessions during entire project period) Venue: Length: 5 days
5.	Water Management <ul style="list-style-type: none"> - When to irrigate - How much water to apply - For how long - Water rights Crop Management <ul style="list-style-type: none"> - Crop selection - Crop rotations - Cropping calendar - How to apply fertilizer - Use of organic manure / compost - Weeding - Crop harvesting & storage 	<ul style="list-style-type: none"> • Extension workers and Farmers • Extension workers and Farmers TRAINER: PRIVATE CONSULTANT OR MAFS	<ul style="list-style-type: none"> • 10 Extension Workers • 30 Farmers from various trial farms trained 	(Four sessions during the entire project period) Venue: Farms Length: 5 days per session Total cost: \$ 13,500.00
6.	Pesticide Management <ul style="list-style-type: none"> - Pesticides Types and Use - Packaging, labelling and Handling - Storage, Stacking and Release - Pesticides Record Maintenance Pesticides Procurement <ul style="list-style-type: none"> - Identification of Pesticide Dealers - Pesticides Handling & Transportation - Record Maintenance Pesticides Application and Disposal <ul style="list-style-type: none"> - Types and Handling of Equipment - Pesticides Toxicity - Safety of Applicators (OSHA) - First Aid 	<ul style="list-style-type: none"> • Store Keepers • Pesticide Transporters • Pesticide Users • All Farmers • Trial Farm Management Committee TRAINER: MINISTRY OF AGRICULTURE	<ul style="list-style-type: none"> • 10 members of Scheme Procurement Committee Trained • 10 Extension Workers • 30 Farmers from various trial farms trained 	(Three sessions for the entire project period) Venue: Farms Length: 5 days per session Total cost: \$11,400.00

No.	TRAINING ACTIVITY	TARGET GROUP / TRAINER	MEANS OF VERIFICATION	COST ESTIMATES
	- Care, Cleaning and Disposal of Pesticides and Equipment			
7.	Maintenance of the Agricultural Facilities <ul style="list-style-type: none"> - Detecting the damaged structures - Materials needed to maintain the damaged structures Hygiene and Sanitation <ul style="list-style-type: none"> - Water supply - Sanitation - Water and sanitation related diseases - Infrastructure needed on the scheme for sanitation enhancement 	<ul style="list-style-type: none"> • Extension workers and Farmers • Extension workers and Farmers TRAINER: PRIVATE CONSULTANT OR MAFS	<ul style="list-style-type: none"> • 10 Extension Workers • 30 Farmers from various trial farms trained 	(Two sessions during the entire project period) Venue: The farms Length: 5 days per session Total cost: \$6,800.00
8.	Research Facility Management <ul style="list-style-type: none"> - Handling of chemicals/ reagents, - disposal of wastes, - biosafety, - security, - emergency response. 	<ul style="list-style-type: none"> • Research Scientists • Research technicians • Admin and general centre staff 	<ul style="list-style-type: none"> • 10 Research Scientists • 10 Research technicians • 5 admin staff 	(Two sessions during the entire project period) Venue: research laboratories Length: 5 days per session Total cost: \$8,300.00
9.	TOTAL ESTIMATED BUDGET			68,600.00

9.3 Proposed Approach in Executing Training Activities

Lesotho APPSA will adopt a strategy of running workshops and refresher courses to disseminate the safeguards instruments. It will also use the training of trainers and community exchange visits approach.

It will be important that key decision makers, the PIU coordinator and management staff and other high-level persons are sensitized in the potential environmental and social risks and impacts due to the proposed APPSA activities, in particular research activities to be conducted at the RCoLs. This training may be conducted by a private consultant or by the Department of Environment.

The training activities in Environmental and Social Impact Assessment can be conducted by the Department of Environment or private consultants under the supervision of the Department of Environment. This will have to be done at the beginning of the project, before the project activities start, so that the participants are ready in time to apply the knowledge during implementation of the project activities. Skills in the screening process will be very useful for assessing the environmental and social implications of the project activities before they start.

Pest Management and Pesticide Management training activities will be implemented by MAFS and APPSA who have the requisite knowledge of types of pesticides and their application. They also have the practical knowledge and experience with different pest and pesticides. The training may be conducted during the early stages of the project activities but before that first planting season. This

training should be executed twice during the project life, preferably at the beginning and at project mid-term.

Training in Project Planning and Implementation should be done before any project activities start in order to prepare the participants to use their knowledge during project implementation. The training should be done once during the project life. The Lesotho Institute of Management (LIPAM) is well placed for this training. However, there are other private consultants that may also be able to conduct the training.

The HIV/AIDS awareness campaigns would be conducted by the Aids Council under their planned national activities. The Ministry of Agriculture is already collaborating with the Aids Council on programmes that have already been drawn up. This training activity should be conducted at the beginning of the project activities and annually thereafter.

Agricultural Technology and Management; Water Management; Crop Management, Procurement, Marketing and Financial training would be facilitated internally by APPSA with the assistance from the Department of Agriculture or the appropriate private consultants would have to be engaged to carry out the training. These training activities should be conducted at the beginning of the operation phase, soon after construction activities, to take advantage of the farming activities for practical training.

The management of agricultural facilities and research centres requires the application of management plans and standard operating procedures to ensure all aspects of safety, security and environmental and social compliance.

9.4 Funding Requirements for Environmental and Social Training

The proposed environmental training activities for the project will be funded directly by the project resources in accordance with the proposed plan laid out in Table 9-1 above. A summary of the budgetary requirements for the proposed training activities is given in Table 9-2 below.

Table 9-2: Estimated Training Costs (Rand)

No.	TRAINING ACTIVITIES	BUDGET (Rands)
1	High level training in Environmental and Social Risks of APPSA Lesotho	2,600.00
2	Training in Environmental and Social Impact Assessment	10,200.00
3	Training in Pest Management	15,800.00
4	Facilitate HIV/AIDS awareness	0.00
5	Water and Crop Management Training	13,500.00
6	Training in Pesticide Management	11,400.00
7	Maintenance and Hygiene and Sanitation	6,800.00
8	Research Facility Management	8,300.00
TOTAL		68,600.00

10 ESMF BUDGET.

10.1 ESMF Implementation Budget

The actual quantities, specifications and estimated costs of design measures to avoid or mitigate negative impacts will be assessed by the civil design contractor and incorporated into the bidding documents. The contractor will execute all required works and will be reimbursed through pay items in the bill of quantities, which will be financed by the project.

The cost estimates for the rest of the activities in the environmental and social management plan are given below in US dollars. The detailed budget is meant for implementing and monitoring the recommended mitigation measures throughout the project duration. It is recommended that the budget be integrated into the overall project costs to ensure that the proposed mitigation measures are actually implemented.

Table 10-1: Budget for ESMF Implementation (USD)

No.	YEAR ACTIVITY	REFERENCE TABLE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
1.	Technical Assistance	Environmental assessment studies, R&D, M&E,	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00	150,000.00
2.	Site-specific ESIA's and ESMPs	Site specific EA work for sub-projects.	45,000.00	30,000.00	25,000.00			100,000.00
3.	Mitigation Measures	Table 6-7	30,600.00	30,600.00	30,600.00	30,600.00	30,600.00	153,000.00
4.	Monitoring	Table 8-1	1000.00	15,000.00	15,000.00	15,000.00	15,000.00	61,000.00
5.	Training	Table 9-2	25,000.00	15,000.00	12,000.00	10,000.00	6,600.00	68,600.00
6.	Annual Audit			10,000.00	10,000.00	10,000.00		30,000.00
7.	End of Project Audit						10,000.00	10,000.00
	TOTAL							504,000.00

However, it must be noted that ESIA's and ESMPs will be prepared for all subprojects which have potential significant negative impacts, and these provide cost estimates for the implementation of specific mitigation and management measures for those subprojects.

11 GUIDELINES FOR SUBPROJECT SCREENING, APPRAISAL, APPROVAL AND IMPLEMENTATION

11.1 Introduction

This chapter describes the process for ensuring that potential environmental and social impacts are adequately addressed. The first step of the process is to consult the schedule to the Environment Act which lists all types of projects and activities that are subject to Environmental Assessment (EA). If the project is in the list the next step is to determine the level of EA work required. Agricultural projects generally require EA work under Lesotho legislation.

At the PCN stage, APPSA was rated environmental and social assessment Category B and thus most of the subprojects will fall within this category. There will not be a Category A subproject funded by APPSA. However, it is recommended that APPSA should avoid sensitive areas and take steps to ensure that subprojects stay within Category B. Thus, every subproject that will be funded under APPSA will require environmental and social screening.

All the refurbishments and research work will be conducted at the Department of Research's (DAR) existing facilities, including a lot of the trial runs. However, some farmers will also be selected to participate in these technology trial runs. The environmental and social screening process will be conducted on both the DAR research stations and the farmer trial run plots. DAR will conduct the environmental and social screening on all the participating research stations and selected farmers, so as to avoid or minimize adverse environmental and social impacts. They will use the Environmental and Social Screening Form (see Appendix 1) together with information on typical subproject impacts and mitigation measures in the environmental and social management plans (ESMPs) (Tables 5-11, 5-12 and 5-13).

In some cases, special planning reports (e.g. IPMP, Biosafety Management Plans, etc.) may have to be developed and implemented. These will require extra resources to prepare and this may require amendments to the subproject design.

The sections below (11.3 – 11.8) detail the stages of the environmental and social screening process (the screening process) leading towards the review and environmental and social approval of any subproject that will be undertaken in the Agricultural Productivity Programme in Southern Africa (APPSA). This will be used in conjunction with the APPSA site selection criteria.

11.2 Exclusion List

Table 11-1 below provides criteria based on which subprojects and activities which will not be eligible for financing under APPSA Lesotho:

Table 11-1: Subproject and Activity Exclusion List

No.	Negative sub project list
	The proposed APPSA project will automatically exclude subprojects or research activities that:
1	Require acquisition of land and physical or economic displacement of people.
2	Block the access to or use of land, water points and other livelihood resources used by others
3	Encroach onto fragile ecosystems, marginal lands or important natural habitats (e.g. ecologically-sensitive ecosystems; protected areas; natural habitat areas, forests and forest reserves, wetlands, national parks or game reserve; any other environmentally sensitive areas)
4	Impact on physical cultural resources of national or international importance and conservation value
5	Have risks assessed as requiring biosafety levels BSL-3P and BSL-4P containment

In addition to the above, any subprojects that would be categorised as World Bank Category A subprojects will not be eligible for financing under APPSA.

11.3 Desk Appraisal

11.3.1 Environmental and Social Screening

The selected DAR participating research stations will be subjected to a rigorous environmental and social screening process. The initial stage is a desk appraisal of the activities plans, including designs. This will be carried out at the APPSA Lesotho PIU Head Office in Maseru by a technical team comprising experts from the MAFS - DAR, Ministry of Tourism, Environment and Culture (MTEC), Ministry of Forestry, Range and Conservation, and Ministry of Local Government and Chieftainship, to ensure that all pertinent environmental and social issues are identified.

This initial screening will be carried out through the use of the Environmental and Social Screening Form (Appendix 1). This form will be completed by APPSA Lesotho PIU (Head Office) with assistance from the above-mentioned technical team.

Completion of this screening form will facilitate the identification of potential environmental and social impacts, determination of their significance, assignment of the appropriate environmental and social category, proposal of appropriate environmental and social mitigation measures, and conduct any further environmental and social work, if necessary.

Suitably qualified officials will conduct the screening process and if none are available, training will be provided.

Each participating research station that will be funded through APPSA Lesotho will have to undergo the Environmental and Social Screening Process, as outlined in Figure 11-1 below.

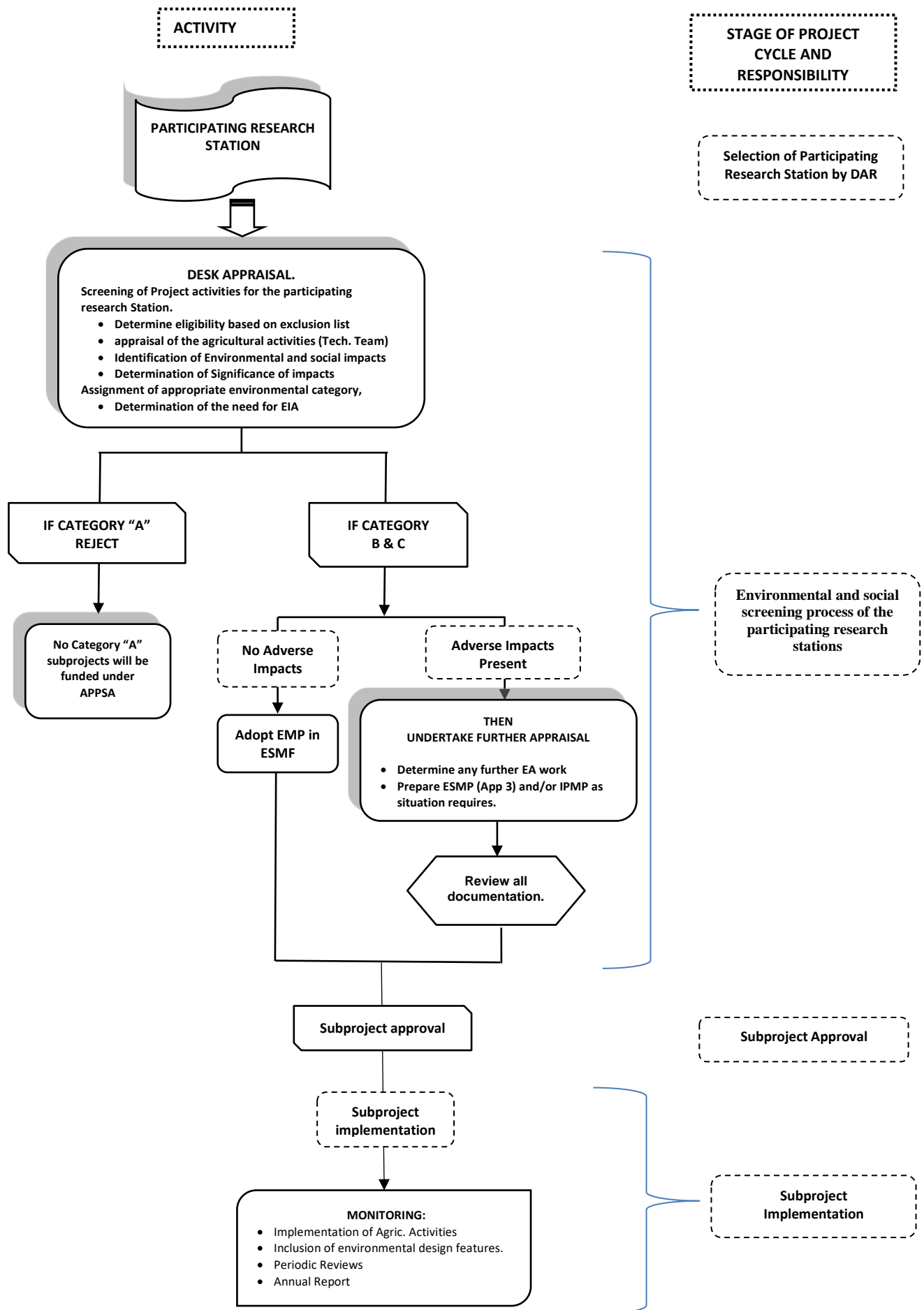


Figure 11-1: Subproject Screening Process

11.3.2 Assigning the Environmental and Social Categories

The assignment of the appropriate environmental and social category to a particular participating research station will be based on the information provided in The Environmental and Social Screening Form (Appendix 1). The same technical team of experts, will be responsible for categorizing and research or agricultural activity either as A, B, or C.

The assignment of the appropriate environmental and social category will be based on provisions in the World Bank's Operational Policy (OP) 4.01 Environmental Assessment. Consistent with this operational policy, most of the subprojects and activities of the current project are likely to be categorized as B, meaning that their potential adverse environmental and social impacts on human populations or environmentally important areas – including wetlands, forests, grasslands, and other natural habitats – are site-specific, few if any of the impacts are irreversible, and they can be mitigated readily. For these subprojects, environmental and social impact assessments will have to be carried out which will include environmental and social management plans specific to those subprojects and their activities. In addition, the ESIs will develop specific standard operating procedures or additional management plans that will be necessary to ensure environmental and social compliance and mitigation.

Some rehabilitation activities such as the water proofing of leaky tanks or painting buildings might be categorized as “C” if the environmental and social screening results indicate that such activities will have no significant environmental and social impacts and therefore do not require additional environmental and social work. Thus, if the screening form has only “No” entries, the proposed activity will not require further environmental and social work, and the technical team of experts will recommend approval of this proposal and implementation can proceed immediately in line with category 1 of the Government of Lesotho EIA guidelines.

The environmental and social category “A” (significant, irreversible impacts) will not apply to the research and agricultural subprojects and activities to be funded through APPSA – these subprojects and activities will be eliminated at the first stage of screening, where the eligibility of the subprojects is determined.

11.4 Review of Recommendations

All the screening information is then submitted to the Director for Agricultural Research (DAR Head office.) for review. The Director for Agricultural Research will review the recommendations in the screening form, review the proposed mitigation measures, and conduct public consultations. The Director for Agricultural Research will further determine, whether (a) the application of simple mitigation measures outlined in the Environmental and Social Screening Form (Appendix 1) will suffice; or whether further Environmental and social work needs to be done.

If the desk appraisal indicates that the proposed subproject may have environmental or social concerns that are not adequately addressed in the current documentation, the Director for Agricultural Research may require the preparation of additional mitigation plans as the situation may require. Once all the requisite documentation has been compiled the Director for Agricultural Research will make recommendations to National Level for approval.

11.5 Approval of Environmental and Social Work

The completed screening form along with any additional planning reports (e.g. IPMP) will be forwarded to the review authority, which is the MAFS at National Level.

The first step in the approval process is to determine if all the relevant information has been provided, and that it is adequate. MAFS (National Level) will also check if the technical team has

thoroughly considered all environmental and social issues with regards to the identification of potential adverse effects arising from the subproject as well as mitigating measures to adequately address negative impacts.

Based on the desk appraisal and if needed, the field appraisal, MAFS (National Level) will refer the application to the approval authority – the Department of Environment - with recommendations for approval conditions and implementation supervision (e.g. erosion control, pollution control, waste management, human safety).

11.6 Public Consultation and Disclosure

Public consultations are critical in preparing an effective proposal for the agricultural activities. The first step is to hold public consultations with the communities surrounding the research stations and all other interested/affected parties during the screening process and in the course of any further environmental and social work. These consultations should identify key issues and determine how the concerns of all parties will be addressed.

The public consultation methods include press conferences, information notices, brochures/fliers, interviews, questionnaires and polls, open houses, community meetings, advisory committees, and public hearings. The guidelines for public consultation include, among others, a requirement that major elements of the consultation program should be timed to coincide with significant planning and decision-making activities in the project cycle. In terms of Lesotho's EA process, public consultation should be undertaken during (i) the preparation of the EA terms of reference; (ii) the carrying out of an EA; (iii) government review of an EA report; and (iv) the preparation of environmental and social terms and conditions of approval.

To meet the consultation and disclosure requirements of the Bank, the Lesotho Government will issue a disclosure letter to inform the Bank of (i) the Government's approval of the ESMF; (ii) the actual disclosure of these documents to all relevant stakeholders and potentially affected persons in Lesotho, and (iii) the Government's authorization to the Bank to disclose these documents on its external website. The steps towards disclosure of the safeguard documents have to be completed prior to appraisal of the subproject as required by the Bank's Disclosure Policy OP 17.50.

11.7 Annual Monitoring and Reviews

Environmental and social monitoring needs to be carried out during the implementation of the subprojects. Monitoring of the compliance of subproject implementation with the mitigation measures set out in the ESMF and IPMP will be carried out jointly by the research station management, extension teams and APPSA Lesotho. APPSA Lesotho field officers should supervise the monitoring activities and are required to report annually on subproject activities during the preceding year. The information to be included in these annual reports is shown in Appendix 4. An annual monitoring report must be submitted to the WB by the APPSA.

Compliance monitoring comprises on-site inspection of activities to verify that measures identified in the ESMF and IPMP are being implemented. This type of monitoring is similar to the normal tasks of a supervising engineer whose task is to ensure that the Contractor is achieving the required standards and quality of work. The appointed environmental and social safeguards specialists will have the responsibility of conducting the environmental and social inspections. An annual inspection report must be submitted (together with the monitoring report) to the WB for review and approval.

Annual reviews may be carried out by an independent local consultant, NGO or other service provider that is not otherwise involved with APPSA. Annual reviews should evaluate the annual monitoring

report from APPSA field officers and the annual inspection report from MAFS/APPSA. The purpose of the reviews is three-fold:

1. To assess compliance with ESMF procedures, learn lessons, and improve future ESMFs;
2. To assess performance in terms of environmental and social risk management;
3. To assess the occurrence of, and potential for, cumulative impacts due to APPSA-funded and other development activities.

The annual reviews will be a principal source of information to the APPSA for improving performance, and to Bank supervision missions. Thus, they should be undertaken after the annual report on monitoring has been prepared and before Bank supervision of the project. Guidance on undertaking annual reviews is provided Appendix 3 of this ESMF.

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13 APPENDICES

APPENDIX 1: Environmental and Social Screening Form (ESSF)

1. EXCLUDED ACTIVITIES

The following subprojects will NOT be eligible for funding through APPSA Lesotho:

- Subprojects that require acquisition of land and physical or economic displacement of people.
- Subprojects that block the access to or use of land, water points and other livelihood resources used by others
- Subprojects that encroach onto fragile ecosystems, marginal lands or important natural habitats (e.g. ecologically-sensitive ecosystems; protected areas; natural habitat areas, forests and forest reserves, wetlands, national parks or game reserve; any other environmentally sensitive areas)
- Subprojects that Impact on physical cultural resources of national or international importance and conservation value
- Subprojects that have risks assessed as requiring biosafety levels BSL-3P and BSL-4P containment

2. COMPLETENESS OF SUB-PROJECTS APPLICATION:

Does the sub-project application document contain, as appropriate, the following information?

	Yes	No	N/A
Description of the proposed project and where it is located			
Information about how the site was chosen, and what alternatives were considered			
A map or drawing showing the location and boundary of the project including any land required temporarily during construction			
The plan for any physical works (e.g. layout, buildings, other structures, construction materials)			
Any new access arrangements or changes to existing road layouts			
A work program for construction, operation and decommissioning the physical works, including any site restoration needed afterwards			
Information about measures to avoid or minimize adverse environmental and social impacts			
Details of any permits required for the project			

3. ENVIRONMENTAL AND SOCIAL CHECKLIST

		Yes	No	ESMF Guidance
A	Type of activity – Will the subprojects involve:			
	Breeding for resistance to pests and diseases and tolerance to abiotic stresses (drought, heat)			
	Germplasm collection, characterization and conservation			
	Integrated pest and disease control			
	Management of newly emerging pest and disease threats (e.g. Fall army worm)			
	Seed production, supply and delivery systems			
	Conservation agriculture and climate adaptation measures			
	Soil fertility improvement			
	Water management and water use efficiency			
	Post-harvest processing, marketing and value addition			
	Improved storage practices			
	Food safety (mycotoxin/aflatoxin management)			
	Reducing pre- and post-harvest losses			
	Agricultural mechanization (tools for pre- & post-harvest operations; labor-saving devices)			
	Marketing/ trade of crop produce - linking Farmers to markets			
	Nutrition (e.g.. utilization of grain legumes)			
<i>If the answer to any of questions 1-15 is "Yes", please use the indicated Resource Sheets or sections(s) of the ESMF for guidance on how to avoid or minimize typical impacts and risks</i>				
B	Environment – Will the subproject or any of its associated activities:			
	Adversely impact air quality?			
	Risk causing the contamination of drinking water?			
	Affect the quantity or quality of surface waters (e.g. rivers, streams, wetlands), or groundwater (e.g. wells)?			
	Cause poor water drainage and increase the risk of water-related diseases such as malaria or bilharzia?			
	Harvest or exploit a significant amount of natural resources such as trees, soil or water?			
	Create a risk of increased soil degradation or erosion?			
	Create a risk of increasing soil salinity?			
	Produce, or increase the production of, solid or liquid wastes e.g. water, biological, hazardous, domestic or construction wastes)?			
	Genetically contaminate traditional or other crop varieties?			
	Has the subproject been assessed for biosafety risks and assigned a biosafety level?			
<i>If the answer to any of questions 10-18 is "Yes", please include an Environmental and social Management Plan (ESMP) with the sub-projects application.</i>				
C	Social: Gender, Land acquisition and access to resources – Will the sub-projects:			
	Require that land (public or private) be acquired temporarily for its development?			
	Use land that is currently occupied or regularly used for productive purposes (e.g. Gardening, farming, pasture, fishing locations, forests)			
	Result in and maintain adverse gender balances?			
	Exacerbate existing gender imbalances?			
	Positively address gender imbalances in the agriculture sector?			

		Yes	No	ESMF Guidance
	Include less privileged potential beneficiaries? (i.e. Youths, disabled persons, child headed households, farmers with less than 1ha, the poorest).			
	Institute procedures to protect intellectual property			
	Erode indigenous knowledge relating to traditional plant uses?			
D Pesticides and agricultural chemicals – Will the sub-projects:				
	Involve the use of pesticides or other agricultural chemicals, or increase existing use?			
<i>If the answer to question 24 is “Yes”, please consult the ESMF and, if needed, prepare a Pest Management Plan (IPMP).</i>				

CERTIFICATION

We certify that we have thoroughly examined all the potential adverse effects of this sub-project. To the best of our knowledge, the sub-project plan as described in the application and associated planning reports (e.g. ESMF, ESMP, IPMP), if any, will be adequate to avoid or minimize all adverse environmental and social impacts.

SIGNATURES:

.....
EXTENSION TEAM REPRESENTATIVE

.....
DATE

.....
PIU ENVIRONMENTAL SAFEGUARDS SPECIALIST

.....
DATE

APPENDIX 2: Safeguards Checklist for General Supervision

Checklist for General Supervision

Environmental and Social Safeguards Implementation

Ensure that documentation on specific sites and subprojects, environmental and social impacts monitoring reports, and reports on the status of safeguards implementation are furnished to the mission team at or before the kick-off meeting.

- Meet with key beneficiaries and other stakeholders
- Review a random sample of subprojects, making sure all safeguards issues are evaluated
- Get an overview of all the projects/sub-projects and their categories in terms of EIA
- Identify projects with applicable environment safeguards
- Identify projects with applicable social safeguards
- Based on the reports, determine projects that have potential critical safeguards issues, and focus on those
- Discuss findings and significant noncompliance issues, if any with the TTL and agree on correcting actions
- Assess the project's experience in managing social and environmental risks
- Field visit to review recently completed subprojects, where possible review project proposals and impact monitoring records
- Assess the use of environmental and social screening checklists contained in the Environmental and Social Management Framework (ESMF) for proposed sub-projects/investments
- Assess implementing agencies' awareness and use of the ESMF
- Find out if there is an established ESMF monitoring and tracking system to ensure effective oversight of project activities at the national level
- Identify weaknesses in procedures, internal control mechanisms, supervision and post reviews
- Has there been/Is there any training plan to improve the awareness and capacity of implementing agencies on the use of ESMF
- Find out if there is an Environmental and social Officer at the District. If not, why? Any plan to recruit someone? Who is currently responsible for environmental and social issues at the district?
- Assess the borrower's capacity to plan and implement safeguard policy issues
- Make practical recommendations for across the project-specific action plans
- Assess the impacts from any changes in the project design or new components. If required agree upon a revised safeguards management plan, monitoring and reporting requirements
- Agree with the borrower on additional measures required, and if non-compliance or unresolved safeguards issues remain, establish a plan for follow on supervision

Methodology:

- Examine sub-project design, review and approval process, social and environmental safeguards compliance, quality and effectiveness of project outputs.

APPENDIX 3: Guidelines for Annual Reviews

Objectives: The objectives of annual reviews of ESMF implementation are two-fold:

- a) To assess Project performance in complying with ESMF procedures, learn lessons, and improve future performance; and*
- b) To assess the occurrence of, and potential for, cumulative impacts due to APPSA-funded and other development activities.*

The annual reviews are intended to be used by APPSA management to improve procedures and capacity for integrating natural resources and environmental/social management into project operations. They will also be a principal source of information to Bank supervision missions.

Scope of Work: *ESMF Performance Assessment*

The overall scope of the performance assessment work is to:

- a) Assess the adequacy of the sub-project approval process and procedures based on interviews with project participants, project records, and the environmental and social performance of a sample of approved sub-projects;
- b) Assess the adequacy of ESMF roles and responsibilities, procedures, forms, information resource materials, etc.;
- c) Assess the needs for further training and capacity building;
- d) Identify key risks to the environmental and social sustainability of sub-projects; and
- e) Recommend appropriate measures for improving ESMF performance.

The following tasks will be typical:

- a) Review provincial and district records of sub-projects preparation and approval (e.g. applications; screening checklists; ESMFs, and PMPs appraisal forms; approval documents), monitoring reports as well as related studies or reports on wider issues of natural resources and environmental and social management in the country;
- b) On the basis of this review, conduct field visits of a sample of approved sub-projects to assess the completeness of planning and implementation work, the adequacy of environmental/social design, and compliance with proposed mitigation measures. The sample should be large enough to be representative and include a substantial proportion of sub-projects that had (or should have had) a field appraisal according to established ESMF criteria (see Section 11.2 The Screening Process). Sub-projects in sensitive natural or social environments should especially be included.
- c) Interview project and district officials responsible for sub-projects' appraisal and approval to determine their experience with ESMF implementation, their views on the strengths and weaknesses of the ESMF process, and what should be done to improve performance. Improvements may concern, for example, the process itself, the available tools (e.g. guidelines, forms, and information sheets), the extent and kind of training available, and the amount of financial resources available.
- d) Develop recommendations for improving ESMF performance.

Cumulative Impacts Assessment

This part of the annual review assesses the actual or potential cumulative impacts of sub-projects with other sub-projects or development initiatives on the environment, natural resources and community groups. Cumulative impacts result from a number of individual small-scale activities that, on their own, have minimal impacts, but over time and in combination generate a significant impact. For example:

- Decline in groundwater levels or quality due to the construction of numerous wells and the introduction of numerous small-scale irrigation works;
- Overwhelmed or illegal waste and dumping sites due to the inappropriate disposal of increasing amounts of waste materials;
- Illegal poaching of wildlife due to expansion of land under cultivation or increased proximity and access to protected areas through construction of small access roads; and
- Attraction of large migrant populations to communities that have successfully introduced improve social infrastructure (such as schools, health centres or water sources) resulting in overcrowding, depletion of resources (e.g. space, supplies, water), etc.

The function of this assessment is primarily as an "early warning" system for potential cumulative impacts that might otherwise go undetected and unattended to. It will be largely based on the observations of people interviewed during the field work, and trends that may be noticed by district or regional officials. Where cumulative impacts are detected or suspected, recommendations will be made to address the issue, perhaps through more detailed study to clarify matters and what should or can be done about them.

Qualifications for Undertaking Annual Reviews:

The reviews should be undertaken by an individual or small team with training and experience relevant to the likely issues to be encountered (e.g. environmental and natural resources management). They should also be familiar with the methods and practices of effective community consultation, and with typical methods and processes for preparing, appraising, approving and implementing small-scale community development projects.

Timing:

Annual reviews should be undertaken after the annual monitoring report has been prepared and before Bank supervision of the project, at the closing of each year of the project. It is expected that each review would require 3-4 weeks of field work (interviews, examination of sub-projects), and that the review report would be completed within 2 weeks of completing the field work.

Outputs:

The principal output is an **annual review report** that documents the review methodology, summarizes the results, and provides practical recommendations. Distinct sections should address: a) ESMF performance and b) cumulative impacts. Annexes should provide the detailed results of the field work, and summarize the number of approved sub-projects by district and their characteristics according to the annual report format (see Appendix 4). Copies of the annual review report should be delivered to APPSA Steering Committee, to each district/provincial office responsible for appraisal, approval and implementation of sub-projects, and to the World Bank. The Provincial Review Panel may also want to host national or district workshops to review and discuss the review findings and recommendations.

APPENDIX 4: Guidelines for Annual Report

Name of the Project:
(APPSA)

Application Number:

1. **Name of District or Local Government:**
2. **Name and Position of Review Authority Completing the Annual Report:**
3. **Reporting Year:**
4. **Date of Report:**
5. **Community Sub-project (s):**

Please enter the numbers of sub-projects in the following table.

<i>Types of Activities</i>	Approved year	Application included an ESMP checklist	Field Appraisal	ESMP	IPMP	Specific TA
Breeding for resistance to pests and diseases and tolerance to abiotic stresses (drought, heat)						
Germplasm collection, characterization and conservation						
Integrated pest and disease control						
Management of newly emerging pest and disease threats (EG Fall Army Worm)						
Seed production, supply and delivery systems						
Conservation agriculture and climate adaptation measures						
Soil fertility improvement						
Water management and water use efficiency						
Post-harvest processing, marketing and value addition						
Improved storage practices						
Food safety (mycotoxin/aflatoxin management)						
Reducing pre- and post-harvest losses						
Agricultural mechanization (tools for pre- & post-harvest operations; labor-saving devices)						
Marketing/ trade of crop produce - linking Farmers to Markets						
Nutrition (EG. utilization of grain legumes)						

6. Were there any **unforeseen environmental or social problems** associated with any sub-project approved and implemented this year? If so, please identify the sub-project (s) and summarize the problem (s) and what was or will be done to solve the problem (s). Use a summary table like the one below.

Sub-project	Problem(s)	Actions taken	Actions to be taken

7. Have any **other environmental or social analyses** been carried out by other public or private agencies in your district/province? If so, please describe them briefly.

.....

8. Have you noticed any particular **problems with implementing the ESMF** in the past year (e.g. administrative, communications, forms, capacity)? If so, please describe them briefly.

.....

9. **Training:** Please summarize the training received in your district/province in the past year, as well as key areas of further training you think is needed.

Group	Training Received	Training Needed
Review Authority		
Approval Authority		
Extension Teams		
NGOs/Associations		

APPENDIX 5: World Bank Environmental and Social Safeguard Policies

APP 5.1 World Bank Environmental and Social Safeguard Policies

- **Environmental Assessment (OP/BP 4.01).** Outlines Bank policy and procedure for the environmental assessment of Bank lending operations. The Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of EA process. This environmental process will apply to all sub-projects to be funded by the proposed project.
- **Natural Habitats (OP/BP 4.04).** The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs. If the environmental assessment indicates that a project would significantly convert or degrade natural habitats, the project includes mitigation measures acceptable to the Bank. Such mitigation measures include, as appropriate, minimizing habitat loss (e.g. strategic habitat retention and post-development restoration) and establishing and maintaining an ecologically similar protected area. The Bank accepts other forms of mitigation measures only when they are technically justified. Should the sub-project-specific EMPs indicate that natural habitats might be affected negatively by the proposed sub-project activities with suitable mitigation measures, such sub-projects will not be funded under this project
- **Pest Management (OP/BP 4.09)** The policy supports safe, effective, and environmentally sound pest management. It promotes the use of biological and environmental control methods. An assessment is made of the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management. This policy was not triggered by the proposed project.
- **Involuntary Resettlement (OP/BP 4.12)** This policy covers direct economic and social impacts that both result from Bank-assisted investment projects, and are caused by (a) the involuntary taking of land resulting in (i) relocation or loss of shelter; (ii) loss of assets or access to assets, or (iii) loss of income sources or means of livelihood, whether or not the affected persons must move to another location; or (b) the involuntary restriction of access to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons. The project did not trigger this policy.
- **Indigenous Peoples (OP/BP 4.20)** This directive provides guidance to ensure that indigenous peoples benefit from development projects, and to avoid or mitigate adverse effects of Bank-financed development projects on indigenous peoples. Measures to address issues pertaining to indigenous peoples must be based on the informed participation of the indigenous people themselves. Sub-projects that would have negative impacts on indigenous people will not be funded under the proposed project.
- **Forests (OP/BP 4.36)** This policy applies to the following types of Bank-financed investment projects: (a) projects that have or may have impacts on the health and quality of forests; (b) projects that affect the rights and welfare of people and their level of dependence upon or interaction with forests; and (c) projects that aim to bring about changes in the management, protection, or utilization of natural forests or plantations, whether they are publicly, privately,

or communally owned. The Bank does not finance projects that, in its opinion, would involve significant conversion or degradation of critical forest areas or related critical habitats. If a project involves the significant conversion or degradation of natural forests or related natural habitats that the Bank determines are not critical, and the Bank determines that there are no feasible alternatives to the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs, the Bank may finance the project provided that it incorporates appropriate mitigation measures. Sub-projects with likelihood of having negative impacts on forests will not be funded under the project.

- **Cultural Property (OP/BP 4.11)** The term “cultural property” includes sites having archaeological (prehistoric), paleontological, historical, religious, and unique natural values. The Bank’s general policy regarding cultural property is to assist in their preservation, and to seek to avoid their elimination. Specifically, the Bank (i) normally declines to finance projects that will significantly damage non-replicable cultural property, and will assist only those projects that are sited or designed so as to prevent such damage; and (ii) will assist in the protection and enhancement of cultural properties encountered in Bank-financed projects, rather than leaving that protection to chance. The management of cultural property of a country is the responsibility of the government. The government’s attention should be drawn specifically to what is known about the cultural property aspects of the proposed project site and appropriate agencies, NGOs, or university departments should be consulted; if there are any questions concerning cultural property in the area, a brief reconnaissance survey should be undertaken in the field by a specialist. The proposed project will not fund sub-projects that will have negative impacts on cultural property.
- **Safety of Dams (OP/BP 4.37)** For the life of any dam, the owner is responsible for ensuring that appropriate measures are taken and sufficient resources provided for the safety to the dam, irrespective of its funding sources or construction status. The Bank distinguishes between small and large dams. Small dams are normally less than 15 m in height; this category includes, for example, farm ponds, local silt retention dams, and low embankment tanks. For small dams, generic dam safety measures designed by qualified engineers are usually adequate. This policy does not apply to the proposed project.
- **Projects on International Waterways (OP/BP 7.50)** The Bank recognizes that the cooperation and good will of riparians is essential for the efficient utilization and protection of international waterways and attaches great importance to riparians making appropriate agreements or arrangement for the entire waterway or any part thereof. Projects that trigger this policy include hydroelectric, irrigation, flood control, navigation, drainage, water and sewerage, industrial, and similar projects that involve the use or potential pollution of international waterways. The proposed project did not trigger this policy.
- **Disputed Areas (OP/BP/GP 7.60).** Project in disputed areas may occur in the Bank and its member countries as well as between the borrower and one or more neighbouring countries. Any dispute over an area in which a proposed project is located requires formal procedures at the earliest possible stage. The Bank attempts to acquire assurance that it may proceed with a project in a disputed area if the governments concerned agree that, pending the settlement of the dispute, the project proposed can go forward without prejudice to the claims of the country having a dispute. This policy is not expected to be triggered by sub-projects. This policy is unlikely to be triggered by sub-projects to be funded by this project.

APP 5.2 Safeguard Policies That Were Triggered

Safeguard Policies	Triggered?	Explanation (Optional)
Environmental Assessment OP/BP 4.01	Yes	<p>The policy is triggered as a result of: (i) proposed research activities under component 1 which could include breeding, germplasm, and on farm technology testing that can involve the application of agro-chemicals including chemical pesticides; and (ii) capacity building for Regional Centers of Leadership under component 2, which would include financing for civil works investment in field rehabilitation, office and lab infrastructure and irrigation related upgrading or construction. Angola and Lesotho will prepare an Environment and Social Management Framework (ESMF) as the safeguard instruments which will provide mitigation measures and a uniform approach for addressing identified potential negative environmental impacts as well as screening procedures and monitoring plans for compliance management.</p> <p>The project is proposed to be classified as an EA category B.</p>
Natural Habitats OP/BP 4.04	No	<p>The policy is not triggered as the program would not involve significant conversion of natural habitats through its direct or indirect activities. APPSA support under component 1 activities are intended to improve the productivity of agriculture through the adoption of improved technologies (intensification) rather than expansion of agricultural production (extensification). Technologies developed, tested and released under the project would not specifically target natural habitats but would aim to improve the productivity of existing agricultural practices. Under Component 2 the project is expected to finance infrastructure upgrading on already existing agricultural research stations and fields. No new land would be acquired and natural habitats are not known to be inside or adjacent to research stations.</p>
Forests OP/BP 4.36	No	<p>The policy is not triggered as program activities do not have any direct impacts on the health and quality of forests, people who depend on forests, nor is there an aim to change the management, protection, or utilization of forests.</p>
Pest Management OP 4.09	Yes	<p>The program may purchase pesticides or agrochemicals at very low volumes as part of project supported research activities. No pesticides or agrochemicals will be purchased and supplied to farmers outside of their participation in research trials or demonstrations activities. Adoption of improved agricultural technology generated by APPSA could indirectly result in increased use of pesticides and agrochemicals by farmers, but the scale of this indirect impact is not known. For this reason, each participating country will prepare a Pest Management Plan (PMP) which incorporates Integrated Pest Management (IPM) procedures.</p>
Physical Cultural Resources OP/BP 4.11	Yes	<p>The policy is not triggered as implementation is not expected to involve any known physical cultural resources and will take place on land already actively in use for agricultural purposes either within agricultural research stations or farmer fields. Nonetheless, lessons learned from other projects in Lesotho have shown that in some of the districts where the project will be implemented, such as Leribe and Butha Buthe, artefacts from historical cultural resources have been found at some places. Therefore, the Chance Find Procedures will be included in the ESMF in case of chance finds during implementation project.</p>
Indigenous Peoples OP/BP 4.10	TBD	<p>This Policy may be triggered for Angola, given the possibility of IP communities being present in the project areas. Based on the review of potential project locations, an IPPF will be prepared in order</p>

		<p>determine and provide measures to avoid and mitigate potential negative impacts. The framework will be specific for each group identified and will as well be focused on providing positive benefit for this vulnerable population.</p> <p>OP4.10 is not triggered in Lesotho as there are no indigenous people within the project area of influence.</p>
Involuntary Resettlement OP/BP 4.12	Yes	<p>The policy is triggered in Angola and to be determined in Lesotho. Although no land acquisition is expected under the project and activities will take place on land already under the management of agricultural research stations or farmers, in some cases land is currently fallow or not actively used and local communities may have encroached into fields for their own farming. While all land which is required for project activities belongs to the respective clients, there is a risk that informal occupation or use may occur during project implementation. OP4.12 is therefore triggered as a precautionary measure to guide implementation and mitigation measures to avoid resettlement impact. An RPF will be prepared in Angola and a determination made whether it is required for Lesotho during the course of preparation.</p>
Safety of Dams OP/BP 4.37	Yes	<p>The policy is triggered. Although the project would not invest in large scale dam construction the project would invest in small productive rural infrastructure, such as the establishment or rehabilitation and improvement of small-scale irrigation and drainage works for research stations under the RCoLs, and possibly include small-scale earth dams to harvest and store water. These structures, however these would generally be far less than 10 m in height. The FAO manual on small dams will guide implementation and be incorporated into the relevant safeguards instruments. The small dams would be designed and the construction supervised by a qualified engineer.</p>
Projects on International Waterways OP/BP 7.50	No	<p>The policy is not triggered as the project would not invest in any large scale irrigation works that would adversely affect the quality or quantity of water flow within shared waterways. Small scale irrigation within the context of technology demonstration or research could be financed by the program but would be within the context of research facilities and would not exceed more than 50 hectares per station/center.</p>
Projects in Disputed Areas OP/BP 7.60	No	<p>The policy is not triggered as the area where the program will be implemented is not known to include any disputed areas</p>

APPENDIX 6: Proof of Public Consultation

APP 6.1 list of the stakeholders


The following is a list of the stakeholders who were consulted in the process of developing the current ESMF.

No.	CONSULTED STAKEHOLDER	DESIGNATION/ORGANISATION
1	Mr. Nchemo Maile,	Principal Secretary, Ministry of Agriculture and Food Security
2	Mr. Khotso Moleleki,	Director, Public Debt, Ministry of Finance
3	Dr Lefulesele Lebesa	Director for Agricultural Research, Ministry of Agriculture and Food Security
4	Mr. Ntitia Tuoane –	Director of Field Services, Ministry of Agriculture and Food Security
5	Dr Lebone Molahlahi	Director of Crops Services, Ministry of Agriculture and Food Security
6	Ms Rethabile Nchee	Chief Research Officer – Extension, Ministry of Agriculture and Food Security
7	Dr Bataung Kuenene	Chief Research Officer – Crops, Ministry of Agriculture and Food Security
8	Mathoriso Molumeli	Director of Planning and Policy Analysis, Ministry of Agriculture and Food Security
9	Mrs. M. Phakisi –	Chief Economic Planner, Ministry of Agriculture and Food Security
10	Ms Monica Lephole –	Chief Research Officer – Nutrition and Food Technology, Ministry of Agriculture and Food Security
11	Mr. Mataoana Lekhao	Mahobong Ha Joung
12	Mr. Teboko Seboka	Khubetsoana
13	Thato Masela	Machache
14	Matokiso Rikabe	Maseru
15	Matsepang Semoli	Nyakosoba
16	Matumelo Lifahlo	Maseru
17	Khotso Senqunyana	Mafeteng
18	Mamahali Sekhonyana	Leribe
19	Teboho Seboka	Siloe
20	Ramphahama TebohoSiloe	Siloe
21	Khotho Mokallimotso	Khubetsoana - Maseru
22	Thekiso Thulo	Siloe
23	Phanyane Maope	Ha Sakoane
24	Maramabanta Lerotholi	Matsieng
25	Mopeli Motsoene/Molapo	Tsifa-li-Mali
26	Mrs. Keletso Hlelesi	Senior Internal Auditor, Ministry of Agriculture and Food Security
27	Ms Puleng Pali	Chief Legal Officer, Ministry of Agriculture and Food Security
28	Mr. Moeketsi Mokati	Project Director, Wool and Mohair Project (WAMP)
29	Mr. Thekiso Thulo	Local Chief Siloe Mohale's Hoek
30	Mr. Ramabanta Lerotholi	Local Chief Matsieng Maseru
31	Mrs. 'Masekonyela Maama	Local Chief Nyakosoba Maseru
32	Mr. Seetsa Theko	Local Chief Machache Maseru
33	Mr. Phanyane Maope	Local Chief Ha Sakoane Berea
34	Mr. Khethisa Khethisa	Local Chief Mahobong Leribe
35	Mr. Mopeli Molapo	Local Chief Ts'ifa-li-Mali Leribe
36	Mr. Keli	Area Extension Officer Molumong Mokhotlong
37	Mr. Tsepo Ramoipone	Livestock attendant Thaba- Tseka
38	Dr. Monica Murata	APPSA Coordinator. CCARDESA
39	Melissa Brown	Senior Economist, World Bank
40	Ijeoma Emenanjo	Natural Resource Management Specialist and Task Team Leader, Smallholder Agricultural Development Project (SADP), World Bank
41	Sarah Simons	Senior Agriculture Specialist, World Bank

APP 6.2 Proof of Public Consultation

A sample of the response to the administered questionnaire and a record of a direct interview have been included as proof of public consultation:

APP 6.2.1 Meeting with Mr. Matavana Lekhao


MINISTRY OF AGRICULTURE AND FOOD SECURITY - LESOTHO
AGRICULTURAL PRODUCTIVITY PROGRAM OF SOUTHERN AFRICA (APPSA)
QUESTIONNAIRE

NAME Matavana Lekhao
ORGANISATION Mahobong Ha Joang
PHYSICAL ADDRESS _____
PHONE NUMBER 57635922 E-MAIL ADDRESS _____

The Government of Lesotho (GoL) is seeking funding to participate in the Agricultural Productivity Program in Southern Africa (APPSA), under the Ministry of Agriculture and Food Security (MAFS) with the objective of increasing the productivity of horticulture (fruits and vegetables crops systems) through the introduction of improved varieties and modern farming technologies. The proposed APPSA will support agricultural technology generation and dissemination by supporting the strengthening and scaling up of Regional Centres of Leadership (RCOLs) to carry out research activities of regional importance through regional collaboration.

The key component of the proposed program will "Technology Generation and Dissemination". This component will support technology generation and dissemination activities associated with Regional Centres of Leadership (RCOLs) and involve:

1. Refurbishment and rehabilitation of the research facilities such as Seed storage facilities; Greenhouses; Laboratories; Chemical stores; Growth chambers; and Plant tissue facilities.
2. Research activities at the improved research facilities aiming at improving horticulture (fruits and vegetables) technologies and improving the capacity of MAFS to strengthen technical training of beneficiary farmers, extension agents and advisory service providers.
3. Dissemination of horticulture technology or technology transfer to beneficiary farmers.

These programmes have a bearing on the social and environmental dimension. What are your views about this proposed Developmental Project as regards their potential social and environmental impact?

ENVIRONMENTAL AND SOCIAL CONCERNS
1.0 Refurbishment and rehabilitation of the research facilities

1.1 As the project is being introduced to the area and people start planning to implement (surveys, demolitions, clearing etc) what environmental and social impacts do you envisage?
The village will be developed, people will get fruits seedlings, people will also get jobs.

1.2 As the project is being implemented (Demolition and refurbishments of research facilities, etc.) what environmental and social impacts do you envisage?
The station will be operational like old days. It will also open the market.

2.0 Research activities at the improved research facilities

- 2.1 As the research activities will be underway there will be a lot of activities generating various types of waste what environmental and social impacts do you envisage?

environmental and social impacts do you envisage?

Air pollution, our livelihoods will be endangered
endangered soil acidity

- 2.2 What mitigation measures would you like to see being put in place to counter the impacts you envisage?

people should be trained about the use of chemical use of best liming materials

- 2.3 Are there any locally available genetic resources and indigenous knowledge on horticulture and vegetable production that you would like to see preserved and how would you want this done?

buying of fruit and vegetables

1.2 Dissemination of horticulture technology or technology transfer

- 3.1 As the technology dissemination gets underway what environmental and social impacts do you envisage?

increased production of vegetables and fruits through new technologies.

- 3.3 What mitigation measures would you like to see being put in place to counter the impacts you envisage?

Training of producers on preservation of vegetables and potatoes

OTHER COMMENTS

SIGNED

Matasana dehaa
INTERVIEWEE

DATE 06/03/18

Interviewer:

DATE 06/05/18

AP 6.2.2 Meeting with Mr. Teboko Seboka



MINISTRY OF AGRICULTURE AND FOOD SECURITY - LESOTHO

AGRICULTURAL PRODUCTIVITY PROGRAM OF SOUTHERN AFRICA (APPSA)

QUESTIONNAIRE

NAME Teboko Seboka
 ORGANISATION Village
 PHYSICAL ADDRESS Khutha, Mafeteng, Bojale
 PHONE NUMBER 5850 0000 E-MAIL ADDRESS tebokoseboka@gmail.com

The Government of Lesotho (GoL) is seeking funding to participate in the Agricultural Productivity Program in Southern Africa (APPSA), under the Ministry of Agriculture and Food Security (MAFS) with the objective of increasing the productivity of horticulture (fruits and vegetables crops systems) through the introduction of improved varieties and modern farming technologies. The proposed APPSA will support agricultural technology generation and dissemination by supporting the strengthening and scaling up of Regional Centres of Leadership (RCoLs) to carry out research activities of regional importance through regional collaboration.

The key component of the proposed program will "Technology Generation and Dissemination" This component will support technology generation and dissemination activities associated with Regional Centres of Leadership (RCoLs) and involve:

1. Refurbishment and rehabilitation of the research facilities such as Seed storage facilities; Greenhouses; Laboratories; Chemical stores; Growth chambers; and Plant tissue facilities.
2. Research activities at the improved research facilities aiming at improving horticulture (fruits and vegetables) technologies and improving the capacity of MAFS to strengthen technical training of beneficiary farmers, extension agents and advisory service providers.
3. Dissemination of horticulture technology or technology transfer to beneficiary farmers.

These programmes have a bearing on the social and environmental dimension. What are your views about this proposed Developmental Project as regards their potential social and environmental impact?

ENVIRONMENTAL AND SOCIAL CONCERNS

1.0 Refurbishment and rehabilitation of the research facilities

- 1.1 As the project is being introduced to the areas and people start planning to implement (surveys, demolitions, clearing etc) what environmental and social impacts do you envisage?

We will get jobs for local expertise, Movement of people will be restricted, animals will not have access for grazing

- 1.2 As the project is being implemented (Demolition and refurbishments of research facilities, etc) what environmental and social impacts do you envisage?

The people will be able to use the facilities to improve their production through learning by showing

2.0 Research activities at the improved research facilities

- 2.1 As the research activities will be underway there will be a lot of activities generating various types of waste what environmental and social impacts do you envisage?

If waste is not well managed it will pollute areas around and affect drinking water for animals and people

- 2.2 What mitigation measures would you like to see being put in place to counter the impacts you envisage?

Good management of waste, training of the people around the project area, Good security by fencing & night watch.

- 2.3 Are there any locally available genetic resources and indigenous knowledge on horticulture and vegetable production that you would like to see preserved and how would you want this done.

There is knowledge on horticulture & vegetable production crops are affected by frost, we need shade nets/greenhouses for protected production

3.0 Dissemination of horticulture technology or technology transfer

- 3.1 As the technology dissemination gets underway what environmental and social impacts do you envisage?

It help to improve peoples lives and people will know types of crops to produce at what time, to improve soil. People will be able to produce for market and increase income

- 3.2 What mitigation measures would you like to see being put in place to counter the impacts you envisage?

Good follow up after people are trained and given some resources, Regular trainings for new technologies

OTHER COMMENTS

The project will be very helpful to our community if it will be well implemented

SIGNED.

Fabola
INTERVIEWEE

08/08/18
DATE

[Signature]
INTERVIEWER

08/08/18
DATE

AP 6.2.2 Meeting with Mr. Khetho Mokaumotso



MINISTRY OF AGRICULTURE AND FOOD SECURITY - LESOTHO

AGRICULTURAL PRODUCTIVITY PROGRAM OF SOUTHERN AFRICA (APPSA)

QUESTIONNAIRE

NAME Khetho Mokaumotso
ORGANISATION Village
PHYSICAL ADDRESS Boinyatso Khubetsoana
PHONE NUMBER _____ E-MAIL ADDRESS _____

The Government of Lesotho (GoL) is seeking funding to participate in the Agricultural Productivity Program in Southern Africa (APPSA), under the Ministry of Agriculture and Food Security (MAFS) with the objective of increasing the productivity of horticulture (fruits and vegetables crops systems) through the introduction of improved varieties and modern farming technologies. The proposed APPSA will support agricultural technology generation and dissemination by supporting the strengthening and scaling up of Regional Centres of Leadership (RCOLs) to carry out research activities of regional importance through regional collaboration.

The key component of the proposed program will "Technology Generation and Dissemination" this component will support technology generation and dissemination activities associated with Regional Centres of Leadership (RCOLs) and involve:

1. Refurbishment and rehabilitation of the research facilities such as Seed storage facilities; Greenhouses; Laboratories; Chemical stores; Growth chambers; and Plant tissue facilities.
2. Research activities at the improved research facilities aiming at improving horticulture (fruits and vegetables) technologies and improving the capacity of MAFS to strengthen technical training of beneficiary farmers, extension agents and advisory service providers.
3. Dissemination of horticulture technology or technology transfer to beneficiary farmers.

These programmes have a bearing on the social and environmental dimension. What are your views about this proposed Developmental Project as regards their potential social and environmental impact?

ENVIRONMENTAL AND SOCIAL CONCERNS

1.0 Refurbishment and rehabilitation of the research facilities

- 1.1 As the project is being introduced to the areas and people start planning to implement (surveys, demolitions, clearing etc) what environmental and social impacts do you envisage?

The project will provide the community with jobs although people are used to hire their relatives

- 1.2 As the project is being implemented (Demolition and refurbishments of research facilities, etc) what environmental and social impacts do you envisage?

The services will be near and will sell our tree seedling to the department.

2.0 Research activities at the improved research facilities

- 2.1 As the research activities will be underway there will be a lot of activities generating various types of waste what environmental and social impacts do you envisage?

The chemicals will affect or kill animals and grass as it may be washed away and people may breath it.

- 2.2 What mitigation measures would you like to see being put in place to counter the impacts you envisage?

The department should protect the areas and train people around on the danger of the chemicals

- 2.3 Are there any locally available genetic resources and indigenous knowledge on horticulture and vegetable production that you would like to see preserved and how would you want this done.

Protection of seedlings through use of chemicals.
Preservation of vegetables and fruits by sun drying

3.0 Dissemination of horticulture technology or technology transfer

- 3.1 As the technology dissemination gets underway what environmental and social impacts do you envisage?

We will be able to increase our production and sell for income

- 3.2 What mitigation measures would you like to see being put in place to counter the impacts you envisage?

installation of irrigation systems, continuous training of farmers and teaching on climate change

OTHER COMMENTS

SIGNED.

Mokotimotso
INTERVIEWEE

08/08/18
DATE


INTERVIEWER

08/08/18
DATE

APPENDIX 7: Germplasm Improvement

1.0 INTRODUCTION

The core of plant breeding is the selection of better types among variants, in terms of yield and quality of edible parts; ease of cultivation, harvest, and processing; tolerance to environmental stresses; and resistance against pests. Each of these aspects of agronomic or food value can be dissected in many specific traits, each presenting its own range of variation.

Plant breeding methods have been an evolving technology, as levels of knowledge of the underlying mechanisms and the control of the process of generating and selecting superior plant types have been increasing. There are three main eras of plant breeding:

- (i) plant breeding based on the selection of observed variants, disregarding their origin;
- (ii) generation and selection of expanded variation by controlled mating; and
- (iii) monitoring the inheritance of within-genome variation and selection of specific recombinants - marker-assisted breeding.
- (iv) the creation and introduction of novel variation into genomes through genetic engineering.

Traditional breeding methods were based on the complementarity between parental characteristics. However, little or nothing was known about which part of the genome came from each parent until the advent and dissemination of molecular marker technologies, which made it possible to monitor the transmission of chromosome segments in the progeny.

2.0 PLANT BREEDING BASED ON OBSERVED VARIATION

This is done by selecting naturally occurring variants in the wild and, in cultivated fields. Genetic variation is then continuously submitted to the selection pressure of the planting–harvesting cycles.

2.1 Plant Domestication: The Origin of Crops.

Some plants that could not survive in the wild due to natural selection received the protection from competition by being cultivated. This resulted in the plants mutating into more favourable phenotypes either in terms of cultivation or in terms of food quality, thus conferring a selective advantage, and becoming the predominant type through human selection.

2.2 Intuitive Farmer Selection: The Origin of Landraces.

Landraces are populations of plants that have been cultivated for many generations in a certain region, being shaped by biotic and abiotic stresses, crop management, seed handling, and eating preferences. They are dynamic genetic entities: continuously changing as a consequence of intentional and unintentional selection, seed mixture, and pollen exchange.

2.3 Pure Line Selection and Mass Selection: The Origin of Cultivars.

This method of plant breeding is based on an elementary knowledge of the laws of inheritance. It involves the selection of plants within landraces, based on the assumption that the progenies of the best individuals are expected to be superior to the progeny of a random sample of the population. This realization can be considered as the origin of the paradigm of homogeneity that dominates breeding, and agriculture as a whole.

3 PLANT BREEDING BASED ON CONTROLLED MATING

Applying selection on pre-existing diversity is an eroding process that eventually comes to a limit. The true creative power of plant breeding resides in promoting recombination for shuffling favourable

alleles. The combination of different alleles in many loci results in a virtually infinite number of genotypes. Given the myriad of possible genotypes resulting from crossing diverse parents, the limitation for genetic gains becomes the capacity of the breeding program to evaluate a large number of plants, derived from a large number of crosses.

3.1 Pedigree Breeding: Playing with Parents.

The Pedigree breeding method consists of crossing parents and generating segregating populations, which are conducted through generations of self-pollination and selection, until a set of derived lines that combines the good characteristics of both parents is obtained. Because it is based on the complementation of traits, this method is efficient for breeding for qualitative traits, such as disease resistance, or easily classifiable traits, such as plant architecture or the colour or shape of plant parts. The pedigree method is appealing to breeders because it allows building better varieties by putting together, in the same plant, good characteristics that were present in different materials.

3.2 Ideotype Breeding: Playing with Traits.

The ideotype breeding approach can be regarded as a strategy to improve the capacity of the pedigree method to promote gains for quantitative traits, especially yield. It is based on the hypothesis that one can improve complex traits by changing simpler traits that are positively correlated with them. The advantage of this method is that, if the underlying hypothesis proves correct, one could promote significant gain for yield, even with a small breeding program, taking the “smart” approach, as opposed to the “numbers game” approach of large-scale breeding programs. Additionally, it is scientifically attractive to breeders, because they have a chance of changing paradigms in their favourite crop.

3.3 Population Breeding: Playing with Genetic Variance.

Although all breeding methods imply the application of selection pressure on a variable population, the term “population breeding” indicates a method designed to improve the phenotypic performance of an intermating population by increasing the frequency of favourable alleles controlling traits of interest. The simplest version of population breeding is the mass selection method applied to cross-pollinated species, in which the improved population is directly used as a cultivar. Population breeding is an open-ended scheme of consecutive rounds of selection and recombination, thus being also known as recurrent selection breeding.

3.4 Hybrid Breeding: Playing with Heterosis.

Heterosis is the superiority of hybrid individuals compared to inbred individuals. Within certain limits, the more divergent are the parents, the higher is the heterosis on their offspring. Hybrid vigour decays rapidly through generations of inbreeding, indicating that, whatever is the mechanism underlying heterosis, it is due to the presence of heterozygous loci.

4 PLANT BREEDING BASED ON MONITORED RECOMBINATION

This method uses molecular marker technologies, which made it possible to monitor the transmission of chromosome segments in the progeny and making easy to know which part of the genome came from which parent.

Virtually any sequence variation between individuals can be used to design a marker that will allow the identification of the parent that contributed a specific segment of the chromosome in a recombinant line. Until recently, the most popular markers were the simple sequence repeats (SSRs), also known as microsatellites. Those markers were superseded by the single nucleotide polymorphisms (SNPs), which are more abundant in the genome and more amenable to high-throughput genotyping.

Molecular markers are essential tools for studying the genetic control of any trait of interest, eventually leading to the identification of the genes underlying the trait and the metabolic chains involved. This venue can be broadly defined as molecular biology, which dominated the field of biological sciences in the past decades. However, in this paper we limit the discussion to the application of molecular markers as tools for plant breeding

4.1 Mapping Genes of Interest: Finding Needles in the Haystack.

When many molecular markers are genotyped in a set of plants derived from a single cross, the frequency of recombination between them can be used to infer their order and relative distance in the chromosomes, resulting in a genetic map. If those plants, or their progeny, are evaluated for a quantitative trait, a statistical model can be built in which part of the phenotypic variance can be explained by some of the markers, which implies that those markers should be linked to the genes underlying the trait. This approach results in quantitative trait loci (QTL) maps, which are normally the first step toward understanding the genetic control of a quantitative trait. From a QTL map, a plant breeder can get an insight into the number of loci controlling a trait, their relative importance, and their approximate position in the genome.

4.2 Marker-Assisted Selection: Building Tailored Genotypes.

Whereas in the case of marker-assisted gene integration the breeder will normally tag only one gene, a full-featured marker-assisted selection scheme would monitor several genes simultaneously. Knowledge of the allele borne by each plant in each major locus of interest creates the means for building specific allele combinations that would maximize the agronomic value of the line. However, when one is dealing with several genes, it is important to keep in mind that the interaction between genes (epistatic effect), and not only the additive effects of the genes, defines the expression of a trait.

4.3 Genomic Selection: Speeding up Genetic Progress.

Recent advancements in genotyping technology sharply reduced the cost of genotyping, creating the possibility of scoring thousands of markers in populations of plants under selection. The several steps of genetic analysis required to identify the relationship of each of those markers with the phenotype could not keep pace with that. In this scenario, the breeder can have a large amount of genotypic information with unknown relationship with the traits under selection. The genomic selection approach proposes that knowledge of the relationship between specific markers and specific genes is not necessary in the breeding context. Instead, the breeder can use the information available for all markers in a plant to predict its breeding value, without effectively evaluating its phenotype, based on previous statistical models built for those markers using a “training population” for which all genotypes and phenotypes have been scored. Markers are considered as random factors, in the framework of mixed model analysis, because the number of markers used in genomic selection is normally superior to the number of individuals in the training population, such that estimating the effect of each marker would not be possible due to the lack of degrees of freedom. Simulation studies demonstrated that genomic selection can accelerate the genetic progress of quantitative traits in population breeding.

APPENDIX 8: Archaeological Chance Finds Procedure

1.0 INTRODUCTION

The purpose of the Archaeological Chance Finds Procedure is to address the possibility of archaeological deposits, finds and features becoming exposed during earthmoving and ground altering activities that will be associated with the APPSA and to provide procedures to follow in the event of a chance archaeological find.

The objectives of these procedures, are to identify and promote the preservation and recording of any archaeological material that may be discovered and notify the relevant District Authority, the Environment Department and the Department of Culture to resolve any archaeological issue that may arise.

2.0 ARCHAEOLOGICAL CHANCE FINDS PROCEDURE

During the project induction meeting/training, all contractors/construction teams will be made aware of the need to be on the lookout for objects of archaeological interest as they carry out their earthmoving and excavation activities.

Generally, the following procedure is to be executed in the event that archaeological material is discovered:

- All construction activity in the vicinity of the find/feature/site will cease immediately.
- The discovered find/ feature/ site will be delineated immediately.
- Record the find location, and make sure all remains are left in place.
- Secure the area to prevent any damage or loss of removable objects.
- Contact, inform and notify the RDC, DEO and Department of Culture immediately.
- The Authorities so notified will avail an archaeologist.
- The archaeologist will assess record and photograph the find/feature/ site.
- The archaeologist will undertake the inspection process in accordance with all project health and safety protocols under direction of the District Health and Safety Officer.
- In consultation with the RDC, DEO and Department of Culture authorities the Archaeologist will determine the appropriate course of action to take.
- **Finds retrieval strategy:** All investigation of archaeological soils will be undertaken by hand, all finds, osteological remains and samples will be kept and submitted to the National Museum as required. In the event that any artefacts need to be conserved, the relevant license (License to Alter) will be sought from the Department of Culture.
- An on-site office and finds storage area will be provided, allowing storage of any artefacts or other archaeological material recovered during the monitoring process.
- In the case of human remains, in addition to the above, the Local Leadership will be contacted and the guidelines for the treatment of human remains will be adhered to. If skeletal remains are identified, an osteoarchaeologist will be available to examine the remains.
- **Conservation:** A conservator should be made available to the project, if required.
- The on-site archaeologist will complete a report on the findings as part of the licensing agreement in place with the Department of Culture.
- Once authorization has been given by the responsible statutory authorities, the client will be informed when works can resume.

APPENDIX 9: APPSA Lesotho Grievance Redress Mechanism

1.0 INTRODUCTION

The grievance redress mechanism (GRM) is a system by which queries or clarifications about the project will be responded to, problems with implementation will be resolved, and complaints and grievances will be addressed efficiently and effectively.

2.0 PURPOSE OF THE GRM

The GRM will serve a purpose:

- to be responsive to the needs of beneficiaries and to address and resolve their grievances;
- to serve as a conduit for soliciting inquiries, inviting suggestions, and increasing community participation;
- to collect information that can be used to improve operational performance;
- to enhance the project's legitimacy among stakeholders;
- to promote transparency and accountability;
- to deter fraud and corruption and mitigate project risks.

3.0 STRUCTURE OF THE GRM

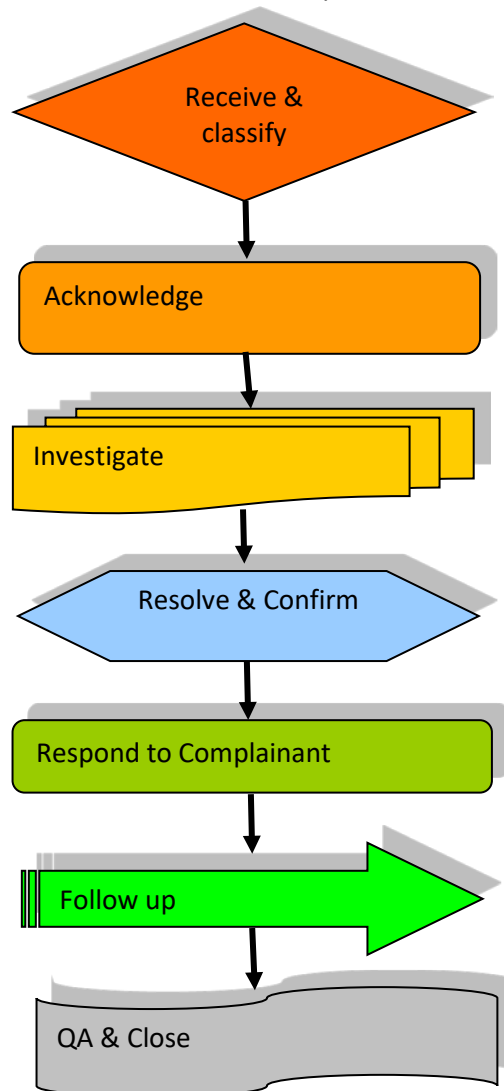
The GRM consists of a small number of components:

- The access point for impacted/concerned people
- Grievance log
- Assessment stage
- Acknowledgement stage
- Response
- Room for appeal
- Resolution

The components are summarized in the process flow diagram below.

Process Overview

The following key steps must be followed for all complaints received by Lesotho APPSA staff:



The requirements for each of these steps is detailed below



1.0 Receive & classify

Summary

Ensure that all potential issues are captured and classified for escalation, review and action as required.

The access points will be as close to the users as possible. An easily accessible and well publicized focal point or user-facing 'help desk' is the first step. This will be established at each research station, Lesotho APPSA Offices and DAR Head office so that it will be seen as credible and accessible. The main issues for the access point include the following:

- Uptake channels should include some or all of the following:
 - phone hotline,
 - email,
 - mail,
 - SMS,
 - webpage,
 - or face-to-face.
- The uptake channels will be publicized and advertised via local media and the implementing agency.
- Verbal complaints should be recorded by staff for them to be considered.
- Many complaints may be resolved 'on the spot' and informally by project staff but should also be logged in order to (i) encourage responsiveness; and (ii) ensure that repeated or low-level grievances are being noted in the system.
- The GRM should have the ability to handle anonymous complaints.

Typically, the complainant will be provided with a receipt and 'roadmap' telling him/her how the complaint process works and when to expect further information.

- Any complaint, issue or negative stakeholder interaction (whether this is formally logged by the complainant or not), must be logged and classified for action.
- All of these complaints must be formally logged using the standard forms.
- All complaints must be prioritised as follows:
 - ✓ **Priority 1 – urgent**, potential high health and high business impact. **This require a response to the Complainant within three (3) working days.**
 - This should be used (sparingly) for major health issues where the complaint may have disastrous impacts on either human, the environment or Lesotho APPSA itself.
 - Also, this could be used in a situation where the complainant may be in a position to influence or make public statements that would impact upon the Lesotho APPSA reputation.

- ✓ **Priority 2, - non-urgent**, lower health environmental and social impact. This requires a response to the complainant within 2 working weeks.
 - This should be used for most complaints with individual stakeholders, as this allows a reasonable time to collect information and produce a balanced response.
 - Discretion and flexibility should be exercised in prioritising all complaints
 - The staff member logging the complaint should review the complaint and its priority with the Research Facility Manager before proceeding to the next step.
 - Research Facility Managers will decide on the appropriate person(s) to carry out subsequent steps, including the investigation.
 - **All Priority 1 complaints must be escalated immediately to the Research Facility Manager.**

2.0 Acknowledge

Summary

Ensure that every complaint receives a formal written acknowledgement, containing an expectation of when they will receive a response, and the person dealing with it.

- All complaints, regardless of priority, should receive a pro forma acknowledgement sent out 1st class mail on the day of receipt.

3.0 Investigate

Summary

Follow up all aspects of the complaint, both internal and external, to ensure that the key facts are identified and clarified.

- The priority of the complaint will drive the timescale for completion (3 days for urgent or 2 weeks for non-urgent).
- All areas of interaction and communication should be established (who, what, where, when, why etc) and documented where possible.

4.0 Resolve & Confirm

Summary

Ensure that the final resolution is clear and fair. Also confirm the proposed action and resolution with another senior person.

- Ensure that the proposed resolution meets corporate guidelines and does not prejudice Lesotho-APPSA in any unnecessary legal or financial manner.
- Document the proposed action and discuss and agree with the Research Facility Manager.
- Discuss and review the solution from both the corporate and complainant viewpoint to ensure fairness and clarity.
- The review should include recognition and documentation of any underlying issues that have contributed to the complaint and recommendations for actions to prevent further occurrence.
- This should then be reviewed as part of the bi-monthly quality assurance reviews.

5 Respond to Complainant

Summary

Provide the Complainant with the resolution within the timescales promised.

- The details of the findings and proposed resolution should be clearly explained (in written or verbal form as appropriate) to the complainant- within the agreed timescales.
- If this cannot be done on time the Complainant should be contacted by telephone to request further time.

6.0 Follow up

Summary

Ensure that complaints are followed up to confirm that the complainants are satisfied with the response given.

- All Priority 1 complaints and 95% of priority 2 complaints must be followed up within a reasonable timescale.
- This will be carried out by the Research Station Administration team / Research Facility Manager's office.
- The follow-up should identify the following
 - Is the complainant satisfied with the response?
 - Did they feel that their complaint was properly and fairly handled?
- Any negative responses to these questions should be referred to Research Facility Managers for action and direct follow up with the complainant.

7.0 QA & Close

Summary

Ensure that the Lesotho APPSA - PIU as a whole is aware of the complaints and any underlying issues. Plan actions to remove these and prevent future recurrence.

- All complaints should be reviewed monthly as part of the quality assurance review meetings.
- Any complaints where action can be taken to avoid recurrence must be acted upon and raised with the appropriate managers/teams across the Lesotho APPSA.

APPENDIX 10: Indicative Outline of ESIA Report

An ESIA report should include the following major elements (not necessarily in the following order):

- (1) **Executive summary:** Concisely discusses significant findings and recommended actions.
- (2) **Legal and institutional framework:** Summarizes the analysis of the legal and institutional framework for the project, within which the social and environmental assessment is carried out, including (a) the country's applicable policy framework, national laws and regulations, and institutional capabilities (including implementation) relating to social and environmental issues; obligations of the country directly applicable to the project under relevant international treaties and agreements; (b) applicable World Bank Environmental and social Safeguard Policies; and (c) and other relevant social and environmental standards and/or requirements, including those of any other donors and development partners.
- (3) **Project description:** Concisely describes the proposed project and its geographic, social, environmental, and temporal context, including any offsite activities that may be required (e.g., dedicated pipelines, access roads, power supply, water supply, housing, and raw material and product storage facilities), as well as the project's primary supply chain. Includes a map of sufficient detail, showing the project site and the area that may be affected by the project's direct, indirect, and cumulative impacts. (i.e. area of influence).
- (4) **Baseline data:** Summarizes the baseline data that is relevant to decisions about project location, design, operation, or mitigation measures; identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions; assesses the scope of the area to be studied and describes relevant physical, biological, and socioeconomic conditions, including any changes anticipated before the project commences; and takes into account current and proposed development activities within the project area but not directly connected to the project.
- (5) **Social and environmental risks and impacts:** Predicts and takes into account all relevant social and environmental risks and impacts of the project, including those related to the Bank's environmental and social safeguards Policies. These will include, but are not limited to, the following:
 - (a) *Environmental risks and impacts*, including: any material threat to the protection, conservation, maintenance and rehabilitation of natural habitats, biodiversity, and ecosystems; those related to climate change and other transboundary or global impacts; those related to community health and safety; those related to pollution and discharges of waste; those related to the use of living natural resources, such as fisheries and forests; and those related to other applicable standards.¹⁵

¹⁵ For example, the *Environmental, Health, and Safety Guidelines (EHSs)*, which are technical reference documents with general and industry-specific statements of Good International Industry Practice. The EHSs contain information on industry-specific risks and impacts and the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable cost. Available at www.ifc.org/ehsguidelines.

- (b) *Social risks and impacts*, including: any project-related threats to human rights of affected communities and individuals; threats to human security through the escalation of personal, communal or inter-state conflict, crime or violence; risks of gender discrimination; risks that adverse project impacts fall disproportionately on disadvantaged or marginalized groups; any prejudice or discrimination toward individuals or groups in providing access to development resources and project benefits, particularly in the case of disadvantaged or marginalized groups; negative economic and social impacts relating to physical displacement (i.e. relocation or loss of shelter) or economic displacement (i.e. loss of assets or access to assets that leads to loss of income sources or means of livelihood) as a result of project-related land or resource acquisition or restrictions on land use or access to resources; impacts on the health, safety and well-being of workers and project-affected communities; and risks to cultural heritage.
- (6) **Analysis of alternatives:** systematically compares feasible alternatives to the proposed project site, technology, design, and operation – including the "without project" situation – in terms of their potential social and environmental impacts; assesses the alternatives' feasibility of mitigating the adverse social and environmental impacts; the capital and recurrent costs of alternative mitigation measures, and their suitability under local conditions; the institutional, training, and monitoring requirements for the alternative mitigation measures; for each of the alternatives, quantifies the social and environmental impacts to the extent possible, and attaches economic values where feasible. Sets out the basis for selecting the particular project design.
- (7) **Mitigation Measures:** Inclusion or summary of (with attachment of full) Environmental and Social Management Plan (ESMP) (see indicative outline of ESMP below.) The ESMP identifies mitigation measures required to address identified social and environmental risks and impacts, as well as measures related to monitoring, capacity development, stakeholder engagement, and implementation action plan.
- (8) **Conclusions and Recommendations:** Succinctly describes conclusion drawn from the assessment and provides recommendations.
- (9) **Appendices:** (i) List of the individuals or organisations that prepared or contributed to the social and environmental assessment; (ii) References – setting out the written materials both published and unpublished, that have been used; (iii) Record of meetings, consultations and surveys with stakeholders, including those with affected people and local NGOs. The record specifies the means of such stakeholder engagement that were used to obtain the views of affected groups and local NGOs, summarizes key concerns and how these concerns addressed in project design and mitigation measures; (iv) Tables presenting the relevant data referred to or summarized in the main text; (v) Attachment of any other mitigation plans; (vi) List of associated reports or plans.

Appendix 11: Indicative Outline of an ESMP

An ESMP may be prepared as part of the Environmental and Social Impact Assessment (ESIA) or as a stand-alone document. The content of the ESMP should address the following sections:

- (1) **Mitigation:** Identifies measures and actions in accordance with the mitigation hierarchy that avoid, or if avoidance not possible, reduce potentially significant adverse social and environmental impacts to acceptable levels. Specifically, the ESMP: (a) identifies and summarizes all anticipated significant adverse social and environmental impacts; (b) describes – with technical details – each mitigation measure, including the type of impact to which it relates and the conditions under which it is required (e.g., continuously or in the event of contingencies), together with designs, equipment descriptions, and operating procedures, as appropriate; (c) estimates any potential social and environmental impacts of these measures and any residual impacts following mitigation; and (d) takes into account, and is consistent with, other required mitigation plans (e.g. for displacement, indigenous peoples).
- (2) **Monitoring:** Identifies monitoring objectives and specifies the type of monitoring, with linkages to the impacts assessed in the environmental and social assessment and the mitigation measures described in the ESMP. Specifically, the monitoring section of the ESMP provides (a) a specific description, and technical details, of monitoring measures, including the parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions; and (b) monitoring and reporting procedures to (i) ensure early detection of conditions that necessitate particular mitigation measures, and (ii) furnish information on the progress and results of mitigation.
- (3) **Capacity development and training:** To support timely and effective implementation of social and environmental project components and mitigation measures, the ESMP draws on the environmental and social assessment of the existence, role, and capability of responsible parties on site or at the agency and ministry level. Specifically, the ESMP provides a description of institutional arrangements, identifying which party is responsible for carrying out the mitigation and monitoring measures (e.g. for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training). Where support for strengthening social and environmental management capability is identified, ESMP recommends the establishment or expansion of the parties responsible, the training of staff and any additional measures that may be necessary to support implementation of mitigation measures and any other recommendations of the environmental and social assessment.
- (4) **Stakeholder Engagement:** Outlines plan to engage in meaningful, effective and informed consultations with affected stakeholders. Includes information on (a) means used to inform and involve affected people in the assessment process; (b) summary of stakeholder engagement plan for meaningful, effective consultations during project implementation, including identification of milestones for consultations, information disclosure, and periodic reporting on progress on project implementation; and (c) description of effective processes for receiving and addressing stakeholder concerns and grievances regarding the project's

social and environmental performance.

- (5) **Implementation action plan (schedule and cost estimates):** For all four above aspects (mitigation, monitoring, capacity development, and stakeholder engagement), ESMP provides (a) an implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project implementation plans; and (b) the capital and recurrent cost estimates and sources of funds for implementing the ESMP. These figures are also integrated into the total project cost tables. Each of the measures and actions to be implemented will be clearly specified and the costs of so doing will be integrated into the project's overall planning, design, budget, and implementation.