USAID/DOCIA Project

Environmental Management Monitoring Report

Environmental Monitoring Program for Special Horticultural Areas
Suko Lequitura, Suko Liurai, and Suko Sarin

PREPARED FOR

David Dyer, Chief-of-Party
Development of Communities through Intensive Agriculture

PREPARED BY

Ron Sissem, Senior Environmental Specialist

October 21, 2010

TABLE OF CONTENTS

SUMMARY 2

1.0 BACKGROUND AND PURPOSE 3

1.1 Background Brief 3

1.2 Environmental Management Monitoring Report Purpose 5

2.0 EXISTING ENVIRONMENTAL CONDITIONS AND SCOPE OF ENVIRONMENTAL EFFECTS 7

2.1 Baseline Environmental Conditions 7

2.2 Scope of Activities/Effects to be Monitored 11

2.3 Monitoring for Best Management Practices 13

2.4 Regulatory Risk Issues 16

2.5 DOCIA's Positive Impact on Environmental Resource Conservation 17

3.0 ENVIRONMENTAL MANAGEMENT MONITORING PROGRAM 19

3.1 Selection of Indicators to be Monitored 19

3.2 Monitoring Program Design 20

3.3 Monitoring Program Implementation 21

4.0 ADDITIONAL MONITORING PROGRAM CONSIDERATIONS ... 23

Attachments

Attachment A Monitoring and Reporting Checklist – Suku Lequitura SHA

Attachment B Monitoring and Reporting Checklist – Suku Liurai SHA

Attachment C Monitoring and Reporting Checklist – Suku Sarin SHA

Tables

Table 1 Potential Environmental Effects - SHA Site Development & Operations

Summary

The Development of Communities through Intensive Agricultural project (DOCIA) provides agricultural technology and production technical assistance to communities within three Special Horticultural Areas (SHAs) located in Suku Lequitura, Suku Liurai, and Suku Sarin. Field assessments of existing conditions and operations within each SHA have been conducted as a basis for developing an environmental management monitoring program for each SHA.

The type and scale of improvements and operations, and the performance of community members within each SHA and are such that significant adverse environmental or public health effects from site development, greenhouse and related infrastructure installation and operations, and greenhouse operations and management were not observed. Nevertheless, these activities could create effects of limited scope and scale that should be avoided or minimized to the extent practical based on the balance between intervention costs and risk reduction achieved.

USAID and DOCIA have an opportunity to demonstrate sensitivity to the Timorese people and the environmental resources on which they depend. Opportunity also exists to enhance economic productivity of each community by reducing environmental and public safety risks to production. These opportunities can be captured by monitoring environmental conditions and the performance of community members. A monitoring checklist has been developed for each SHA. The checklists will be used by DOCIA staff as a tool to monitor selected environmental effect and community performance indicators. Potential outcomes of the monitoring process include recommendations for targeted technical assistance and for site planning, infrastructure modification and maintenance, and changes in production operations or management that enhance community environmental management performance.

Monitoring results will be included in DOCIA quarterly reports to USAID along with recommendations for additional action.

1.0
Background and Purpose

1.1 Background Brief

USAID and the DOCIA Project

From fall 2006 to spring 2010, as a contractor to the US Agency for International Development (USAID), Development Alternatives Inc. implemented the Desenvolve Sector Privadu (DSP) project in Timor-Leste. The DSP project was designed to deliver technical assistance in the form of technology transfer, training, and other support to three selected SHAs to enhance agricultural production, add value to agricultural commodities, and expand markets. In fall 2010, DOCIA was initiated as a three-year, follow-on project to DSP. The overall DOCIA goal is to build upon the technical assistance foundations and achievements of the DSP in the three SHAs and to expand its technical assistance to additional target SHAs. In its first year, DOCIA is focusing on taking over activities in the three existing SHAs that were unfinished by DSP.

The core technology transfer component of DSP and DOCIA is the introduction and installation of greenhouse facilities and associated infrastructure. Greenhouses and supporting infrastructure (i.e. water supply, access, nutrient storage and supply systems, etc.) were installed in each SHA by DSP staff and international subcontractors, with substantial support from SHA community members. Funding for the greenhouse technology in the pilot SHA at Lequitura was provided by a USAID Small Grants program. Core greenhouse operations and production training and capacity building has been provided on a continuous basis by DSP and DOCIA staff and subcontractors. To expand technical and practical capacity, community members in each SHA attended an intensive, three-month comprehensive greenhouse operations and production training in Bali, with one group attending in late 2009 and the other attending in early 2010. Selected community members in each SHA have received additional targeted training.

Environmental Evaluation Background

USAID is mandated to evaluate the potential environmental impacts of projects it proposes to implement. The process for doing so is codified in 22 CFR 216. A Strategic Objective-Level Initial Environmental Evaluation was conducted for the DSP project in 2006. Because DSP was primarily a training and technical assistance pilot project, a project type whose implementation does not typically create direct environmental effects, DSP activities were found to be largely exempt from further environmental evaluation.

In March 2010, the USAID East Timor Mission completed an Initial Environmental Evaluation for the DOCIA project. Because DOCIA is follow-on to DSP, its activities too were found to be largely exempt from further environmental review. However, several activities were found to have potential environmental effects. Conditions to address those effects were identified. One condition requires preparation of a Pesticide Evaluation Report/Safe Use Action Plan (PERSUAP) if agricultural chemicals are proposed for purchase by the DOCIA project or for use by SHA communities, unless one or more specific secondary conditions are met. One of theses conditions has been met. As part of the above-note Bali training, SHA community members were trained in the safe handling, use, and storage of agricultural chemicals, as well as in integrated pest management. These components of the training are intended to safeguard the health of community members and the local environment and to illustrate production methods that minimize the need for chemical use. DOCIIA does not procure agricultural chemicals. The Lequitura SHA community purchases chemicals directly using its own funds. KAMANEK, the marketing intermediary for the Liurai and Sarin SHA communities purchases chemicals for their use. A second condition recommended the preparation of an environmental management plan to assure that proposed activities in the SHAs will be environmentally sound. In conjunction with the environmental management plan, a third condition calls for monitoring activities within each SHA to ensure that "environmental soundness" is achieved.

Development Alternatives Inc.'s proposal for the DOCIA project includes two related Technical Proposal Activities:

> Identify actions required to ensure that a basic respect for Timor-Leste's natural resources is incorporated into all HC planning and production decisions (Technical Proposal Activity 7)
>
> Formulate a plan for protecting natural resources that permit horticultural production and use the plan to work with HC farmers and communities to integrate environmental protection practices into their daily habits (Technical Proposal Activity 7.2)

These activities are consistent with the conditions identified in the DOCIA IEE.

1.2 Environmental Management Monitoring Report Purpose

The purpose of this environmental management monitoring report is to define a monitoring and reporting program for use in evaluating the environmental management issues and performance within the three SHAs. Site development and/or greenhouse operations and management activities will be systematically reviewed to identify existing environmental effects in need of mitigation/remediation and to enable early identification of potential effects that can be avoided or reduced. DOCIA technical assistance interventions and recommendations to SHA communities for site remediation and/or operations modifications will be used to enhance environmental management.

Integration of sound environmental management practices into an economic development project improves conservation of environmental resource values and ecosystem functions on which humans depend. Such practices can also protect and enhance the economic viability of a development project by reducing risks to productivity and reducing production costs. Doing so is an important component of the economic and social development goals of the DOCIA project and of USAID's broader economic development strategic objectives. Potential sources of risk to productivity and economic return resulting from poor environmental planning or management performance can include, but are not limited to:

- Degradation of quality or quantity of inputs to production such as water and soil;
- Inefficient use of natural or other resource inputs that results in added production/operations costs;
- Creation of hazards that threaten or damage project infrastructure or other project investments;
- Investments in infrastructure that could be avoided through appropriate site planning;
- Constrained or interrupted production cycles resulting from local community or broader stakeholder concerns with development project externalities, i.e. impacts such as threats to community public health and safety or water quality contamination; and
- Adverse health impacts on community workers/employees resulting in reduced agricultural production/productivity.

The environmental management monitoring program will also serve as a communications tool. Regularly evaluating the environmental management performance of DOCIA project beneficiaries, identifying potential sources of environmental and community health and safety concern, and providing targeted technical assistance and recommendations for corrective action

will demonstrate USAID and DOCIA commitment to the well being of the Timorese and their environment.

Replicating agricultural production successes of the three existing communities in new communities is a fundamental DOCIA project goal. Lessons learned through the environmental management monitoring program will enable DOCIA to refine the site selection and planning process, craft future technical assistance and training interventions that reinforce sound environmental management practices, and prevent or reduce environmental and public health risks in new SHA communities.

1.3 Information and Data Collection

This environmental management monitoring program was formulated based on completion of the following tasks:

- Review of DSP and DOCIA project documentation;
- Research and review of greenhouse operations best management practices;
- Two field visits to each of the three community SHAs to observe site planning, land use, and natural resource conditions; greenhouse and supporting infrastructure improvements and systems; and greenhouse operations/management practices; and
- Interviews with community members/greenhouse managers at each SHA;
- Consultations with DOCIA project staff; and
- Consultation with and inputs from the USAID COTR and Environmental Officer.

2.0 EXISTING ENVIRONMENTAL CONDITIONS AND SCOPE OF ENVIRONMENTAL EFFECTS

Development projects and activities that introduce change to a set of baseline conditions have potential to create environmental and public health effects. Regional and local environmental baseline conditions in each SHA are briefly reviewed in this section to provide context for the type and magnitude of potential effects resulting from existing SHA site and infrastructure development and production operations. A scope of potential effects is then identified. The effects are the focus of the environmental management monitoring program.

2.1 BASELINE ENVIRONMENTAL CONDITIONS

East Timor Conditions

Key environmental/natural resource management issues within East Timor help to illustrate the macro scale scenario within which development in each SHA has taken place. Most of the Information in this section has been taken from the *FAA 118/119 Report: Conservation of Tropical Forests and Biological Diversity in East Timor* prepared by USAID in 2004. Information was also taken from the World Bank's 2009 publication *Timor-Leste: Country Environmental Analysis*, the conclusions of which are largely consistent with those in the USAID document. The following bullets summarize key points gleaned from the two documents that have relevance to understanding the SHA site development and operations context:

- Precise data on land cover and the distribution, condition, and quality of natural resources within East Timor is limited. Data is largely unavailable as a basis for understanding resource conditions on a site or local area basis.

- Deforestation is the single most pressing problem. Pressures on forests are driven primarily by the need for firewood, clearing for agriculture and escaped fires during land clearing or hunting. Fifty percent of the land is degraded due to deforestation and cultivation of steep slopes.
- Impacts from soil erosion from farming and deforestation include loss of forest habitat through landslides and degradation of river and coastal habitats through sedimentation. Stream sedimentation is very high from upland soil erosion.
- Given the low amount of appropriate agricultural land, and a growing human population engaged primarily in subsistence agriculture, the pressure on forest resources will continue unabated, unless steps are taken in the immediate future.
- Ten endangered terrestrial mammals and three endangered reptiles are found in East Timor - nearly all mammals and one of the reptiles utilize forest habitats with two reptile species dependent on wetlands. The two known, endangered plant species are trees - sandalwood and Blume (*Mangfera timorensis)*.
- Pollution from a variety of sources has potential for negative impacts particularly upon aquatic biodiversity. For example, upstream pollution of rivers from agricultural inputs and human wastes is contaminating rivers and streams and adversely affects coral reefs.
- Land degradation is one of the many factors limiting agricultural productivity as are constraints on fertile soil and cultivable terrain; poor access to and low application of quality seeds, fertilizer, and pesticides; limited irrigation; lack of farming mechanization; non-existent credit institutions; scarce market access; and inefficient markets.

It is evident from field observations that other factors have contributed to land degradation. Some of these include: grading and excavations on steep slopes for unimproved road access, uncontrolled excavation of building materials (stone and gravel) from roadside cut slopes, inadequate or poorly designed storm water collection and discharge infrastructure that channels runoff to highly erodable slopes, and land clearing/excavations to create pads for building/home site construction.

SHA conditions or activities with potential to exacerbate existing critical environmental problems would logically be of priority concern and a focus for environmental management monitoring. However, as discussed in the following section, implementation of DOCIA assisted activities within each SHA are not now, nor would be expected to substantially worsen environmental conditions of critical concern. In fact, as discussed in Section 2.5, DOCIA assistance has potential to help halt agricultural related deforestation and land degradation.

SHA Baseline Environmental Conditions and Improvements/Activities that Modify Baseline Conditions

Conditions Common to All SHAs. Agricultural production has been historical use of land on which greenhouses and the majority of supporting infrastructure has been constructed. Topography within the developed portions of the SHAs is generally level. Surrounding land uses are also largely rural agriculture/residential related. None of the SHAs are located within nationally designated protected areas. All SHAs draw water supply from surface water or natural springs or a combination of the two.

Suku Lequitura. Key resource conditions include prevalence of saturated soils and a small pond immediately adjacent to the greenhouse. This area is fed by surface water runoff and possible a minor spring. Spring water and storm water runoff from the site partially drain, via a shallow swale next to the greenhouse, to a stream located approximately 50 meters downslope of the greenhouse. Little natural vegetation is found on the stream banks and the stream does not exhibit characteristics of valuable riverine habitat. There are no forest resources or related habitat value within the immediate area. Slopes located at elevations above the site are degraded and denuded with significant evidence of erosion. Evidence of significant slope failure/landslides can be seen on hillsides in the immediate vicinity, but do not pose a hazard to project improvements. The greenhouse is located approximately five meters from the edge of a slope that descends to the stream. The slope currently shows no visible signs of historic failure or initial signs of future failure. However, given widespread evidence of slope failures in the area and potential for project operations to exacerbate failure, as described below, monitoring of slope conditions is warranted.

A 1,000 square meter greenhouse is the primary infrastructure improvement. Storm water from the roof of the greenhouse is collected and directed via a concrete channel to the previously described shallow swale. Two approximately 1,000 liter nutrient solution storage tanks have been constructed above the previously noted pond and saturated area. The nutrient distribution line that conveys nutrient solution from the tanks to the greenhouse also traverses this area. Nutrients granules are hand mixed into the nutrient storage tanks. Nutrient and irrigation water leachate is not collected or recycled. Leachate from individual plant containers drips to the greenhouse floor and percolates into the soil below.

Vehicular access is via a highly degraded, unpaved road located on a relatively steep slope. The road bed and adjacent cut slopes are being eroded by surface water runoff and by a small creek that crosses a portion of the road bed.

Small amounts of pesticides and fungicides purchased by Zero-Star, the Lequitura SHA's product purchase and marketing partner, are stored together in a cardboard box on the floor of a locked, closed room. Access to the room is limited to the greenhouse manager and one other

person who attended the Bali training. According to DOCIA technical staff, the volumes of pesticide and fungicide stored represent a supply for only about one to two months of use depending on application frequency and need. Sprayers are located in the same room, but protective equipment is stored elsewhere, if available. Bags of nutrient mix are stored in a different closed and covered building.

Suku Liurai. Key resource conditions include an absence of nearby springs or perennial surface water (water supply is drawn from a spring located approximately 1.5 km upslope of the site), forest/tree cover on three sides of the site (non-continuous canopy), highly denuded/eroded hillsides located above the site, and an intermittent stream/drainage course located adjacent to and below the greenhouse. Vegetation within and on the banks of this drainage course appears to be stable.

A range of infrastructure improvements have been made, including installation of a 1,000 square meter greenhouse Three approximately 10,000 liter water storage tanks and an approximately 10,000 liter recycled nutrient leachate storage tank have been constructed in-line. They are located upslope of the greenhouse on a pre-existing cut bench that is accessed by a pre-existing road. The fill slope below the tank site has been revegetated by community members. Evidence of erosion along the tank road and road cut is present. The cut slope above the tank road and tank site bench is denuded and highly eroded, but appears stable.

Excess nutrient leachate is delivered by gravity to two approximately 1,000 liter capacity tanks located approximately 30 meters behind and downslope of the greenhouse. The tanks were placed below grade in a large, excavated hole. Excavated materials remain stockpiled. Leachate is pumped back upslope to the leachate storage tank via a solar powered pump. Storm water runoff from the greenhouse roof is collected and conveyed via concrete channel to the adjacent intermittent stream channel where it is discharged onto the vegetated creek bank.

Access is either via an existing road/route that traverses through the grounds of an adjacent school or via a pre-existing road on steep slopes that traverses through the intermittent creek. Gabion structures have been constructed in the creek bed to stabilize the road and it has been improved to enable access to the site.

Small amounts of pesticides and fungicides, purchased by KAMANEK, are stored together in a cardboard box on the floor of a secured, locked metal shipping container located at the home of the greenhouse site property owner. Bags of nutrient mix had also been stored in the container, but because the container is apparently leaking, were moved into the owner's home where they are stacked on the floor. Access to the shipping container is limited to the site owner. As with the Lequitura site, DOCIA technical staff believes that the volumes of pesticides and fungicides stored represent a supply for only about one to two months of use depending on application frequency and need. Sprayers and protective clothing/respirators were located elsewhere.

Suku Sarin. Key resource conditions include a spring located approximately 100 meters upslope of the greenhouse that is used for backup water supply and a perennial stream located approximately 10 meters from the greenhouse from which primary water supply is drawn. According to circumstantial information provided by community members, the perennial stream has never flooded. Hillsides in the vicinity of the site are deforested with significant evidence of erosion. The perennial stream shows signs of excessive sedimentation and unbalanced morphology caused by upstream deforestation and erosion. Intermittent vegetation has developed along some portions of the stream bank. Like many smaller fresh water tributaries/creeks in East Timor, this one does not appear to provide significant wildlife habitat. Timor has over 40 freshwater fish species. However, a SHA community member noted that he has seen only one type of fish in the creek and in very few numbers. Mature trees (non-contiguous canopy) are located on three sides of the greenhouse site. Two raptors were observed circling overhead.

Infrastructure systems include a 1,000 square meter greenhouse and significant integrated in-stream improvements for erosion control and water supply. In-stream erosion control consists of rock cladding placed at the base of eroding stream cut banks. This is combined with a concrete stream retention wall and spillway, and a system of ram pumps and piping to convey water to elevated water supply tanks located adjacent to the stream. The greenhouse is located approximately 10 meters from the edge of the creek bank. An excess nutrient irrigation water collection tank of approximately 10,000 liter capacity is located approximately 100 meters from the greenhouse.

Small amounts of pesticides and fungicides, purchased by KAMANEK, are stored together in an unlocked metal filing cabinet inside an unlocked metal shipping container along with a range of other materials and supplies. The shipping container is adjacent to a building where community members congregate. It appears that Sarin community members have used little, if any, of the pesticides provided to them to date. As with the other SHA sites, DOCIA technical staff believes that the volumes stored represent a supply for only about one to two months of use depending on application frequency and need. Sprayers were also stored in the shipping container, but protective clothing/respirators were not observed and presumably are located elsewhere.

Bags of nutrients granules were stored on the floor inside a covered shed, with sidewalls that were partially open.

2.2 Scope of Activities/Effects to be Monitored

The purpose of this section is to identify the general types of direct and indirect physical environmental and public safety effects resulting from SHA community activities. In summary,

site development activities conducted to date do not and future operations should not have effects with potential to substantially exacerbate critical environmental problems. However, adverse effects at an incremental, smaller scale are possible and should be avoided. These effects are the focus of the environmental management monitoring program.

Boundaries of Activities/Effects to be Monitored

The boundary of activities and potential direct effects to be monitored is limited largely to the boundary of each respective SHA within which all project activities occur. In fact, community activities are undertaken within a subset of the broader SHA boundary – that area in which greenhouses and supporting infrastructure have been constructed and related agricultural production occurs. The boundaries of potential indirect physical and health and safety effects are broader than each SHA boundary. For example, some activities have potential to adversely affect water quality and biological resource conditions outside each SHA boundary.

DOCIA also provides technical assistance that facilitates linkages between SHA communities and external markets/product buyers. However, the physical environmental/public health and safety effects that may result from market and buyer operations are beyond DOCIA's influence. The ability of DOCIA to affect improved environmental management of these activities is highly limited and, therefore, such activities are not addressed in this report.

General Scope of Potential Environmental and Public Health and Safety Effects to be Monitored

Table 1, Potential Environmental Effects – SHA Site Development and Operations, lists potential environmental and public health and safety effects/risks of greenhouse and infrastructure construction and operations and greenhouse production and management activities. The list is divided into two sections: Effects with Higher Potential Risk/Concern and Effects with Lower Potential Risk/Concern. Effects were placed into either category in consideration of: 1) the existing environmental setting within which the activities take place; 2) the type, scale, and intensity site development and operations activities; and 3) field observations and interviews with SHA community members/greenhouse managers. Extensive experience with environmental compliance evaluations of a wide range of small and medium sized enterprises was also used to inform categorization of risk.

Three general categories of action/activity are the primary casual factors for effects identified in Table 1: 1) greenhouse siting, construction, and operations; 2) supporting infrastructure siting, construction, and operations; and 3) greenhouse production and production management activities conducted by community members and greenhouse managers. Environmental management monitoring is focused on these causal factors and their related potential effects.

It is assumed that no new major construction or earthwork/grading will take place within the existing SHA's during the remaining period that DOCIA will provide technical assistance to the SHAs. Therefore, program level mitigation/monitoring guidelines that would address expanded site development and operations are not included in this environmental management monitoring program.

2.3 MONITORING FOR BEST MANAGEMENT PRACTICES

Greenhouse best management practices (BMPs) are generally defined as recommended methods, structures, and practices designed to prevent or reduce water pollution or other potential environmental and public health and safety effects while maintaining economic returns. BMPs related to water pollution typically address non-point source pollution, such as runoff from greenhouse operations. Nutrients and pesticides/fungicides are the typical sources of non-point water pollution. BMPs of major relevance address:

- Pesticide handling and storage
- Fertilizer storage and nutrient management
- Pest control and integrated pest management (IPM)
- Good housekeeping (especially chemical storage and use)
- Irrigation management
- Water use, recovery, conservation, and reuse
- Storm water runoff management, drainage, and erosion control

Table 1 - Potential Environmental Effects – SHA Site Site Development and Operations

Topic	Actions	Potential Effects
Effects with Higher Potential for Risk/Concern		
Hydrology	Action 1: Construction of in-stream water supply infrastructure improvements	Effect 1: Changes in stream morphology/hydraulics resulting in upstream or downstream bank erosion, sedimentation, and/or increased localized flood hazards Effect 2: Degradation of riparian/riverine biological resource quality

	Action 2: Construction of stream bed/bank erosion control infrastructure	See Hydrology Effects 1 and 2
	Action 3: Construction of storm water collection facility infrastructure that concentrates and discharges storm water to surface water bodies or natural drainage courses	Effect 3-1: Erosion of the bed or banks of the receiving water body/drainage course resulting in sediment contamination and reduction in downstream water quality. Effect 3-2: Degradation of riparian/riverine biological resource quality
Water Quality	See Hydrology Actions 1 and 2	See Hydrology Effects 1 and 2
	Action 1: Siting/construction of nutrient storage/delivery infrastructure near surface water or water courses	Effect 1: Failure/leaking of infrastructure causing contamination or eutrophication of surface water Effect 2: Degradation of riverine biological resource quality
	Action 2: Operational phase mishandling, transport, use, or storage of agricultural chemicals – pesticides and fungicides	Effect 2-1: Contamination of surface water or groundwater that may be used as a domestic/agricultural water source Effect 2-2: Degradation of riverine biological resources
	Action 3: Operational phase accidental release of nutrients or chemicals applied in greenhouses	Effect 3-1: Contamination of surface water or groundwater that may be used as a domestic/agricultural water source. Effect 3-2: Degradation of riverine biological resources
Soil Erosion	Action 1: Excavations, grading, vegetation removal or other site development activity that expose soil to rain and storm water runoff erosion	Effect 1: Loss of soil/agricultural productivity. Effect 2: sediment contamination of downstream water bodies that may be used as a domestic/agricultural water source Effect 3: Degradation of riverine biological resources
Hazardous Materials[1]	Action 1: Mishandling, transport, use, or storage of agricultural chemicals – pesticides and fungicides associated with greenhouse production processes	Effect 1: Contamination of surface water or groundwater that may be used as a domestic/agricultural water source Effect 2: degradation of riverine biological resources Effect 3: Worker and community health and safety – medical costs/lost productivity
Circulation Access	Action 1: Construction, reconstruction, and use of vehicular access routes	Effect 1: Erosion and sedimentation, slope instability Effect 2: Degradation of riverine biological resources

		Effect 3: public safety concerns
Biological Resources	Actions: See Hydrology, Water Quality, Soil Erosion, Hazardous Materials, and Circulation Access actions	Effects: See Hydrology, Water Quality, Soil Erosion, Hazardous Materials, and Circulation Access effects.
Geologic Hazards	Action 1: Construction of facilities on lands subject to seismic hazards or operations with potential to increase geologic hazards	Effect 1: Damage to greenhouses or infrastructure due to improper siting or irrigation practices that contribute to slope instability.
Solid Waste	Action 1: Disposal of used, degraded plastic greenhouse sheeting	Effect 1: Potential for improper disposal of waste plastic, leading to landscape degradation or creation of air contaminants (if burned)
Effects with Lower Potential for Risk/Concern		
Aesthetics	Construction of facilities and improvements that create a substantial change in visual conditions or degrade visual resource conditions an area of designated scenic vistas or in a sensitive visual corridor	Considered lower potential for concern because greenhouse production is consistent with the rural agricultural character of the SHA communities
Agriculture	Facilities constructed on productive, agricultural land of limited availability	Permanent conversion of productive agricultural land to non-agricultural use. Lower level of concern because greenhouse and ancillary infrastructure is not permanent and project activities contribute to agricultural production
Cultural Resources	Construction, excavation, grading and other activities in areas of moderate or high potential to contain subsurface archaeological resources or known historic resources	Potential for damage to or loss of locally or nationally valued cultural resources is not expected to be significant. It is assumed that local communities can identify culturally valuable areas to be avoided
Land Use	Siting of greenhouse facilities adjacent to land uses of substantially different character	Conflicts with adjacent land uses/property owners (i.e. noise, access, etc.) are not expected as project activities are consistent with adjacent agricultural land uses and of limited scale and intensity
Noise	Construction activities or operational activities that generate periodic, high noise levels or cause a substantial increase in ambient noise levels	Project activities are not a source of significant or sustained noise generation

[1]DOCIA does not purchase pesticides or fungicides for use within any SHA. Such materials are purchased by SHA marketing partners. Where needed, DOCIA technical staff provides consulting support to minimize need for chemical use. Implementation of this environmental management monitoring plan includes measures to further safeguard public safety and the environment.

As noted in Section 1.1, number of community members in each SHA attended a three-month, intensive training on a diverse range of greenhouse operations and commodity production and marketing topics in Bali in fall 2009 and spring 2010. The curriculum included principles of and hands-on practical training in pesticide handling and use, fertilizer/nutrient application, IPM, and irrigation management.

Effective implementation of IPM practices can have a substantial influence on the type, frequency, and volume of pesticides or fungicides applied in a greenhouse and in turn, on risks associated with pesticide handling, use, storage, and disposal. Other BMPs such as irrigation management practices also play an indirect role by affecting plant health and resistance to pest infestation or fungus attack. In short, the extent to which SHA community members are trained and gain practical experience with implementing BMPs is an important indicator about each community's ability to lessen or avoid related potentially adverse environmental and public health risks. Further, each community's ability to maintain collective understanding of these practices over time is also an important indicator. If and as trained community members opt out of participating in agricultural production activities, each community's "store" of BMP practice knowledge and experience is degraded or lost. Measuring these indicators is essentially a function of auditing training delivery and community based knowledge.

The Bali trainings did not address noted BMPs such as water use, recovery, conservation, and reuse; storm water runoff management, drainage, and erosion control; renovation and new construction or other physical site planning and site development practices/actions that occur outside the greenhouse environment. Responsibility for these planning, installation, and construction activities and practices has been assumed largely by DSP/DOCIA staff and international subcontractors. Therefore, community members have limited familiarity with considering and minimizing the potential adverse environmental effects that can result from these activities.

2.4 Regulatory Risk Issues

Regulatory compliance related to permitting and licensing of land development and natural resource use/extraction projects can be important source of risk. Conditions placed on such projects by local or national institutions can be used as important environmental and resource management and protection indicators, the satisfaction of which can reduce compliance related risk. However, in the case of Timor-Leste, the legal framework and institutions responsible for urban/spatial planning, natural resource planning and management, and regulatory compliance enforcement are in a period of transition.

As described in the World Bank's 2009 publication *Timor-Leste: Country Environmental Analysis*, several Timorese institutions have responsibility for environmental management. The State Secretariat for the Environment, under the Ministry of Economy and Development, and the Ministry of Agriculture and Fisheries (MAF) are the two primary responsible bodies. A number of Secretaries of State under MAF and ministries are also responsible for environmental management and resource issues.

The *Timor-Leste: Country Environmental Analysis* draws general conclusions about the current state of the Timorese legal and regulatory framework, capacity of Timorese environmental management related institutions, and development licensing/permitting processes. In short, at present, there is minimal legal and regulatory structure in place to guide land development or resource use activities, environmental related institutions lack capacity to evaluate or assess such activities, and permitting/licensing process for such activities are largely undeveloped. Further, capacity to enforce environmental regulations that are in place is highly limited. This state of affairs is not unexpected for a country in transition. Moreover, the World Bank notes that "there is some evidence to suggest that environmental protection is considered as a luxury for the newly developing country".

Based on discussions with SHA community members and DOCIA project staff, permits have not been required for project development activities within any of the SHAs. Consequently, none of the activities have been conditioned to perform in any particular manner by any Timorese land use, natural resource management, or enforcement institution. Given the state of environmental management institutions and the related legal/regulatory system, it does not appear that for the foreseeable future, activities within each of the SHAs would face risks related to regulatory compliance. Consequently, regulatory risk indicators are not included in the environmental monitoring program.

2.5 DOCIA's Positive Impact on Environmental Resource Conservation

Based on information in the prior sections of this report, a conclusion has been drawn that site development and operations/management activities within each SHA have limited potential to create significant environmental or public safety effects. Nevertheless, common-sense due diligence/monitoring is appropriate for reducing or avoiding identified potential adverse incremental environmental effects.

While an environmental management monitoring program will be of benefit, DOCIA will have positive impacts that reach beyond the SHA level. As described in Section 2.1, land clearing to expand subsistence farming is a leading cause of deforestation and its attendance negative

impacts. Deforestation is considered the biggest environmental management problem in East Timor. USAID's *FAA 118/119 Report: Conservation of Tropical Forests and Biological Diversity in East Timor* notes that unsustainable, low-yielding agricultural practices are a fundamental cause of deforestation. DOCIA provides technical assistance that models agricultural technologies and production processes that help local communities diversify the types of products grown, facilitate production of high value commodities that are in high demand, and improve production processes. By doing so, the productivity of existing agricultural land is improved and the economic livelihoods of local agricultural communities are enhanced. These outcomes reduce pressure for local communities to continue to expand destructive forest conversion practices.

3.0 ENVIRONMENTAL MANAGEMENT MONITORING PROGRAM

3.1 SELECTION OF INDICATORS TO BE MONITORED

Monitoring the environmental management performance of each SHA community will be conducted based on a set of indicators. An indicator is information or a situation that enables an observer of an indicator to determine whether specific conditions exist or whether certain results have or have not been achieved.

Two primary classes of indicators have been selected. The first class consists of physical site and infrastructure operations effects within each SHA as generally described in Section 2.2. The second class consists of community greenhouse operations and practices indicators that include several reference BMPs discussed in Section 2.3. An effort has been made to select indicators that are easy to interpret, independent of the person making the observation, and are specific to environmental and public health and safety risk.

Several indicators, especially those related to agricultural chemical handling, use, and storage, are common to all three communities. Others are SHA-specific due to differences in environmental setting conditions; infrastructure type, design, and location; or greenhouse management and production practices.

3.2 MONITORING PROGRAM DESIGN

Rigor, Ease and DOCIA/Community Resource Requirements

Given that none of the activities at the SHAs is deemed to be a source of substantial existing or potential future environmental or public health and safety impacts, the monitoring program is designed accordingly. It seeks to prevent potential adverse environmental effects and identify changes in community actions and activities that incrementally improve environmental management performance.

The monitoring program does not require substantial technical knowledge or investment in testing or technical evaluation, though some incremental training of national DOCIA project staff may be needed to enable monitoring of a handful of the indicators. The indicators selected can be readily monitored through visual inspection and simple auditing of community member capacity, capability, and experience. As is discussed below, monitoring would be conducted on a quarterly basis. DOCIA project staff visit each of the SHA sites to deliver other types of technical assistance on a much more frequent basis. Therefore, monitoring can be conduced in parallel with the delivery of other technical assistance. The monitoring approach is also intended to be reliable and replicable.

Based on the above factors, DOCIA's cost of implementing the monitoring program in terms of staff time and resource needs should be minimal.

Involvement of SHA Community Members

Input from stakeholders that will be responsible for implementing a monitoring program is helpful in crafting the program design. Input is used to identify appropriate monitoring program goals, monitoring indicators, data collection methodologies, and reporting needs and requirements. Since the monitoring program will be implemented by DOCIA staff, DOCIA staff has provided the primary inputs to the program design process.

Involvement of community members in DOCIA staff's monitoring activities would be advantageous as a learning exercise. It is recommended that SHA community members "shadow" DOCIA monitoring staff so that staff can describe and illustrate site conditions, infrastructure planning and function, and production operations and management activities that are potential sources of adverse environmental and health and safety effects. Doing so should build at least an increment of improved awareness of the physical resource and safety implications of operating greenhouse infrastructure and of related agricultural production operations activities.

Monitoring Program Tools – Monitoring Checklists

Monitoring checklists for Suku Lequitura, Suku Liurai, and Suku Sarin are included in Attachments A, B, and C, respectively. The checklists include indicators selected for each SHA. Space if provided for DOCIA staff to identify recommendations for actions needed to enhance environmental management performance relative to the indicator. This information is provided as guidance for the monitoring process and for DOCIA consideration of additional/modified technical assistance targeted to enhance environmental management performance.

Monitoring Process Outcomes

The monitoring process will result in two primary types of outcomes. The first is identification of targeted technical assistance that can be provided by DOCIA to help SHA communities implement actions that avoid or lessen environmental and health risks. The second will be recommendations to SHA communities regarding actions they can take to avoid or lessen environmental and health risks. Recommendations will likely focus on monitoring/mitigation of existing or potential secondary effects of site development and infrastructure installation, infrastructure monitoring and assessment, and monitoring and refinement of greenhouse management and production processes.

3.3 Monitoring Program Implementation

Schedule

Monitoring of activities within each SHA will be conducted on a quarterly basis. Monitoring will be completed in sufficient time to enable the results to be discussed with the Chief of Party and other pertinent DOCIA staff and conclusions incorporated into the DOCIA quarterly report to USAID.

Reporting Format and Data Management

The monitoring checklists included in Attachments A, B, and C are designed to enable ease of reporting to the Chief-of-Party and for entry of summary conclusions into the DOCIA quarterly report to USAID. It is recommended that the completed checklists be saved to DOCIA's reporting database as "pdf" files. Translation of reports to Tetum will be required for discussion with community members.

Monitoring and Reporting Process Steps and Roles and Responsibilities

A recommended sequence of monitoring and reporting steps including roles and responsibilities for implementing each step is as follows:

1. DOCIA staff selected by the Chief-of-Party to conduct monitoring at each SHA. A monitoring manager should be selected who is ultimately responsible for implementing the monitoring program.

2. DOCIA staff conducts monitoring visits to each SHA. DOCIA staff should be accompanied by the SHA greenhouse manager and preferably, other community members that have attended DOCIA sponsored trainings or received other specialized technical assistance.

3. DOCIA staff and the greenhouse manager, and other community members as noted in #2 above confer to discuss the preliminary monitoring results and recommendations for follow-up actions. No commitment of DOCIA technical assistance or financial resources is to be made by DOCIA staff without subsequent consultation and approval from the Chief-of-Party.

4. DOCIA staff presents preliminary monitoring results to the Chief-of-Party. Decisions are made regarding approach for additional DOCIA technical assistance, if any, and for the formal recommendations to be made to each SHA.

5. DOCIA staff finalizes and translates the monitoring report.

6. DOCIA staff meets with the SHA greenhouse managers and selected community members to deliver the final monitoring report, present and discuss proposed DOCIA technical assistance decisions, if any, and present recommendations for community follow-up actions. Review the timing and responsibilities for implementing technical assistance and recommended community actions.

7. The monitoring checklist can be modified over time to eliminate discrete actions that have been completed or to add additional indicators/actions that address site and operational issues identified over time.

4.0 Additional Monitoring Program Considerations

The following are issues to be considered in monitoring program design or implementation:

- The ability of DOCIA to influence behavior in Suku Lequitura may be limited as the project has largely transitioned out of an active role with the community.
- The ability of DOCIA to influence behavior in Suku Liurai and Suku Sarin may also be limited and depend on good faith and trust – the major infrastructure investments needed have been made.
- While the costs of environmental management interventions should not be significant, the marginal benefit of any intervention must be weighed against its cost. This is especially true given that none of the site improvements or operations in the SHAs is deemed to have or likely to have substantial environmental or safety impacts.
- Responsibility for costs of interventions resulting from greenhouse or infrastructure siting/construction effects must be considered. If potential effects are a result of DSP or DOCIA site development decisions, questions may arise whether an SHA community is solely responsible for corrective actions.

- From a cultural perspective, the value of environmental management on its face may not be embraced by SHA community members. Therefore, it may be necessary for DOCIA to "market" the value of monitoring as a tool for minimizing risks to each SHA's productivity and financial returns as described in Section 1.1. This approach may improve community willingness to invest time and resources in environmental management activities.
- Expectations of how rapidly SHA communities can implement corrective actions may need to be managed. However, the "good housekeeping" actions, especially those related to the handling, use, and storage of chemicals, can be readily implemented at low cost.
- Lessons learned from the monitoring program can be used to inform site selection and planning at future SHAs. Potential exists to avoid existing or potential future environmental effects identified for the three existing and to avoid investments in site infrastructure/modifications.

ATTACHMENT A

SUKU LEQUITURA MONITORING CHECKLIST

ATTACHMENT B

SUKU LIURAI MONITORING CHECKLIST

ATTACHMENT C

SUKU SARIN MONITORING CHECKLIST

DOCIA Environmental Management Monitoring Checklist

Suku Lequitura Special Horticultural Area

Checklist Completed by: _____ Monitoring Visit Date: _____

Monitoring for Quarter #_____, Year_____

MONITORING INDICATOR/ACTION	RESPONSIBILITY	MONITORING STATUS	RECOMMENDED REMEDIATION OR FOLLOW-UP ACTION	FOLLOW-UP COMPLETED – YES/NO IF NO – LIST NEXT STEPS
NUTRIENT MANAGEMENT **Manage the Nutrient System to Reduce Potential for Surface Water Contamination/Eutrophication**				
Nutrient storage tanks are maintained and continually inspected to detect leakage into adjacent surface water.	DOCIA staff	Leakage Detected? Yes/No		
Nutrient solution distribution piping from tanks to greenhouse is continually maintained and inspected to detect leakage into surface water.	DOCIA staff	Leakage Detected? Yes/No		
Mixing of bulk nutrient in storage tanks performed to minimize spillage. Tanks site inspected to detect spillage.	DOCIA staff	Spillage Detected? Yes/No		
Irrigation system is operated only by trained SHA members to minimize potential for waste nutrient leachate, which now percolates into the greenhouse soil floor.	DOCIA staff	Yes/No		
NUTRIENT MANAGEMENT MONITORING NOTES:				
STORM WATER COLLECTION AND DISPOSAL Manage to Reduce Soil Erosion and Sedimentation				
Potential flood damage to greenhouse is minimized. Adjacent drainage swale is inspected to detect if greenhouse roof runoff volume exceeds swale capacity.	DOCIA staff/ SHA members	Localized Flooding? Yes/No	Consider excavating swale to incrementally increase capacity if needed. Excavate during dry season if possible.	
Soil erosion at base of greenhouse roof downspouts is minimized.	DOCIA staff	Erosion Detected? Yes/No	Install "splash pads" at based of downspouts if erosion detected.	

Sedimentation is reduced through regular cleaning of concrete greenhouse roof storm water conveyance channel.	DOCIA staff	Canal Cleaned? Yes/No		
STORM WATER MANAGEMENT MONITORING NOTES:				
VEHICULAR ACCESS ROUTE CONDITIONS Route Remediation to Reduce Erosion/Sedimentation				
Erosion of and damage to access road cut banks and road bed is minimized.	DOCIA staff/ SHA members	Yes/No	Formulate and implement erosion control plan (i.e. install erosion control bars, control storm water flow across road, cut bank stabilization, etc.)	
VEHICULAR ACCESS MONITORING NOTES:				
AGRICULTURAL CHEMICAL HANDLING, USE, AND STORAGE Manage to Reduce Accidental Release, Water Quality and Health and Safety Impacts				
A minimum number of SHA members are currently trained in IPM to ensure practices that minimize need for pesticide and fungicide application.	DOCIA staff/ SHA members	Yes/No		
Greenhouse access is limited only to SHA members trained in IPM. Greenhouse door is closed at all times.	DOCIA staff/ SHA Members	Yes/No		
Pesticides and fungicides are handled, mixed, and applied only by formally trained SHA members.	DOCIA staff/ SHA members	Yes/No		
Pesticides and fungicides are mixed away from any surface water or water source.	DOCIA staff/ SHA Members	Yes/No		
Access to chemicals is limited to SHA members trained in safe handling, use, and storage.	DOCIA staff/ SHA Members	Yes/No		
Pesticides and fungicides are stored in a clean, locked, weather proof, fire resistant, ventilated, clean and dry room. Chemicals are stored separately from other equipment	DOCIA staff/ SHA Members	Yes/No		

or supplies.				
Pesticides and fungicides are stored in separate, leak proof containers. Containers should be located off of the ground surface.	DOCIA staff/ SHA Members	Yes/No		
Labeling for all chemicals is intact and chemicals are stored in their original containers – avoid repackaging.	DOCIA staff/ SHA Members	Yes/No		
Chemical storage room should be a minimum of 20 meters from surface water or water source and outside any area prone to flooding.	DOCIA staff/ SHA Members	Yes/No		
All chemical application equipment, sprayers, and protective clothing (respirators, goggles, clothing, gloves, and boots) are continuously available in a number required by the community and consistently utilized.	DOCIA staff/ SHA Members	Yes/No	Store chemicals and application equipment together. Personal safety equipment stored in a separate, but adjacent room. Integrate chemical safety signage.	
Bulk nutrients are stored off of the ground in a secure, water tight room.	DOCIA staff/ SHA Members	Yes/No		
Bulk nutrients and pesticides are stored in separate rooms/ locations.	DOCIA staff/ SHA Members	Yes/No		
Bulk nutrients stored a minimum of 20 meters from any surface water body or water source and not stored within offices, dwellings, or working areas.	DOCIA staff/ SHA Members	Yes/No		
Continuous effort is made to minimize volume of fertigated leachate.	DOCIA staff/ SHA Members	Yes/No		
AGRICULTURAL CHEMICAL MONITORING NOTES:				
GEOLOGIC HAZARDS				
Irrigation and nutrient leachate is minimized to reduce volume percolated into the soil greenhouse floor and to reduce soil saturation and potential slope instability. Slope below greenhouse is	DOCIA staff/ SHA Members	Yes/No	Consider installing an irrigation and nutrient leachate collection and recycling system similar to those installed at Suku Liurai and Suku	

visual inspected for initial signs of failure (i.e. cracks, soil slip faces)			Sarin	
GEOLOGIC HAZARDS MONITORING NOTES:				
WASTE MANAGEMENT				
Solid waste, primarily plastic sheeting is disposed of only in an approved location. Maximize plastic sheeting reuse. Avoid burning plastic wastes whenever possible.	DOCIA staff/ SHA Members	Yes/No		
WASTE MANAGEMENT MONITORING NOTES:				

USAID | TIMOR-LESTE
HUSI POVO AMERICANO

Lequitura - Photo Key to Environmental Management Monitoring Checklist

Nutrient storage tanks are maintained and continually inspected to detect leakage into adjacent surface water.

At time of Oct 21, 2010, nutrient tank was overflowing onto adjacent soil with possible migration of nutrient solution to adjacent saturated soil/surface water

Nutrient solution distribution piping from tanks to greenhouse is continually maintained and inspected to detect leakage into surface water.

Mixing of bulk nutrient in storage tanks performed to minimize spillage. Tanks site inspected to detect spillage.

Irrigation system is operated only by trained SHA members to minimize potential for waste nutrient leachate, which now percolates into the greenhouse soil floor

Potential flood damage to greenhouse is minimized. Adjacent drainage swale is inspected to detect if greenhouse roof runoff volume exceeds swale capacity

Erosion of and damage to access road cut banks and road bed is minimized.

Pesticides and fungicides should be stored in separate, leak proof containers. Containers should be located off of the ground surface.

Bulk nutrients should be stored off of the ground

Irrigation and nutrient leachate is minimized to reduce volume percolated into the soil greenhouse floor and to reduce soil saturation and potential slope instability. Slope below greenhouse is visually inspected for initial signs of failure (i.e. cracks, soil slip faces)

DOCIA Environmental Management Monitoring Checklist

Suku Liurai Special Horticultural Area

Checklist Completed by: _____ Monitoring Visit Date: _____

Monitoring for Quarter #_____, Year_____

MONITORING INDICATOR/ACTION	RESPONSIBILITY	MONITORING STATUS	RECOMMENDED REMEDIATION OR FOLLOW-UP ACTION	FOLLOW-UP COMPLETED – YES/NO IF NO – LIST NEXT STEPS
WATER AND RECYCLED NUTRIENT STORAGE TANK SITE Monitor Existing Installation Site to Minimize Erosion				
Erosion of water supply/nutrient storage tank site access road cut and fill slopes and cut slope above the tank site is minimized.	DOCIA staff	Erosion Detected? Yes/No	Implement road cut bank and fill slope restoration consistent with existing tank site slope restoration	
Instability of cut slope above tank site is minimized to protect tank infrastructure. Conduct visual monitoring for surface fracturing or beginnings of slope failure.	DOCIA staff	Instability Detected? Yes/No	Consider revegetation program on hillside above tank site and other control measures to slow surface runoff and reduce soil saturation	
RECYCLED NUTRIENT COLLECTION TANK SITE Restore Existing Site for Erosion Control and Landscape Restoration				
Erosion is controlled and landscaped conditions restored.	DOCIA staff	Yes/No	Backfill tank site hole, regrade and level stockpile sites and revegetate	
NUTRIENT COLLECTION TANK SITE MONITORING NOTES:				
STORM WATER COLLECTION AND DISPOSAL Manage to Reduce Soil Erosion and Sedimentation				
Inspect point where greenhouse roof storm water collection and conveyance channel discharges runoff onto intermittent creek bank for evidence of erosion.	DOCIA staff	Erosion Detected? Yes/No	Existing gabion at outfall should provide sufficient energy dissipation. If not, install flow speed dissipater at channel exit point or install expanded splash pad/gabion	
Greenhouse roof storm water conveyance channel is regularly cleared to reduce creek	DOCIA staff	Channel Cleaned? Yes/No		

channel sedimentation.				
Inspect lower concrete storm water conveyance channel located on stream bank to detect structure undercutting during high stream flows, if any.	DOCIA staff	Undercutting Detected? Yes/No	If yes, consider removing lower channel segment and installing flow dissipater/splash pad at discharge point of first segment	
STORM WATER MANAGEMENT MONITORING NOTES:				
VEHICULAR ACCESS ROUTE CONDITIONS Route Monitoring to Reduce Erosion/Sedimentation				
Potential for accelerated erosion of intermittent creek bed and bank due to flow changes resulting from installation of access road gabion in creek bed.	DOCIA staff/ SHA members	Erosion Detected Yes/No	If yes, consider removing gabion structures if access road no longer in use.	
Modify access route through the adjacent school site so that vehicles travel the perimeter of the play field – reduce potential safety conflicts.	DOCIA staff/ SHA members	Route Modified? Yes/No	SHA members to discuss access issues with school administration and all members. Consider signage at existing access points to the play field to redirect vehicles	
VEHICULAR ACCESS MONITORING NOTES:				
AGRICULTURAL CHEMICAL HANDLING, USE, AND STORAGE Manage to Reduce Accidental Release, Water Quality and Health and Safety Impacts				
A minimum number of SHA members are currently trained in IPM to ensure practices that minimize need for pesticide and fungicide application.	DOCIA staff/ SHA members	Yes/No		
Greenhouse access is limited only to SHA members trained in IPM. Greenhouse door is closed at all times.	DOCIA staff/ SHA Members	Yes/No		
Pesticides and fungicides are handled, mixed, and applied only by formally trained SHA members.	DOCIA staff/ SHA members	Yes/No		
Pesticides and fungicides are mixed away from surface water or water sources.	DOCIA staff/ SHA Members	Yes/No		

Access to chemicals is limited to SHA members trained in safe handling, use, and storage.	DOCIA staff/ SHA Members	Yes/No		
Pesticides and fungicides are stored in a clean, locked, weather proof, fire resistant, ventilated, clean and dry room. Chemicals are stored separately from other equipment or supplies.	DOCIA staff/ SHA Members	Yes/No		
Pesticides and fungicides are stored in separate, leak proof containers. Containers should be located off of the ground surface.	DOCIA staff/ SHA Members	Yes/No		
Labeling for all chemicals is intact and chemicals are stored in their original containers – avoid repackaging.	DOCIA staff/ SHA Members	Yes/No		
Chemical storage room should be a minimum of 20 meters from surface water or water source and outside any area prone to flooding.	DOCIA staff/ SHA Members	Yes/No		
All chemical application equipment, sprayers, and protective clothing (respirators, goggles, clothing, gloves, and boots) are continuously available in a number required by the community and consistently utilized.	DOCIA staff/ SHA Members	Yes/No	Store chemicals and application equipment together. Personal safety equipment stored in a separate, but adjacent room. Integrate chemical safety signage.	
Bulk nutrients are stored off of the ground in a secure, water tight room.	DOCIA staff/ SHA Members	Yes/No		
Bulk nutrients and pesticides are stored in separate rooms/ locations.	DOCIA staff/ SHA Members	Yes/No		
Bulk nutrients stored a minimum of 20 meters from any surface water body or water source and are not stored within offices, dwellings, or working areas.	DOCIA staff/ SHA Members	Yes/No		
Continuous effort is made to minimize volume of fertigated leachate.	DOCIA staff/ SHA Members	Yes/No		
AGRICULTURAL CHEMICAL MONITORING NOTES:				

WASTE MANAGEMENT				
Solid waste, primarily plastic sheeting is disposed of only in an approved location. Maximize plastic sheeting reuse. Avoid burning plastic wastes whenever possible.	DOCIA staff/ SHA Members	Yes/No		
WASTE MANAGEMENT MONITORING NOTES:				

USAID | TIMOR-LESTE
HUSI POVO AMERICANO

Liurai - Photo Key to Environmental Management Monitoring Checklist

Erosion of water supply/nutrient storage tank site access road cut and fill slopes and cut slope above the tank site is minimized

Instability of cut slope above tank site is minimized to protect tank infrastructure. Conduct visual monitoring for surface fracturing or beginnings of slope failure

Erosion is controlled and landscaped conditions restored at nutrient tank excavation/soil stockpiling area

Inspect point where greenhouse roof storm water collection and conveyance channel discharges runoff onto intermittent creek bank for evidence of erosion

Inspect lower concrete storm water conveyance channel located on stream bank to detect structure undercutting during high stream flows, if any.

Potential for accelerated erosion of intermittent creek bed and bank due to flow changes resulting from installation of access road gabion in creek bed

Pesticides and fungicides are stored in a clean, locked, weather proof, fire resistant, ventilated, clean and dry room. Chemicals are stored separately from other equipment or supplies

Pesticides and fungicides are stored in separate, leak proof containers. Containers should be located off of the ground surface

Bulk nutrients are stored off of the ground in a secure, water tight room

Bulk nutrients stored a minimum of 20 meters from any surface water body or water source and are not stored within offices, dwellings, or working areas

At time of visit, nutrients stored in Afonso's home. Need to remove to clean, dry, locked location – metal storage container outside was "leaking"

DOCIA Environmental Management Monitoring Checklist

Suku Sarin Special Horticultural Area

Checklist Completed by: _____ Monitoring Visit Date: _____

Monitoring for Quarter #_____, Year_____

MONITORING INDICATOR/ACTION	RESPONSIBILITY	MONITORING STATUS	RECOMMENDED REMEDIATION OR FOLLOW-UP ACTION	FOLLOW-UP COMPLETED – YES/NO IF NO – LIST NEXT STEPS
NUTRIENT MANAGEMENT **Manage the Nutrient System to Reduce Potential for Surface Water Contamination/Eutrophication**				
Nutrient recycling system is repaired to eliminate system overflow into adjacent creek.	DOCIA staff/ SHA Members	System Repaired? Yes/No		
IN-STREAM WATER SUPPLY AND EROSION CONTROL INFRASTRUCTURE Monitor Existing Installation Site to Minimize Erosion				
Stream banks downstream of ram pump facility are inspected to detect accelerated bank erosion due to changes in stream flow dynamics.	DOCIA staff	Erosion Detected? Yes/No	If yes, DOCIA to provide erosion control program design and implementation assistance.	
Stream bank upstream of the in-stream erosion control cladding is inspected to detect undercutting of cladding.	DOCIA staff	Undercutting Detected? Yes/No	If yes, DOCIA to provide erosion control program design and implementation assistance.	
Inspect check pond upstream of ramp pump for sedimentation. Sediment is removed at regular intervals to avoid flow overtopping of check dam and downstream bank erosion.	DOCIA staff/ SHA Members	Yes/No		
Stream bank stabilization plantings are completed.	DOCIA staff/ SHA Members	Yes/No	Implement program of stream bank stabilization plantings. Plantings set back from edge of existing cut bank.	
STORM WATER COLLECTION AND DISPOSAL				

Manage to Reduce Soil Erosion and Sedimentation				
Inspect area below concrete ramp pump installation to determine if greenhouse roof storm water discharge is facilitating stream bed/bank erosion.	DOCIA staff	Erosion Detected? Yes/No	If yes, install flow speed dissipater at channel exit point to ramp pum concrete pad	
Greenhouse roof storm water conveyance channel is regularly cleared to reduce creek channel sedimentation.	DOCIA staff	Channel Cleaned? Yes/No		
STORM WATER MANAGEMENT MONITORING NOTES:				
AGRICULTURAL CHEMICAL HANDLING, USE, AND STORAGE Manage to Reduce Accidental Release, Water Quality and Health and Safety Impacts				
A minimum number of SHA members are currently trained in IPM to ensure practices that minimize need for pesticide and fungicide application.	DOCIA staff/ SHA members	Yes/No		
Greenhouse access is limited only to SHA members trained in IPM. Greenhouse door is closed at all times.	DOCIA staff/ SHA Members	Yes/No		
Pesticides and fungicides are handled, mixed, and applied only by formally trained SHA members.	DOCIA staff/ SHA members	Yes/No		
Pesticides and fungicides are mixed away from surface water or water sources.	DOCIA staff/ SHA Members	Yes/No		
Access to chemicals is limited to SHA members trained in safe handling, use, and storage.	DOCIA staff/ SHA Members	Yes/No		
Pesticides and fungicides are stored in a clean, locked, weather proof, fire resistant, ventilated, clean and dry room. Chemicals are stored separately from other equipment or supplies.	DOCIA staff/ SHA Members	Yes/No		
Pesticides and fungicides are stored in separate, leak proof containers. Containers	DOCIA staff/ SHA Members	Yes/No		

should be located off of the ground surface.				
Labeling for all chemicals is intact and chemicals are stored in their original containers – avoid repackaging.	DOCIA staff/ SHA Members	Yes/No		
Chemical storage room should be a minimum of 20 meters from surface water or water source and outside any area prone to flooding.	DOCIA staff/ SHA Members	Yes/No		
All chemical application equipment, sprayers, and protective clothing (respirators, goggles, clothing, gloves, and boots) are continuously available in a number required by the community and consistently utilized.	DOCIA staff/ SHA Members	Yes/No	Store chemicals and application equipment together. Personal safety equipment stored in a separate, but adjacent room. Integrate chemical safety signage.	
Bulk nutrients are stored off of the ground in a secure, water tight room.	DOCIA staff/ SHA Members	Yes/No		
Bulk nutrients and pesticides are stored in separate rooms/ locations.	DOCIA staff/ SHA Members	Yes/No		
Bulk nutrients stored a minimum of 20 meters from any surface water body or water source and are not stored within offices, dwellings, or working areas.	DOCIA staff/ SHA Members	Yes/No		
Continuous effort is made to minimize volume of fertigated leachate.	DOCIA staff/ SHA Members	Yes/No		
AGRICULTURAL CHEMICAL MONITORING NOTES:				
WASTE MANAGEMENT				
Solid waste, primarily plastic sheeting is disposed of only in an approved location. Maximize plastic sheeting reuse. Avoid burning plastic wastes whenever possible.	DOCIA staff/ SHA Members	Yes/No		
WASTE MANAGEMENT MONITORING NOTES:				

USAID | TIMOR-LESTE
HUSI POVO AMERICANO

Sarin SHA - Photo Key to Environmental Management Monitoring Checklist

Stream banks downstream of ram pump facility are inspected to detect accelerated bank erosion due to changes in stream flow dynamics

Stream bank upstream of the in-stream erosion control cladding is inspected to detect undercutting of cladding

Inspect check pond upstream of the ramp pump for infilling with sediment. Sediment is removed regularly to maintain adequate water capacity in the pond and avoid flow overtopping of check dam and downstream bank erosion

Erosion is controlled and landscaped conditions restored at nutrient tank excavation/soil stockpiling area

Inspect point where greenhouse roof storm water collection and conveyance channel discharges runoff onto intermittent creek bank for evidence of erosion

Inspect lower concrete storm water conveyance channel located on stream bank to detect structure undercutting during high stream flows, if any.

Potential for accelerated erosion of intermittent creek bed and bank due to flow changes resulting from installation of access road gabion in creek bed

Pesticides and fungicides are stored in a clean, locked, weather proof, fire resistant, ventilated, clean and dry room. Chemicals are stored separately from other equipment or supplies

Pesticides and fungicides are stored in separate, leak proof containers. Containers should be located off of the ground surface

Bulk nutrients are stored off of the ground in a secure, water tight room

Bulk nutrients stored a minimum of 20 meters from any surface water body or water source and are not stored within offices, dwellings, or working areas

At time of visit, nutrients stored in Afonso's home. Need to remove to clean, dry, locked location – metal storage container outside was "leaking"