

QUANG NGAI RURAL DEVELOPMENT PROGRAM (QNRDP) - PHASE 2

Environmental Specialist Report



VIET NAM-AUSTRALIA

Prepared for

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- Appendix 1: Environmental Impact Assessment Checklist
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Limitations

URS Australia Pty Ltd (URS) has prepared this report for the use of AusAID Quang Ngai Rural Development Program in accordance with the usual care and thoroughness of the consulting profession. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Program Design Document.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared during March 2003 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

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Acronyms

AEZ	Agro-Ecological Zones
AusAID	Australian Agency for International Development
ASAS	Australian Small Assistance Scheme
ATL	Australian Team Leader
CCG	Commune Contact Group
CPC	Commune Peoples Committee
CPO	Communications and Promotions Officer
DCG	District Contact Group
DDOs	District Development Officers
DPC	District Peoples Committee
DPI	Department of Planning and Investment
EIAC	Environmental Impact Assessment Checklist
EMG	Environmental Management Guideline
EPBC Act	Environment Protection and Biodiversity Conservation Act, 1999
EPL	Environmental Protection Law
GOA	Government of Australia
GOV	Government of Viet Nam
IEO	Infrastructure and Environment Officer
MEGO	M&E and GIS Officer
O&M	Operation and Maintenance
PEMM	Program Environmental Management Manual
PMB	Commune Program Management Board
PDA	Participatory Development Adviser
PMS	Program Management System
PMU	Program Management Unit
PPC	Provincial People's Committee
QN	Quang Ngai
QNRDP	Quang Ngai Rural Development Program
SC	Supervision Consultant
TOR	Terms of Reference
UNICEF	United Nations International Children's and Environmental Fund
VAT	Value Added Tax
VTL	Vietnamese Team Leader

1 Introduction

This report details the findings of the Environmental Specialist input into the QNRDP Program (the 'Program') in March 2003. The aim of the input was to enhance the ability of the Program via Program, commune, district and provincial staff to implement a range of agricultural activities and small-scale infrastructure works that cause minimum adverse effect on the environment. This was achieved via undertaking a preliminary environmental audit (an 'Audit') of the potential for environmental impact to arise from Program activities, and to assess the scope of measures in place to control them and make recommendations as to their adequacy.

The Terms of Reference (TOR) for the Environmental Specialist input into the Program therefore required a review and update of the Program Environmental Management Manual (PEMM), the Environmental Impact Assessment Checklist (EIAC), and the Environmental Management Guidelines (EMG) to ensure their adequacy in achieving these aims.

The principal output of the Audit is therefore this report and Annexes containing an updated EIAC and EMGs for the Program. The PEMM is a document that provides general information regarding the framework for managing issues of relevance to the Program and has not been included as it remains unchanged.

In order to fulfil the TOR, the Environmental Specialist undertook the following range of activities during the period 3-14 March 2003:

- audit visits to each of the three communes currently working with the Program and a review of the activities being undertaken;
- a desk top review of activities being undertaken in the 3 communes within the 3 Agro-Ecological Zones (AEZs);
- a review of the EIAC against Program activities;
- a review of the adequacy and scope of activities covered by the EMG component of the PEMM;
- a workshop/training program to discuss findings with PMU and other interested parties;
- a training course for the Infrastructure and Environment Officer (IEO) and PMU in the use of the EIAC, EMG and PEMM; and
- the preparation of a summary report, updated PEMM, EIAC and EMG that more closely reflect the scope of work being undertaken by the Program.

2 Scope of Preliminary Environmental Audit

The Audit of Program activities and subprojects was undertaken to ensure that the Program is in compliance with AusAID's requirements as specified in the following information sources:

- The Environmental Management Guide for Australia's Aid Program 2003 that describes AusAID's environmental management system (EMS), and outlines the steps to be followed in environmental assessment of Program activities, as well as the procedures for managing potential environmental impacts.
- AusAID obligations under the Environment Protection and Biodiversity Conservation Act, 1999 (EPBC Act).
- AusAID publication, 'Australian Aid: Investing in Growth, Stability and Prosperity', 2002.
- Applicable Vietnamese laws and regulations, and good environmental practice.
- The PEMM, EMGs, and EIA Checklist prepared by the Program in response to the above obligations and set out in *The Environmental Impact and Management Issues Scoping Study, December 2001* ('*The Environmental Scoping Study*').

Furthermore, the Audit included a review of the adequacy and effectiveness of the PEMM, EMGs, and EIA Checklist prepared by the Program in terms of ensuring Program activities do not result in potential environmental and environmental health impacts.

In accordance with the aims of the environmental audit as set out in the *Environmental Scoping Study*, the Audit furthermore should "if warranted, undertake remedial action, including changes to operational procedures and/or revision of the PEMM if required". Following the Audit, final EMGs are then to be prepared and adopted.

The Audit was undertaken by an Environmental Specialist, working with, and providing on-the-job training to, the IEO. This Audit took place after initial infrastructure work had been completed in the three pilot/target communes. Subsequent audits are likely to be undertaken by the IEO and his DPI counterpart with assistance/guidance from the Environmental Specialist as required once the next three target communes are involved with the Program at the beginning of the next financial year.

3 Methodology

3.1 Program of Work

Site visits were conducted by the Environmental Specialist accompanied by the IEO to each of the three communes currently working with the Program, comprising one from each AEZ. The Audit visits were carried out in order to assess the potential for environmental impact arising from Program activities, and to assess the adequacy and scope of the EIA Checklist and EMGs in mitigating these impacts via a combination of planning, implementation and operation based controls.

At the time of the visit, 3 more communes were in discussion with the Program regarding the program of works intended for the July 2003- June 2004 funding period within their communes. These 3 communes will again comprise one from each of the 3 AEZs within the Quang Ngai Province. The following means were used to carry out the Audit of Program activities:

- Audit visits to each of the three communes currently working with the Program, comprising one in each of the 3 AEZs identified in the Environmental Impact and Management Issues Scoping Study.
- A desk top review of activities being undertaken in the 3 communes within the 3 AEZ's, including discussions with key Program personnel, including the Infrastructure and Environment Officer (IEO), Participatory Development Advisers (PDAs), the Communications and Promotions Officer (CPO), and the Australian and Vietnamese Team Leaders (ATL & VTL).
- A review of the Environmental Impact Assessment (EIA) Checklist against Program activities, including an assessment of their adequacy in terms of the scope of activities currently being undertaken and the adequacy of measures contained within them.
- A review of the adequacy and scope of activities covered by the Environmental Management Guidelines (EMG) component of the PEMM in terms of their relevance to current and proposed program operations and from the point of view of their being usable by members of the program team, in particular the EIO.
- A review of the Program activities against the requirements of AusAID, applicable Vietnamese laws and regulations, and good environmental practice

3.2 Reporting

The audit divides up findings into two main areas:

Sections 5 and 6 that address any environmental implications that are associated with the two main components of the Program, namely Infrastructure and Income Generation activities.

Section 7 that summarises the effectiveness of the PEMM in ensuring good environmental practice and the scope and adequacy of measures contained within the EIA Checklist to address issues related to Program activities.

It is important to note that aspects of Infrastructure such as the proposed road in Son Hai and the kindergarten in Duc Phong are in fact equally related to the capacity of the commune to generate income as they are to infrastructure, and so could be reported on under either the Income Generation of Infrastructure component of Program activity. The road in Son Hai for example is being considered as a means to provide access to a new area of cassava planting, enabling the crop to be transported to a proposed cassava mill some 4 kilometres away to generate income for the commune. Similarly, the kindergarten in Duc Phong, although being constructed as an amenity for young children, is also designed to free up time that parents might otherwise spend tending to the children, enabling them to work and generate income.

For simplicity, infrastructure works such as roads and buildings have been regarded as Infrastructure activities and reported on as such in Section 5.

4 Background to AEZs

Quang Ngai Province is divided into three AEZs reflecting the three broad bands of topographical and land use features, although the boundaries of the AEZs are diffuse and cannot be definitively plotted *Quang Ngai Rural Infrastructure and Services Feasibility & Design Mission* (Project Design Document; June 2000). The three communes currently involved with the Program and a brief description of each is outlined below.

Duc Phong - Coastal AEZ

Duc Phong commune is located in the coastal AEZ approximately 20km south of Quang Ngai in the Mo Duc District and consists of five villages with a combined population of 17,098 (*Environmental Scoping Study*). Aquaculture is important in Duc Phong and existing fisheries (including shrimp farms) cover 2 ha and produce about 7 tonnes per year. It is noted that CPC want to increase the area under shrimp farm development to some 180 ha within the next few years. The fishing industry yields some 70 tonnes per year being made up in roughly equal amounts of inshore and offshore fishing. The other main agricultural activity is grain production.

The coastal AEZ features long and continuous sand bars (up to 5km in length) landward of which are river mouth estuaries, estuarine lagoons, remnant woodlands, and further inland villages and cropland (sugar cane, rice and cassava). The estuaries are now important sources of fish and provide harbours for local fishing fleets and boat builders. Former lagoons (severed from the river mouths) have largely been converted to rice fields.

Tinh Tho - Lowland AEZ

Tinh Tho commune comprises five villages and has a total population of 12,222 (*Environmental Scoping Study*) and a total area of 3,940 ha. The main agricultural land use in Tinh Tho is rice production and livestock (pigs, buffalo and chickens). A large number of households in Tinh Tho are also engaged in vegetable production and the area under vegetable cultivation (846 ha) is slightly more than for rice (753 ha).

The lowland AEZ in which Tinh Tho is situated comprises the alluvial plain made up of sands and gravels deposited by the four major rivers and their tributaries. There are many small bedrock hills and older sandy terraces protruding from the finer alluvium. Between the rivers and the hills are the lowlands, which have up to 10 m of finer textures soil. The plains have been almost entirely converted to irrigated rice fields. The villages and communes tend to be located between the rivers and the hills.

Son Hai - Mountainous AEZ

Son Hai commune is situated approximately 60km west of Quang Ngai in Son Ha District, with over 80% of people being from the H're ethnic group. It consists of four villages and a total population of 2,545 and 550 households (*Environmental Scoping Study*). Agricultural land use in Son Hai consists mainly of rice, corn and cassava production. Son Hai produces roughly equal amounts of cereal and rice.

The mountainous AEZ in which Son Hai is situated makes up the western two-thirds of Quang Ngai province with steep hills and mountains up to 1,900 m in height being present. The terrain in this AEZ is deeply dissected by the valley systems created by the four main rivers. This zone is characterised by sandy, low fertility soils. The mountains are prone to erosion during heavy rain, especially in areas that have been deforested.

5 Audit Findings - Infrastructure Activities

5.1 Wells, Bathrooms/Toilets & Water Filters

The wells being built by the Program are designed to reduce contamination, which involves them being concrete lined. The use of the more expensive wells in preference to bores is limited to those areas where rock makes bore construction impractical. The well design features a concrete surface slab and lining and barricade wall to reduce contamination, and a sand/gravel filter at the base of the well.

Sanitation facilities consist of combined bathroom/toilet buildings in Duc Phong and combined bathroom/well constructions in Son Hai. Water filters are being constructed to improve the final quality of water being pumped from groundwater sources in Duc Phong and are an above ground separator unit with a series of concrete baffles and a final gravel filter.

Son Hai

To date 35 wells with attached bathrooms have been funded by the Australian Small Assistance Scheme (ASAS) and put in place by the Program. Of these, 32 wells have been finished and testing has taken place with samples being compared with the Vietnamese standard for drinking water, as set out in Ministry of Health Decision 505/BYT/QD (1992) and the Vietnamese environmental standards relating to water quality, published by MOSTE. Due to delays with well construction, not all wells are sunk to the same depth as water had partially filled some of them due to the start of the rainy season. The remaining 3 wells were not completed as rock was encountered.

Elevated E coli and Faecal Coliform ('Coliform') levels were recorded in 13 of the 32 wells. In those wells where E coli and Coliform levels were detected, the results for Coliforms ranged from 20 to 14,100 MPN/100ml with 3 MPN/100ml being the acceptable level for groundwater stipulated in the Vietnam water quality standard (*Refer Table 25, Environmental Scoping Study*). The acceptable limit for E Coli and Coliforms stipulated in Australian Water Quality and World Health Organisation (WHO) Drinking Water Guidelines is zero.

Within the remainder of the financial year, the plan is to get the original contractor to construct the remaining 3 wells to complete the initial allocation of 35 wells. It has also been agreed that a further 15 wells will be constructed when the water table lowers sufficiently. This is expected to take place during the summer once the water table has lowered sufficiently.

Elevated E coli and Coliform levels can cause illness and normally indicate the ingress of faecal matter into the water source. In the situations where well samples indicated elevated E coli levels the well was normally situated close to and downslope of a buffalo wallow or animal pen. Nearly all households in Son Hai however do not have latrines and even the self-composting latrine provided at the health clinic in Son Hai is not used, so human waste could also be a contributing factor to the elevated levels present. A final possibility for the presence of E coli in a small number of the wells was the degree to which they were cleaned out following installation.

Duc Phong

During the site visit it was noted that most of the households in Duc Phong use bores rather than wells. Of the wells in place in the commune, quite a number are concrete and brick constructions with a concrete surface slab and lining and barricade wall to reduce contamination. It was unknown however as to whether a sand/gravel filter was put in place at the base of the wells at the time of their installation. Dates inscribed on these wells indicate that they were built between 1980 and 1996.

Many households within the commune have however dug their own wells and these are unlined constructions with the well entrance being level with the ground surface. Although some households had fencing around the well to prevent animals from drinking from them, many did not, and animal tracks were noted adjacent to some of the wells indicating that they were using them. These wells have not been sampled.

Samples have however been taken from 8 households within the Duc Phong commune and compared with the Vietnamese standard for drinking water, and international standards (presumed to include Australian Water Quality and WHO Drinking Water Guidelines). These 8 households were selected to give an indication of background reading of likely levels of metals, pH and E Coli/Coliform levels present in the commune's groundwater.

Results indicated elevated iron levels in 5 of the 8 samples taken, ranging from 1.41 to 5.71 mg/l, as compared with the permissible level of 0.5mg/l as set out in the Vietnamese standard for drinking water. Manganese levels were also elevated above the permissible level set by international guidelines of 0.05mg/l in all of the samples taken, although the samples exceeded the Vietnamese standards for water quality permissible level of 0.5mg/l in only one location.

Of the 8 locations sampled, elevated E coli levels were recorded in one of the samples. Slightly elevated Coliform levels were recorded in 7 of the sample locations, (including the location with an elevated E Coli result), although the majority of these levels were low, ranging from 2-25 MPN/100ml. The only location to record an elevated E Coli level had a Coliform level of 140MPN/100ml.

The Program's response to the elevated manganese and iron levels in the water and slightly elevated Coliform levels in certain sampling locations in Duc Phong has been to implement a number of infrastructure measures. These include the introduction of water filters to improve water quality and taste, and installation of bathroom/toilet constructions to serve the joint purpose of improving women's health issues and controlling human effluent migration into groundwater. Both of these infrastructure solutions are appropriate and are likely to significantly improve drinking water quality.

The water filters work on the principle that aeration of the incoming water takes place via thin slots cut in the inflow pipe. The inflow pipe discharges the water into a series of chambers. The first chamber intercepts floating matter such as organic material and hydrocarbon residues that remain on the surface of the water as clean water passes under the concrete baffle into the second chamber. The second chamber involves water passing over the top of a concrete baffle into the final chamber. This intercepts sediment that sinks to the bottom of the chamber. Clean water (free of the majority of sediment and gross pollutants) then passes over the top of a baffle into the final chamber. The final chamber involves the water passing through a gravel bed that acts as a final filter via encouraging microbial action on any remaining bacteria to occur.

Summary & Recommendations

The significant environmental issues for QNRDP associated with the construction of minor infrastructure such as wells, bathrooms and toilets are related to the design and siting, the kinds of materials being used in their construction, and the practices followed when constructing them in terms of noise, dust and waste management.

As reported in the Engineering assessment conducted in February 2003, an important design parameter is the siting of wells to limit contamination from sanitation facilities and animals. The rule of thumb as reported in the engineering assessment report is to provide at least 20 metres distance from uphill latrines, animal pens and buffalo wallows where possible. The report states that this is sometimes difficult to achieve in hilly areas where suitable aquifers are difficult to locate, and there is reluctance amongst farmers to relocate wallows and animal pens away from their current situation. Important actions for QNRDP are:

- Encourage the relocation of any potential sources of well contamination away from locations immediately adjacent and upslope of the wells. This will include animal pens, buffalo wallows and human toilets.
- Make the contractor and supervisor responsible for adequate clean out of the wells before commissioning the remaining 3 wells and the next allocation of 15 wells in Son Hai.
- Advise households within Duc Phong commune that have dug their own (often very wide and shallow wells due to the shallow nature of groundwater) to erect fencing around them to prevent animals from drinking from them. If demanded as a priority they should be replaced with proper wells, or shared wells for a number of households, to safeguard against ingress of faecal matter from animals.
- Take additional samples in the dry season from those wells in Son Hai where elevated levels of Coliforms and E coli were found to be present. Test the samples for E Coli and Coliforms and compare with the Vietnamese and International standards for drinking water, (*Refer Table 25, Environmental Scoping Study*). If elevated levels remain, encourage the relocation of any potential sources of contamination away from locations immediately adjacent and upslope of the wells. This will include animal pens, buffalo wallows and human toilets. Make further tests under similar conditions when these changes to practices have occurred.
- Make the contractor pump out and re-sample the wells in Son Hai that were not adequately cleaned out following installation, where elevated E Coli and Coliform levels have been recorded,

In addition to the introduction of water filters, and installation of bathroom/toilet constructions to address the contamination encountered the following actions need to be implemented by QNRDP:

- Ensure that during construction cement residues from washing tools etc are not permitted to enter watercourses and that all waste materials such as cement bags are appropriately disposed of.
 - Use tin or other safe material for roofing as an alternative to asbestos. The bathroom/toilet buildings in Duc Phong and the bathrooms in Son Hai have roofs constructed of asbestos cement sheets which has the potential for the asbestos to be damaged and release fibres over time. Asbestos fibres can cause serious respiratory ailments if inhaled in a dust form.

- Examine installation of rain water collection systems for drinking in situations where well water remains contaminated. Then use the well water only for washing, cooking (if the water is boiled), toilets and animal consumption.

5.2 Kindergartens and Health Centers

As a result of the community consultation process three kindergartens and two health centres have been proposed for support by the Program. These include:

Son Hai

A new kindergarten serving households of the B'reo (H're ethnic group), situated across the river from the main commune.

Tinh Tho

A new kindergarten and additional work to upgrade a health centre that has been completed and provision of equipment. QNRDP are addressing poor construction practices by the contractor relating to certain aspects of the upgrade where structural cracks have appeared.

Duc Phong

An upgrade to an existing kindergarten and an ASAS funded health centre in Duc Phong.

Summary & Recommendations

Kindergartens and health centers are infrastructure and amenity items designed to free up time that people might otherwise spend either tending to young children, or not working due to illness. The biggest effect on the environment over time will be people having an increased ability to farm greater areas and at more intensive levels than before.

The PMU will need to work closely with DPI to ensure that land use planning occurs to minimise primary forest being cleared for agricultural use as expansion occurs over time; and that appropriate crops are selected that take into account the capability of the land being developed.

The environmental health issue associated with the construction of rural health centres and kindergartens relate their design and siting, the kinds of materials used in their construction, and the practices followed when constructing them in terms of noise, dust and waste management. QNRDP needs to adopt the following:

- Avoid construction of buildings where there is possible disturbance of areas of primary forest or valued habitat.
- Avoid the use of asbestos and use tin or tiles as roofing material to avoid possible serious respiratory ailments.
- Do not use lead based paints on internal walls, surfaces etc, particularly given that young children put toys and food etc into their mouths that may have come into contact with painted surfaces.

- Ensure that during construction cement residues from washing tools etc are not permitted to enter watercourses and that all waste materials such as cement bags are appropriately disposed of.
- Use rainwater collection systems as a means of supplying clean water for communal buildings such as health centres and kindergartens in the event that problems exist with respect to groundwater quality in the vicinity of such buildings. This is due to the relative susceptibility of children and sick people to issues relating to poor water quality and the relative ease of constructing such a rainwater collection tank on a single communal building.

5.3 Road and Bridge Construction

Vietnam has road and bridge design standards based on road classification to ensure consistent and appropriate design standards across the nation. These design standards have been incorporated for the most part into the bridge constructed in Tinh Tho commune. Further information relating to the adequacy of this bridge construction can be found in the report by the Engineering Specialist dated February 2003.

There are a number of significant environmental issues associated with the construction of items of infrastructure such as roads, roads and bridges. These relate principally to their design and siting, the capacity of such structures to impact upon the flow regimes and quality of water within rivers and watercourses, the potential for accelerated erosion and impact upon watercourses during construction, and the practices followed during constructing in terms of noise, dust and waste management. Comments follow on the construction proposed to date in the three cycle 1 communes.

Son Hai

A graded, unsealed road of approximately 3.5kms in length is to be built to the west of Lang Trang hamlet in Son Hai to a new development called Mang Hien (the name selected for the new satellite settlement). Approximately 130 ha has been set aside at Mang Hien for the planting of 100 ha of cassava, with the remaining 30 ha being allocated for forestry and housing. A cassava mill funded by GoV is planned to be built near to the main commune building in Lang Trang to process the cassava grown in this area.

Although it was reported that the land for the Mang Hien development had not yet been cleared upon visiting the site on 5 March 2003, much of the land had already recently been cleared and burnt, presumably in anticipation of the road being built (refer Section 6.2 Alternative agricultural activities).

The road will be unsealed passing through rolling terrain, and will extend an existing track by approximately 2.5kms. The proposed route of the road was walked by Program and CPC personnel at the time of the site visit. It appears to follow the line of a minor watercourse for some of its length, before following a rolling route (dictated largely by terrain) up and down a series of small hills on slightly higher ground for the remainder. The varied nature of the terrain along the route is due to its following a notional straight line route to the site of the proposed development at Mang Hien.

Duc Phong

The road is likely to comprise an upgrade of approximately 1-1.5kms of existing inter-village track between Van Ha and Thach Thang hamlets. The route of the track is orientated approximately east – west and has been requested by the commune due to the extent of flooding which occurs during the wet season on the existing track.

The upgrade is likely to require further raising the level of the existing raised road by as much as one metre. It will also require that culverts be put in place to allow water to move from north to south under the route of the road as its route crosses a natural drainage line for the area.

At the time of the site visit it was noted that the area to the south of the road comprises flood irrigated rice fields with little or no remnant natural vegetation. It is in this direction that water flows from the higher ground on the northern side of the track during rainfall events. When flooding of the river occurs however, the water first floods the lower lying irrigated fields to the south until its level exceeds the raised level of the existing track at which point it flows over the track to fill the lower ground behind it. If the level continues to rise, inundation of houses on the northern side of the road can occur. According to CPC personnel this happens quite often in the wet season.

The northern side of the track appears to have some stands of native trees and shrubs and housing associated with the hamlets along much of its length. The section of road to be upgraded was walked by Program and CPC personnel during the site visit.

Tinh Tho

The bridge is approximately 18m long and 3.5 m wide, and, according to the IEO represents a significant amendment by the Department of Transport from the original design which was for a narrower, slightly shorter bridge. As a result, structural cracking has appeared in the wing supports of the bridge, despite the fact that the bridge is not yet open to vehicular traffic. (for details of this refer to Engineer's report dated February 2003).

From an environmental point of view, it is unknown as to the precise nature of construction practices followed during the building of the bridge. It was apparent from the visit to the bridge on 12 March however that the river is quite silted up around the bridge supports, and that this has probably been contributed to by practices followed during bridge construction. This can be assumed given the fact that subsidence of the banks of the river around the bridge have clearly occurred.

Furthermore, some 10-15 empty hessian and plastic bags (that are likely to have previously contained sand and cement) are littered in the river bed. This is not good environmental practice given both their potential to clog up the free flow of what is a small river, and also given that they are likely to have discharged residues into the river.

Also planned is the upgrading of a track to a road in Tho Bac village. It is still in the early pre-construction stages.

Summary & Recommendations

A number of environmental issues exist with respect to infrastructure items such as roads and bridges. These relate principally to the requirement to clear native vegetation and habitat for their construction, and the possibility of bridge sites or road routes encroaching on historically or culturally significant sites. Bridges furthermore have the potential to result in temporary disruption of natural river flows during placement of foundations in or adjacent to river bed/banks, and also significant potential to result in increased erosion of soil into rivers and streams during the construction phase.

Furthermore there is potential for construction related impacts associated with cement and hydrocarbon residues reaching rivers from washing of tools, use of plant and equipment, and for associated noise, dust and waste management issues during construction.

- Roads and tracks have the potential to permanently disrupt the natural course of rivers and isolate communities of plants, animals and fish. The placement of culverts under the track at **Duc Phong** should however serve the purpose of allowing water to still reach the irrigated fields from the northern side of the track. It is also unlikely that the track upgrade will have any significant impact upon the natural vegetation or serve to isolate it from other populations in any way.

As the track is an upgrade to an existing track that does not require the clearance of any vegetation there is no impact. The irrigated areas to the south of the track are not furthermore likely to be reliant on flows of water from the northern side as a means of supplying the majority of nutrients which they are likely to get from periodic flooding events by the river and fertiliser application.

- QNRDP needs to ensure that the routing of the road in **Son Hai** minimises impact through not occupying prime low lying areas which lend themselves to growing irrigated crops and being habitats for fish and amphibians. As it is an upgrade to an existing track for the first 1.5kms or so it does not require the clearance of any vegetation up until this point.

The remaining 2 kms or so of its route variously includes land already cleared and burnt by CPC personnel and local farmers, and secondary vegetation such as plants and shrubs, that is not likely to be of high environmental value.

- In terms of the final route selection for the track, it should, where possible follow the line of contours to avoid steep, erosion prone sections. Where steeper or longer sloped sections are unavoidable, cross drains and catch banks should be put in place to reduce the flow of water down the track. Once the track is established the sides should furthermore be stabilised using either mechanical means such as wooden stakes and a mulch cover, or via the establishment of a vegetation cover to prevent erosion.
- When borrow pits are established for the purposes of track construction, appropriate areas should be selected that do not require the clearance of trees or steeply sloping areas that are likely to be subject to erosion, particularly if they are adjacent to a river. If this is unavoidable, ensure that erosion control measures are in place Eg earth contour bunds.

6 Audit Findings - Income Generation Activities

6.1 Introduction

For the purposes of this report, the Program's Income Generation activities have been deemed to relate principally to providing communes with alternative agriculture based revenue streams and alternative technologies to assist in generating income. This includes the following:

- Investment in training and support for alternative agricultural activities;
- Investment and support for livestock rearing including cattle, pigs, chickens and cattle fattening;
- Assistance with respect to irrigation technology;
- Provision of electricity supply for household and irrigation use (the proposed Tinh Tho electricity substation); and
- The potential for a bio-gas generation project utilizing multiple sources including chicken, cattle and human waste.

6.2 Alternative Agriculture Activities

Cassava - Son Hai

A 100 Ha area of mixed forest/secondary vegetation has recently been cleared and burnt by individuals from the CPC in the Mang Hien area of the Son Hai commune to make way for planting of a commercial cassava crop. This has occurred in response to a GOV initiative to construct a cassava mill in Son Hai some 4 kilometres away from Mang Hien.

The land clearance that has occurred to date, appears to have occurred indiscriminately, with only a handful of larger trees having been retained. It is unclear as to how many others were destroyed in the land clearance process, although stumps indicate that several larger trees were lost.

Based on these developments, the Program has now agreed to support the construction of a graded, unsealed road between Mang Hien and the proposed mill site. This is felt to represent the best course of action for ensuring that sound economic and environmental outcomes are achieved given that the land has already been cleared. Discussions with the ATL for the Program indicated this will occur via the Program establishing a Road Activity Group to manage the road on an ongoing basis and via provision of advice regarding the adoption of sustainable farming practices in the Mang Hien area.

Sustainable farming practices will require that fertility and soil structure is maintained. This is important, not only to help bring about high yields and reduce requirement for additional land clearance to achieve the desired outputs/income, but also as part of good environmental practice. In particular it will be important to ensure that fertilisers and pesticides do not percolate into ground water, run off to surface water, or accumulate in the soil where they may change its composition. This will be of added importance when people start to access the groundwater in this area for consumption. Furthermore, given the relative steepness of the slopes in this area, appropriate ground cover or erosion control measures such as small contour bunds may need to be put in place to safeguard against erosion.

Further to this, there are several hills adjacent to the cleared area that are naturally forested. Although CPC members stated at the time of the site visit that they had no plans to clear these areas, the Program should ensure that it is involved in any consultation process that occurs relating to the potential development of these areas. For example, instead of clearance of new areas to generate additional output, improved practices for getting better yields from those areas already being worked could be explored.

Livestock Rearing

Livestock rearing principally relates to cattle, pig and chicken rearing and cattle fattening as far as the program is concerned. To date, demonstrations have been undertaken in each of the three communes, with cattle fattening having been determined as the optimal activity in terms of relative ease of learning the activity and deriving an income from it.

Apparently neither cattle fattening or cattle rearing have met with much interest in Son Hai. Program personnel felt it was a combination of the fact that they are not as literate as in the other communes, that feed is not as easily accessible, and that they have little familiarity with cattle, being more used to tending to buffalo.

Home Gardening Activity

Home gardening activity has also been considered as a potential activity in the communes as there are nutritional issues. To date this activity has not been commenced.

6.3 Irrigation Schemes

No Program assistance with the development of irrigation schemes has occurred to date, however Son Hai commune has asked for support for an irrigation scheme once an electricity supply has been put in place. It is understood that this may occur later this year.

6.4 Power Lines and Electrical Transformers

The Program is awaiting a formal proposal from the Tinh Tho commune to provide assistance with the construction of a 1.1 km long, 15kV overhead power line and transformer. The power line will enable electricity to be distributed to hamlets that do not currently have power, with the transformer enabling the 15kV power to be stepped down to 0.4kV voltage suitable for domestic use. It is understood that the main reason for the power supply is to provide households with electricity for domestic use.

The proposed route of the power line is across irrigated fields, with little or no requirement for vegetation clearance. The supports for the pylons furthermore are to be constructed from prefabricated concrete sections, avoiding the requirement for any concrete mixing in the field. The proposed location for the transformer is in an area currently under cultivation, that according to commune personnel does not flood during the wet season.

Further to this, three 0.4kV feeder lines will be taken from the transformer to distribute power to hamlets/households in the area. The Program is not however responsible for these 0.4kV feeder lines, which are being developed by the commune independently. It was noted at the time of the site visit however that these feeder lines will follow the line of existing tracks and cross irrigated fields, with no requirement for vegetation clearance.

The only significant environmental issue relating to the power line and transformer at Tinh Tho, other than safety issues associated with relatively high voltage electricity is likely to be the potential for leakage of transformer oils with corrosion of the unit over time. This would be of particular concern if the oils within the transformer unit contained Poly chlorinated Biphenyls (PCBs). PCBs are a carcinogen and tend to bio-accumulate in the environment, and for this reason their use has been phased out in transformers and electrical switchgear in most developed countries.

At the time of the site visit several transformers similar to the one proposed at Tinh Tho were sighted in the area. These had a concrete wall and concrete floor around them, and if the Program's transformer is constructed to a similar design this should safeguard against any oils that might escape from leaks reaching ground or water receptors.

6.5 Summary & Recommendations

Alternative Agriculture Activities

Although encouragement of income generation activity is one of the principal aims of the Program, it is important to ensure that land use planning takes place to avoid the clearance of valued habitats (*Refer Section 2.4, Environmental Scoping Study for definition of these*). Any Program activities involving changes to land use, but most specifically related to widespread agricultural land use change therefore need to consider the following three issues:

- (i) If the land use is to be changed does it result in the destruction or loss of any valued habitats? This is particularly relevant where natural land is being cleared as is the case at Mang Hien. If valued habitat is to be significantly impacted upon, then, where practical, alternative areas for the activity in question should be sought.
- (ii) Once a decision has been made with respect to the parcel of land to be developed, the establishment of that land parcel needs to involve appropriate practices. This includes where possible retaining mature trees (as has occurred to a limited extent at Mang Hien), burning practices that allow animals to escape, and the establishment of a mulch, ground cover or contour bunding on steeply sloping land to safeguard against erosion before a crop is established.
- (iii) Finally, appropriate practices need to be established in order to maintain the fertility of the land and safeguard the broader environment from environmental impacts. This relates principally to fertiliser and pesticide application rates and erosion control measures.
 - In order to bring this about, fertiliser rates commensurate with the crop being grown should be applied so that the selected crop(s) absorb the amounts applied (*Refer Tables 21 & 22, Environmental Scoping Study*). This is important as excess fertilisers not absorbed by crops can migrate to deeper strata of soil and reach ground water and rivers where eutrophication can occur. Eutrophication is caused by nutrients bringing about increased aquatic plant growth and as a consequence, reduced amounts of Dissolved Oxygen (DO) for fish. Fertilisers such as nitrate and phosphate can furthermore accumulate in soils, altering its physical and chemical composition, causing it to become more acid, compact, and porous.
 - Pesticides similarly can accumulate in ground and surface water causing impacts upon plants and animals and people, particularly if water is being used for drinking as boiling will not render it safe for consumption. The prevention of erosion will also

be important to maintain the productivity of the land on an ongoing basis. This is particularly important in an areas like Mang Hien where some slopes are of up to 20 degree steepness.

- Livestock rearing, including cattle and pigs can give rise to increased erosion on the land is question due to the cloven hooped nature of the animals. Grazing animals such as cattle will also significantly alter the nature of the vegetation in the area that they graze. Situation of cattle and pigs away from source of drinking water is also an important consideration with respect to the keeping of such animals. Attention should also be paid to the spreading of manure of these animals on land as there are naturally occurring higher levels of metals within pig faeces for example.

Irrigation Schemes

Irrigation schemes have the potential to give rise to a number of potential environmental issues, not least of all the requirement for a fundamental change to land use resulting in the disruption of the existing ecosystem and introducing a range of new species, including the intended crops, plants and fish. The presence of standing water also means that insects and birds are likely to move to the irrigated area dependent on the crop being established. Water borne contaminants are also able to move more easily if standing water is maintained permanently.

Disruption of the flows of the river being utilised as a source of irrigation water, or the potential for the lowering of groundwater levels via drawdown associated with pumping from bores or wells may also cause issues.

The infrastructure associated with irrigation pumps, including the establishment of electricity supplies or the use of pumps with diesel or electric motors can similarly give rise to issues. Construction related issues associated with the establishment of a permanent electricity supply may for example give rise to the potential for soil and cement residues to enter watercourses, and the potential may exist for hydrocarbon residues to reach water resources and impact upon drinking water quality if more temporary diesel electric pumps are used. Noise issues may also exist for households situated near pumps, dependent upon their hours of operation,

Power Line and Electrical Transformer

A number of environmental issues exist with respect to infrastructure items such as power lines and transformers. These relate principally to the requirement to clear small amounts of native vegetation and habitat for their construction, safety issues associated with relatively high voltage electricity, construction related issues to do with the potential for soil and cement residues to enter watercourses, and the potential for leakage of transformer oils with corrosion of transformer units over time.

This would be of particular concern if the oils within the transformer unit contained Poly chlorinated Biphenyls (PCBs):

- The Program should ensure that the transformer unit does not contain PCBs, and that a concrete wall and concrete floor are constructed around them to safeguard against any spills or leaks of transformer oils reaching ground or water receptors.

7 Audit of Environmental Management Procedures

The Preliminary audit required an assessment of the adequacy of the PEMM, the EMG's and EIAC in terms of their relevance to current and proposed Program operations and from the point of view of their being useable by members of the PMU, in particular the IEO.

7.1 PEMM

Background

The main objective of the PEMM is to provide a framework for the management and protection of the environment of Quang Ngai with regard to the activities and subprojects that are implemented under the Program.

It is designed to provide a straightforward process by which PMU and Infrastructure and Environmental Officer (IEO) can assess the environmental impact of activities and subprojects, identify mechanisms to minimise or avoid negative impacts and develop an environmental management plan (EMP) to implement and monitor these mechanisms.

To this end the PEMM concentrates on the planning, design and implementation phases of prospective activities and focuses on activities and subprojects that will require changes in land use or construction of infrastructure.

Summary and Recommendations

The PEMM is a good framework by which Program activities can be controlled from an environmental point of view. A number of amendments however are recommended to make it a more useful and useable document:

- The PEMM was originally developed to meet, Government of Australia's (GOA) Environment Protection Act 1974, AusAID's obligations under its *Ecologically Sustainable Development Policy* and the raft of Government of Viet Nam (GOV) laws, regulations and decrees that comprise the Environmental Protection Law (EPL). This remains relevant other than the fact AusAID's obligations now relate to the Environment Protection Biodiversity Conservation Act (EPBC) 1999 that superseded the Environment Protection Impact of Proposals Act, 1974.
- The PEMM relies on the adequacy of the EIAC and the EMGs in providing a user friendly guide to Program staff for making both a rapid and a more detailed assessment of the environmental issues that might be associated with a particular Program supported activity. Following their review, significant amendments were recommended to the EIAC and EMGs and these are discussed in Sections 7.2 and 7.3).

7.2 EIA Checklist

Background

The EIAC is designed to be the primary tool in the environmental management process. It allows for identification of environmental issues, includes references to relevant EMGs to address these issues and provides recommendations where further action may be required.

The review of the draft EIAC revealed that it required some amendment and reworking to render it of more useable by the Program, due principally to its scope that differs from Program activities and its ease of use. As a result a revised EIAC has been prepared and it is recommended that it is adopted by the Program and inserted into the PEMM for subsequent use by the IEO and PMU. This is contained within Appendix 1.

Summary and Recommendations

The reasons for the amendments to the EIAC as contained within the Environmental Scoping Study include the following:

- The EIAC did not cover all Program activities and included information on a number of activities that are not relevant to the Program, nor that are likely to be in the future. This included issues such as the construction of runways and dock facilities that are not current or future Program activities. This caused confusion and therefore they have been removed.
- An additional column was felt be required in the EIAC table indicating the nature of the environmental issue that may result from a particular Program activity and associated impact. This serves the purpose of providing training and guidance to the IEO and Program team over and above the information contained within the original EIAC.
- The EIAC did not reference the relevant EMGs to be used as was stated in the PEMM. As these are the principal source of guidance on what action is required to manage a particular issue, this has been incorporated into the revised EIAC.
- The EIAC provided columns for scoring the significance of the issue in question without providing any guidance as to how to make an assessment of the significance of the issue. As this was arbitrary this column has been deleted in the revised EIAC.
- The EIAC provided a column titled 'Supplemental Information' without providing a clear indication as to what the IEO or PMU staff member might usefully use the information for. It was felt more useful to instead reference the relevant EMG for the information concerned. This reference column appears in the revised EIAC.
- The PEMM and EIAC do not clearly indicate when the IEO or PMU staff member is to look to use guidance information contained within the EMGs or when the Mitigation measures information is to be used. This should be clearly indicated in the EIAC as the preliminary source of guidance for the Program. Therefore it is recommended that either the EMG or EIAC reference the appropriate mitigation measure, or that this information is incorporated into the EMG as a one-stop shop for the IEO or PMU staff to use.

7.3 Environmental Management Guidelines

Background

The EMGs are designed to provide guidance in managing issues identified by the EIAC via the provision of advice and recommendations to the PMU and IEO concerning planning or managing potential impacts.

The review of the draft EMGs revealed that they required some amendment to render them useable by the Program. Principally this includes amendments to individual EMGs, additions to the 12 EMGs to ensure the range of Program activities are adequately covered, and additional references within them to ensure other relevant sources of information are adequately referenced. The amended EMGs are contained in Appendix 2.

Summary and Recommendations

Amendments to the EMGs as contained within the Environmental Scoping Study include the following:

- The original EMGs did not cover all Program activities, or adequately address some of those issues covered. For example nutrient management, including fertiliser and pesticide application advice was not included in the EMG for either Land & Vegetation Clearance or Soil Erosion (the 2 logical EMGs where one might expect to find this information). A modified EMG for Soil Erosion has therefore been prepared entitled ‘Soil and Nutrient Management’.
- No EMG existed for managing water resources from the point of view of ensuring that natural drainage lines are not disrupted by infrastructure or changed land use. This is a significant issue and one not adequately covered by the original EMGs. A new EMG ‘Water Management’ has been prepared.
- Significant repetition exists within the EMGs for two principal reasons: Firstly, the EMGs describe both **activities** that may cause an impact eg. Stockpiles and Spoil heaps as well as those **receiving environments** where impacts might be felt eg stormwater. Therefore management advice for stockpiles and spoil heaps appears duplicated in both of these EMGs. The EMGs have therefore been amended to reduce some of this repetition.
- The EMGs did not reference other sources of guidance such as the Environmental Scoping Study that provides useful technical information to enable the PMU and IEO to make more informed decisions regarding issues. They have been amended to include this information.
- The Original EMG entitled ‘Site Control’ has been changed in name to ‘Construction Management and has been extended in scope to include a reference to appropriate disposal of wastes and non-use of asbestos containing building materials.’

A revised EMG list has been prepared and this is included as Appendix 2 to this report. It is recommended that it is adopted for use by the Program and inserted into the PEMM for use by the IEO and PMU.

8 Final Conclusions and Recommendations

8.1 Introduction

One of the main aims of the Program is to introduce means by which communes can generate additional income from changing and improving current agricultural practices and introducing or improving infrastructure. In general terms, the biggest long term environmental effects that encouraging these activities is likely to have relate to the following possible scenarios:

- That people are likely to farm larger areas due to increased access to resources, technology, improved infrastructure and markets.
- That those areas they do farm are likely to be more intensively farmed due to improvements in access to resources, technology, infrastructure and markets, which is likely to place a greater emphasis on additional pesticide and fertiliser inputs.

In order to ensure that these potential impacts are mitigated, alternative agricultural practices and crops better suited to the capability of the land and natural environment need to be encouraged to generate greater incomes for less net environmental impact.

This will represent the best outcome from an environmental standpoint, especially if it can be achieved without the requirement for large, potentially damaging fertiliser and pesticide inputs. The reality however is more likely to represent a combination of these scenarios and it will therefore be important to ensure that Program support of all Income Generation and Infrastructure activities uses the process set out in the PEMM.

Adequacy of Environmental Management Procedures

The PEMM references the EIAC as the primary tool in the environmental management process. It allows for identification of environmental issues, includes references to relevant EMGs to address these issues and provides recommendations where further action may be required.

The PEMM is a good framework by which Program activities can be controlled from an environmental point of view. A number of amendments however are recommended to make it a more useful and usable document in this regard:

- The PEMM should now reference the EPBC Act, 1999 that supersedes the Environment Protection Impact of Proposals Act 1974.
- The PEMM relies on the adequacy of the EIAC and the EMGs in providing a user friendly guide to Program staff for assessing the environmental issues associated with a particular Program supported activity. Following their review, significant amendments were recommended to the EIAC and EMGs.

The review of the draft EIAC revealed that it required some amendment and reworking to render it of more useable by the Program, due principally to its scope differing from Program activities and its ease of use. These include the following:

- The EIAC and EMGs did not cover all Program activities and included information on a number of activities that are not relevant to the Program. These have been amended.

- An additional column was required in the EIAC table indicating the nature of the environmental issue that results from a Program activity and associated impact. This provides training and guidance to the IEO and PMU over and above that contained in the original EIAC.
- The EIAC did not reference the relevant EMGs to be used as was stated in the PEMM. As these are the principal source of guidance on what action is required to manage a particular issue, this has been incorporated into the revised EIAC.
- The EIAC provided columns for scoring the significance of the issue in question without providing any guidance as to how to make an assessment of the significance of the issue. This has been removed and additional guidance provided to enable a better judgement to be made.
- The EIAC provided a column titled 'Supplemental Information' without providing a clear indication as to what the IEO or PMU staff member might usefully use the information for. The EIAC now references the relevant EMG.
- The PEMM and EIAC do not clearly indicate when the IEO or PMU staff member is to look to use guidance information contained within the EMGs or when the 'Mitigation Measures' information is to be used. It is recommended that the preliminary source of guidance for the Program should be the EIAC and EMGs with supplementary detail provided by the Environmental Scoping Study.
- The original EMGs entitled 'Site Control', 'Soil Erosion' and 'Controlling Stormwater' have been amended. They are now entitled 'Construction Management', 'Soil and Nutrient Management' and 'Water Management' and have been extended in scope to reflect Program activities.
- Significant repetition existed within the original EMGs, such that **activities** that may cause an impact and those **receiving environments** where impacts might be felt are both described. The original EMGs have been amended to reduce this repetition.
- The original EMGs did not reference other sources of guidance such as the Environmental Scoping Study that provides useful technical information to enable the PMU and IEO to make more informed decisions regarding issues. The new EMGs have been amended to include this information.

Methodology for Assessing Environmental Impacts

A three phased approach to the environmental assessment of Program activities is recommended via the amended EIAC. This does not require any changes to the content and intent of the PEMM but requires that Planning, Implementation and Operational phases of Program activities are listed in the amended EIAC. A description of these phases is outlined below.

Planning Phase

When considering an infrastructure or income generation activity, the first question to ask is does it require a change in land use and if so does it result in the destruction or loss of any valued habitats or sensitive environmental areas? This is particularly relevant where natural land is being cleared. If valued habitat is to be significantly impacted upon, then, where practical, alternative areas for the activity in question should be sought. Valued habitats and environmentally sensitive areas include for example natural forest areas, natural wetland areas with high bird populations and estuaries, and of course those areas set aside by the GOV. Development of and impacts upon such areas should be avoided where possible.

Implementation Phase

Once a decision has been made with respect to an area of land to be developed, the establishment of that land parcel for the new activity needs to involve appropriate practices. As far as development of natural habitat for agricultural use is concerned, this should include retaining mature trees where possible, burning practices that allow animals to escape, and the establishment of a mulch, ground cover or contour bunding on steeply sloping land to safeguard against erosion prior to crop establishment.

In terms of infrastructure such as roads, tracks and bridges, the potential exists for such structures to impact upon the flow regimes and quality of water within rivers and watercourses, the potential for accelerated erosion and impact upon watercourses during construction, noise, dust and waste management issues during construction.

Wells, toilets and bathrooms alternatively tend to give rise to the potential for environmental health issues relating to their design and siting if they are not installed to correct specifications and taking into account the location of potential source of contamination such as animal pens. Furthermore it is important to ensure that the kinds of materials used in their construction do not give rise to the potential for human health issues.

Operational Phase

Finally, appropriate practices need to be established in order to ensure that the infrastructure put in place, or land developed for an alternative end use is appropriately managed over time. This is particularly important in terms of agricultural land use where the capability of the land needs to be taken into account when considering crop selection.

Selection of an appropriate crop will help safeguard against erosion occurring and the requirement for large fertiliser and pesticide inputs. This is important as excess fertilisers not absorbed by crops can migrate to deeper strata of soil and reach ground water and rivers where eutrophication, or oxygen starvation of rivers can occur. Fertilisers such as nitrate and phosphate can furthermore accumulate in soils, altering its physical and chemical composition, causing it to become more acid, compact, and porous.

Pesticides similarly can accumulate in ground and surface water causing impacts upon plants and animals and people, particularly if water is being used for drinking as boiling will not render it safe for consumption. The prevention of erosion will also be important to maintain the productivity of the land on an ongoing basis.

Appendix 1

Environmental Impact Assessment Checklist

Appendix 1: Environmental Impact Assessment Checklist

Road & Bridge Construction

Activity affecting environment	Impacts on the environment	Applicable? Yes/No	Main environmental issue	Recommended action	EMG References
Planning Phase					
New track, road or bridge or widening of existing track, road or bridge	Clearance of native vegetation and habitat		Loss of biodiversity	Select alignments and site to avoid areas of undisturbed forest vegetation or areas of known environmental value	3
	Encroachment on historically or culturally significant sites		Cultural impacts for community	Consult with community to avoid these areas. Select alignments to avoid them.	1, 2, 3
	Creation of pathways for disease vectors		Disease spread to humans and animals and plants	Consult with community to safeguard against this if disease is known to be present in a particular area	2, 6
New track/road or widening of existing track/road	Disruption of natural course of river		Affects water communities such as fish, plants and birds	Select alignments to avoid these areas, or ensure that culverts are put in place to allow natural flows	11
	Isolation of communities of plants, animals and fish		Isolation can cause communities to deteriorate and die out	Select alignments to avoid the most valued natural habitats eg undisturbed forest areas	11
	Creation of opportunity for further illegal land clearing activity		Loss of biodiversity	Consult with community to safeguard against this	2, 3

Activity affecting environment	Impacts on the environment	Applicable? Yes/No	Main environmental issue	Recommended action	EMG References
Implementation Phase					
Track/road/bridge construction activity	Increased erosion during construction that enters rivers and streams		Soil and other materials can affect plant, fish and bird communities, via smothering and altering river pH	Ensure that sand and cement is covered or contained and cannot escape into rivers	4, 9
	Noise and dust during construction period		Nuisance to community	Provide safety protection for workers. Limit days and time of construction	2, 4, 5, 6
Bridge construction activity	Temporary disruption of natural flow of river during placement of foundations in or adjacent to river bed/banks		Affects water communities such as fish, plants and birds	Ensure river flow is maintained	4
Storage of road, track or bridge building materials	Soil, sand and cement may enter rivers due to rain or wind		Soil and other materials can affect plant, fish and bird communities, via smothering them and altering river pH	Ensure that sand and cement is covered or contained and cannot escape into rivers	4, 7, 8, 9, 10
Digging of borrow pits for a track, road or bridge	If borrow pits are located in sensitive areas eg steeply sloping areas or near rivers, erosion can occur with borrow entering river		This can cause impacts upon water quality in rivers, making it dirty and smothering plants and fish	Select suitable borrow pits or ensure that erosion control measures are in place Eg earth contour bunds	4, 7, 8, 9, 10
Construction waste generated from track, road, bridge construction	Waste such as cement bags, plastic etc may enter rivers etc. and cause an impact on the environment		They can cause blockages in the river and small amounts of cement etc to enter the river, affecting water quality for humans and fish and birds	Appropriately dispose of wastes	4

Activity affecting environment	Impacts on the environment	Applicable? Yes/No	Main environmental issue	Recommended action	EMG References
Use of heavy plant and machinery	Potential for hydrocarbons to reach river		Impacts on water quality making it bad unsafe to drink and impacts upon fish	Appropriate practices to ensure no wash down of plant in rivers and that fuels and oils are adequately contained	4, 7
Operational Phase					
Track/road use	Noise and dust pollution		Nuisance to certain households in community	Site track/bridge away from sensitive community facilities eg kindergartens if possible	2, 3, 4, 5, 6
Track/road operation	Erosion of soil from roadsides if not revegetated		Soil can wash into local rivers and streams	Maintenance of road and stabilise sides with structures or vegetation	4, 8

Agricultural Activities Changing Land Use

Activity affecting environment	Impacts on the environment	Applicable? Yes/No	Main environmental issue	Recommended action	EMG References
Planning Phase					
Clearance of natural forest areas for agricultural use	Destruction of native vegetation and habitat		Loss of biodiversity	Try to avoid areas of undisturbed forest vegetation or areas of known environmental value and suggest alternatives	1, 2, 3,12
	Isolation of plant and animal communities either side of cleared areas		Isolation can cause communities to deteriorate and die out	Leave corridors to prevent animals and plants becoming isolated	1, 2, 3,11,12
Clearance of natural vegetation in protected area for agricultural use	Destruction of native vegetation and habitat		Against the Vietnam GOV and AusAid laws and guidelines	Consult with Vietnam regulatory authorities to ensure area being cleared is not protected	3,12

Activity affecting environment	Impacts on the environment	Applicable? Yes/No	Main environmental issue	Recommended action	EMG References
Clearance of natural forest areas for housing associated with newly cultivated area	Destruction of native vegetation and habitat		Loss of biodiversity	Minimise clearance of primary forest vegetation when constructing buildings	3,12
Housing associated with newly cultivated area	Potential for activities associated with housing eg waste and effluent generation to impact upon river and groundwater		Potential impacts on water quality causing impacts on fish communities and potential human health issues	New housing should construct appropriate wells and toilets to safeguard against health and environmental issues	2, 7
Introduction of livestock grazing	Cloven hooved animals can cause accelerated erosion, and change habitat of an area		Reduction in soil fertility and vegetation and fish smothering due to erosion	Selection of appropriate stocking levels on appropriate land units	7, 8, 11
	Potential for ingress of faecal matter to water sources		Potential impacts on water quality from human consumption point of view	House animals at least 20m away from wells and preferably not upslope of them	2, 7
Implementation Phase					
Clearing of natural vegetation areas	Increased erosion once clearance has occurred that may enter rivers		Soil and other material can smother plants and fish and affect bird communities	Make earth contour bunds on steep slopes and leave cleared vegetation as mulch to reduce erosion and encourage regrowth. Clear during dry season	4, 8
Operational Phase					
Establishment of new crop	Increased erosion of soil if chosen crop is not able to bind soil together or provide sufficient cover. (ie not well suited to the land capability)		Soil may enter rivers, smothering plants and fish and affecting birds	Select appropriate crop for the particular land being cleared	4, 7, 8, 11

Activity affecting environment	Impacts on the environment	Applicable? Yes/No	Main environmental issue	Recommended action	EMG References
	Requirement for additional/high fertiliser application due to loss of fertility through erosion and other means if poor crop selection made		High fertiliser application can cause algal growth in rivers and death of fish and plants through oxygen depletion ('Eutrophication')		
Potential for introducing disease with animals into an area eg cattle and pigs	Potential for introducing disease into local animal populations		Potential for disease into local populations to have adverse effect on health and livelihoods of people	Ensure introduced animals are vaccinated	2
Potential for genetic deterioration of introduced animals if kept within same village	Increased likelihood of disease amongst animals			Inter-village trade of animals to prevent genetic deterioration	2
High pesticide/herbicide application	Impacts upon river quality and deaths of non-pest animals eg insects and birds		Loss of biodiversity and destruction of local habitats. Potential human health issue	Provision of advice on suitable application rates.	7, 8, 11
Fertiliser application	Incorrect fertiliser application can change soil composition causing acidity and hardness, and high nutrient levels in rivers		Loss of soil fertility causing loss of income, and potential damage to river ecosystems	Provision of advice on suitable application rates.	7, 8, 11
Track/road use to new area	Noise and dust pollution		Nuisance to community	Site track away from sensitive community facilities eg kindergartens if possible	2, 4, 6, 7

Buildings & Minor Infrastructure

Activity affecting environment	Impacts on the environment	Applicable? Yes/No	Main Environmental issue	Recommended action	EMG References
Planning Phase					
Clearance of natural forest areas for buildings or electrical infrastructure	Destruction of native vegetation and habitat		Loss of biodiversity	Try to avoid areas of undisturbed forest vegetation or areas of known environmental value and suggest alternatives	2, 3, 12
Construction of a new village or satellite community with new housing	Potential for activities associated with housing eg general waste and effluent generation to impact upon river and groundwater		Potential impacts on water quality causing impacts on fish communities and potential human health issues	New housing should construct appropriate wells and toilets to safeguard against health and environmental issues	2, 3, 12
Implementation Phase					
Situation of well downstream and near to source of human or animal effluent eg. buffalo wallow or toilet	Potential for water quality to be impacted upon by elevated E coli and other micro organisms		Principally a human health issue. Potential for sickness amongst people	Try to ensure that wells are located a significant distance away from buffalo wallows if downslope of them, or that buffalo wallows are relocated	4, 7
Location of toilet adjacent to watercourse or source of water eg. A pre-existing unlined well				Try to ensure that toilets are not constructed adjacent to pre-existing wells taking groundwater from a similar depth, or install appropriately lines and filtered well	4, 7
Use of asbestos sheeting for roofs in buildings eg. toilets and bathrooms	Although unlikely, the potential exists for asbestos to be damaged and release fibres.		A human health issue. Asbestos fibres can cause serious respiratory ailments if inhaled in a dust form.	Alternative roofing materials should be utilised where practical. Eg Tin	4

Activity affecting environment	Impacts on the environment	Applicable? Yes/No	Main Environmental issue	Recommended action	EMG References
				Existing asbestos roofs should be painted to extend life and safeguard against fibre release	4
Storage of construction materials	Soil, sand and cement may enter rivers due to rain or wind		Soil and other material can affect plant, fish and bird communities by smothering them and altering river pH	Ensure that sand and cement is covered or contained and cannot escape into rivers. Washing of tools should take place over natural ground away from watercourses	4, 7, 8, 9, 10
Construction waste generated	Waste such as cement bags, plastic etc and some residues of materials may enter rivers etc. and cause an impact on the environment		They can cause blockages in the river affecting water quality for humans, fish and birds. Can be ingested by animals	Appropriately dispose of wastes	4, 7
Transformer construction	Potential over time for leakages of oils from transformers that can cause impacts on water quality, particularly if oils contain Poly chlorinated Biphenyls (PCBs)		Oil in water supply will cause issues for human consumption. PCBs are a carcinogen (cancer causing) and bio-accumulate	Ensure that transformers put in place are banded ie they are situated on a concrete base with concrete retaining wells to safeguard any spill from reaching the environment	7, 8
Operational Phase					
Use of pesticides/herbicides around buildings	Impacts upon rivers and deaths of non-pest animals eg insects and birds		Loss of biodiversity and potential human health issue if children ingest pesticides/herbicides	Control use of pesticides and herbicides	2, 7, 8
Lead based paints in kindergarten buildings			Potential human health issue if children come into contact with our ingest lead based paint from surfaces	Site track away from sensitive community facilities eg kindergartens if possible	4

Irrigation Activities

Activity affecting environment	Impacts on the environment	Applicable? Yes/No	Main environmental issue	Recommended action	EMG References
Planning Phase					
Establishment of new irrigated area	Clearance of native vegetation and habitat		Loss of biodiversity	Select sites that avoid the requirement to clear areas of undisturbed forest vegetation or areas of known environmental value	2, 3, 11, 12
	Encroachment on historically or culturally significant sites		Cultural impacts for community	Consult with community to avoid use of these areas	2, 3
	Disruption of natural course of river		Affects water communities such as fish, plants and birds	Select alignments to avoid these areas, or ensure that culverts are put in place to allow natural flow rates	3, 11
	Isolation of communities of plants, animals and fish		Isolation can cause communities either side of area to deteriorate and die out	Select alignments to avoid the most valued natural habitats eg undisturbed forest areas	3, 11
	Reduced flow in river due to water being diverted		Affects water communities such as fish, birds and plants by reducing available habitat and nutrients	Ensure that diversion into irrigated area is not too great so as to disrupt natural river flow	3, 11
	Potential for drawdown if groundwater being used as source of irrigation water		Can result in lowering of water table and drying of wells impacting upon peoples health	Ensure that an assessment of the suitability of the source of irrigation water is made prior to implementation	11

Activity affecting environment	Impacts on the environment	Applicable? Yes/No	Main environmental issue	Recommended action	EMG References
Implementation Phase					
Construction of new irrigated area	Increased erosion during construction of bunds that may enter rivers and streams		Soil can smother plants and fish and affect bird communities	Ensure that sand, cement and soil is covered or contained and cannot escape into rivers	4, 7, 8, 9
	Noise and dust during construction period		Nuisance to community	Provide safety protection for workers. Limit days and time of construction	4, 5, 6
Storage of building materials for construction of irrigated area	Soil, sand and cement may enter rivers due to rain or wind		Soil and other material can affect plant, fish and bird communities by smothering them and altering river pH	Ensure that sand and cement is covered or contained and cannot escape into rivers	4, 7, 8, 9
Waste generated from construction of irrigated area eg concrete channels etc	Waste such as cement bags, plastic etc may enter rivers and cause an impact on the environment		They can cause blockages in the river and small amounts of cement etc to enter the river, affecting water quality for humans, fish and birds	Appropriately dispose of wastes	4, 7, 11
Operational Phase					
The newly established irrigation area will be subject to herbicide and pesticide application	Impacts upon river water quality and deaths of non-pest animals eg insects and birds		Loss of biodiversity and potential human health issue	Control use of pesticides and herbicides	2, 7, 8
The newly established irrigation area will be subject to fertiliser application	Impacts upon river water quality through elevated levels of nutrients		High fertiliser application can cause algal growth in rivers and death of fish and plants through oxygen depletion ('Eutrophication')	Use appropriate quantities and types of fertilisers, such as natural fertilisers like buffalo manure where practical	2, 7, 8

Activity affecting environment	Impacts on the environment	Applicable? Yes/No	Main environmental issue	Recommended action	EMG References
Petrol or diesel pumps in use on irrigation system	Diesel or petrol residues may escape to river		Hydrocarbons such as petrol and diesel can cause fish deaths and affect quality of water for human consumption	Ensure petrol and diesel is appropriately stored away from sensitive receptors such as rivers	2, 4, 7
	Noise pollution		Nuisance to certain households in community	Site pump away from houses where possible or restrict hours of use	2, 5

Appendix 2

Environmental Management Guidelines

Appendix 2: Environmental Management Guidelines (EMG)

Summary Sheet

District:

Commune:

Village:

Date:

USER NOTES: The following Summary Sheet is to be completed by QNRDP Program Management Unit (PMU) and Infrastructure and Environment Officer (IEO) once the various environmental control guidelines required for Program activities and subprojects have been identified. This document and the environmental management guidelines (EMGs) it nominates will become the QNRDP Environmental Management Plan (EMP) and should be attached to the documents submitted for Department of Science, Technology and Environment (DOSTE) approvals and licenses, tender documentation and the final contract documentation. ***Further information can be obtained from the Environmental Impact and Management Issues Scoping Study, URS, December 2001 ('Environmental Scoping Study') and references are made within the EMGs to information contained within this report.***

Tick the box adjacent to the EMGs required for this activity or subproject and attach the EMG to the back of the Summary Sheet.

<input type="checkbox"/>	EMG 1 - Cultural Heritage
<input type="checkbox"/>	EMG 2 - Social and Community Concerns
<input type="checkbox"/>	EMG 3 - Protection of Sensitive Areas
<input type="checkbox"/>	EMG 4 - Construction Management
<input type="checkbox"/>	EMG 5 - Noise Control
<input type="checkbox"/>	EMG 6 - Dust Control
<input type="checkbox"/>	EMG 7 - Water Quality
<input type="checkbox"/>	EMG 8 - Soil and Nutrient Management
<input type="checkbox"/>	EMG 9 - Controlling Sediment
<input type="checkbox"/>	EMG 10 - Management of Stockpiles & Spoil heaps
<input type="checkbox"/>	EMG 11 - Water Management
<input type="checkbox"/>	EMG 12 - Vegetation Clearance

Signed and Dated:

QNRDP Infrastructure and Environment Officer

PEMM Environmental Management Guideline No. EMG 1

CULTURAL HERITAGE

Policy/Objective To ensure that the works have only acceptable impact on the cultural heritage of the local population.

1. The Contractor will liaise with the local community to identify sites of cultural importance.

2. The Contractor shall ensure that all such areas, trees, structures or sites of cultural importance are protected, if necessary by barriers.

Control Measures

3. The Contractor shall ensure that all construction workers are aware of the significance of such sites.

4. Local community to appoint a watchperson to ensure that such sites are not damaged or violated.

Monitoring The IEO will liaise with local community to ensure that sites of cultural importance are protected.

Corrective Action If any damage occurs, discuss with the local community and implement any remedial actions requested by them.

PEMM Environmental Management Guideline No. EMG 2

SOCIAL AND COMMUNITY CONCERNS

Policy/Objective To minimise social disturbance and maximise community benefits from QNRDP activities and subprojects.

Control Measures

1. The PMU will advise the local community of QNRDP plans in advance of any works, construction or activities, and through QNRDP participatory framework involve them in planning and implementation.
2. The Contractor will liaise with the local community to identify culturally sensitive areas and avoid disturbing them (refer to EMG 1).
3. The Contractor to negotiate access to and use of local resources with the local community and DOSTE.
4. The contractor to negotiate with the local community and DOSTE regarding the location of disposal areas and stockpiles (refer EMG 10).
5. The Contractor to avoid disturbances near residential areas where possible.
6. The Contractor shall control runoff and manage sediments near gardens, fishponds and water bodies (refer EMG 11)
7. The Contractor shall arrange for local people to be employed and trained on aspects of the activity or subproject.
8. Women's Union and other commune groups to be included in subproject activities.

9. The community should be consulted to establish whether diseases are present in an adjacent area that could be spread by the establishment of a road or planting of a particular crop type

10 The community should be consulted to establish whether establishment of road or bridge infrastructure is likely to give rise to added pressure to degrade local natural resources, such as via logging activity etc

Monitoring The IEO will liaise with local community to ensure that the local community is fully informed and that any areas of concern are acted upon.

Corrective Action Any problems or complaints to be recorded and actions taken to resolve concerns undertaken immediately and also recorded.

PEMM Environmental Management Guideline No. EMG 3

PROTECTION OF SENSITIVE AREAS

Policy/Objective To minimise negative impacts on sensitive ecosystems, culturally sensitive areas and the natural environment. (*Refer Section 2.4, Environmental Scoping Study*)

Control Measures

1. The PMU will advise the local community of QNRDP plans in advance of any works, construction or activities, and through QNRDP participatory framework involve them in planning and implementation.
2. The Contractor will liaise with the local community to identify culturally sensitive areas and avoid disturbing them (**refer to EMG 1**).
3. The PMU shall locate all construction sites/activities away from sensitive areas.
4. The PMU shall ensure that the Contractor is aware of locations of sensitive areas and avoids them.
5. The Contractor shall ensure that all construction workers are aware of the significance of such sites and the need to avoid impacts on any such sites.

6. Ensure that Program activities/infrastructure do not result in isolation of communities of plants, animals and fish, or disrupt watercourses. Ensure that culverts etc are in place to allow natural flow lines to be maintained
7. Ensure that Program infrastructure such as roads and bridges do not contribute to increased exploitation of natural resources e.g. by providing improved access for illegal logging activity

Monitoring The IEO will liaise with communes to ensure that environmentally sensitive sites are protected.

Corrective Action If any damage occurs, discuss with the communes and DOSTE and implement any remedial actions requested by them.

PEMM Environmental Management Guideline No. EMG 4

CONSTRUCTION MANAGEMENT

Policy/Objective	To minimise inconvenience and to ensure that construction workers, school students, QNRDP staff and local residents are not endangered during the implementation of activities and subprojects and that appropriate construction materials are used and wastes are appropriately disposed of (particularly during construction works).
Control Measures	<p>The Contractor shall ensure that all health and safety requirements are in place on the construction site, and with the IEO shall conduct an awareness campaign for staff and local residents to ensure that all are aware of possible danger. Erect barriers to restrict access to work areas and ensure personnel are appointed to monitor movement around work sites. Control measure shall include:</p> <ol style="list-style-type: none">1. Erection of personnel barriers to limit access to unauthorised personnel2. Construct and maintain alternative routes around work sites3. Employ local residents to facilitate awareness and monitor the movement of residents around work sites so they are not endangered in any way4. Clearly signpost alternate routes and detours5. Store all materials and equipment on site so as to prevent damage to the site and minimise hazards to persons, materials, equipment and the environment6. Hazardous goods (including fuel and oil) shall be stored and handled only within an area set aside for that purpose and was down of vehicles should occur in a contained area away from watercourses7. Ensure that activities do not significantly disrupt the natural flows of rivers during construction8. Ensure that asbestos containing materials are not used in building construction. Where asbestos roofing materials have been used, these should be painted to safeguard against deterioration and prevent fibre release9. Ensure all wastes generated are appropriately disposed of in accordance with GOV laws and guidelines10. Ensure that all transformers are underlain by concrete and banded to contain any leakages of oils that could potentially occur via leakage
Monitoring	IEO to conduct regular inspections during construction activities, check on safety measures and waste management issues. Contractor and IEO to liaise with local CPU leaders regarding appropriate locations for work sites and alternate routes and detours if required.
Corrective Action	Any problems to be acted upon immediately and recorded by IEO.

PEMM Environmental Management Guideline No. EMG 5

NOISE CONTROL

Policy/Objective

To minimise the impact of noise on residents and commune facilities (schools, health clinics, halls etc)

Control Measures

The IEO shall ensure that the Contractor prevent noise levels that are likely to an annoyance to the commune. All noise generating plant and equipment and processes shall be controlled to minimise noise. Control measure shall include:

1. Use of modern and well maintained equipment
 2. Use of noise screens or mounds near residential areas
 3. Advise commune leaders, school and health clinic staff etc when there will be unavoidable noise
 4. Generally carry out all noisy construction activities during normal working hours. Contractor and IEO to negotiate with commune leaders, school and health clinic staff to identify any 'noise free' requirements and ensure that noisy activities are avoided at these times.
-

Monitoring

Weekly inspection of all noise producing sources on activities and subprojects. Discuss any problems with representatives of the commune.

Corrective Action

Any machines, plant or processes producing excessive noise shall cease operation and remedial action taken to the satisfaction of the IEO.

PEMM Environmental Management Guideline No. EMG 6

DUST CONTROL

Policy/Objective

To ensure there is no health risk or inconvenience or nuisance due to dust production

Control Measures

The Contractor shall control construction activities to prevent excessive dust generation. Control measures shall include:

1. Spray water on exposed surfaces
 2. Install wind breaks, dust screens or fences between exposed surfaces, concrete or tar batching areas and commune facilities and houses
 3. Wet roads and tracks and fill being carried in open trucks
-

Monitoring

Weekly inspection of all dust producing sources on activities and subprojects. Discuss any problems with representatives of the commune.

Corrective Action

Any problems or complaints to be acted upon immediately.

PEMM Environmental Management Guideline No. EMG 7

WATER QUALITY

Policy/Objective To avoid contamination of potable water sources from solid waste, sewerage and construction activities. (*Refer Table 25, Environmental Scoping Study for Vietnam Drinking Water Quality Guidelines*)

The Contractor shall ensure that all construction activities and disposal of waste products are managed to minimise their impact on local water sources. Control measures shall include:

1. Isolate construction plant, workshops, storage areas, concrete or tar batching areas etc from other surface runoff to prevent spillage entering local water sources. Clean and rehabilitate when activities are complete
2. Hazardous goods (including fuel and oil) shall be stored and handled only within an area set aside specifically for that purpose. This area shall be located away from drainage lines and bunded off from the remainder of the site.
3. Direct runoff from the site and wash up operations into a settling basin
4. Contain all stored waste within the construction site
5. During site clean up dispose of contaminants in an approved manner: burn all spilled fuel oil etc; discharge gaseous contaminants - diluting with fresh air; chemical and other liquid contaminants shall be stored in appropriate containers and disposed of at an authorised toxic landfill site
6. Crush, burn and bury all inorganic waste in an approved area
7. Compost or use as animal food all green organic wastes
8. New toilet facilities shall be: located away from sources of potable water supply; of sufficient capacity to service the population using the facility; and, above waterable pit latrines or composting toilets
9. All wells installed should be situated a recommended 20 metres away from any upslope source of contaminants such as a water buffalo wallow, animal pen, or unlined toilet
10. Ensure septic tank outflows are not located near potable water supplies or drain into the natural watercourse catchments

Monitoring Daily visual assessment of control measures and water quality together with consultation with CPC leaders

Corrective Action Any problems or complaints regarding water quality shall be addressed immediately by whatever measures are required to fix the problem.

PEMM Environmental Management Guideline No. EMG 8

SOIL & NUTRIENT MANAGEMENT

Policy/Objective To control the severity and extent of erosion and prevent rivers and soil against deterioration via application of inappropriate amounts/rates of pesticides and fertilisers

The Contractor shall implement pre-construction, construction and post construction controls and management practices to minimise erosion. Control measures shall include:

- Control Measures**
1. Construct necessary temporary/permanent control structures such as catch drains, slope drains and bunds to divert stormwater around activities and construction sites
 2. Earthworks to be completed in stages such that a minimal area of ground is open or clear or exposed at any one time
 3. Keep vegetation clearing to a minimum
 4. Avoid disturbance on steep slopes
 5. Keep construction vehicles, plant and equipment on defined tracks
 6. Encourage revegetation after construction activities have finished
 7. Ensure that borrow pits are located in areas not prone to erosion or that adequate erosion control measures are in place
 8. Ensure that pesticides and fertilisers are applied in accordance with GOV guidelines (*refer Tables 21 & 22 in Environmental Scoping Study and Section 2*)
-

Monitoring The Contractor shall; regularly inspect the site to ensure that erosion control measures are in place and working effectively; and, inspect the site after heavy rains to check for damage such as scour, soil erosion or sediment deposition. The IEO shall inspect the site regularly during construction and activities to ensure compliance with the guidelines

Corrective Action Repairs to damaged areas, re-establishment of vegetation re-growth. Modify and improve drainage control strategies

PEMM Environmental Management Guideline No. EMG 9

CONTROLLING SEDIMENT

Policy/Objective	To minimise the impact of stormwater containing sediment on streams and coastlines
Control Measures	<p>The Contractor shall implement pre-construction, construction and post construction controls and management practices to minimise sedimentation. Control measures shall include:</p> <ol style="list-style-type: none">1. Construct necessary temporary/permanent control structures at the outset of construction. These structures may include the installation of filter-sediment fences, hay bales, filter drains, filter strips, grass outlets and sediment transport basin traps around culverts, drains, soil stockpiles and all other areas which may have the potential to erode or be affected by sedimentation2. All disturbed areas that are not to be paved or gravelled should be revegetated or prepared for natural revegetation after final landscaping3. Ground disturbance should be staged so that it is limited to areas of a workable size4. Construction and activities should be scheduled so that large areas of soil and earth are not exposed during the wet season5. Isolate construction plant, workshops, storage areas, concrete or tar batching areas etc from other surface runoff6. Avoid discharging water onto unstable slopes or old landslips7. Encourage revegetation after construction activities have finished
Monitoring	<p>The Contractor shall; regularly inspect the site to ensure that sedimentation control measures are in place and working efficiently; and, inspect the site after heavy rains to check for damage such as scour, soil erosion or sediment deposition. The IEO shall inspect the site regularly during construction and activities to ensure compliance with the guidelines</p>
Corrective Action	<p>Repairs to damaged areas, re-establishment of vegetation re-growth. Modify and improve drainage control strategies</p>

PEMM Environmental Management Guideline No. EMG 10

MANAGEMENT OF STOCKPILES & SPOIL HEAPS

Policy/Objective To manage these features so that dust and sediment runoff are minimised

- Control Measures**
1. The Contractor shall negotiate with commune leaders about the location of dumping areas. If spoil is to be dumped in the local area, prepare a level site on which spoil can be dumped and piled
 2. The stockpile or spoil heap location should be chosen so as to avoid blocking surface runoff or drainage lines. If this is not a ridge crest or flat plain site, the base should be levelled and contained
 3. If the stockpile or spoil heap contains fine sediments, it should not be left bare for long periods and should be covered to prevent dust generation, erosion and sediment runoff in areas of high rainfall
 4. Stockpiles and spoil heaps must be subject to stability calculations to safeguard against a major slip occurring
 5. Where possible, spoil should be used to backfill quarry areas or waste disposal sites or pits before they are re-vegetated
 6. Isolate construction plant, workshops, storage areas, concrete or tar batching areas etc from other surface runoff
 7. Avoid discharging water onto unstable slopes or old landslips
 8. Encourage revegetation after construction activities have finished
-

Monitoring The Contractor shall regularly inspect stockpiles and spoil heaps, in particular after heavy rains to check for damage such as scour, soil erosion or sediment deposition. The IEO shall inspect the site regularly during construction and activities to ensure compliance with the guidelines

Corrective Action Repairs to damaged areas, re-establishment of vegetation re-growth.

PEMM Environmental Management Guideline No. EMG 11

WATER MANAGEMENT

Policy/Objective To minimise the impact of contaminated runoff water and minimise the disruption to watercourses by infrastructure; and the selection of appropriate alignments for roads etc that avoid blocking lines of natural drainage where possible (**Refer Table 25 Environmental Scoping Study**)

Control Measures The Contractor shall implement pre-construction, construction and post construction controls and management practices to minimise sedimentation. Control measures shall include:

1. Runoff from non-construction areas should be diverted (temporarily) around the construction site to keep natural flow separate from construction runoff
2. The Contractor shall liaise with commune leaders to ensure that in areas of intensive gardening, shrimp farming or sensitive agriculture, especially in areas of high rainfall, runoff from construction sites will not be directed onto garden plots or fish ponds etc
3. Stormwater runoff from construction sites should pass through a gross pollutant trap (to filter plastics, cans etc) and over a vegetated surface to remove petroleum-based organic pollutants before discharging into drainage systems
4. Drains and culverts should be designed to remove all runoff water without scour. On steep slopes culverts may need to be stepped using rock slabs or gravel in gabion baskets
5. Select appropriate alignments for roads and other linear features that may disrupt drainage lines and ensure measures such as culverts allow for natural flow regimes to be maintained
6. Any new irrigation activity should take into account the volume of water available from groundwater resources to safeguard against lowering of water levels in wells and impacts upon the community

Monitoring The Contractor shall regularly inspect the site to ensure that stormwater control measures are in place and working effectively, in particular after heavy rains to check for damage such as scour, soil erosion or sediment deposition. The IEO shall inspect the site regularly during construction and activities to ensure compliance with the guidelines

Corrective Action Repairs to damaged areas, re-establishment of vegetation re-growth.

PEMM Environmental Management Guideline No. EMG 12

VEGETATION CLEARANCE

Policy/Objective	To minimise the environmental impact of vegetation clearance on natural ecosystems, including flora and fauna
Control Measures	<ol style="list-style-type: none">1. The Contractor shall liaise with DOSTE and commune leaders to identify vegetation areas that have significant value2. Mature trees or trees of environmental significance must, where possible, be retained. Where trees in or near the construction site are to be retained they shall be protected throughout the construction period3. Vegetation clearing shall be kept to a minimum4. Encourage re-vegetation after construction activities have been completed
Monitoring	The Contractor shall regularly inspect vegetation areas to ensure that trees and vegetation of significance are not damaged (Refer Section 2.4 Environmental Scoping Study). The IEO shall inspect the site regularly during construction and activities to ensure compliance with the guidelines
Corrective Action	If significant vegetation or trees are cleared/damaged in the construction process, the need for rehabilitation works shall be discussed with DOSTE and commune leaders
