ENVIRONMENTAL MANAGEMENT PLAN

Oil Search

PNG BIOMASS

PNG BIOMASS MARKHAM VALLEY

MARCH 2017
Report No. 01183B_3_v3

ERIAS GROUP

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Markham Valley Biomass Limited

PNG Biomass Markham Valley

Environmental Management Plan

March 2017
(Report No. 01183B_3_v3)

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1. Introduction

1.1 Context

Oil Search Limited (Oil Search/OSL), through its wholly-owned subsidiary Markham Valley Biomass Limited (MVB)[1], proposes to develop the PNG Biomass Markham Valley project (hereafter referred to as 'the Project') in Morobe Province, Papua New Guinea (PNG). The Project area (also referred to as Area A) is located in the Markham Valley, about 50 km west-northwest of the provincial capital Lae (Figure 1.1).

The Project involves the development of up to 16,000 ha of eucalypt plantations and a 30 MW biomass power plant (two 15 MW units). The power plant will generate electricity for supply to the Ramu grid using existing transmission lines. The preferred site for the power plant is located in the southeast part of the Project area.

1.2 Scope and Purpose

This Environmental Management Plan (EMP) applies to the power plant construction and plantation development activities as summarised in Chapter 2. The EMP serves to guide the MVB workforce in identifying, managing and mitigating potential environmental impacts that may result from these activities. In so doing, this document describes the environmental management framework that is required to identify and assess risks, implement appropriate mitigation measures, and monitor and evaluate their success to facilitate continual improvement.

It is a requirement for all MVB personnel and contractors to comply with the EMP.

The EMP will sit within the framework of the Integrated Management System (IMS) that is currently being developed as described in Chapter 5. The IMS will ultimately encompass all activities undertaken for the Project, from office-based work through to plantation establishment and harvesting, and operation of the power plant. From an environmental perspective, the IMS will also be consistent with Oil Search's policies, statutory obligations, and commitments made as part of the environmental assessment (EA) process in accordance with the requirements of the *Environment Act 2000*.

The IMS will be developed in line with the principles of relevant international standards such as ISO 9000 (quality and loss control), ISO 14000 (environment) and OHSAS 18000 (occupational health and safety), and will incorporate all aspects of MVB's documentation including policies, planning procedures, standard operating procedures (SOPs) and management prescriptions. The environmental aspects will be consistent with ISO 14001:2015, as reflected in the Australian and New Zealand equivalent AS/NZS ISO 14001:2016 (see Chapter 5).

[1] The entity name of Markham Valley Biomass Limited (MVB) will be changed to PNG Biomass Limited. However, for the purposes of this report, the former will be used. This EMP applies to the activities of both MVB and its subsidiary Markham Valley Power Limited (MVP).

PROJECT AREA LOCATION

PNG Biomass Markham Valley I Environmental Management Plan

FIGURE 1.1

Image Source: Google Earth.

2. Project Description

2.1 Eucalypt Plantations

The plantations will be developed and operated to comply with Forest Stewardship Council (FSC) sustainability criteria, and will use a fast-growing *Eucalyptus* tree species (*E. pellita*, which is indigenous to Papua New Guinea) or a hybrid species. Establishment of up to 16,000 ha of plantations within the Project area will occur over a seven-year period between 2017 and 2023, with the plantation area to be maintained indefinitely. During this initial phase, plantation establishment will be around 2,000 ha/year on average, with a maximum of 4,500 ha/year in 2019. The plantation area (which excludes non-planted areas such as roads, watercourses, villages, gardens and buffer zones) will be sufficient to supply biomass fuel to the 30 MW power plant. Plantations will be developed in a manner that is consistent with the development timeline of the power plant. Road upgrades and establishment of a large plant nursery will be associated with the plantations.

Plantation establishment will involve the following stages:

- Site clearing – primarily of grasslands and introduced raintrees. The latter will provide biomass supply to the new power plant for its first few years of operation.
- Site preparation – including soil cultivation and application of FSC-approved herbicides.
- Progressive planting of approximately 20 million tree seedlings (at 1,333 stems/ha) and application of chemicals (e.g., fertiliser, hydrogel, FSC-approved herbicides).
- Plantation management on a rotation with up to two coppice cycles.
- Mechanical harvesting with leaves, much of the bark and small branches left behind as mulch, while timber is transported to the power plant via trucks.

All timber will initially be grown for biomass for the power plant, with a supply contingency buffer. Commencing in Year 4, part of the plantation estate will be managed to generate timber for solid timber products such as veneer and sawlogs.

2.2 Biomass Power Plant

2.2.1 Construction

Construction of the initial 15 MW power plant unit will take about 26 months and will involve the following steps:

- Site preparation – providing site access and undertaking clearing, cut and/or fill, and site compacting, as well as establishing site drainage, roads/parking/fencing, and temporary laydown areas, warehouses and construction site offices/cabins (including stores, toilets and workers' eating facility).

- Building construction – including an administration building, weigh bridge building and truck scale, workshop and warehouse, control room and other facilities.
- Mechanical equipment, structures and pipework installation – including installation of pipe racks, piping, tanks, boiler, cooling water tower, water supply bores, water treatment plant and similar.
- Electrical and instrument installation – including installation of cables, cable trays, ducts, lighting, transformers, switchgear, lightning and earthing protection systems, plant lighting and fire detection and alarm systems, and similar.

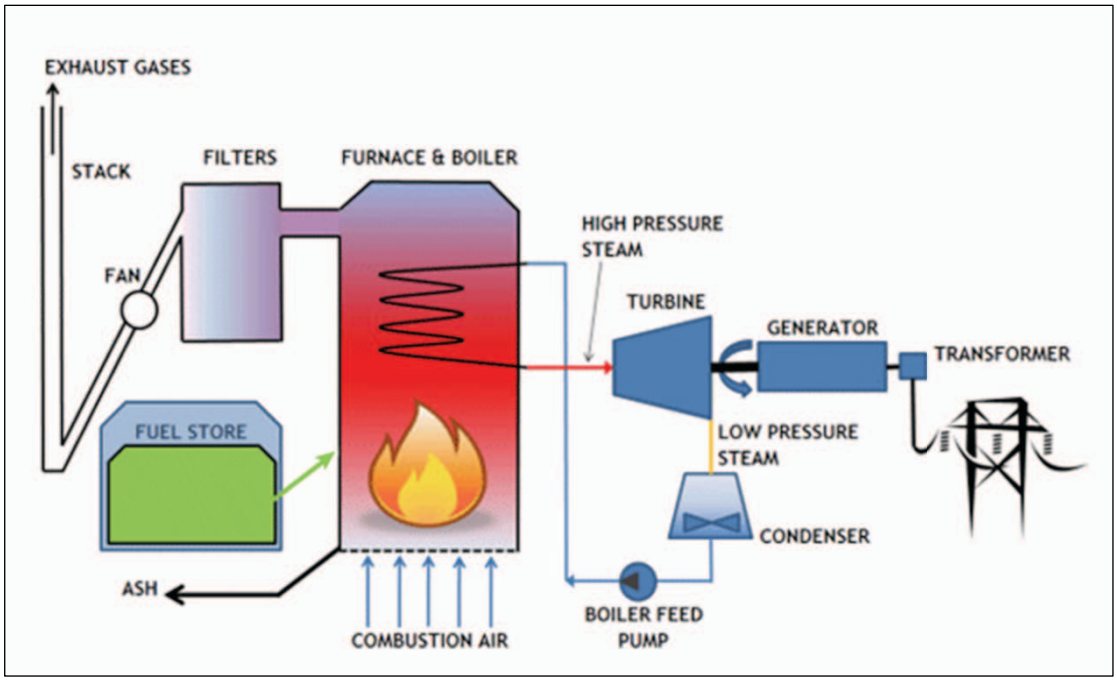
The power plant footprint that is initially established will allow for the second 15 MW unit, which will be constructed several years after the first unit.

2.2.2 Operation

Trees grown in the plantations will be used as biomass fuel for a 30 MW power plant consisting of two 15 MW modules, which will be located close to the Highlands Highway (see Figure 1.1) and an existing electricity transmission line. The power plant site (plus log yard) is expected to cover a total area of about 31 ha.

Each power plant module will consist of a biomass boiler and steam turbine (Plate 2.1), fuelled by wood chips supplied from the dedicated plantations. Fuel security is assured through the Project owning and operating the plantations in partnership with local landowners. The power plant will employ conventional thermal boiler technology. The proposed configuration of each module will be a single boiler and a single steam turbine. Cooling will involve a wet evaporative mechanical system, using water abstracted from groundwater bores installed on site.

Plate 2.1 – Biomass Power Plant Schematic



Source: AEL, 2016.

Key stages and aspects of power plant operation include:

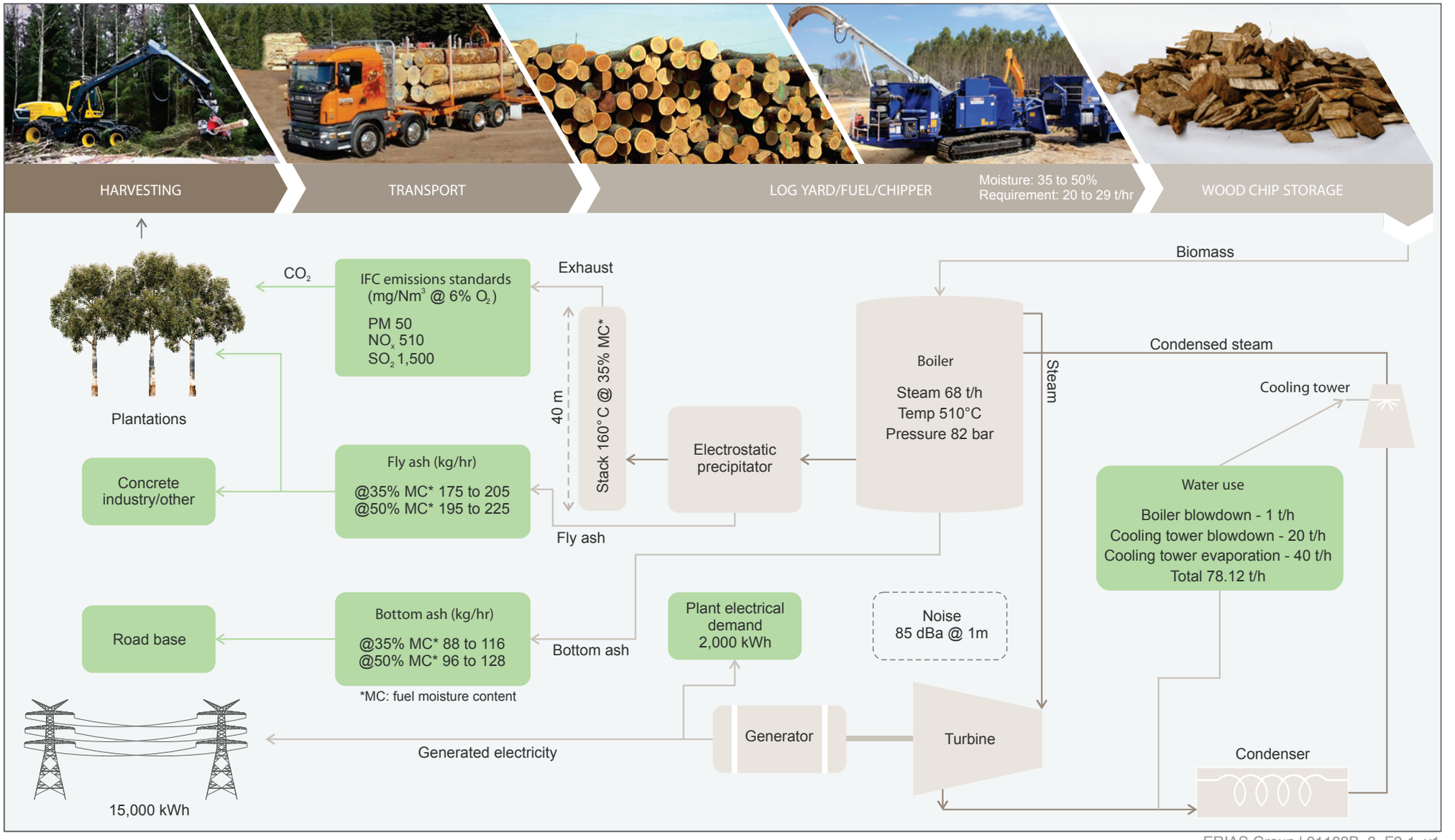
- Transport of biomass supply – biomass log demand (for the power plant) is expected to reach 175,300 BDMt/yr (bone dry metric tonnes per year) by 2023 and then be maintained at this level.
- Stockpiling and chipping – the biomass fuel (logs) will be brought to site by truck and placed in the log yard, which will have a capacity of around 90 days storage. The logs will be allowed to dry naturally before being chipped. The woodchips will be stored in the open (outdoor) storage yard, which will be sized for a storage capacity of 10 days at full capacity.
- Power generation – combustion of dry biomass will boil water in the power plant boilers to create steam, which in turn will drive turbines and generate electricity. High furnace temperatures will ensure that combustion is complete and that emissions are limited to applicable international standards. A proportion of the fly ash will be trapped in a dust collector, with the remaining material being collected in an electrostatic precipitator (ESP).
- Water input – total water required for use power plant is conservatively estimated to be about 160 t/h (0.044 m^3/s), and this is likely to be extracted from water bores to be constructed at the power plant site or next to the Markham River. Three 50% power plant capacity submersible raw water pumps may also be installed to allow raw water to be pumped from the Markham River to the pre-treatment plant as an alternative water supply.
- Emissions/discharges, including:
  - Steam and gaseous emissions, primarily from the power plant stacks.
  - Ash (two types) generated by combustion of biomass. ‘Fly ash’ may be incorporated within plantation area soils to enhance soil properties or sold to local industries as an input for concrete production, while ‘bottom ash’ can be used in road construction.
  - Wastewater discharges from the power plant, which will be treated before release to ensure that IFC discharge guideline values for thermal power plants (IFC, 2008) are met. This treated wastewater will either be used for irrigation or discharged to a man-made drainage line that reports to the Markham River.
- Generated electricity – the power plant will be connected to the Ramu grid through a Loop In Loop Out (LILO) interconnection arrangement which will assist grid stability. Power will be generated by the steam turbine generator at 11 kV and then delivered via a step-up transformer and a 132 kV circuit breaker to the grid connection.
- Maintenance – the power plant will be maintained at regular intervals to ensure minimal downtime and high reliability.

Project inputs and outputs are summarised in Figure 2.1.

PROJECT INPUTS AND OUTPUTS

PNG Biomass Markham Valley I Environmental Management Plan

FIGURE 2.1



3. Legislation, Policy and Guidelines

3.1 Context

This section describes the key PNG Government development goals and planning strategies, and environmental and socio-economic legislation and agreements that are relevant to the Project, along with international standards and principles that the Project has adopted. While minor aspects of many other acts and regulations will be relevant to the Project, such acts and regulations have only been listed rather than specifically discussed, as they do not relate directly to environmental project approvals or require specific action.

3.2 Constitutional Goals and Directives

The Project is consistent with the constitutional goals and directives of Papua New Guinea, which promote the development of its resources through various policies aimed at encouraging investment. While encouraging foreign investors, a priority of the PNG Government is that the people of Papua New Guinea must benefit from any such development.

As outlined in the Constitution of Papua New Guinea (PNG Government, 1975), key relevant aspirations and principles for the development of the nation are presented in Goals 2, 3 and 4:

> We declare our second goal to be for all citizens to have an equal opportunity to participate in, and benefit from, the development of our country.
>
> We declare our third goal to be for Papua New Guinea to be politically and economically independent, and our economy basically self-reliant.
>
> We declare our fourth goal to be for Papua New Guinea's natural resources and environment to be conserved and used for the collective benefit of us all, and be replenished for the benefit of future generations.

Markham Valley Biomass will ensure that use of skills and resources available in the local area, Morobe Province and, finally, the rest of Papua New Guinea is maximised, thereby providing opportunities for PNG citizens to participate in, and benefit from, the Project. In developing the plantations and power plant, the Project will provide significant employment opportunities during construction and operations, and will enhance the capacity of the local and/or regional workforce and infrastructure to support future development projects. This in turn will also contribute to the economy, employment opportunities, and longer term improvements in infrastructure and services. Furthermore, the Project will create employment in a region distant from conventional energy resources, in a manner that creates social, environmental and development opportunities for PNG citizens.

Development of the power plant will diversify the electricity supply industry in Papua New Guinea, which is currently dominated by hydropower, oil (diesel) and gas. The Project is therefore consistent with the PNG Government's initiatives and policies to provide a long-term energy solution that provides secure, sustainable, baseload power.

3.3 PNG Government Plans and Policies

In 2009, the PNG Government, through the National Strategic Plan Taskforce, released 'Vision 2050' (NSPT, 2009). This describes the country's long-term strategy and reflects the aspirations of Papua New Guineans, with the goal that Papua New Guinea will be ranked in the top 50 countries in the United Nations Human Development Index by 2050 (NSPT, 2009). The NSPT (2009) lists seven strategic areas, of which the development of the Project particularly aligns with the following:

- 1: Human Capital Development, Gender, Youth and People Empowerment.
- 2: Wealth Creation.
- 5: Environmental Sustainability and Climate Change.

In addition, the Project is consistent with the Papua New Guinea Development Strategic Plan (PNGDSP) 2010-2030 (DNPM, 2010), which states that the nation's long-term goal for energy development is that:

> All households have access to a reliable and affordable energy supply, and sufficient power is generated and distributed to meet future energy requirements and demands.

The Project will also contribute to PNGDSP and PNG Forest Authority goals and targets concerning forestry in Papua New Guinea.

Further to the PNGDSP, the PNG Department of National Planning and Monitoring has developed shorter-term initiatives in the form of medium-term development plans that have goals stemming from Vision 2050, aim to implement the PNGDSP, and are the benchmark for all sectoral, provincial, district and local level government plans. The Papua New Guinea Medium Term Development Plan 2016-2017 (DNPM, 2015) defines forestry assets as strategic and states that:

> …government investment will focus on developing and strategically positioning these assets to meet the needs of current as well as future generations of Papua New Guineans.

The Project also directly addresses a number of relevant PNG Electricity Industry Policy (PNG Government, 2011) objectives, particularly with regards to:

- Actively seeking landowner participation and establishing arrangements with landowners.
- Using technologies for electricity generation that are environmentally and socially sound (i.e., biomass power as opposed to fossil fuels).
- Emissions reduction (as discussed above), which qualifies the Project under the Kyoto Clean Development Mechanism or similar international emissions reduction schemes.

The Project will contribute to the local region, Morobe Province, and Papua New Guinea as a whole, in terms of economic, social and environmental sustainability benefits. As such, the Project aligns with the government's overall priorities.

3.4 Regulatory and Policy Framework

3.4.1 Environmental Legislation

The *Environment Act 2000* (the Act) prescribes requirements for proponents seeking environmental approvals for new developments or changes to existing developments, and is administered by the Conservation and Environment Protection Authority (CEPA). The related Environment (Prescribed Activities) Regulation 2002 (the Regulation) lists the types of approvals required for different levels of activities under the Act.

On 4 September 2015, MVB submitted to CEPA an application for an environment permit and notification of intention to carry out preparatory work. Subsequently, CEPA formally advised (by letter dated 8 March 2016) that the Project would be classified as a Level 2 (Subcategory 10.2) activity. Subcategory 10 relates to energy production, with clause 10.2 specifically addressing power stations:

> 10.2. Operation of fuel burning power stations with a capacity of more than 5 MW, but not including emergency generators.

As such, and in accordance with the Department of Environment and Conservation (DEC; now superseded by CEPA) Operational Procedure – Information Requirements for Permit Applications and Registration of Intention to Carry Out Preparatory Work (DEC, 2013) prepared in accordance with the Act (s.132), the Project prepared the following:

- An EA report reflecting the findings of baseline environmental and social studies.
- An EMP (this document) developed on the basis of the environmental risks posed to the identified environmental values, as well as mitigation and management measures required to minimise those risks.

Other associated and subsidiary Project activities also classified as Level 2, including the plantations, will be permitted under the umbrella of the approvals pursued for the main Level 2 activity. The Project EA report and EMP need to be consistent with Schedule 3 – General Guidelines on the Additional Information Required to Support a Permit Application for a Level 2 Activity (DEC, 2013).

Part VII of the Act provides for permits for the use of water resources in Papua New Guinea, including dams and diversions, discharges of wastes and/or contaminants, water investigations and the taking of water resources via specific conditions in an environment permit.

3.4.2 Forestry Legislation

The *Forestry Act 1991* (Forestry Act) (and its amendments from 1993, 1996, 2000 and 2005) is the primary piece of legislation governing the management, protection and use of forests and forest resources in Papua New Guinea. The Forestry Act is administered by the Papua New Guinea Forest Authority (PNGFA) and is supported by the Forest Regulation 1992 and the Forestry Regulation 1998 (in operation from January 1996).

Under the Forestry Act (Part IV), to engage in forest industry activities involving harvesting, chipping and selling of the finished timber product, MVB must be registered as a Forest Industry Participant (FIP). This FIP registration does not relate to the planting of the eucalypt plantations.

A Forest Clearing Authority (FCA) (s.90B of the Forestry Act) will also be required and MVB will apply for this prior to harvesting of the plantation trees.

3.4.3 Other Relevant Legislation

In addition to legislation discussed in Sections 2.4.2 and 2.4.3, the legislation, industry codes and plans listed in Table 3.1 are also relevant to the Project.

Table 3.1 – Other Legislation, Industry Codes and Plans Applicable to the Project

Environment
♦ *Conservation Areas Act 1978 and Conservation Areas (Amendment) Act 2014* ♦ Environment (Council's Procedures) Regulation 2002 ♦ Environment (Fees and Charges) Regulation 2002 ♦ Environment (Water Quality Criteria) Regulation 2002 ♦ Environment (Permits) Regulation 2002 ♦ *Fauna (Protection and Control) Act 1966, Fauna (Protection and Control) Act 1974 (Chapter 154)* and *Fauna (Protection and Control) (Amendment) Act 2014* ♦ *International Trade (Fauna and Flora) Act 1979 (Chapter 391)* and *International Trade (Fauna and Flora) (Amendment) Act 2014* ♦ *Plant Disease and Control Act 1953 (Chapter 220)* ♦ Public Health (Drinking Water) Regulation 1984 (Chapter 226)
Forestry
♦ *Forestry (Amendment) Act 1993* ♦ Forest Regulation No. 15 1992 ♦ Forestry Regulations 1996 ♦ *Forest (Timber Permits Validation) Act 2007* ♦ National Forest Policy 1991 ♦ National Forest Development Guidelines of 1993 ♦ National Forest Plan 1996
Protection and Preservation of Sites/Features of Archaeological and Cultural Heritage Significance
♦ *National Cultural Property (Preservation) Act 1965* and National Cultural Property (Preservation) Regulation 1965 ♦ *National Museum and Art Gallery Act 1992*
Land Acquisition and Compensation
♦ *Business Groups Act 1965* ♦ *Land Act 1996* ♦ *Land Dispute Settlement Act 1975* ♦ *Land Groups Incorporation Act 1974* and *Land Groups Incorporation (Amendment) Act 2009* ♦ Land Groups Incorporation Regulation 1974 ♦ *Land (Ownership of Freeholds) Act 1976* ♦ *Land Registration Act 1999* and *Land Registration (Amendment) Act 2009* ♦ Land Registration Regulation 1999 ♦ *Land Registration (Customary Land—Amendment) Act 2009* ♦ Land Regulation 1999 ♦ *Valuation Act (Chapter 327) 1967*

Table 3.1 – Other Legislation, Industry Codes and Plans Applicable to the Project (cont'd)

Power Generation, Transmission and Distribution
♦ *Electricity Industry Act (Chapter 76) 2002* ♦ Electricity Code ♦ Third Party Access Code ♦ Grid Code
Power Plant Construction
♦ *Physical Planning Act 1989* ♦ Physical Planning Regulation 2007 ♦ *Building Act (Chapter 301) 1971* ♦ Building Regulations 1994

In addition to the items listed in Table 3.1, a number of other acts and regulations may be of relevance to the Project in relation to matters such as public and workforce health and safety, and commercial and professional matters. These matters are beyond the scope of this EMP.

3.4.4 International Standards, Agreements and Guidelines

3.4.4.1 International Financing Standards and Guidelines

The EMP has been prepared to satisfy PNG regulatory requirements and be consistent with the requirements of the Equator Principles and associated International Finance Corporation (IFC) Environmental and Social Performance Standards (IFC, 2012).

The Equator Principles provide a risk management framework that is adopted by financial institutions for determining, assessing and managing environmental and social risk in large infrastructure and industrial projects. The principles refer to the IFC performance standards as well as the World Bank Group Environmental, Health and Safety (EHS) Guidelines.

The IFC performance standards (IFC, 2012) are directed towards project proponents and provide guidance on how to identify and manage environmental and social risks and impacts. They also establish the standards that proponents are to meet throughout the life of an investment by the IFC.

The World Bank Group EHS Guidelines are technical reference documents that are specifically referred to in the performance standards and provide both general and industry-specific examples of good industry practice. The General EHS Guidelines provide guidance to users on common EHS issues that are potentially applicable to all industry sectors (IFC, 2007) and should be used in conjunction with the relevant industry sector guidelines, e.g., the thermal power plants guideline (IFC, 2008).

3.4.4.2 Forest Stewardship Council

The Forest Stewardship Council (FSC) is an independent, not for profit, non-government organisation, which is dedicated to the promotion of responsible forest management. The FSC Principles and Criteria (P&C) describe the essential elements or rules to support environmentally appropriate, socially beneficial, and economically viable management of the world's forests. There are ten principles, each supported by several criteria that provide a way of judging whether the principle has been met in practice, thereby forming the basis of FSC certification of forest

management. All ten principles and criteria apply to all forest types and to all areas within the management unit included in the scope of the certificate, and must be applied to any forest management unit before it can receive FSC certification. The P&C are not specific to any particular country or region; they are applicable worldwide and are relevant to forest areas and different ecosystems, as well as cultural, political and legal systems.

The FSC's 2010 National Forest Management Standards for Papua New Guinea (FSC, 2010) is an adaptation of the FSC P&C (FSC's International Standard) in relation to the specific conditions in Papua New Guinea. The National Forest Management Standards for Papua New Guinea set the principles, criteria, indicators and verifiers by which all forest operations in the country can be judged, and are tailored to reflect the country's unique social, economic and environmental situation.

The ten principles of the National Forest Management Standards for Papua New Guinea – including requirements to conserve environmental values, maintain high conservation forests, and manage plantations in a manner than complements sustainable management of natural forests – have been taken into account by the Project.

The 2010 version of the National Forest Management Standards for Papua New Guinea is currently under review and a 2016 draft version has been released for public consultation (FSC, 2016). Finalisation of the document will occur in the first half of 2017, and subsequent approval by FSC is likely to occur in Q4 2017 (Dam, pers. com., 2017).

The FSC's position on plantations (FSC, 2014) is described as:

> FSC supports the responsible use of plantations as a strategy to complement conservation and the sustainable use of natural forests. While plantations cannot replace the richness, stability and beauty of natural forests or the complexity of the services they provide, applying the FSC standards to them ensures that their management is defined by transparency and fairness and minimizes negative environmental and social effects.

This allows for plantation certification, apart from any plantation that was established as a result of forest conversion after 1994, and efforts have been made by the FSC over the past decade to better integrate its requirements for plantation management into those that apply to all types of forests.

3.4.4.3 International Conventions, Treaties and Protocols

Relevant international treaties, conventions and protocols that the PNG Government has signed, ratified or acceded to, are shown in Table 3.2.

Table 3.2 – Applicable International Conventions, Treaties and Protocols

Title	Summary/Objective
Paris Agreement (2015)	Strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C

Table 3.2 – Applicable International Conventions, Treaties and Protocols (cont'd)

Title	Summary/Objective
Kyoto Protocol to United Nations Framework Convention on Climate Change (1997)	Stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system Places onus on industrialised (Annex 1) countries to reduce emissions; developing countries such as Papua New Guinea are exempt from this requirement
Vienna Convention for the Protection of the Ozone Layer (the Vienna Convention) (1993) and the Montreal Protocol on Substances that Deplete the Ozone Layer (1992)	Protect the ozone layer
Convention to Ban the Importation into Forum Island Countries of Hazardous Wastes and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes Within the South Pacific (Waigani Convention) (2001)	Reduce and eliminate transboundary movements of hazardous and radioactive waste, to minimize the production of hazardous and toxic wastes in the Pacific region and to ensure that disposal of wastes in the Convention area is completed in an environmentally sound manner
Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel Convention), 1989	Protect human health and the environment against the adverse effects of hazardous wastes
Stockholm Convention on Persistent Organic Pollutants (POPs) (2004)	Protect human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of humans and wildlife, and have harmful impacts on human health or on the environment)
International Tropical Timber Agreement (ITTA, Geneva), 2006	Promote the expansion and diversification of international trade in tropical timber from sustainably managed and legally harvested forests and to promote the sustainable management of tropical timber producing forests This replaces the International Tropical Timber Agreement, 1994
Convention on Biological Diversity (1993)	Preserve and sustain biological diversity, sustainable use of its components and the fair and equitable sharing of benefits from genetic resources
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (RAMSAR Convention), 1971 and the international regime for the 'conservation and wise use' of wetlands and waterfowl populations	Halt the worldwide loss of wetlands and promote the conservation and wise use of all wetlands through cooperative management
Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora (1975)	Ensure that international trade in specimens of wild animals and plants does not threaten their survival
International Plant Protection Convention (Rome), 1951 (revised 1997)	Prevent and control the introduction of pests of plants and plant products
Convention for the Safeguarding of Intangible Cultural Heritage (UNESCO) (2003)	Safeguard intangible cultural heritage, ensure respect for the intangible cultural heritage of the communities, groups and individuals, and raise awareness at the local, national and international levels of the importance of intangible cultural heritage

Table 3.2 – Applicable International Conventions, Treaties and Protocols (cont'd)

Title	Summary/Objective
Convention Concerning the Protection of World Cultural Heritage and Natural Heritage (1972)	Identify, protect and conserve cultural and natural heritage

3.4.4.4 Industry Standards and Codes of Practice

Project adherence to standards and guidelines will follow a hierarchical approach:

1 Applicable Papua New Guinea acts, regulations and standards.
2 International standards and guidelines.

The Papua New Guinea Logging Code of Practice (PNGFA/DEC, 1996) and, where appropriate, the Forest Practices Code developed by Tasmania's Forest Practices Authority (2015) will be used by the Project.

In the absence of PNG standards or where additional guidance is warranted alongside the use of PNG standards, internationally recognised standards and guidelines will be applied including, for example, those developed by the Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand (e.g., ANZECC/ARMCANZ, 2000), the World Health Organization (e.g., WHO, 2011) and the International Finance Corporation (e.g., IFC, 2012).

3.5 Company Policies and Standards

Markham Valley Biomass is committed to operating the Project in a manner that meets the environmental and social sustainability principles that Oil Search (as the owner of MVB) has developed through its Health, Safety, Environment and Security Policy (Box 3.1) and its Social Responsibility Policy (Box 3.2).

Box 3.1 – Oil Search Health, Safety, Environment & Security Policy

Oil Search

Health, Safety, Environment & Security Policy

Oil Search is committed to achieving incident free operations through the provision of effective Health, Safety, Environmental and Security (HSES) Management across all of its operations and worksites that benefit employees, contractors and the community.

The Company is committed to:

- Promoting HSES objectives, leadership, responsibilities and behaviour as an integral part of the duties of management and all employees;
- Complying with applicable laws and other obligations and requirements that the company subscribes to, and where adequate laws do not exist, adopting and applying standards that reflect Oil Search's commitment to HSES outlined in this policy;
- Reporting and evaluating risks, threats, hazards and impacts to company operations that have the potential to adversely affect the environment or the health and safety of employees, contractors or the community;
- Implementing appropriate control and contingency measures to prevent pollution and minimise and manage these risks, threats, hazards and impacts to an acceptable level;
- Establishing and ensuring that standards are followed and effective practices promoted to ensure that the environment, people, property and information are protected from harm;
- Selecting and engaging contractors whose management systems are acceptable to Oil Search and whose commitment to this policy is clearly and continuously demonstrated;
- Providing competent human resources to manage relevant aspects of health, safety, environment or security;
- Communicating openly with all stakeholders on HSES related issues;
- Providing training, instruction and supervision to personnel to enable them to attain the knowledge and skill levels necessary to perform their work incident free;
- Maintaining appropriate contingency arrangements;
- Continually monitoring, reviewing and improving HSES performance and associated management systems so that our activities can continue without interruption and;
- Ensuring that oversight of accident, incident and near miss investigations is assumed by the appropriate executive manager and that those investigations are conducted to a level of detail that is appropriate to the event's actual and potential severity.
- A consistent and equitable approach to the prevention of HIV among employees, families and their communities; the management of the consequences of HIV including the care and support of employees and their families; and protecting the rights of employees living with HIV from discrimination, victimisation or harassment.

Every employee and contractor working for the Company has a responsibility to promote a culture whereby their actions and those of their colleagues are consistent with this Policy.

Richard Lee
Chairman

Peter Botten
Managing Director

EMS-PRO-000006 Updated: 7 December 2015

Box 3.2 – Oil Search Social Responsibility Policy

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Oil Search

Social Responsibility Policy

With operations in environmentally, culturally and socially sensitive locations, Oil Search's commitment to social responsibility stems from a culture that strives for the highest ethical, social and moral values and a desire to be recognised as delivering "excellence in socially responsible oil and gas exploration and production".. We set ourselves apart from our peers by our sustainable development approach and our ability to contribute positively and creatively to the growth and development of communities in which we operate.

The Company is committed to:

- Operating with integrity at all times as well as adopting and advocating for principles, practices and standards that respect diversity, local culture, human rights, labour rights, women's protection and empowerment, and the environment, and which contribute towards combatting corruption;
- Generating shared value by ensuring positive, sustainable outcomes for the communities in which we operate, while at the same time ensuring secure and continued operations and being mindful of our responsibility to shareholders and other stakeholders;
- Maintaining and enhancing our social license to operate through high levels of stakeholder engagement; establishing and maintaining strong and mutually beneficial community relationships; leaving a long-term positive social development legacy; and monitoring the impact of our activities on our project area communities;
- Continuous performance improvement by continuing to grow and leverage our social responsibility capability; seeking ways to enhance our approach; and improving measurement and reporting of performance.
- Seek ways to manage natural resources responsibly by minimising our environmental impact and operating in an environmentally sustainable way by adoption of the precautionary principle and giving consideration to effective and efficient use and re-use of resources and;
- Upholding the Ten Principles of the UN Global Compact, the Voluntary Principles for Security & Human Rights, and contributing to the progress of the Sustainable Development Goals in its countries of operation.

To achieve this commitment, Oil Search will:

- Ensure governance systems are in place to oversee, monitor, measure, report and drive social responsibility performance and decision making including social responsibility objectives and leadership responsibilities.
- Comply with all social and environmental laws, regulations and obligations and, where these do not exist adopt and apply standards that are in alignment with the intent of this policy and internationally accepted norms of behaviour.
- Proactively identify, evaluate, transparently report and manage any risks, threats or impacts related to our operating context that have the potential to adversely affect the environment, the well-being of the local community or our social license to operate. Appropriate control and contingency measures will be adopted to minimise and manage concerns and opportunities.
- Use our sphere of influence to advocate for the commitments contained in this policy, including but not limited to our supply chain and local content.

Every employee and contractor working for the Company has a responsibility to promote a culture whereby their actions and those of their colleagues are consistent with this Policy.

Richard Lee
Chairman

Peter Botten
Managing Director

EMS-POL-000009 Approved: 7 December 2015

4. Environmental and Social Setting

4.1 Environmental Setting

4.1.1 Physical Environment

The Project area is situated on broad, flat alluvial plains associated with the Markham River and its tributaries, where the river flows in a generally west to east direction and forms the area's southern border (see Figure 1.1). The area itself straddles the northern floodplain of the Markham River between Leron and Nadzab, and encompasses the Leron, Erap, Rumu and Maralumi sub-catchments. These four main waterways are all considered to be ephemeral.

The geology of the Project area is relatively young, deep Quaternary alluvial fan deposits, consisting of rounded coarse gravels, sand and silt laid down during both the Pleistocene and Holocene periods. The area is seismically active, with seismicity of up to 7.0 M_W recorded along the northern margin of the Markham Valley.

Soils vary across the Project area but are generally deep alluvial deposits consisting of well to imperfectly drained, undifferentiated soils subject to seasonal moisture stress due to low water holding capacity.

The Project area has a tropical climate with distinct wet (October to April) and dry (June to August) seasons. Annual rainfall for the Project area is in the range of 1,200 to 1,400 mm. Rainfall varies considerably between years, and also between different locations within the Markham Valley. Mean annual maximum temperature in the Project area is around 31°C, with the coolest months being June to September (mean monthly maximum of 29.2°C). Wind speeds are generally light to moderate, most frequently from the east and associated with the southeast trade winds from May to October.

The Markham River has a braided form along its entire length, with the braids, islands and bars of the river channel continually changing. The four sub-catchments in the Project area consist of very steep headwaters, draining onto flat alluvial fans, which is indicative of very high sediment loads. However, in addition to sediment-rich and turbid waterways, a number of smaller clearwater streams appear to originate downslope of the fans produced by the high-energy headwater streams.

Water quality in the Project area is generally consistent with similar watercourses elsewhere in Papua New Guinea, i.e., generally good quality water in terms of maintaining aquatic ecosystems and potentially providing drinking water for local communities, but with elevated suspended solids concentrations in some rivers and elevated faecal coliform levels at most sites. Similarly, sediment quality is consistent with other similar watercourses in Papua New Guinea, and is indicative of generally good sediment quality in terms of maintaining aquatic ecosystems.

Groundwater in the area comprises two main types: deep (4 to 70 m) and shallow (0 to 3 m). Deep groundwater movement is not related to the surface drainage, in contrast to the lateral movement of shallow groundwater. The water table fluctuates seasonally and reflects rainfall patterns with a delayed response time, with recent data indicating a maximum increase in groundwater depth during the dry season of a little more than 2 m. Groundwater quality is 'fresh', i.e., total dissolved solids (TDS) levels are less than 500 mg/L, with generally alkaline or near-neutral pH values. Hardness is variable, ranging from soft through to very hard, with the latter being more common.

Background air quality is expected to be generally good with negligible concentrations of gaseous pollutants, reflecting the Project's location and the virtually complete absence of nearby industrial sources. Potential particulate matter air pollutants are expected to be low, although not negligible. The ambient background noise levels are expected to be consistent with insects, heavy rain, birds, domestic animals, wind noise in foliage, and typical village domestic activities.

4.1.2 Biological Environment

The Project area is dominated by vegetation in a degraded, highly modified condition, with natural vegetation being an extremely limited component of the landscape. No intact vegetation was recorded during a terrestrial ecology survey of the area. No Kunai grassland habitats within the Project area are considered to be in a natural condition due to the importance of anthropogenic influences in the origin and maintenance of such grasslands. No critically endangered or endangered flora species have been detected and none are considered likely to occur. Furthermore, no habitat areas of significant importance to endemic or restricted-range species were identified and there is no evidence to suggest that habitats support key evolutionary processes, most of which have been substantially modified by repetitive anthropogenic disturbance. No forest in the Project area qualifies as High Conservation Value Forest.

Four main terrestrial fauna habitat types have been characterised within the Project area: alluvial forest and woodland; grassland; watercourses and wetlands; and highly disturbed anthropogenic habitats. A field survey recorded a total of 89 terrestrial vertebrate fauna species, and discussions with local informants identified at least a further 10 mammal species, 8 bird species and 5 reptile species that are likely to occur in the Project area. Anabat detectors identified the presence of 8 microbat species. However, no threatened or near-threatened terrestrial vertebrate fauna species were detected and no threatened or near-threatened species are considered likely to occur in the area. Two introduced fauna pest species, the giant African snail (*Achatina fulica*) and cane toad (*Bufo marinus*), were common throughout the survey area and were the only fauna trapped.

Four broad aquatic habitat types have been characterised within and near the Project area that reflect factors including bed structure, sediment loads and hydrology. Fish species recorded from the Project area are characteristic of lowland rivers and tributaries in northern Papua New Guinea. Fish species richness (16 species total) in the Project area is within the range of that recorded from previous surveys in the Lower Watut and Markham rivers (11 to 21 species). However, the generally reduced diversity of in-stream and off-river habitats, the turbid and semi-ephemeral nature of streams in the Project area are expected to limit fish species diversity. Introduced fish species dominated at a number of sites, and introduced exotic and translocated fish species represent a major stressor on the system.

4.2 Socio-economic Setting

The Markham Valley, within which the Project is located, runs through the centre of Morobe Province. Morobe Province is headquartered in Lae and occupies an area of 33,525 km^2, extending from the Owen Stanley Range northeast across two major fault valleys to coastal ranges and offshore islands. The province is one of the three most populated provinces in Papua New Guinea and contains almost 9.3% of the country's total population (674,810 persons in the 2011 census).

The Highlands Highway connects the Project area and Lae, and has a network of smaller feeder roads. The power plant site is located about 10 km west of Lae Nadzab Airport.

The Project area is inhabited by a single language group (Wampar). Wampar social organisation is based around membership of clan (*sagaseg*) and patrilineal[2] lineage groupings. Nine clans have been identified, although each Wampar village has a multi-clan composition. Previously, these groups were physically demarcated within the settlement, but today clans-people are intermixed residentially.

As a result of over a century's exposure to mission activity, many of the Wampar are converts to various denominations, including Seventh Day Adventists, the Assemblies of God, the Lutheran Renewal and PNG Revival churches. Despite this, traditional beliefs persist with regards to malicious spirits and agencies (*masalai*), which are believed to inhabit rivers, rocks and big trees. Further, traditional beliefs endure regarding sorcery and angry ancestral spirits as the source of sickness and death.

Wide variation in income levels occurs across Project area households. Sale of agricultural products and trade store ownership are the main sources of income, with the local villagers also often receiving income from relatives or friends who receive a wage. Cash income levels in the study area are generally high to very high by rural Papua New Guinea standards, but vary depending on the proximity of communities to the Highlands Highway, the 40 Mile and 41 Mile markets, and other key service centres such as Wawin National High School, and their cultural-linguistic affiliation. Disparities also occur within communities, where these reflect different levels of access to agricultural land, particularly for perennial tree or cash cropping activities.

The proximity of the Project area to Lae, and the longevity of exposure to contact, has meant there has always been a number of people moving into the area from surrounding provinces and rural enclaves. Wampar social networks have been influenced for more than a century by the links the population has had with the occupants of Lae.

Health services and infrastructure, education infrastructure, and other services that concern matters such as law and order, banking and various urban facilities are available to varying degrees either in the Project area or in Lae.

Three broad land use categories occur within the Project area: smallholder agriculture, capital agriculture and 'no' agriculture. Most Wampar people maintain gardens that supply food for their families (i.e., smallhold agriculture). The dominant staple crop is triploid banana (*kalapua* variety),

[2] Relationships are traced through the father of a family.

a high-yielding cultivar that tolerates poor and challenging growing conditions. Gardens usually also include sweet potato, taro and diploid banana (often inter-planted with corn, sugarcane and greens), as well as yam and cassava. Chinese taro (another hardy staple species) is often planted beneath triploid banana. A number of other fruits and vegetables and perennial tree crops are also commonly planted in gardens, and some are planted in older gardens, areas of woody regrowth and near residences in established settled areas. Sago is the most important staple food not grown in garden plots.

Local communities make extensive use of other natural resources, with relevant activities including foraging, hunting and fishing. These natural products used include bark, cane, clay, flowers, grass, leaves, river stones, sap, seeds/fruits, timber and vines/stems. Village chickens and pigs are kept for sale and self-consumption (particularly on special occasions), and some families raise cattle (for meat) and horses (for riding). Households buy only very small quantities of locally grown food; markets are primarily used for convenience or 'top-up' purposes. Processed foods are also purchased and can constitute between a third and one half of some families' diets, particularly rice, tin fish and meat, noodles, salt and cooking oil.

Food shortage is not a major issue for villagers in any of the communities surveyed, with people generally reporting surplus production and a ready market for most of their crops in Lae. Any disruption to their food supply is readily compensated by purchased food, particularly imported rice and flour.

Beyond subsistence gardening, the market economy in the area is increasingly important and many Wampar are engaged in commercial activities including the services economy and agribusiness/capital agriculture. However, this is constrained by the fact that most land within the Project area has low agricultural potential caused by poor soils, low (within the PNG context) average annual rainfall, a long dry season, and frequent inundation in floodplain areas.

Sixty two cultural heritage and archaeological sites have been identified in the Project area during Project-specific surveys, although none were associated with the proposed power plant site.

Ecosystem services are benefits that ecosystems provide to people. For the Project area, resource use or 'provisioning' services are key, where these include:

- Fresh water (including groundwater) for drinking, washing and similar.
- Food from crops or livestock (domestic or commercial), wild fish catch, and hunting/foraging (as discussed above).
- Biological raw materials from plants and animals for non-food uses (e.g., wood products, hemp, rope, leather, flowers).
- Other services, such as biomass fuel for energy production (wood, charcoal, dung), genetic resources used for animal breeding/plant improvement, and natural medicines and biocides from plants.

5. Environmental Management Framework

5.1 Background

Markham Valley Biomass is developing an integrated management system (IMS) that, as well as addressing other areas of the Project, will contain elements of an environmental management system (EMS) that are consistent with the requirements of AS/NZS ISO 14001:2016 (Environmental Management Systems). The management system is being developed in a staged manner that is commensurate with Project activities.

The environmental management elements required to manage power plant construction and plantation development are described in this chapter. As the Project proceeds to power plant operation, these will evolve into a whole-of-project EMS as part of the broader IMS.

AS/NZS ISO 14001:2016 specifies that an EMS should consist of the following, which are tailored specifically to the activities of the business: leadership, planning, support and operation, performance evaluation, and improvement.

These elements as they relate to the Project are described in the following sections.

5.2 Leadership

The leadership element, as described in AS/NZS ISO 14001:2016, encompasses leadership and commitment, environmental policy, and organisational roles, responsibilities and authorities.

Oil Search is committed to managing its activities in Papua New Guinea in an environmentally and socially responsible manner that is consistent with the environmental and social sustainability principles that it has developed through its Health, Safety, Environment and Security Policy (see Box 3.1) and its Social Responsibility Policy (see Box 3.2), as well as those of the PNG Government. This commitment is equally applicable to MVB.

These policies provide the framework for the Project's approach to environmental management and establish the principles and goals for environmental performance against which the effectiveness of the system will be evaluated. Oil Search, as Project proponent and operator, holds full and ultimate responsibility for the implementation of these policies. These responsibilities will be clearly explained to all Oil Search/MVB personnel and in turn to primary contractors and sub-contractors.

The MVB Stakeholder Engagement Manager is accountable for ensuring compliance with national legislation, the Project’s environment permit, and company environmental policies.

The key roles and responsibilities to ensure protection of the environment and to meet environmental objectives for the Project are described in Table 5.1.

Table 5.1 – Environmental and Social Performance Management Responsibilities

Role	Responsibility
Corporate (Markham Valley Biomass)	
Project Director	♦ Ensure that Project activities are completed in an environmentally and socially responsible manner ♦ Ensure that the Project is compliant with the EMP ♦ Suspend works should an incident cause, or have the potential to cause, serious environmental harm or in instances where the environment is deemed to be at risk ♦ Participate in the annual review process of the EMP and the EMS
Stakeholder Engagement Manager	Environmental: ♦ Report to the Project Director ♦ Provide environmental leadership, advice and support ♦ Implement the relevant components of the Project's management system and demonstrate commitment to Health, Safety, Environment and Security (HSES) and Social Responsibility (SR) policies and objectives ♦ Define roles and responsibilities, and allocate resources, to ensure that environment permit requirements, as well as other compliance requirements, are implemented and maintained during Project activities ♦ Ensure that all personnel and contactors are aware of their obligations under the EMP ♦ Ensure that sufficient resources are available to support the implementation of the Project's management system ♦ Ensure that contractors are aware of the conditions and requirements of the Project's environment permit and integrate these in their terms and condition and operations ♦ Monitor, evaluate and review the suitability and effectiveness of the EMP, update accordingly and take appropriate preventive and corrective actions in case of unsatisfactory environmental performance ♦ Ensure that all required environment permits are acquired, maintain a permits register, and monitor adherence to the relevant environmental legislative requirements, commitments, conditions and procedures ♦ Oversee environmental monitoring plans and studies, and relevant databases ♦ Ensure that EMP compliance audits are conducted ♦ Ensure that contractors are competent and adequately trained and resourced to implement requirements of the EMP ♦ Liaise closely with the contractors' Health, Safety, Environment (HSE) officers concerning environmental performance and management ♦ Review environmental audit results and determine corrective actions, if any, to ensure continual improvement ♦ Ensure that corrective action requests or incident response actions are completed in the specified timeframe. ♦ Review and approve Environmental Performance Reports ♦ Lead the annual review process of the EMP and management system
	Stakeholder engagement: ♦ Develop and maintain good working relations with stakeholders ♦ Develop and implement stakeholder activities as per stakeholder engagement plan ♦ Support the organisation and participate in meetings and consultations with stakeholders ♦ Liaise with key regulatory stakeholders (e.g., CEPA, PNGFA) in the event of an incident or unplanned event ♦ Act as key contact person, communicator and conduit between stakeholders and MVB, receiving requests and/or complaints, managing issues and providing information and feedback

Table 5.1 – Environmental and Social Performance Management Responsibilities (cont'd)

Role	Responsibility
Corporate (Markham Valley Biomass) (cont'd)	
Stakeholder Engagement Manager (cont'd)	♦ Ensure that the grievance and complaint procedure is implemented and understood by all stakeholders ♦ Identify and provide alerts on areas of concern such as environmental, security and other issues
All other personnel	♦ Conduct all activities in compliance with the EMP, as well as applicable legislation and statutory obligations ♦ Follow good housekeeping procedures and work practices ♦ Report all incidents to the stakeholder engagement manager or contractor HSE officers, as applicable ♦ Ensure that any corrective action requests, or incident response actions, nominated to specific personnel are completed within the specified timeframe ♦ Actively participate in tool box talks, lessons learned sessions, and technical and environmental safety awareness initiatives
Contractors	
HSE officers	♦ Ensure that relevant environmental legislative requirements, commitments, conditions and procedures are being applied consistently across all relevant site activities ♦ Provide resources to ensure that environment permit requirements, as well as other compliance requirements, are implemented and maintained during Project activities ♦ Maintain clear communication with other contractors and MVB on environmental issues ♦ Conduct and coordinate emergency response training, including in the use of spill response equipment ♦ Perform environmental incident investigations ♦ Oversee environmental audits ♦ Monitor and verify closeout of corrective actions arising from environmental audits ♦ Ensure that stocks of spill clean-up and response equipment are regularly checked and replenished to ensure appropriate supply quantities are on hand at all times ♦ Attend and participate in daily toolbox talks. Suggest preventive and corrective measures and provide feedback on their implementation ♦ Perform routine inspections to ensure equipment functionality and compliances with permit conditions ♦ Implement waste management plan and maintain register of waste and garbage ♦ Ensure that environmental matters are a regular agenda item in HSE meetings ♦ Examine all certification and maintenance records to assess their validity ♦ Conduct and coordinate HSES and SR inductions for all new contractor employees ♦ Conduct and coordinate emergency response training, including in the use of spill response equipment ♦ Report to MVB's stakeholder engagement manager on environmental performance, such as waste management activities, wastewater and drainage control, spill prevention activities and general housekeeping
All other personnel	♦ Conduct all activities in compliance with the EMP, as well as applicable legislation and statutory obligations ♦ Follow good housekeeping procedures and work practices ♦ Report all incidents to the MVB stakeholder engagement manager or contractor HSE officers, as applicable ♦ Ensure that any corrective action requests, or incident response actions, nominated to specific personnel are completed within the specified timeframe ♦ Actively participate in toolbox talks, lessons learned sessions, and technical and environmental safety awareness initiatives

Different contractors will be engaged during the construction phase to execute various activities. It is therefore essential that each contractor (and sub-contractor) is inducted to the requirements of the EMP to ensure compliance with their environmental obligations.

Each contractor (and sub-contractor) will be responsible for ensuring full environmental compliance within their area of responsibility and control. Each contractor will therefore provide MVB with its detailed EMPs, as specified in this EMP, together with their environmental organisation and responsibilities, to ensure it is aligned with MVB's expectations and the requirements of the Project. The delivery of these EMPs will be a requirement under the terms and agreement to perform services.

The MVB Project team is ultimately accountable for the implementation of the EMP. However, the construction contractors and any person engaged by MVB to undertake any aspects of construction of the Project, including sub-contractors engaged by the main contractor, also bear this responsibility.

5.3 Planning

Planning requirements include:

- Identifying:
  - The environmental aspects[3] related to Project activities managed under this EMP, taking into account possible changes, abnormal conditions and reasonably foreseeable emergency situations.
  - Compliance obligations applicable to environmental and social management of Project activities.
  - Risks and opportunities that need to be addressed.
- Establishing, implementing and maintaining environmental and social objectives relevant to Project activities, and determining how these can be achieved.

This document incorporates these requirements into the EMP structure as follows:

- Environmental aspects are identified in Table 5.2 and further discussed in Chapter 6.
- Legal and other requirements are detailed in Chapter 3.
- Environmental objectives and associated targets and programs (i.e., mitigation procedures) are presented in Chapter 6.

[3] This is defined in AS/NZS ISO 14001:2016 as 'element of an organization's activities or products or services that interacts or can interact with the environment'. That document further notes that an environmental aspect can cause an environmental impact.

Table 5.2 – Key Project Environmental Aspects and Potential Impacts

Project Environmental Aspect	Potential Impact
Air emissions from operating machinery and equipment, where these can include dust, combustion emissions (from wood and diesel fuel), volatile fuels, particulates from fires and other fugitive emissions	Air quality; sensitive receptors
Air emissions from operating machinery and equipment, where these can include combustion emissions (from wood and diesel fuel), volatile fuels and other fugitive emissions	Greenhouse gases
Soil erosion and sedimentation from establishing plantations, access roads (including watercourse crossings), laydown areas, and other areas of vegetation clearing and ground disturbance, and harvesting plantations	Surface water quality, bed sediment quality, freshwater and/or terrestrial habitats/flora/fauna, ecosystem services
Disturbance of cultural heritage and/or archaeological sites due to vegetation clearing and ground disturbance	Local communities, archaeological community
Noise and light spill from construction works and from operating miscellaneous items of machinery and equipment	Sensitive receptors
Generation and disposal of waste soil and rock from construction activities	Surface water quality, bed sediment quality, freshwater and/or terrestrial habitats/flora/fauna, ecosystem services
Use of hydrocarbons (e.g., fuels, oils) and chemicals (e.g., solvents, cleaning fluids, herbicides)	Surface water quality, bed sediment quality, groundwater quality, freshwater and/or terrestrial habitats/flora/fauna, ecosystem services
Generation of non-hazardous waste	Surface water quality, bed sediment quality, freshwater and/or terrestrial habitats/flora/fauna, ecosystem services
Use of surface water and/or groundwater during construction and operations, and related wastewater discharges (e.g., from the holding pond) and runoff of turbid water	Surface water hydrology, groundwater quantity/hydrogeology, surface water quality, bed sediment quality, freshwater habitats/flora/fauna, ecosystem services
Introduction of invasive alien species (including introduced pests and pathogens) through personnel and equipment movements, and plantation establishment	Freshwater and/or terrestrial habitats/ flora/fauna, ecosystem services
Project physical presence and land alienation	Terrestrial habitats/flora/fauna, ecosystem services, visual amenity
Major accidental event (e.g., forest fire, vehicle collision)	Surface water quality, bed sediment quality, freshwater and/or terrestrial habitats/flora/fauna, ecosystem services

Environmental aspects listed in Table 5.2 can potentially adversely impact on local flora and fauna. For example, vegetation clearing, air and noise emissions, and introduction of invasive alien species can all have deleterious effects on biodiversity conservation values. Similarly, soil erosion, use of hydrocarbons and chemicals, management of waste soil and rock, and general waste management can all affect water quality in local watercourses and the associated beneficial values.

5.4 Support and Operation

5.4.1 Resources

As noted in Table 5.1, a key task for both the stakeholder engagement manager and the contractors' HSE officers is to provide resources to ensure that environment permit requirements, as well as other compliance requirements, are implemented and maintained during Project activities.

5.4.2 Competence and Awareness

Contractors will ensure that their personnel are fit for work and are appropriately trained, qualified and experienced to perform the tasks required, taking into account relevant environmental aspects and issues.

Contractors will develop management procedures for relevant Project activities. These procedures will detail key safety mechanisms that include but are not limited to the following:

- Inductions.
- Safety meetings.
- Reporting lines.
- Permit to Work system.
- Job safety analysis.
- Hazard and management control.
- Hydrocarbon and chemical spill contingency.

Personnel will similarly undergo an environmental induction to inform them of their obligations and Project-specific environmental management procedures. Environmental inductions will be linked to safety inductions for efficiency, with additional training undertaken on an as-needs basis. Inductions will address relevant policies, legislative and regulatory compliance, local environmental sensitivities including the environmental aspects and issues described in Chapter 6, the specific roles and responsibilities of personnel in relation to environmental management and performance, chains of command and communications, and the implications of not conforming with the Project's requirements. In terms of issue-specific management procedures, the inductions and subsequent training will address matters including, but not limited to, the following:

- Cultural heritage and archaeology.
- Vegetation clearing, earthworks, topsoil management and rehabilitation.
- General waste management.
- Hydrocarbon, chemical and hazardous waste management.
- Noise management.

- Air emissions and air quality management.
- Invasive alien species management.
- Surface water and groundwater management.
- Watercourse crossings management.
- Environmental incident and non-compliance reporting.
- Emergency response plans and drills.
- Environmental auditing.

Markham Valley Biomass will ensure that each contractor identifies the environmental training needs relevant to their personnel and the activities being performed, together with induction and task training to ensure conformance with Project's environmental requirements. Appropriate records of environmental management training will be maintained.

As well as this EMP and the various environmental procedures described above, MVB will submit a Forest Management Plan (FMP) for the plantation operations to PNGFA, for their approval. This plan will be consistent with the requirements of the FSC standards for Papua New Guinea and will address a range of matters, from a description of the markets and compliance requirements through to plantation design and areas to be planted, species and genetics, plantation and stand management regimes, planned harvesting and other forestry operations methods. It will be, in effect, a five-year tactical forestry plan.

Implementation of the FMP will be supported by a Project-specific Forest Management Information System (FMIS; GIS-linked software) that will collate and manage information and allow planning regarding the following aspects of plantation operation:

- Stand management (asset registry) – stand/asset registry attributes; spatially overlay features with environmental reference layers to identify potential concerns; volume/inventory information.
- Silviculture activity management – planning/scheduling activities such as site preparation, weeding, harvest; budget estimated costs.
- Nursery management – batch/seedlot information; seedling requests; mother plant management.
- Roads – road attributes, e.g., ownership; plan road construction/maintenance activities.
- Integration of field and office activities via a ‘Mobile Builder’, with real-time systems to mobilise management of silviculture activities and incident reporting.
- Incident reporting – record health, safety, environmental and security (HSES) incidents; record spatial location of incident.

- Stakeholder engagement – spatially overlay features with political reference layers to identify potential concerns; stakeholder group information/members; land group/community, e.g., family, clan, incorporated land group; agreements; documentation of communications.
- Contract management and accounting.

Markham Valley Biomass will also prepare a number of social management plans during Front End Engineering and Design (FEED) and detailed design. These will address a range of matters including Project-induced in-migration, a resettlement policy framework, and communal resource plan.

5.4.3 Communication

Markham Valley Biomass will engage with personnel (employees and contractors) concerning matters such as environmental aspects/issues that impact on them or their area of responsibility, changes to the management system, and ways to improve environmental performance. Relevant information will be communicated to the workforce by a number of methods, including but not limited to:

- Induction and awareness training (as described above). These will be conducted multiple times to accommodate shift changes for all personnel, including third-party contractors.
- General signage, noticeboard announcements and newsletters to establish and maintain awareness.
- Meetings and presentations, e.g., weekly health, safety and environment meetings (held twice to ensure that all shifts are covered).
- Toolbox sessions. These will be held daily before each shift to raise HSES and social responsibility (SR) matters as well as general work practice issues from the previous shift, and discuss changes needed and lessons learnt.
- Training sessions with signed attendance sheets to confirm personnel participation.

Communication will be integral to the Project's environmental performance and will continue through plantation establishment, construction (of the power plant, nursery and roads) and operations. All regular meetings will be required to have HSES and SR issues as a standing agenda item and shall commence with an appropriate HSES and SR discussion topic.

All personnel working on the Project will have the opportunity to express their opinions on any relevant HSES and SR issue to the relevant HSE officer or MVB's stakeholder engagement manager. Markham Valley Biomass and its contractors will provide all necessary means to allow site workers the opportunity to highlight concerns they may have and/or provide suggestions on ways to improve HSE and SR standards or systems. Any such suggestions or concerns will be relayed to management.

The Project will establish a grievance mechanism to be adopted by contractors in order to record and respond to concerns/complaints. The purpose of the grievance mechanism, which will be based on current procedures, is to provide workers (and other stakeholders) the opportunity to raise grievances about the Project without redress and to ensure that concerns are adequately

responded to in a timely manner, with appropriate corrective actions being implemented and the complainant being informed of the outcome.

Practical recommendations arising from stakeholder communication and feedback will be incorporated into the management plans where appropriate.

Communication with external stakeholders concerning environmental matters will be undertaken as part of the Project's broader stakeholder engagement plan, including matters relating to compliance obligations. This is discussed further in Chapter 7.

5.4.4 Documented Information

Information storage and retrieval is an important part of environmental management, particularly in terms of achieving issue resolution and continuous improvement. Environmental management plan documentation includes documents and records necessary to ensure the effective planning, operation and control of processes that relate to significant environmental aspects. Markham Valley Biomass will maintain a database for storage and retrieval of environmental data, records and other relevant Project information, and will implement appropriate document control procedures.

5.4.5 Operational Planning and Control

Markham Valley Biomass will comply with applicable Papua New Guinea legislative requirements related to environmental management. In the absence of such requirements or relevant national policies or guidelines, appropriate industry practices will be adopted.

The Project will adopt the following principles in relation to environmental management and mitigating adverse impacts:

1. Avoid, i.e., avoid creating impacts from the outset.
2. Minimise, i.e., reduce the duration, intensity and/or extent of impacts that cannot be completely avoided.
3. Restore or rehabilitate, i.e., return an area to its original condition (restore) OR restore basic ecological functions and/or ecosystem services (rehabilitate).

However, waste generation is unavoidable, and hence the Project's waste minimisation strategy will reflect the need to (in order of priority):

1. Avoid waste generation.
2. Reduce waste generation.
3. Reuse waste (where feasible).
4. Recycle waste (where feasible).
5. Treat waste (where required).
6. Dispose of waste (where necessary).

Markham Valley Biomass will ensure a high level of staff, employee and contractor awareness of these principles. Development and implementation of specific controls will incorporate the following:

- Engineered Controls (Best Available Technology) – where practicable, these are the first level of preferred mitigation because, when installed and operating properly, they provide consistent, uninterruptable mitigation for potential impacts. Examples of engineered controls include secondary containment and fail-safe systems.
- Operational Controls (SOPs) – where Project activities do not warrant the long-term protection provided by engineered controls, operational controls are the second preferred approach. Examples include maintenance and treatment.
- Monitoring and Inspection – early detection programs that provide advance notice of a potential problem or, at the least, discover the problem before it becomes unmanageable.

Environmental management procedures that address specific issues are provide in Chapter 6.

5.4.6 Emergency Preparedness and Response

Emergency preparedness and response is addressed in Procedure 11 (PR11) Emergency Response Plans and Drills procedure in Chapter 6. This procedure will ensure an appropriate response to unplanned events, based on the potential emergency scenarios identified by a risk assessment process. These events can include natural disasters and operational or process hazards that cause releases into the environment, such as heavy rainfall/floods, high winds, lightning, major seismic events, fire, ground subsidence, vehicle accidents involving transport of hazardous substances, and hazardous chemical/reagent release or spill.

As noted in PR11, the emergency response plan (ERP) will allow for:

- Hazard identification and risk assessment (including periodic review and update).
- Preventative measures.
- Organisational responsibilities.
- Response procedures.
- Communications prior to, during and after an emergency.
- Training and exercises.
- Coordination of emergency responders.

A process to review the emergency system after a drill or incident, as well as routine auditing, will also be implemented. The ERP will be further developed during detailed design.

5.5 Performance Evaluation

5.5.1 Monitoring and Internal Audits

Procedures in this EMP contain relevant monitoring requirements, which will be used to determine the effectiveness of mitigation measures, confirm impact predictions, and demonstrate compliance with environment permit conditions. Monitoring will also allow the need for corrective actions to be identified and implemented as required.

In addition to implementing these requirements, the Project will implement a monitoring program to assess compliance with the EMP, as detailed in the environmental auditing procedure (PR12). Ad hoc audits will also be undertaken as required, e.g., following events such as an environmental incident, a major storm, an environment-related community complaint, or the occurrence of Project-related impacts on sites that are environmentally or culturally sensitive.

5.5.2 Records and Reporting

The outcomes of the auditing and monitoring programs will be routinely recorded and reported to the Project's senior management, with appropriate corrective action being undertaken as required. Reporting of auditing and monitoring results to regulatory authorities will be undertaken in accordance with regulatory requirements. Details of reporting are provided in the specific procedures in Chapter 6.

A compliance register has been developed and will be maintained by the stakeholder engagement manager. All environmental (and other) permitting requirements will be identified, applied for in a timely manner and tracked to ensure full regulatory compliance.

5.5.3 Management Review

Management reviews will be undertaken to ensure that environmental and social management systems remain suitable, adequate and effective, and appropriately communicated to all relevant parties. In particular, the reviews will focus on ensuring that all aspects of the environmental and social management systems remain relevant to the specific tasks being undertaken on site and the associated environmental and social risks. The management reviews will therefore typically include consideration of matters such as:

- The extent to which the EMP has been implemented and the effectiveness of the procedures contained within the EMP.
- Results of audits and monitoring data, and performance against objectives and targets.
- Communications from (and with) internal and external stakeholders (including complaints).
- Environmental incidents or non-compliances/non-conformities, and actions taken to address these events.
- Actions from previous management reviews.
- Changing circumstances, such as in relation to:
  - Significant environmental aspects.
  - Legislation, government policies or other aspects of compliance obligations.
  - Risks and opportunities.
  - Other relevant issues.
- Adequacy of resources.

- Opportunities for continuous improvement.

The results of reviews will be appropriately documented, including information concerning the review conclusions, decisions about continual improvement opportunities or changes to the management system, actions when environmental objectives haven't been achieved, opportunities to improve integration with other business processes, and implications for the organisation's strategic direction.

Findings from reviews will be communicated and discussed with the operating personnel to better understand the root causes and systemic failures, if any. Markham Valley Biomass will immediately bring to the attention of relevant personnel and contractors any consequent modifications to the EMP.

5.6 Improvement

Markham Valley Biomass will establish and maintain procedures for inspections, handling non-conformance and taking corrective actions, the results of which will be recorded.

Routine inspections provide the basis for effective management of any issue arising from equipment malfunction, non-compliances or failures in operational control procedures. This ensures that all issues are systematically identified, investigated, reported, communicated and managed to identify root causes and contributing factors. This also allows corrective actions to be implemented to ensure that such events are effectively closed out and do not recur. It also enables the effective implementation of the measures described in the EMP.

All employees and contractors are responsible for identifying non-conformances of operational, procedural or accidental incidents. Corrective actions will be the responsibility of the relevant superintendents, since they are usually aimed at the behavioural elements of individuals. The Project will establish an 'Action Log' (i.e., a database that will facilitate data interrogation) as part of the IMS that will record and manage accidents/incidents, forest fires, management corrective and preventative actions, training (including dates for refresher training) and job observations, and will also include a meetings register.

In addition, management review (as discussed above) is essential for the continual improvement of the management system and EMP. Corrective actions will be communicated to appropriate personnel to ensure continual improvement, with subsequent follow up to ensure their effectiveness. One objective of the review process is to continually improve the management system to enhance the Project's environmental performance.

The EMP is a living document that will be reviewed and updated as required during Project development. Contractors will be contractually required to prepare their own EMPs aligned with this EMP, which will include detailed SOPs. This will ensure that contractors and sub-contractors are aware of, and aligned with, their explicit environmental obligations.

6. Environmental Management Procedures

The various environmental concerns discussed in Chapter 5 are addressed via the procedures outlined in this section, as follows:

- Cultural heritage and archaeology (PR1).
- Vegetation clearing, earthworks, topsoil management and rehabilitation (PR2).
- General waste management (PR3).
- Hydrocarbons, chemical and hazardous waste management (PR4).
- Noise management (PR5).
- Air emissions and air quality management (PR6).
- Invasive alien species management (PR7).
- Surface water and groundwater management (PR8).
- Watercourse crossing management (PR9).
- Environmental incident and non-compliance reporting (PR10).
- Emergency response plans and drills (PR11).
- Environmental auditing (PR12).

The construction phase involves the use of only conventional practices in a generally non-sensitive environment. The adoption of well-established industry norms, international good practices and established SOPs will therefore minimise risks and potential adverse impacts, both in construction and continuing through operations. This also applies to plantation development, where environmental management procedures will be supported by documents such as 'Management Prescriptions', which describe what Project foresters need to do, and 'Best Operating Practices' (BOPs) that provide instructions for workers. Examples of each are provided as Attachments A and B, respectively.

<table>
<tr><th colspan="2">PR1 – Cultural Heritage and Archaeology Procedure (p1)</th></tr>
<tr><td colspan="2">Purpose</td></tr>
<tr><td colspan="2">This procedure describes the minimum requirements that will be followed to ensure that sites and artefacts of cultural and archaeological significance are identified, protected and managed in accordance with legal requirements to avoid or minimise impacts. The scope of this procedure applies to planning, clearing, plantation establishment and construction activities</td></tr>
<tr><td colspan="2">Context</td></tr>
<tr><td colspan="2">Clearing, plantation establishment and construction activities have the potential to uncover and damage artefacts and sites of archaeological and cultural heritage significance. This procedure will ensure that all sites and artefacts of cultural, historical and archaeological significance are identified, protected and managed in accordance with statutory requirements</td></tr>
<tr><td colspan="2">Proposed Management and Mitigation Measures</td></tr>
<tr><td>Planning</td><td>The likelihood of impacting on sites of cultural heritage or archaeological significance can be reduced with appropriate planning before commencing field activities. The following practices will be undertaken before any ground disturbance commences:
Conduct focused stakeholder engagement to determine community sensitivities and establish site and clan-specific protocols, taking into account the various types of sites (i.e., spirit sites, former settlement sites, burial/cemetery sites, skull house site, historic sites, archaeological sites)
Restrict access to known cultural heritage and archaeological sites in the vicinity of the clearing and construction activities with temporary fencing or markers and appropriate buffer zones
Ensure that, where practicable, clearing and construction activities are aligned and sited to avoid all known archaeological and cultural heritage sites
Prior to commencing ground disturbance, prepare a cultural heritage clearance request (CHCR), review the cultural heritage database and develop site-specific mitigation measures
Conduct cultural heritage and archaeology inductions for Project staff and contractors to generate awareness of local cultural heritage sensitivities, including management and avoidance strategies
If disturbance of an archaeological or cultural heritage site is unavoidable, seek approval from the PNG National Museum and Art Galley for removal of the artefacts. Note that artefacts will NOT be removed without prior approval from the PNG National Museum and Art Gallery</td></tr>
<tr><td>Ground disturbance</td><td>Upon approval of ground disturbance, the following will be implemented:
A qualified archaeologist will monitor the large-scale ground disturbance associated with construction at the power plant site
All works must take place within the areas approved for ground disturbance. Should there be any changes to the scope and location of work, approval of a revised CHCR must be sought
All personnel will observe access restrictions to sites of cultural heritage significance, i.e., fencing
Ground disturbance will not occur within the areas fenced for protection, i.e., direct impacts to known sites will be avoided
Vehicles will stay on established tracks or designated right of ways
Should previously unrecorded cultural material be discovered during ground disturbance, actions will be taken as described below
No items of cultural material will be removed or interfered with by any unauthorised person
If Markham Valley Biomass personnel or contractors disturb or interfere with a site of cultural heritage or archaeological significance, an incident report will be completed so that necessary mitigation/remediation procedures can be initiated</td></tr>
</table>

PR1 – Cultural Heritage and Archaeology Procedure (p2)

Proposed Management and Mitigation Measures (cont'd)

Discovery of a site	It is possible that unknown archaeological or cultural heritage sites may be discovered, despite actions taken prior to ground disturbance to identify such sites. If unknown sites are discovered the following steps will be implemented: ♦ In the event of the discovery of suspected human remains and/or cultural heritage artefacts, cease work immediately, secure the site from interference and notify the HSE officer or senior person on site, who will notify the police if the human remains appear to be suspicious (i.e., recent and not part of a cultural burial) ♦ Inspect the site to ensure it is sufficiently protected. This is a responsibility of the HSE officer or senior person on site ♦ Record details regarding the site including photographs, GPS coordinates, activity being undertaken at time of discovery and hand drawings of the site (if these can be obtained without disturbing the site) ♦ If the discovery relates to cultural heritage, contact an archaeological specialist to obtain further advice on management of the site. This is a responsibility of the HSE officer or senior person on site ♦ Notify the PNG National Museum and Art Gallery of the discovery once information has been obtained from the archaeological specialist. This is a responsibility of the HSE officer or senior person on site ♦ Prohibit entry into the area until advice has been sought from the archaeological specialist and all required actions have been completed. Material will not be removed without prior approval from the PNG National Museum and Art Gallery

Proposed Monitoring and Reporting

Action	Frequency	Reporting
Maintain records of planning to avoid such sites	Ongoing/as required	Quarterly
Maintain records of approval from the PNG National Museum and Art Galley for removal of artefacts	Ongoing/as required	Quarterly
Report unauthorised disturbance of such sites	Event based	Reported as an incident
Record number of new sites discovered	Ongoing/as required	Quarterly
Record number of complaints related to disturbance of such sites	Ongoing/as required	Quarterly

PR2 – Vegetation Clearing, Earthworks, Topsoil Management and Rehabilitation Procedure (p1)	
Purpose	
This procedure describes the requirements that will be followed to ensure that vegetation clearing, earthworks and soil management activities are undertaken to minimise potential impacts on the environment, and to rehabilitate areas disturbed by Project activities. The scope of this procedure applies to planning, clearing, access/roading, plantation establishment and construction activities	
Context	
Vegetation clearing can cause loss of habitat, fauna and/or flora of biodiversity or resource significance, as well as erosion and subsequent sedimentation of waterways, reduced water quality and amenity. This activity can also result in reduced visual amenity of an area from both the ground and air At the completion of ground disturbance activities, it is essential that, where feasible, all disturbed areas that are not designated for an agreed new land use (e.g., plantations, roads, power plant, nursery) shall be rehabilitated to minimise ongoing soil erosion and promote the natural revegetation of these areas The aim of rehabilitation is to restore and return disturbed sites as close as possible to their original state or to an otherwise agreed end land use. Early and effective planning, before a site is disturbed, will assist in the successful stabilisation and/or regeneration of cleared areas, as appropriate	
Proposed Management and Mitigation Measures	
General	General measures that will be implemented during vegetation clearing, earthworks and similar activities include the following: ♦ Prohibit disturbance/harassment of sensitive wildlife, hunting of fauna, gathering or possession of wildlife products by Project workers, their resident families or contractors while working, travelling in Project vehicles, and residing in Project field or private accommodation ♦ Prohibit pets, particularly cats and dogs, at Project facilities ♦ Prohibit lighting of fires by staff and contractors without the explicit authority of a Departmental Manager ♦ Control access of wildlife to waste facilities (e.g., rubbish) by fencing where required ♦ Shield external lights and direct lights onto work areas wherever practicable ♦ Implement appropriate speed limits on Project roads and vehicle crossings ♦ Follow PNG quarantine requirements for soil or other plant material ♦ Follow the principles of the PNG Logging Code of Practice
Planning	Determining the vegetated areas to be cleared requires consideration of the following: ♦ Determine whether vegetation clearing is actually required ♦ Determine if existing cleared areas can be used ♦ Consult with landowners prior to vegetation clearing to determine additional requirements that may be important ♦ Where practicable, avoid the removal and disturbance of listed fauna habitats, ecologically sensitive habitats and useful resources ♦ In relation to *Cycas schumanniana*: – Avoid clearing habitat for *Cycas schumanniana* as far as possible – Implement a buffer of 20 m around plants – Should avoidance not be possible, the affected plants will be translocated to suitable habitat and records kept of original location, translocation site and methods used ♦ Limit clearing to the minimum areas required to accommodate the Project footprint and locate plantations and infrastructure in already disturbed habitats as far as possible ♦ Retain existing vegetation where practicably possible ♦ Obtain approval from the Markham Valley Biomass harvesting manager prior to commencing vegetation clearing ♦ Ensure that, where possible, areas to be cleared avoid locations of high erosion potential (e.g., steep slopes), drainage channels and sensitive vegetation

PR2 – Vegetation Clearing, Earthworks, Topsoil Management and Rehabilitation Procedure (p2)	
Proposed Management and Mitigation Measures (cont'd)	
Planning (cont'd)	♦ Co-locate linear infrastructure such as powerlines and access roads where feasible ♦ Identify appropriate areas which could be used for the disposal of excess soils, outside of riparian buffer zones ♦ Design roads to balance earthwork quantities where feasible, thereby minimising the use of borrow pits and soil dumps ♦ Plan to construct roads during the dry season and avoid major earthworks during the wet season where feasible ♦ Align cleared areas to: – Avoid wet areas to the extent possible – Minimise habitat loss and fragmentation ♦ Plan erosion and sediment control measures together with locations and types of control devices (e.g., sediment pond, silt fence, diversion drain)
Vegetation clearing	The actual clearing of vegetation will be consistent with the following guidelines: ♦ Only clear the area to the size required for its designated use, and ensure that the boundaries of areas to be cleared are physically demarcated prior to commencement ♦ Clearly communicate to all staff (contractors and employees) vegetation clearance boundaries and protocols to be implemented to ensure clearing and earthworks contractors avoid impacts on buffer zones and other areas not designated for clearing ♦ Complete a GPS survey of cleared areas ♦ Ensure that removed topsoil and vegetation is stockpiled for later use during rehabilitation OR recycled (for plantations, this includes leaving harvest slash within compartments) ♦ Retain groundcover vegetation if possible ♦ Avoid burning of cleared or standing vegetation wherever practicable ♦ Do not push stripped soil and cleared vegetation into watercourses, surface water drainage lines or standing vegetation ♦ Install sediment controls (e.g., silt fences and sediment ponds) as required ♦ Install runoff controls (e.g., erosion control berms, cut-off drains) to divert water around and away from exposed surfaces or loose soils such as stockpiles, where practicable ♦ Regularly maintain erosion and sediment control structures by: – Cleaning accumulated material from behind sediment fences and barriers, cut-off drains and diversion drains – Re-erecting, tensioning or replacing collapsed, partially collapsed, ripped or otherwise damaged sediment fences or barriers – Installing additional erosion and sediment control structures if the existing measures are found to be inadequate or ineffective ♦ Minimise the length of time that cleared/disturbed areas are exposed to the greatest extent practicable ♦ Ensure that the maximum cleared forest edge to cleared forest road width is 40 m ♦ Minimise the amount of vegetation cleared during road construction ♦ Establish riparian buffer zones as follows: – 100 m from the banks of the Markham River – 60 m from the banks of the Leron and Erap rivers, and also from the edges of lakes, lagoons and swamps – 30 m from the banks on either side of other permanent watercourses with bed widths >5 m – 20 m from the banks on either side of watercourses with average width >1 m but <5 m – At least 5 m from the banks on either side of watercourses with an average width <1 m. In buffer zones for <1 m streams only, vegetation clearing will be minimised to the extent practicable (rather than excluded, as for buffers on larger watercourses)

PR2 – Vegetation Clearing, Earthworks, Topsoil Management and Rehabilitation Procedure (p3)	
Proposed Management and Mitigation Measures (cont'd)	
Earthworks	Earthworks will be consistent with the following guidelines: ♦ Follow PNG quarantine requirements for management of soil and plant material ♦ Prevent fauna access to open trenches with fencing or other means e.g., cover ♦ Install trench exit ramps for fauna and restrict the length of trench open at any one time ♦ Check excavations, trenches and similar and rescue trapped fauna on a daily basis ♦ Backfill trenches as soon as practicable ♦ Use compaction equipment (rollers) on both formation earthworks and surfacing layers during construction ♦ During (or following) wet weather, when operations may damage the soil, consider dry weather logging, and/or moving to another log landing or a production area reserved for wet weather logging
Topsoil management	Procedures for managing topsoil include: ♦ Carefully remove and stockpile topsoil when an area is being cleared for subsequent use in rehabilitation where feasible ♦ Stockpile topsoil separately from subsoils (using sediment fences if required) and cleared vegetation ♦ Locate stockpiles with diversion banks on the upper side and sediment fences 1 to 2 m down gradient, and at least 10 m from natural drainage lines and watercourses ♦ Consider the need to re-access the stockpile for use at a later date ♦ Ensure that stockpiles are low in height (generally less than 2 m), have a reasonable surface area and are gently battered (generally <15°) ♦ Do not store topsoil for more than 12 months if possible, as storage time diminishes seed viability and microbial activity ♦ Promote revegetation of the stockpiles to protect the soil from erosion, discourage weeds and maintain soil microbe populations
Rehabilitation	Disturbed areas not designated for an agreed new land use will be rehabilitated in accordance with the following guidelines: ♦ Rehabilitate progressively where possible and commence rehabilitation activities promptly, using revegetation and seeding on bare soil, where appropriate ♦ Remove all structures, equipment, waste material and contaminated soil ♦ Fill all pits and sumps, remove drainage diversion structures and re-establish natural drainage lines ♦ Ensure that all rehabilitation work promotes the contouring and subsequent blending of the area back to the original landform ♦ Loosen areas (e.g., ripping or harrowing (along the contours of sloping sites)) of compacted subsoils and effectively re-distribute stored topsoil and stockpiled vegetation (if available) over re-contoured areas ♦ For borrow pits, regrade and shape the pits to create a well-contoured level surface that is self-draining, rip the floor of the pit to a 50 cm depth at a 2 m line spacing, rip along in-pit contours and install controls to divert run-on water from above the pit

Proposed Monitoring and Reporting

Action	Frequency	Reporting
Visually monitor erosion and sediment control devices at the power plant site	Fortnightly and following prolonged heavy rainfall or storm events	Monthly
Visually monitor stormwater runoff from disturbed areas at the power plant site to identify poor quality runoff and, if required, implement management measures	Fortnightly and following prolonged heavy rainfall or storm events	Monthly

PR2 – Vegetation Clearing, Earthworks, Topsoil Management and Rehabilitation Procedure (p4)		
Proposed Monitoring and Reporting (cont'd)		
Action	**Frequency**	**Reporting**
Record number of hectares cleared (recorded monthly; reported quarterly)	Monthly	Quarterly
Record number of hectares rehabilitated (recorded monthly; reported quarterly)	Monthly	Quarterly
Visually monitor success of regenerated areas, including areas prone to erosion	Monthly	Quarterly
Record number of animal deaths, injuries and/or entrapments as a result of Project activities	Daily	Monthly
Visually monitor riparian buffer zones, particularly along plantation borders after herbicide use	Monthly	Quarterly

PR3 – General Waste Management Procedure (p1)	
Purpose	
This procedure describes how general waste generated by Project activities is handled and managed in a responsible manner	
Context	
Domestic and industrial non-hazardous wastes such as steel, paper and cardboard, wood, tyres, plastics, cans, putrescible wastes and power plant ash waste will require disposal to keep the Project area tidy and safe, and to ensure that landowner expectations are met, that land and water contamination through inappropriate disposal does not occur, and that pest fauna are not encouraged This document does not include procedures for managing hazardous waste (PR4) or wastewater (PR8)	
Proposed Management and Mitigation Measures	
General	The approach to general waste management will be based on the following principles: ♦ A site specific waste management plan must be developed prior to Project execution which identifies waste streams and details the identified waste management practices for each stream ♦ Instruct site personnel in the recognition, handling and the appropriate and safe disposal of wastes at Project sites/areas ♦ Minimise waste through efficient use of resources ♦ Maximise reuse and recycling opportunities ♦ Minimise volumes of waste disposed to landfill (by prioritising waste reduction, reuse and/or recycling) ♦ Segregate wastes at the source ♦ Appropriately treat wastes where applicable and possible ♦ Ensure handling, storage and disposal practices meet environment permit requirements ♦ Prohibit littering ♦ Mitigate adverse environmental impacts ♦ Facilitate disposal of waste in a responsible manner ♦ Promote continual improvement in areas such as material handling and waste management training ♦ Follow the principles of the PNG Logging Code of Practice where applicable ♦ It will be the contractors' responsibility to remove from site all relevant waste ♦ A waste register that records all incoming and outgoing waste must be implemented and maintained. The register must as a minimum include waste type, volume, name of the waste producer, nominated disposal/treatment/storage facility ♦ Waste receiving facilities and waste management contractors must be assessed to determine suitability and risk based controls implemented ♦ Waste management/receiving facilities must be inspected by the environment discipline ♦ Waste management practices must be regularly audited by the environment discipline
Putrescibles/ biodegradable solids	Measures to minimise impacts associated with putrescible wastes will include: ♦ Waste generation will be lessened by minimising over-ordering of goods such as food ♦ Putrescible and biodegradable litter will be collected in lidded containers located at designated points at the power plant and nursery sites before collection and burial in the onsite landfill (that will be constructed and operated in accordance with the Environmental Code of Practice for Sanitary Landfill Sites (OEC, 2001)) ♦ Alternatively, putrescible waste may be disposed of by incineration, aerobic composting in bins or other containers, recycled as stockfeed where appropriate, or transported to an urban waste disposal facility ♦ No logs, timber off cuts or trimmings will be placed in rivers or other watercourses

PR3 – General Waste Management Procedure (p2)	
Proposed Management and Mitigation Measures (cont'd)	
Non-hazardous recyclable waste	Measures to minimise impacts associated with non-hazardous recyclable wastes (e.g., cardboard, paper, scrap metal, aluminium cans, tyres, wood and glass) include: ♦ Waste generation will be lessened by minimising over-ordering of goods. Where possible, goods will be purchased in bulk to reduce packaging, and suppliers will collect their own packaging after use ♦ Where recycling facilities are available (e.g., within the region), commonly-generated recyclable waste materials (e.g., glass, paper, aluminium cans) will be collected in clearly-signed lidded containers located at designated points within the power plant and nursery sites. Other recyclable wastes (e.g., poly pipe, printer cartridges, ferrous and non-ferrous scrap metal, tyres) will also be placed in appropriate designated locations in the power plant before collection and transport off site to appropriate licensed recycling facility/ies, where these exist (e.g., within the region)
Non-hazardous non-recyclable waste	Measures to minimise impacts associated with non-hazardous non-recyclables (e.g., general litter, plastic drums) include: ♦ Waste material will be collected in clearly-signed lidded containers located at designated points around the Project area (e.g., general litter, plastic wrapping, small inert products) before collection and disposal in the onsite landfill ♦ Plastic drums containing non-hydrocarbon/non-hazardous substances will be rinsed and cleaned. If not recyclable, the drums will be crushed and disposed of in on site landfill. If recyclable, the drums will be periodically transferred to an appropriate licensed recycling facility, if one exists (e.g., within the region) ♦ Cleared vegetation will be stockpiled next to cleared areas for use in future rehabilitation
Waste ash from the power plant	Measures to minimise impacts associated with waste ash generated by the power plant include: ♦ Ash to be reused in road construction (bottom ash) or as fertiliser for the plantations (fly ash) will be tested in accordance with the Australian Standard Leaching Procedure for confirmation of the anticipated low risk, prior to its reuse

Proposed Monitoring and Reporting

Action	Frequency	Reporting
Undertake reconciliation of quantities of material ordered versus quantities used	Monthly	Quarterly
Maintain records of waste disposal to on site landfill	Ongoing/as required	Quarterly
Maintain records of waste disposal to licensed recycling facility	Monthly	Quarterly
Audit waste storage facilities and waste management practices	Quarterly	Quarterly
Test fly ash and bottom ash in accordance with the Australian Standard Leaching Procedure	Once off	Once off

PR4 – Hydrocarbons, Chemical and Hazardous Waste Management Procedure (p1)	
Purpose	
This procedure identifies and describes the method by which hydrocarbons, chemicals and hazardous wastes are handled, stored and disposed of during Project activities	
Context	
Hydrocarbons (e.g., fuels, oils), chemicals (e.g., herbicides, solvents, cleaning fluids) and hazardous wastes (e.g., waste chemicals, gas cylinders, other ignitable, corrosive, reactive and/or toxic substances) have the potential to cause environmental degradation (and/or health and safety issues) if they are not managed in a safe and secure manner This procedure does not include procedures for managing non-hazardous waste (PR3) or wastewater (PR8)	
Proposed Management and Mitigation Measures	
General	The approach to management of hydrocarbons, chemicals and hazardous waste will be based on the following principles: ♦ Design and plan hydrocarbon, chemical and hazardous waste management, containment and removal prior to Project execution ♦ Include conditions for the use of hazardous substances in all contractor contracts ♦ Contractors are to notify of, and obtain approval for, hazardous substances to be used before these are brought to site ♦ Minimise use of hazardous substances and select alternatives where possible ♦ Keep inventory levels as low as possible through formal review of hazardous substance requirements and via a hazardous substance approval process ♦ Maintain an up to date manifest of hazardous substances detailing the volume, type and location of each hazardous substance ♦ Minimise waste through efficient use of resources ♦ Maximise reuse and recycling opportunities ♦ Segregate at the source ♦ Appropriately treat where possible ♦ Ensure handling, storage and disposal practices meet environment permit requirements ♦ Mitigate adverse environmental impacts ♦ Facilitate disposal in a responsible manner ♦ Conduct inductions and training for Project staff and contractors concerning appropriate safe and environmentally sound handling, storage, transport and disposal of hydrocarbons, chemicals and other hazardous material ♦ Promote continual improvement in areas such as material handling and waste management training ♦ Follow the principles of the PNG Logging Code of Practice, where applicable ♦ Implement the relevant requirements of the Environmental Code of Practice for Machinery Workshops and Petroleum Storage/Resale/Usage sites (DEC, 1997) ♦ It will be the contractors' responsibility to remove all relevant waste from site
Storage of fuels and oils	Fuel and oil storage requires that safety considerations are met and sufficient secondary containment is provided to contain potential spills. Specifically, the storage of fuels and oils will involve the following measures: ♦ Site permanent fuel storages sites at least 50 m from any office, living quarters, water body or watercourse ♦ Construct a diversion drain to prevent surface water entering the fuel storage area ♦ Bund to a volume of 110% of the largest container of stored fuel ♦ Store in an undercover area and do not exceed the maximum allowable storage quantities ♦ Ensure that a spill response kit is available to clean up spills ♦ Ensure that adequate fire extinguishers are available

PR4 – Hydrocarbons, Chemical and Hazardous Waste Management Procedure (p2)	
Proposed Management and Mitigation Measures (cont'd)	
Storage of fuels and oils (cont'd)	♦ Ensure that fuels and oils are located in an area cleared of all vegetation to a radius of 3 m around the facility ♦ Ensure that storage containers are appropriate, safe and secure, appropriately labelled and routinely inspected for leaks ♦ Implement off-site disposal or recycling if possible ♦ Ensure that stormwater drainage and liquid waste from fuel storage areas (and workshops) is appropriately treated prior to discharge ♦ Site field fuel tanks, re-fuelling points and maintenance areas at least 50 m from any water body or watercourse, outside of riparian buffer zones, and in well-drained areas ♦ Construct workshop floor/s from nonporous material
Use of hydrocarbon products	All refuelling of vehicles and equipment will be managed in accordance with this procedure to limit the probability of spills and subsequent damage to the environment. To achieve this, the following work practices will be adhered to: ♦ Refuel and service vehicles and equipment in a designated bunded area close to the fuel storage area, in a manner that minimises the probability of spills, including checking fuel hoses for splits/excessive wear, ensuring supervision at all times during refuelling, placing drip trays under refuelling points and minimising the distance from the fuel storage to the vehicle ♦ Undertake all unloading, loading or handling of fuels away from drainage lines ♦ Remove all soil contaminated by fuels or oil spills for bioremediation or other appropriate disposal options ♦ Properly stockpile empty fuel and oil drums (lids firmly secured) to eliminate spillage of residual oils and fuels ♦ Periodically remove all empty drums and containers from site for appropriate disposal or recycling, if possible ♦ Regularly maintain designated machinery and storage and washdown/maintenance areas ♦ Where such areas are exposed to rain, erosion or runoff, protect the area with hardstand, bunds, drainage and diversion systems and sediment control devices such as silt socks or silt curtains as appropriate ♦ Report all spills via the incident reporting form and procedure (PR10) provided in this EMP
Use and management of chemicals and other hazardous wastes	Measures to minimise impacts associated with the use and management of chemicals and generation of other hazardous wastes include: ♦ Minimise the amount of hazardous waste kept on the Project site; maintain the number and range of chemicals and fuels used on site to a minimum ♦ Select chemicals with proven environmental safety which are not subject to bans or phase-outs; chemicals used in plantations will be approved for use under FSC guidelines ♦ Ensure that safety data sheets (SDS) are available for all chemicals used on site ♦ Use, store and transport chemicals and hazardous wastes in accordance with the relevant SDS, and ensure that all chemicals are: – Clearly labelled and held in appropriate storage containers – Stored within the manufacturers recommended temperature range for safe storage – Stored in a secure facility – Stored away from accommodation areas – Appropriately segregated ♦ Label containers used to store hazardous waste with the following information: – Clearly marked as 'Hazardous Waste' – Date filled – Type of waste (e.g., waste oil, paint, grease etc.)

PR4 – Hydrocarbons, Chemical and Hazardous Waste Management Procedure (p3)	
Proposed Management and Mitigation Measures (cont'd)	
Use and management of chemicals and other hazardous wastes (cont'd)	– Company name and contact details – Dangerous Goods signage (if required) – Hazardous properties (if required) – PPE requirements (if required) – For transport, also display the appropriate transport placard ♦ Ensure that all staff and field personnel are aware of the potential hazards involved with the handling of chemicals and use appropriate personal protective equipment (PPE), and that clean up procedures in the event of a spill are clearly understood ♦ Securely store supplies of chemicals that are surplus to requirements until they can be removed from the site and disposed of in an appropriate manner ♦ Develop an Emergency Response Plan (ERP) that will include a Spill Response Plan for hazardous substances and provide for appropriate spills containment training of staff as part of the induction process ♦ In relation to herbicides: – Mix, store, secure and dispose of herbicides so that leaks and spillages are avoided – Ensure that no herbicide spraying occurs within riparian buffer zones – Preferentially use formulations of glyphosate that do not include polyethoxylated tallowamine surfactant (POEA) – Avoid or minimise use of residual herbicides – Limit spraying next to riparian buffers when rain is expected in the immediate future – Limit harvesting to the drier months in areas next to riparian buffers, where feasible – Implement an adaptive management approach that seeks to maximise efficiencies between weed control and volume application of glyphosate – After use of liquid herbicides, rinse containers then put holes in them to prevent reuse as water vessels by the community

Proposed Monitoring and Reporting

Action	Frequency	Reporting
Undertake reconciliation of quantities of material ordered versus quantities used	Monthly	Quarterly
Maintain safety data sheets (SDS) records	Ongoing/as required	n/a
Maintain personnel training records	Ongoing/as required	n/a
Maintain an inventory of hazardous wastes that have been segregated and stored for land disposal	Monthly	Quarterly
Maintain records of waste disposal to approved hazardous waste facilities	Monthly	Quarterly
Audit storage facilities	Quarterly	Quarterly

PR5 - Noise Management Procedure (p1)	
Purpose	
This procedure describes the minimum requirements that will be followed to mitigate potential noise impacts on the local community and wildlife as a result of construction and operation of the power plant and nursery, as well as noise impacts of plantation establishment and harvesting activities	
Context	
Project activities, particularly those related to wood chipping at the power plant, will be undertaken in a manner that limits to the extent practicable the amount of noise being generated. This will avoid unacceptable impacts on local communities and minimise impacts on fauna populations	
Proposed Management and Mitigation Measures	
Planning	In planning construction and operations activities, the following will be considered: ♦ Ensure that equipment selection includes assessment of noise emissions and type of equipment to be used, with consideration of the lowest noise emission level ♦ Consult with local landowners concerning the construction and operations programs, hours of operation and duration ♦ Provide local landowners with advanced notice of high noise activities ♦ Confirm that equipment to be used is fitted with appropriate noise suppression equipment ♦ Plan to install acoustic enclosures for permanent facilities/equipment generating noise, where required and practicable ♦ Plan for appropriate mitigation strategies if it is believed that noise emissions may be an issue, e.g., limit hours of operation and/or high noise generating activities, and consider additional noise suppression equipment ♦ Establish and maintain appropriate buffer/offset distances from noise sources to receptors ♦ Ensure that the complaints management system can appropriately address incidents or substantiated complaints relating to noise ♦ Consider implementing the following measures: – Cooling towers: fit a straight lined ducting cowl or suitable attenuator to the vertical discharge fans and implement variable fan speed controls; consider lower speed, larger diameter fans – Turbine building: fit a suitable acoustic enclosure and install ducting – Wood chippers: orientate the feed chute openings away from the direction of nearest residential areas and/or fit acoustically lined shrouds which absorb and screen noise; select suitable wood chippers with lowest noise emissions (LWA values)
Construction and operations	During construction and operations, the following practices will be implemented: ♦ Where practicable, limit the hours of operation of noisy equipment or activities, especially vehicles, plant and equipment operating close to community areas, including respite periods for high noise activities ♦ Position potentially problematic noise generators, e.g., wood chippers, away from sensitive receptors, and ensure the offset distance between noisy plant items and nearby noise sensitive receptors is as great as practicably possible ♦ Limit machinery movements where possible ♦ Monitor noise suppression equipment and undertake plant and machinery maintenance to ensure that it is functioning as intended by the manufacturer and to minimise noise emissions ♦ As far as possible, undertake maintenance work on all construction plant away from noise sensitive receptors and during standard daytime construction hours ♦ Keep site access roads well maintained so as to mitigate the potential for vibration from trucks which induces noise ♦ Minimise the number of individual vehicle pass-bys through villages during the construction phase by grouping vehicles into convoys to the extent possible ♦ Minimise the use of access roads during the night period

PR5 - Noise Management Procedure (p2)		
Proposed Monitoring and Reporting		
Action	**Frequency**	**Reporting**
Undertake ongoing liaison with local communities regarding noise issues related to the Project	Ongoing/as required	Monthly
Measure noise levels at sensitive receptors to ensure that noise mitigation strategies are working as planned	Event-based	Monthly
Record and report complaints related to noise	Ongoing/as required	Monthly

PR6 – Air Emissions and Air Quality Management Procedure (p1)	
Purpose	
This procedure describes the minimum requirements that will be followed to mitigate potential impacts on the local community and vegetation/wildlife within the Project area resulting from emissions to air (e.g., power plant stack emissions, exhaust gases, dust) from construction and operation activities	
Context	
Project activities, particularly those related to power plant stack emissions, will be undertaken in a manner that limits to the extent practicable the generation of air emissions. This will avoid unacceptable impacts on local communities and minimise impacts on fauna populations and vegetation	
Proposed Management and Mitigation Measures	
Planning	In planning construction and operations activities, the following will be considered: ♦ Position point source emissions, e.g., power plant stacks, away from sensitive receptors, and ensure that appropriate offset/buffer distances are maintained between emissions sources and nearby sensitive receptors ♦ Plan to install appropriate control equipment for permanent facilities/equipment generating air emissions, where required and practicable ♦ Plan for appropriate mitigation strategies if it is believed that air emissions may be an issue, e.g., limit cultivation and/or excavation during dry windy periods ♦ Consult with local landowners concerning the Project activities ♦ Confirm that vehicles and equipment to be used are fitted with appropriate exhausts and emission control systems ♦ Plan work to minimise the amount of vegetation clearing, cultivation and earthworks to the extent practicable, thereby limiting dust generation ♦ Ensure that the complaints management system can appropriately address incidents or substantiated complaints relating to air quality ♦ Establish clear communication methods to ensure that affected communities have access to effective communication links to the operational managers
Construction and operations	During construction and operations, the following practices will be implemented: ♦ Obtain approval via a clearance request (VCR) prior to vegetation clearing, and include plans for managing dust generation from cleared areas and soil stockpiles ♦ Apply dust suppression measures as required, such as spraying exposed surfaces, roads, soil stockpiles and other exposed areas contributing to dust generation with (non-saline, uncontaminated) water ♦ Maintain trafficable areas in a compact condition ♦ Vehicles will maintain speed limits ♦ Where loads of materials likely to generate dust (e.g., fly ash or bottom ash) are being transported to or from the power plant, these will be covered if practicable ♦ Limit truck queuing, unnecessary idling of trucks and unnecessary trips through logistical planning of materials delivery and work practices, while ensuring that vehicles keep to marked trafficable areas ♦ Locate stockpiles away from areas prone to erosion or sensitive receptor locations ♦ Avoid burning of cleared or standing vegetation, or waste materials, where practicable. Obtain approval from the Fire Coordinator prior to lighting fires associated with land clearing activities ♦ Minimise the length of time that cleared/disturbed areas are exposed (e.g., prior to establishing plantations or constructing hardstands) ♦ Employ soil stabilisation methods such as matting, grassing or mulch, where practicable ♦ Ensure clean up and restoration proceeds as soon as is practicable after works are completed ♦ Limit machinery movements where possible

PR6 – Air Emissions and Air Quality Management Procedure (p2)			
Proposed Management and Mitigation Measures (cont'd)			
Construction and operations (cont'd)	♦ Maintain exhaust systems and emission control devices on vehicles and equipment to ensure that they are functioning as intended by the manufacturer. ♦ Store fuels and chemicals as specified in their SDS in closed containers ♦ If all available methods of dust management fail to adequately suppress dust and unacceptable impacts on sensitive receptors become evident, temporarily halt construction/plantation establishment activities until dust generating conditions subside ♦ Continually review energy efficiency, and identify and implement opportunities for efficiency improvements		
Proposed Monitoring and Reporting			
Action		**Frequency**	**Reporting**
Undertake ongoing liaison with local communities regarding air quality issues related to the Project, including visual observations of emissions		Ongoing/as required	Monthly
Monitor dust generation (visual)		Event based	Monthly
Monitor dust deposition rates		Monthly	Quarterly
Monitor and report on fuel use (as documented in yearly reporting under Carbon Disclosure Reporting)		Monthly	Quarterly
Monitor point source (e.g., power plant stacks) emissions – upon commissioning each boiler unit, this monitoring will include as a minimum measurement of in-stack concentrations and emission rates (post ESP) of: ♦ Particulate matter ♦ Oxides of nitrogen ♦ Sulfur dioxide ♦ VOCs ♦ Carbon monoxide ♦ Determinations of gas temperature, stack gas velocity, moisture content, CO_2/O_2 content and exhaust gas flow rate		Annually	Annually
Record and report number of complaints related to air quality		Ongoing/as required	Monthly
Record and report on project-related GHG emissions		Ongoing/as required	Annually
If plantation access road construction areas are not located greater than 350 m from existing village/s, consideration will be given to a monitoring program that involves: ♦ PM_{10} baseline monitoring using, e.g., beta-attenuation monitors (BAMs), in villages close to the proposed access road area prior to construction works starting ♦ PM_{10} monitoring downwind of construction activities should complaints regarding dust be received during road construction ♦ PM_{10} monitoring to investigate other complaints or concerns, and to collect baseline monitoring away from the active work areas		As required	Quarterly

PR7 – Invasive Alien Species Management Procedure (p1)	
Purpose	
This procedure describes the minimum requirements that will be followed to prevent the introduction and spread of invasive alien species (including introduced pests and plant pathogens) as a result of Project activities	
Context	
Project activities (e.g., importation of equipment and personnel, plantation development) have the potential to introduce invasive alien species including weeds, plant pathogens or pest fauna into the area or facilitate the spread of existing weeds, plant pathogens and pests beyond their initial range	
Proposed Management and Mitigation Measures	
Training and awareness	Being aware of invasive alien species that are currently in the area, and/or those that could potentially establish in the area, is key to managing this issue. Selected Project personnel will be trained in: ♦ Identifying weed species currently in the area and those that could establish ♦ Identifying plant pathogens and evidence of their presence ♦ Identifying pests known to be in the area and those that could establish ♦ Techniques to prevent and, if necessary, control infestation of invasive alien species
Planning	In planning new activities involving vegetation disturbance, the following will be considered: ♦ Identify existing weeds within the vicinity of areas to be cleared ♦ Determine if there is evidence of plant pathogens on the proposed site ♦ Develop control strategies for weed species already established, using a risk-based approach to prioritise implementation, with a focus on noxious weeds ♦ Ensure that chemicals used to control weeds and equipment are on site and in good condition ♦ Should dieback be identified: – Exclude access to these areas OR – Provide boot-washing facilities for staff leaving the area to prevent further spread of the pathogen ♦ Identify existing pests and those that have the potential to establish in the area ♦ Consult with landowners concerning areas known to be infested by invasive alien species
Movement of machinery/ equipment	Use of machinery and equipment from outside the Project area and subsequent movements within the Project area are likely to be the most common causes of invasive alien species being introduced and/or spread. To minimise the likelihood of this occurring, the following practices will be implemented: ♦ Follow PNG quarantine requirements for importation of construction materials, soil or other plant material to the Project area ♦ Check equipment arriving on site to ensure that it is clean. Collect soil or vegetative matter in a plastic bag for subsequent burial in the Project landfill ♦ Minimise movement of equipment and machinery between areas ♦ Before any equipment is moved, remove soil, seeds and vegetation by washing down, paying particular attention to wheels, under-carriage areas and/or tracks
Construction and operations	During construction and operations, the following will be undertaken: ♦ Control the establishment of noxious weeds and pest animals at the edges of cleared or disturbed areas ♦ Place wastes (food in particular) in a bin (with secure lid) or otherwise in a manner that excludes pest animals such as rodents, and does not allow pest animals to access putrescible waste as a food supply ♦ Do not leave food wastes outside ♦ Initiate weed, pathogen and pest control programs as soon as possible, as required, using species-appropriate methods

<table>
<tr><th colspan="4">PR7 – Invasive Alien Species Management Procedure (p2)</th></tr>
<tr><td colspan="4">Proposed Management and Mitigation Measures (cont'd)</td></tr>
<tr><td>Construction and operations (cont'd)</td><td colspan="3">♦ Control pest rodents including black rat (Rattus rattus) and house mouse (Mus musculus) when detected in Project infrastructure areas
♦ Areas adjacent to and downslope of Acacia test plantings will be monitored for spread of these species. Any identified recruitment of Acacia plants from seed or suckering outside of the test planting areas will be controlled using an appropriate herbicide
♦ When plots of Acacia are harvested or cleared, where practicable these plots will not be burnt (to minimise germination of seeds). Plots will be monitored for recruitment of new Acacia plants, which will be controlled using an appropriate herbicide as required
♦ Implement riparian buffer zones with no plantations being established within the buffers</td></tr>
<tr><td colspan="4">Proposed Monitoring and Reporting</td></tr>
<tr><th>Action</th><th>Frequency</th><th>Reporting</th></tr>
<tr><td>Record and report weed, pathogen and pest presence or changes in extent of existing populations within the Project area</td><td>Quarterly</td><td>Quarterly</td></tr>
<tr><td>Monitor Acacia species within the Project area</td><td>Quarterly</td><td>Quarterly</td></tr>
<tr><td>Record and report pest animal sightings</td><td>Event-based</td><td>Monthly</td></tr>
<tr><td>Audit truck/machinery washing/cleaning facilities</td><td>Quarterly</td><td>Quarterly</td></tr>
</table>

PR8 – Water Management Procedure (p1)	
Purpose	
This procedure describes how surface water and groundwater resources are managed appropriately to minimise impacts on the environment and beneficial uses. The measures described herein will be progressively reviewed and modified as additional information about groundwater and plantation interactions is obtained	
Context	
Inappropriate management of water generated from, or used by, Project activities can impact on surface water and groundwater quality, and surface water and groundwater flow regimes, and associated beneficial values	
Proposed Management and Mitigation Measures	
General	Ensure that the relevant management and mitigation measures detailed in other management procedures, e.g., vegetation clearing (PR2), general waste management (PR3), hydrocarbons and chemicals management (PR4), and watercourse crossing management (PR9), are implemented
Planning	In planning Project activities, the following will be considered: ♦ Design access roads, facility sites and supporting infrastructure to allow adequate surface drainage and avoid redirection of stream flows and drainage lines where practicable ♦ Maximise water reuse and recycling ♦ Identify suitable extraction sites (water and gravel) that are likely to require the least disturbance of vegetation, expose minimal surfaces to erosion and cause least disruption to channel alignment and river depth. Take into consideration access routes to and from extraction sites that also require minimal disturbance ♦ Undertake a risk assessment in relation to acid sulfate soils and, if required, prepare an acid sulfate soils management plan ♦ Preferentially undertake construction activities requiring major earthworks in dry periods ♦ Ensure that appropriate consideration is given to flood prevention and mitigation measures for the power plant and central nursery ♦ Ensure that no plantations are established in areas that may act as water sources for Klin Wara and Maralumi River until additional information is obtained about these areas, where such information could include: – Groundwater and surface water contributions to downstream flows – Environmental characteristics (including terrestrial vegetation, soil characterisation and seepage characteristics of these areas, as well as downstream aquatic ecology) ♦ Where consolidated areas of plantations >100 ha are to be situated upslope of pre-existing water supply well/s, establish buffer zones of at least 300 m between the plantation boundary and the well/s ♦ Establish riparian buffer zones as follows: – 100 m from the banks of the Markham River – 60 m from the banks of the Leron and Erap rivers, and also from the edges of lakes, lagoons and swamps – 30 m from the banks on either side of other permanent watercourses with average widths >5 m – 20 m from the banks on either side of all watercourses with an average width >1 m but <5 m – At least 5 m from the banks on either side of watercourses with an average width <1 m ♦ Prior to construction, develop an ambient surface water monitoring program that takes into consideration flow/hydrology, water quality and geomorphology monitoring in selected major and/or clearwater watercourses within the Project area (and where practicable), and includes environment permit requirements once these are known

PR8 – Water Management Procedure (p2)	
Proposed Management and Mitigation Measures (cont'd)	
Construction and operations	During construction and operations the following will be undertaken: ♦ Install appropriate erosion and sediment control measures including but not limited to settling ponds, cut off drains, sediment traps, downslope silt fencing, revegetation and matting, and other measures described in PR2 ♦ Construct cut-off drains and sedimentation ponds around soil stockpiles ♦ Prevent surface runoff from potential sources of contamination reporting to surface water. If prevention is not possible, segregate this runoff from less contaminated runoff to reduce the volume of water requiring treatment ♦ Do not wash vehicles, equipment or machinery near or within watercourses ♦ Ensure that wastewaters (e.g., treated sewage, holding pond discharge) meet environment permit conditions before discharge into the environment ♦ Protect watercourse channel stability by limiting in-stream and bank disturbance, and ensure that the following activities are excluded from riparian buffer zones: – Machinery access – Felling of trees or clearing of vegetation except where required for designated stream crossings (note that within buffer zones for <1 m streams only, vegetation clearing will be minimised to the extent practicable, rather than excluded) – Establishment of plantations – Storing of logs, soil, machinery, fuels, oils, lubricant or herbicides, or placement of other Project-related infrastructure – Construction of roads, except where required for designated stream crossings or bridges – Crossing of harvesting machinery, except at appropriately constructed permanent crossing points (bridges) or at designated temporary crossings for dry watercourses. Harvesting machinery can cross watercourses where log crossings or culverts are provided ♦ Keep stormwater runoff that has come into contact with power plant, log yard and nursery areas from runoff that has not ♦ Implement bank protection measures downstream of discharge points and sediment basin spillways ♦ Include litter screens at the inlet of sediment traps, where practicable, to reduce waste delivery to watercourses. Regularly remove and dispose of waste trapped by screens ♦ Install and maintain oil-water separators and grease traps as appropriate at refuelling facilities, workshops, light and heavy vehicle washdown pads, parking areas, fuel storage and containment areas ♦ Divert and contain water used to clean vehicles, plant and equipment into an oil/water separator and do not allow uncontrolled release to watercourses or drainage lines ♦ Provide culverts and turnouts on all roads ♦ Maintain road V-drains to prevent damage to roads, and install energy dissipaters or erosion control structures on steep slopes ♦ Install culverts under roads at creek crossings to collect and divert runoff into the natural drainage ♦ Avoid gravel extraction from non-approved sites and reduce the number of gravel extraction sites to limit the area of river disturbance ♦ Establish, and train personnel in, gravel extraction methods that minimise bank disturbance, sediment remobilisation and sediment spills from excavators to watercourses, including undertaking gravel extraction from rivers during periods of low water flow where feasible ♦ Locate groundwater bores for the power plant downslope of plantations and the water supplies of villages and hamlets, where practicable

PR8 – Water Management Procedure (p3)		
Proposed Monitoring and Reporting		
Action	**Frequency**	**Reporting**
Monitor flow/hydrology, water quality and geomorphology as specified in the ambient surface water monitoring program developed prior to construction (and including environment permit requirements); include glyphosate in the monitoring program	TBD	Quarterly
Monitor stormwater quality (visual appearance)	Event-based	Monthly
Record volumes of water extracted by the Project (by source)	Daily	Monthly
Record volumes of water recycled/reused	Daily	Monthly
Record floodplain water depths (during flood events)	Opportunistically	Monthly
Monitor groundwater levels and quality (via monitoring bores)	Monthly	Monthly
Monitor erosion, bank slumping and scouring (visual inspection/photographic record)	Fortnightly and following prolonged heavy rainfall or storm events	Monthly
Monitor erosion and sediment control devices, diversion drains and settling ponds (visual inspection)	Fortnightly and following prolonged heavy rainfall or storm events	Monthly
Record complaints in relation to water quality/quantity	Ongoing/as required	Monthly
Undertake aquatic ecology survey (fish, macrocrustaceans)	As required in response to specific events or concerns	Annually

PR9 – Watercourse Crossing Management Procedure (p1)	
Purpose	
This procedure describes the minimum requirements that will be followed to ensure that watercourse crossings are constructed and rehabilitated in a responsible manner to minimise impacts on the environment	
Context	
Project construction and plantation development will require the installation of a number of watercourse crossings. Poorly designed and constructed crossings can cause river bed and bank erosion and/or modifications to drainage conditions and flow, with subsequent impacts on water quality and aquatic/riparian habitats	
Proposed Management and Mitigation Measures	
Planning	The following measures will be implemented during planning for watercourse crossing installation: ♦ Where practicable, minimise the number of watercourse crossings ♦ Locate watercourse crossings away from watercourse bends or rapids sections ♦ Ensure that watercourse crossings are designed to be perpendicular (within 10º) to water flow ♦ Where harvesting machinery is required to cross watercourses, construct log crossings or culverts ♦ Ensure that spill response and clean up equipment is on site prior to commencing works (see PR4) ♦ Schedule watercourse crossing works for periods of low flow where possible and complete the works in the minimum time required ♦ Ensure that construction machinery is weed free before accessing the watercourse (see PR7) ♦ Locate crossings in riparian grassland where practicable ♦ Consider the flow characteristics of the watercourse being traversed and the characteristics of the resident fauna ♦ Follow the principles of the PNG Logging Code of Practice, where applicable
Clearing and grading	Clearing and grading will involve the following: ♦ Avoid steep approaches to river crossings wherever possible ♦ Only clear riparian vegetation (plants within buffer zones as defined by PR8) where necessary to allow the installation and operation of the watercourse crossing ♦ Do not clear slopes leading to the watercourse and any riparian vegetation until such time as construction of the crossing is about to commence ♦ Ensure that any vegetation (aquatic or riparian) to be removed will be cut to ground level and the roots left in the ground to aid in erosion prevention. If deep excavation is required, remove roots within the construction footprint only ♦ Where grading adjacent to watercourses is required to enable access, grade the soil away from the watercourse ♦ Place topsoil at least 10 m away from the top of the stream banks where practical and erect silt fences or containments berms around stockpiles to minimise loss due to erosion
Erosion control	Erosion control will involve the following: ♦ Install erosion and sediment controls on or near slopes adjacent to watercourses during initial road grading activities, and maintain until final construction clean-up is completed ♦ Direct runoff water discharge to stable areas or via sediment settling basins and do not discharge directly into watercourses ♦ Divert road drainage within the last 50 m of the water crossing away from the watercourse into surrounding vegetation, ensuring suitable stabilisation measures are installed to avoid erosion and scour (e.g., riprap aprons) ♦ Minimise continuous slopes where scouring can occur ♦ Ensure that vehicles keep to well-defined roads

<table>
<tr><th colspan="4">PR9 – Watercourse Crossing Management Procedure (p2)</th></tr>
<tr><td colspan="4">Proposed Management and Mitigation Measures (cont'd)</td></tr>
<tr><td>Construction</td><td colspan="3">Construction activities will involve the following:
♦ Ensure that all material used in construction works will be benign in terms of generating potentially harmful leachates and runoff
♦ Construct log crossings using the most durable timber available
♦ Install ford crossings at the existing natural bed level, and align the lowest point of the crossing with the natural low flow channel
♦ Minimise vegetation clearing, bank modification and disturbance of the streambed when constructing water crossings
♦ Install culverts where required to minimise impacts on water flow, especially where fish movement is likely to be required
♦ Minimise earth moving and changes to the streambed during construction
♦ Avoid the creation of barriers to fish movement that can include hydraulic barriers (e.g., high flow velocity, reduced water depth, steps between culvert and river bed) or physical barriers (e.g., trapping of sediment/logs)
♦ Ensure that loose material is extracted and transported from construction areas at water crossings in a manner that does not allow it to report directly to the watercourse
♦ Keep heavy machinery away from watercourses, unless access is required to construct crossings
♦ Ensure waterway crossings are regularly inspected and maintained</td></tr>
<tr><td>Rehabilitation</td><td colspan="3">For any part of a watercourse bed or banks that has been altered by works, the site will be rehabilitated so that:
♦ Revegetation is undertaken as soon as is practicable
♦ Vegetation is retained or replaced to re-establish plants native to the site
♦ Profiles of bed and banks are reinstated to pre-work profiles and stability
♦ Watercourse bed is retained with natural substrate or reconstructed with substrate comparable to natural substrate size and consistency</td></tr>
<tr><td colspan="4">Proposed Monitoring and Reporting</td></tr>
<tr><th>Action</th><th>Frequency</th><th>Reporting</th></tr>
<tr><td>Monitor sedimentation levels in affected streams/rivers</td><td>Quarterly</td><td>Quarterly</td></tr>
<tr><td>Monitor turbidity levels in affected streams/rivers (upstream and downstream) during and after the cessation of gravel extraction operations/watercourse crossing construction</td><td>Event-based</td><td>Monthly</td></tr>
<tr><td>Monitor stormwater quality (visual appearance)</td><td>Event-based</td><td>Monthly</td></tr>
<tr><td>Monitor erosion, bank slumping and scouring (visual inspection/photographic record)</td><td>Fortnightly and following prolonged heavy rainfall or storm events</td><td>Monthly</td></tr>
<tr><td>Monitor erosion and sediment control devices, diversion drains (visual inspection)</td><td>Fortnightly and following prolonged heavy rainfall or storm events</td><td>Monthly</td></tr>
<tr><td>Monitor crossing integrity</td><td>Fortnightly and following prolonged heavy rainfall or storm events</td><td>Monthly</td></tr>
<tr><td>Record complaints in relation to water quality/quantity</td><td>Ongoing/as required</td><td>Monthly</td></tr>
</table>

PR10 – Environmental Incident and Non-compliance Reporting Procedure (p1)

Purpose

This procedure describes the minimum requirements that will be followed to ensure that all environmental incidents relating to the Project are reported and recorded, as required. This will enable Markham Valley Biomass to meet its statutory requirements for notifiable incidents and also enable the company to monitor and implement corrective actions for non-notifiable incidents

Definitions

- Notifiable incident – an incident in breach of laws or statutory conditions; must be reported to government. The criteria for defining 'notifiable' will be further developed in relation to the Project environment permit, with reporting of 'significant' environmental incidents likely to be a condition within the permit
- Non-notifiable incident – minor incident that does not need to be reported to government; these are not a breach of compliance but will be reported as part of the Project's internal weekly/monthly reporting system
- Incident – requires completing an internal 'Environmental Incident Form'
- Non-compliance – any breach of legislation, environment permit condition or approved management plan (e.g., this EMP)

Proposed Management and Mitigation Measures

General	Responses to environmental incidents will involve the following: • Report all environmental incidents, both notifiable and non-notifiable, to Project environment personnel as follows and using the environmental incident form, taking into account the level of risk: – Level 3, to be reported immediately to the Project Director. Incidents that are likely to affect the business either through likelihood of prosecution or in terms of cost or increased difficulty of doing business if the corporate reputation is affected; environmental impact is major or is a threat to health and safety Examples include: significant contamination of surface and/or groundwater, multiple fatalities, widespread community unrest – Level 2, to be reported within 24 hours to the Project Director. Incidents that could potentially result in prosecution, have significant environmental impact, are a threat to the health or safety of employees or the local community, or have potential to adversely affect relationships between the operation and the local community/broader public Examples include: restricted contamination of surface water and/or groundwater, unauthorised disturbance of significant cultural heritage site – Level 1, to be reported within 24 hours to Project HSE personnel. Incidents that lead to a minor breach of statutory conditions, have the potential to cause a low environmental impact or are unlikely to provoke a response from members of the local community. Examples include: a minor spill that can easily be cleaned up, minor exceedance of water quality standards • Notify the Director of CEPA of notifiable incidents in accordance with the requirements of the environment permit • Include all environmental incidents, both notifiable and non-notifiable, in the Project's routine internal reporting • Include all environmental non-compliances in the Project's routine internal reporting, taking into account the level of risk: – Level 3 non-compliance issues could result in prosecution or are of a significant nature with medium- or long-term effects and potentially serious environmental consequences – Level 2 non-compliance issues may be issues of a continuous nature but with limited environmental impact or short- to medium-term issues with the potential for moderate environmental impacts – Level 1 non-compliance issues may be technical or procedural issues involving environmental laws and regulations or a minor non-recurrent issue (e.g., a minor breach of a water quality standard)

PR10 – Environmental Incident and Non-compliance Reporting Procedure (p2)

Proposed Management and Mitigation Measures (cont'd)

Emergency response	Management measures in relation to emergencies will involve the following: ♦ Schedule and conduct regular drills to practice timely and effective emergency response ♦ Establish a recording system for the management of wastes, stormwater and procedures for clean-up of leaks or spills, and other emergency situations (see 'Additional Comment') ♦ In the event of a hydrocarbon or chemical spill, follow the steps outlined in the emergency response plan
Complaints response	Management measures in relation to complaints will involve the following: ♦ Investigate all complaints and undertake monitoring if appropriate ♦ Manage any complaints received in accordance with the Project's grievance mechanism

Proposed Monitoring and Reporting

Action	Frequency	Reporting
Record number and nature of incidents and non-compliances	Event-based	As required
Record nature of incident and non-compliance response	Event-based	As required

Additional Comment

An 'action log' (database) will be established that will allow the following information to be recorded:

- Incidents:
  - Details of injured employees
  - Details of person reporting incidents
  - Details of damage and expected costs of incidents
  - Details of injuries and expected disability periods
  - Medical treatment (time lost) and incident description
  - Root cause analysis
  - Safety notes
  - Control measures to be implemented to prevent re-occurrence
  - Preventative action; corrective action
  - Follow up required
- Forest fires:
  - Details of person reporting fire
  - Details of the location of the fire
  - Details of start and end time of fires
  - Fire cause analysis
  - Details of conditions at the time of the fire starting
  - Human casualties as a result of fires
  - Details of losses as a result of fire, including natural vegetation, agricultural and forestry, structures, livestock, tools and equipment
  - Details of reports to authorities
  - Preventative action; corrective action
  - Follow up required
- Corrective actions:
  - Details of person entering report
  - Type of complaint and description
  - Details of investigation
  - Details of corrective action and authorisation
  - Details of preventative action
  - Details of follow up
  - Details of closure authorisation

<table>
<tr><th colspan="3">PR11 – Emergency Response Plans and Drills Procedure (p1)</th></tr>
<tr><td colspan="3">Purpose</td></tr>
<tr><td colspan="3">This procedure describes the minimum requirements that will be followed to ensure that an emergency response plan is prepared such that the Project is able to effectively respond to any incident with the objective of minimising adverse consequences on the health and safety of employees and communities, the environment, Project facilities and Markham Valley Biomass' reputation</td></tr>
<tr><td colspan="3">Context</td></tr>
<tr><td colspan="3">Accidents and incidents can occur during construction and operation. The risk of some of these events having significant consequences warrants the preparation of an Emergency Response Plan</td></tr>
<tr><td colspan="3">Proposed Management and Mitigation Measures</td></tr>
<tr><td>Planning</td><td colspan="2">Preparation of a suitable emergency response plan requires the following:
♦ Identifying all hazards and risks of an unplanned incident, and appropriate preventative and control measures
♦ Developing a response strategy to manage potentially significant unplanned incidents
♦ Ensuring clarity of organisational roles and responsibilities in relation to emergency response
♦ Ensuring an appropriate level of employee, contractor, government agency and public awareness of the identified risks and hazards
♦ Having properly trained and experienced emergency response personnel</td></tr>
<tr><td>Emergency response</td><td colspan="2">Emergency response will involve consideration of the following:
♦ Appropriate communication to employees, contractors and the public and, where appropriate, the recovery needs of the community after an emergency
♦ A training program designed to improve the proficiency of the emergency response team as well as all employees and contractors covering operating procedures, emergency and safety procedures, regulatory compliance requirements and communication responsibilities
♦ Periodic review and update of the risk assessment in relation to an accidental release (e.g., of chemicals or wastewater) or other emergencies to employees, contractors, local communities and adjacent neighbours, and actions required to reduce significant risks
♦ Communication of relevant emergency response planning information to appropriate regulatory agencies and local emergency planning committees
♦ Coordination of the written emergency response plan, community emergency response plan and other facility plans. If no community emergency response plan exists, initiation, where appropriate, of community efforts to create one
♦ Identification of emergency responders and, where relevant, provision of facility tours to promote emergency preparedness and to provide current knowledge of facility operations
♦ Conduct, at least annually, of emergency exercise sessions with emergency responders and others where appropriate, to test the workability of the written emergency response plan
♦ Participation in the development and periodic testing of community emergency response plans
♦ Sharing of information and experience with other nearby facilities in the community relating to emergency response planning, exercises and incident handling</td></tr>
<tr><td colspan="3">Proposed Monitoring and Reporting</td></tr>
<tr><td colspan="3"><table>
<tr><th>Action</th><th>Frequency</th><th>Reporting</th></tr>
<tr><td>Audit emergency response plan</td><td>Quarterly</td><td>Quarterly</td></tr>
<tr><td>Record number of emergency response drills</td><td>Ongoing/as required</td><td>Monthly</td></tr>
</table></td></tr>
</table>

PR12 – Environmental Auditing Procedure (p1)	
Purpose	
This procedure provides guidelines for conducting internal environmental audits by Project staff	
Context	
Internal environmental audits are required to achieve a range of objectives including, but not limited to, ensuring that environmental policies and procedures are working and are effective, the environmental management system (EMS) has been properly implemented and maintained, and areas for improvement are being identified	
Proposed Management and Mitigation Measures	
Planning	Preparation of an environmental auditing program requires the following: ♦ Scheduling audits of the Project's EMS taking into account: – Non-conformances and the outcomes and responses to previous audits – Significant changes in management, organisation, policy, techniques or technologies – Significant changes in legal and other requirements – Risk assessments – Changes to the EMS – Opportunities for continual improvement of the EMS – Issues of concern raised by stakeholders ♦ Responding to problems with the audit schedule and updating this if necessary ♦ Where resources permit, assigning audits to someone who is not directly responsible for the processes being audited
Conducting the audit	Conducting the audit will involve the following: ♦ Providing the auditor with an uncontrolled copy of the document/s to be audited and/or the template Internal Audit Report for that particular document (if available) or a blank internal audit report form ♦ Before the audit, ensuring that the auditor carefully reads the document/s being audited, reviews the outcomes and responses to previous relevant audits, and determines how the audit will be conducted. The auditor can: – Use an existing internal audit template relating to that document (if available) OR – Compose a set of questions using a blank internal audit report form OR – Use the uncontrolled document itself (with internal audit report cover page) ♦ Working through the checkpoints and/or questions with the person/s being audited, checking for, and noting down (on the report or document), evidence of the manner in which the process is being carried out ♦ Undertaking an inspection of the power plant and nursery, as well as selected parts of the plantation, as required ♦ At the end of the audit discussions and site inspection, completing the rest of the internal audit report, ensuring that the report lists and defines findings and observations point by point in a succinct manner, and noting any problems about the process being audited and discrepancies between the actual and documented procedure ♦ Submitting the audit report (within 7 days of completing the audit) to senior Project personnel
Audit follow-up	Following submission of the audit report, the nominated Project personnel will: ♦ Implement timely corrective or preventive action in regard to process/system improvement or non-conformities found during the audit, including opportunities or suggestions for improvements ♦ Maintain appropriate cross-referencing between audit records (audit form/report and plan) and the corrective action register (CAR) ♦ Check that CAR numbers have been raised for all corrective actions required

PR12 – Environmental Auditing Procedure (p2)	
Proposed Management and Mitigation Measures (cont'd)	
Audit follow-up (cont'd)	♦ Where other than text changes to the document is required, ensure that the person(s) responsible for the procedure where corrective action is to occur has been correctly identified in the CAR ♦ Update previous CARs which were checked during the audit ♦ Update the audit schedule to show the audit has been completed ♦ Save the audit electronically in the appropriate folder on the Project server ♦ File the audit report in the appropriate hard copy folder ♦ Follow the corrective action procedure and document control procedure as required ♦ If necessary, note any major problems raised during the audit at the next management meeting

Proposed Monitoring and Reporting

Action	Frequency	Reporting
Undertake reconciliation of audits held versus audit schedule	Quarterly	Quarterly
Review selected past audit reports	Quarterly	Quarterly
Review implementation of past audit findings	Quarterly	Quarterly

7. Stakeholder Engagement

7.1 Context

Appropriate environmental management practices are essential to ensure that Project activities are properly controlled and that community concerns are effectively addressed.

One of the most important factors shaping the relationship between the Project and local communities is the ability of the parties to communicate effectively with each other. This requires that MVB develops an understanding of the communities so that issues can be effectively managed as they arise. The building and maintenance of a relationship with the local community is critical to the ongoing success of the Project.

Markham Valley Biomass has therefore developed a stakeholder engagement plan (SEP) that identifies the current relationships of the Project with the main stakeholders based on a number of years of field trials within the Project area. The SEP demonstrates how these relationships will be maintained and enhanced during Project construction and operations, and key aspects are summarised below.

7.2 Issues Requiring Consultation

A number of issues relating to Project development will require consultation with the local community. These may include:

- Areas of sensitivity to landowners, local communities or other stakeholders.
- Location of Project facilities.
- Construction and operations activities, including likely impacts.
- Use of Project roads by the local community.
- Employment, training and supply opportunities, and compensation.
- Access to land and water.

Markham Valley Biomass will ensure that these and other relevant issues are included in the stakeholder engagement consultation program.

7.3 Stakeholder Engagement Plan

The SEP is a comprehensive document that describes the Project's approach to consulting with, and engaging, stakeholders. The document addresses the following:

- Maintaining the Project's 'social licence to operate', in part by maximising the involvement of local community members.

- The Project's guiding principles, these being a commitment to comply with PNG legislation and adhere to a number of internally generated standards, which requires transparent, open and pro-active communication and cooperation between MVB and stakeholders.
- Identifying various stakeholder groups, ranging from individual families using or owning assets in the Project area through to the provincial and national governments, international finance institutions, and international observers.
- A stakeholder communications/action plan that is aimed at ensuring that all stakeholders have been engaged to the appropriate extent and have a sufficient understanding of Project activities (depending on the stakeholder involved).
- Reviewing and adapting the current grievance mechanism to ensure that it is appropriate for the various stages of Project development, including complaints or issues arising from the activities of construction or other contractors.
- The role of independent third party organisations to provide comfort and reassurance to stakeholders, particularly affected clan landowner members.
- Completing risk assessments or reviewing previous risk assessments in light of changes in Project scope, activities or local socio-economic environment.
- Monitoring, evaluation and reporting, where this includes internal monitoring, outcome evaluation and completion audits.
- Community development opportunities, where the Project's aim is to ensure that the communities directly and indirectly impacted by Project activities are provided every opportunity improve their livelihoods in an ongoing and sustainable manner. These include:
  - Project-supported community development, such as donations or sponsorships.
  - Employment, both direct and indirect.
  - Local business development, including maximising (where appropriate) local national content.

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Attachment 1. Example of a Management Prescription – Establishment

1 Scope

This procedure applies to all company forests operations where land is being afforested or reforested.

2 Objective

The objective is optimise land use by ensuring that all planting, watering and blanking is done safely and in such a way as to improve the quality and uniformity of the planted crop, whilst mitigating the impacts of these operations on the environment.

3 Legal Compliance Requirements

Field operations shall comply with all national laws and codes of practice. Where no such code exists, the operation shall comply with the "ILO - Code of Practice on Safety and Health in Forestry"

4 Operational Control

1	Every crew, of more than five people, working in field shall have a first aider present in Field.	**S**
2	First Aiders shall have a first aid kit with them in-field that complies with the company requirements.	**S**
3	Silvicultural employees shall be represented by a SHE representative.	**S**
4	For Personal Protective Equipment (PPE) requirements refer to section 4.1 of the BOP's	**S**
5	Team briefings / team talks / toolbox talks shall be done.	**Q**
6	Daily Production and labour details shall be recorded on the Production Control form.	**P**
7	All silvicultural operations shall have an Annual Plan of Operations (APO) completed before operations commence. (Refer to the Annual Plan of Operations BOP)	**Q**
8	Based on the selection of tending or weeding method refer to relevant BOP's for further health, safety, environmental, quality and productivity standards,	**Q**
9	Ensure compliance with the relevant BOP requirements.	**Q**
10	Sufficient supplies of safe drinking water should be available at the worksite. For physical work in hot climates up to 1 litre per hour may be required.	**S**
11	Non-organic waste shall be disposed of in the correct manner. (Bins/bags shall be provided for such waste disposal).	**E**
12	Areas shall be designated or demarcated in-field (day camp) for: ➢ first aid boxes, food and drinking water storage, ➢ chemical, fuel and oil storage. There should be no risk of food and drinking water being contaminated by chemicals.	**S,E**
13	Smoking shall be restricted to designated areas, as defined by the company.	**E**
14	Refer to the Preventative Action, Corrective Action procedures, and CAR Form where non-compliances to this prescription are observed.	**Q**

4.1 Planting (*consider two sections, establishment and planting*)

Refer to the relevant BOP's for further instruction on the Safety, Environmental and Quality standards for Planting Activities.

1	All planting is to be done in terms of the Establishment Assessment.	**Q**
2	The Establishment Assessment shall be signed by the relevant functions.	**Q**
3	All planting should be done in terms of the Annual Plan of Operations (APO)	**Q**
4	However, the main objective should focus on the quality of preparation, planting and optimum planting windows. This takes precedence over the limiting of the Temporary Unplanted (TU) area.	**Q**
5	When planting on rip lines care must be taken that all air pockets are removed first before planting can take place. Planting on the sides of the rip lines is allowed where not enough soil is left inside the rip line.	**Q**
6	Refer to Policy Manual section 3.3.6.2.2 for planting espacements.	**Q**
7	Complete the relevant sections of the Establishment Assessment form	**P**
8	Refer to the Conservation Management FMP for prescriptions on planting restrictions related to natural areas (including SMZ's) and Areas of Special Interest (ASI's).	**E**

4.2 Refilling (Blanking)

1	Blank within 2 months after planting operation in the same season.	**Q**
2	Aim at a survival rate of 85% plus (see blanking table below).	**Q**
3	If more than 50% blanking is required the planting date shall be altered to the date of blanking.	**Q**
4	Species shall be recorded in the Establishment Assessment Form.	**Q**

5 Responsibility

The following positions are responsible for ensuring compliance with this procedure:

Superior Second Level: **GENERAL MANAGER - FORESTRY**

Superior First Level: **SILVICULTURE FORESTER**

This Position: **PLANNING & RESOURCE SUPERVISOR**

6 Appendix

Establishment Assessment

7 Records

Record	Responsibility	Where kept	Retention
Establishment Assessment	Silviculture Forester	Compartment Register	25 years
Annual plan of operations (APO schedules)	Silviculture Forester	Forest Office	2 years
Monthly Progress reports	Silviculture Forester	Forest Office	2 years
Plantation Audits	Silviculture Forester	Forest Office	5 years

8 References

IMS Manual	OHSAS 18001:2007	ISO 14001:2004	ISO 9001:2000
5.6.2.2	4.4.6	4.4.6	7.1; 7.5.1; 7.5.2
FSC		**Aspect /Impact/Hazard Register**	**BOP**
6.2; 6.3; 6.6; 6.9		Impacts SC150, SC160 Risks G/P/W E04, E05, E06	Refer to Silviculture Site Map

9 Definitions

Attachment 2.
Example of Best Operating Practice – Weeding Using a Slashing Tool

FORESTRY SOLUTIONS

OPERATION	SILVICULTURE	WEEDING – SLASHING

1. SCOPE of the BOP

Land preparation / pit **/** plant / watering / fertilise / blanking / **tending operations**

Species: Pine, *Eucalyptus, Acacia mearnsii*

2. OBJECTIVE

This BOP describes weeding of a designated area of weeds and regrowth using a slashing tool.

3. LEGAL COMPLIANCE REQUIREMENTS (Links to Legal Register)

Field operations shall comply with all national laws and codes of practice. Where no such code exists, the operation shall comply with the "ILO - Code of Practice on Safety and Health in Forestry"

4. OPERATIONAL CONTROL

4.1 ACTIVITY PLANNING

All compartment and daily planning should be carried out according to in house silvicultural planning procedures.

4.2. SAFETY AND THE ENVIRONMENT

Safety Risk factor: Medium
Environmental risk factor: Low

The operation should comply with all in-house safety regulations.

1.	The operator should wear the prescribed Nationally approved safety equipment: a) Overall b) Safety boots – hard tipped toes c) Sunhat / Hard hat (optional) d) All safety equipment shall be in a serviceable condition. All safety equipment shall be in a serviceable condition	**S**
2.	The worker should ensure that when loading and off loading equipment onto the transport vehicle, the correct loading techniques are used. (Bending knees)	**S**
3.	A single worker should not lift loads greater than 25kg.	**S**
4.	Workers should be seated during transportation and all equipment and materials properly secured.	**S**
5.	The workers should pay attention and take note of the points raised in the supervisor during the safety (toolbox) talk.	**S**
6.	The worker may not be under the influence of alcohol or a narcotic, as this impairs his ability.	**S**
7.	Certain animals can be harmful to the worker's health such as bees, wasps and reptiles. These to be reported to the supervisor to remove the threat.	**S**
8.	All non-organic waste is to be removed from infield daily, and disposed of in the appropriate manner.	**E**
9.	Keep clear of Special Management Zones (SMZ's) or Areas of Special Interest (ASI's) SMZ's and ASI's.	**E**
10.	No slashing/weeding activities to take place within the restricted areas in SMZ's and ASI's.	**E**
11.	Remove slash from designated SMZ's and ASI's, which may accidentally have entered these sites.	**E**
12.	The worker should be alerted to endangered species of plant or animals, especially active raptor nests	**E**

4.3. CONTROLS

4.3.1 Daily production control

The manual slashing worker should be allocated a daily production target prior to the commencement of the shift. The supervisor should also allocate and mark out the rows for the worker. Any special instructions should be issued at this time.

1.	Identify the current area to be weeded and determine the planned task level.	**P**
2.	Check the slope, ground cover and soil conditions and ensure that the task level for the conditions corresponds with the plan.	**P**
3.	The workers should use a method and equipment suitable to the conditions being weeded. The equipment should be in a serviceable working condition.	**S**
4.	The operational planning of the compartment should be conducted to ensure that each of the manual slashing workers can function in an organised, safe and continuous manner without interference from or influence of other workers.	**S**
5.	The daily targets set should allow the target to be achieved by the worker, at an even pace, during a working day.	**S**
6.	The daily targets should be realistic and set according to prevailing terrain conditions and prescribed standards	**S**

4.3.2 Job Observation

The Job observation checklist attached in Appendix 2 is to be used to carry out periodic inspections of the required work. This is to be used by the supervisor or various levels of

management to evaluate the work performance of the operator/worker. The Job Observation checklist can be applied to either own or contractor operations.

4.4. QUALITY

The manual slashing worker should ensure that the slashing operation meets the correct quality requirements. The supervisor at the operation will carry out regular quality checks. Factors affecting quality are listed in Appendix 1.

4.5. OPERATIONAL DESCRIPTION

The workers clear a designated area of weeds and regrowth using a slashing tool. They should not slash weeds within a 15cm radius of planted trees; here weeds should be hand pulled due to the risk of tree damage with the slashing tool or hoe. Debris should not be left covering planted trees and if necessary, debris should be cut into smaller pieces. While stacking of slash debris is not required, debris should be flush with the ground and not restrict movement in the compartment.

4.5.1 Operational set-up

The worker is issued with a suitable slashing tool. The supervisor will give a 5-minute safety (toolbox) talk and issue any special instruction. The worker then moves to the allocated row(s) and commences working.

1.	Collect and load the required equipment from stores onto vehicle.	**P**
2.	Travel to the compartment.	**P**
3.	Each worker should off load and prepare their slashing equipment.	**P**
4.	Receive any special instruction, quality requirements and daily tasks.	**P,Q**
5.	Position at the allocated row with the hoe and measuring stick if necessary.	**P**
6.	Mark and tag the row to be slashed with worker's identification tag.	**P**
7.	Check whether SMZ's and ASI's have been marked on the compartment map for the area to be worked and ensure that such sites have been communicated to workers.	**E**

4.5.2 Line clean

The line clean operation is the slashing out of regrowth along a pre-specified tree line or between two planted tree rows. The slashing is carried out using a suitable slashing tool, which may vary according to conditions or circumstances. The line clean requires the slashing of all plant material along a specified width. Regrowth material within 15cm of the planted tree should be pulled by hand to avoid any possible damage to the planted tree. Should the pulling of regrowth, however, result in root disturbance to the planted tree then this may be carefully slashed, provided the necessary caution is taken not to damage the above ground tree portion.

1.	Position at the row to be cleared, determine the weed cover, slope, rocks and any additional factor needing to be considered when hoeing.	**P**
2.	Commence slashing / weeding at the start of the first row and work down the line.	**P**
3.	Remove by hand any debris and large stones within the line clean area.	**Q**
4.	Pull all weeds within the 15cm radius of the planted tree; dispense outside of the line clean area.	**Q**
5.	Ensure the slasher is worked flush with the surface so that all regrowth is cut at the plant base and raked out of the line clean area.	**Q**
6.	If there is any soil disturbance, the soil should remain within the line clean area.	**Q**
7.	When working sloped areas, it is preferable to run the line clean across the slope to prevent water run off. If the line clean should run up and down the slope, then soil should be positioned across the line to dam and collect water, thus reducing soil erosion.	**E**
8.	Use only the necessary force when conducting any slashing action.	**S**
9.	Do not work within 2.0 slasher lengths of another worker.	**S**
10.	Do not walk carrying the slasher over the shoulder; the slasher should be carried in the hand at one's side, with the cutting head in front of the hand, pointing towards the ground.	**S**

4.5.3 Slashing for access

Slashing for access normally takes place in new unplanted areas or larger standing trees, prior to pruning or harvesting operations. The slashing worker, equipped with a suitable slasher and works between two tree rows. The slashing worker slashes all regrowth to a prescribed height.

1.	Position at the rows to be cleared. Determine the weed cover, slope, rocks and additional factors that need consideration when slashing.	**P**
2.	The start and completion points of the daily task should be calculated and marked out per the terrain conditions and the firebreak width.	**P**
3.	Slash all regrowth material down to the prescribed height.	**P**
4.	Reslash and process any larger regrowth material into smaller compact work pieces.	**P**
5.	While it is not necessary to stack debris, there should be free access and movement for the subsequent operations.	**P**
6.	Ensure that standing trees are not damaged during slashing.	**P**
7.	Clear all debris from around standing trees.	**P**
8.	Use only the necessary force when completing any slashing action.	**S**
9.	Do not work within 2.0 slasher lengths of another person.	**S**
10.	Do not walk carrying the slasher over the shoulder; the slasher should be carried in the hand at one's side, with the cutting head in front of the hand, pointing towards the ground.	**S**

4.6 JOB DESCRIPTION

Appendix 3.

4.7 PRODUCTION STANDARDS

The lack of available work-study data and the extensive variation in conditions does not allow for the calculation of a variable points tasking system. The following information has been compiled into a tasking guideline for the slashing operations.

SLASHING ANNUALS – VARIABLE CONDITIONS POINTS TABLE			
Condition	**Variable**	**Points**	**Points**
Slope conditions (%)	0 – 25%	0	
	26 – 35 %	1	
	36 - 50 %	2	
	>50%	3	
Weed cover density	20 – 39 % Light scattered regrowth	0	
	40 – 59 % Consistent scattered regrowth	1	
	60 – 79 % Occasional open areas, height	3	
	80 – 100 % Comp. appears fully covered	6	
Weed height	20 - 40cm	0	
(Average height)	40 – 60cm	1	
	60 - 90cm	2	
	1.0m	4	
Access	Normal to heavy brush residue	0	
	Heavy brush residue – movement restricted	1	
Vegetation type	Annuals	0	
	Annual + scattered woody trees and thorns	1	
	Annuals + mixed woody / thorn < 33%	3	
TOTAL			

SLASHING ANNUALS (bugweed, blackjack Ink berry etc)

Points	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Unit/ha	1.5	2.0	2.5	3.0	3.25	3.5	3.75	4.0	4.25	4.5	4.75	5.0	5.25	5.5	5.75	6.0

SLASHING (WOODY WEEDS) – VARIABLE CONDITIONS POINTS TABLE			
Condition	**Variable**	**Points**	**Points**
Slope conditions (%)	0 – 35%	0	
	36 – 50 %	1	
	>50%	2	
Weed cover density	20 – 39 % Light scattered regrowth	0	
	40 – 59 % Consistent scattered regrowth	1	
	60 – 79 % Occasional open areas, height	3	
	80 – 100 % Comp. appears fully covered	6	
Weed height	0 – 1.0 M	0	
(Average height)	1.1 – 3.0M	2	
	> 3.0M	4	
Access	Normal to heavy brush residue	0	
	Heavy brush residue – movement restricted	1	
Vegetation type	Gum, wattle, blackwood regen	0	
	Bramble, Mauritian thorn	4	
TOTAL			

SLASHING ANNUALS

Points	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Unit/ha	**3**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**

Note: Flexibility should be catered for in the slashing of woody weeds and the table acts as a guideline only. It is not possible to build all the possible conditions into the table due to a lack of available data.

APPENDIX 1

FORESTRY SOLUTIONS

ACTIVITY CHECKLIST

OPERATION:	SILVICULTURE	MANUAL SLASHING

Planning	Attend team / toolbox talk	S
	Issued daily task, start and completion points	P
	Identification and marking of hazardous or environmental areas (SMZ's & ASI's)	SE
	Supervisor checks quality regularly	Q
	Completion of daily production sheets at the end of the shift	PQ
	Prescribed safety equipment issued and used	S
	Operation carried out in accordance to Operational Silviculture Plan and APO	Q
Setup	Correct loading and securing of load during transport	S
	Workers seated during transport and follow the transport perscriptions	S
	Adherence to prescribed safety regulations in BOP	S
Operating Instruction Environmental (Actual)	Correct evaluation, positioning and completion of work areas (work completed correctly)	PQ
	All remaining regrowth slashed	Q
	No spiked stumps remain after slashing	S
	Stumps at the correct height above ground level	Q
	No slash debris left on / covering planted trees	Q
	Where necessary, correct felling techniques are used	Q
	Where possible larger trees directionally felled towards brushlines	Q
	Access pruning using the slasher minimised	Q
	Slashing tool correctly used and does not strike ground or rocks	Q
	Safe working distances maintained (2 slasher lengths)	S
	Slasher carried correctly	S
	Using only necessary force used when completing any slashing action	S
	All non-organic waste removed from infield	E
	No slash into SMZ'S and ASI's	E
	SMZ's and ASI's reported if discovered	E
	No branches/debris into the drainage systems of the forest road network	E

APPENDIX 2

FORESTRY SOLUTIONS

JOB OBSERVATION

OPERATION:	SILVICULTURE	MANUAL SLASHING

Planning	Attend team / toolbox talk	S
	Issued daily task, start and completion points	P
	Identification and marking of hazardous or environmental areas (SMZ's & ASI's)	SE
	Supervisor checks quality regularly	Q
	Completion of daily production sheets at the end of the shift	PQ
	Prescribed safety equipment issued and used	S
	Operation carried out in accordance to OSP (APO)	Q
Setup	Correct loading and securing of load during transport	S
	Workers seated during transport	S
	Adherence to prescribed safety regulations in BOP	S
Operating Instruction Environmental (Actual)	Correct evaluation, positioning and completion of work areas (work completed correctly)	PQ
	All remaining regrowth slashed	Q
	No spiked stumps remain after slashing	S
	Stumps at the correct height above ground level	Q
	No slash debris left on / covering planted trees	Q
	Where necessary, correct felling techniques are used	Q
	Where possible larger trees directionally felled towards brushlines	Q
	Access pruning using the slasher minimised	Q
	Slashing tool correctly used and does not strike ground or rocks	Q
	Safe working distances maintained (2 slasher lengths)	S
	Slasher carried correctly	S
	Using only necessary force used when completing any slashing action	S
	All non-organic waste removed from infield	E
	No slash into SMZ'S and ASI's	E
	SMZ's and ASI's reported if discovered	E
	No branches/debris into the drainage systems of the forest road network	E

Date of observation		**Name of examiner**	
Name of incumbent		**Job title**	
Signature of incumbent		**Signature**	
Total defaults		**Rating of incumbent**	
Comments:			

APPENDIX 3

FORESTRY SOLUTIONS
JOB DESCRIPTION

OPERATION:	SILVICULTURE	WEEDING – SLASHING

1. REPORTING LEVELS

Superior Second Level:	**SILVICULTURE FORESTER**
Superior First Level:	**SILVICULTURE SUPERVISOR**
This Position:	**SILVICULTURE WORKER MANUAL SLASHING**

2. TRAINING

Orientation/Induction
Environmental awareness for workers
Basic safety for workers
Basic fire fighting for workers
Manual slashing or hoe weeding “on the job training”

3. PRE-EMPLOYMENT MEDICAL REQUIREMENTS

1.	Physically strong and fit	
2.	No muscular or skeletal abnormalities or deformities.	
3.	Good co-ordination	
4.	Good eye sight and depth perception.	
5.	No back problems	
6.	2 x Base line Audiometric tests	
7.	No serious medical condition which could jeopardize his, as well as co-workers safety, e.g. diabetes, hypertension, epilepsy – unless such diseases are under control.	

4. PERSONNEL SPECIFICATIONS

Criteria	Specification
Minimum standard of education	Grade 5
Post school education and training	Nil
Linguistic requirements	English
Essential experience	Silviculture worker
Training required till fully proficient	1 Month
Tools/Machines used	Suitable slashing tool
Hours of work	Shift
Working conditions	External manual labour in all weather
Physical requirements	Strong and healthy
Safety of others	Very important
Important people contacts:	
Internal	Silviculture forester, all levels of managements site visitors
External	Contractors, foreign visitors

5. PHYSICAL ATTRIBUTES

Aspects rated on a scale 0-4 (Considering frequency and importance)

0 - None 1 - Low 2 - Average 3 – High 4 - Very high

Physical requirements	**0**	**1**	**2**	**3**	**4**
Climbing onto machinery		✳			
Hearing		✳			
Lifting				✳	
Working bent				✳	
Use of left arm					✳
Use of right arm					✳
Use of left foot				✳	
Use of right foot				✳	
Use of left leg				✳	
Use of right leg				✳	
Walking				✳	
Standing					✳
Sitting		✳			
Vision (Sight)				✳	
Colour distinction			✳		
Depth perception				✳	
Eye/Hand/Foot co-ordination				✳	

Bio-mechanical

Action repeating					✳
High physical exertion		✳			

Working environment	**0**	**1**	**2**	**3**	**4**
High temperature				✳	
Low temperature		✳			
Noise		✳			
Humidity				✳	
Dampness				✳	
Vibration			✳		
Height		✳			
Abnormal positions				✳	

Working conditions

Exhaust fumes		✳			
Dust		✳			
Hazardous substances	✳				

Special requirements

Use of safety visors			✳		
Use of hand gloves					✳
Use of safety boots/shoes					✳
Use of hard hat	✳				
Use of safety belt	✳				
Use of hearing protection	✳				

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