LOGGING OPERATIONS (MAXIMUS INTERNATIONAL)

PUBLIC ENVIRONMENT REPORT

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Executive Summary

This public environment report (PER) considers forestry operations that Maximus International proposes to undertake in its timber concession on Vella la Vella Island in Western Province. The concession has already seen numerous forestry operations by various logging companies in the past.

The primary need for the proposed logging operations stems from national government's requirements to sustain its revenue base and help resource owners get maximum benefit from their resource. Logging contributes significantly to the economic development of Solomon Islands by bringing in the much needed foreign earnings. Without logging the country's economy will collapse due to weak performances of other key sectors. In developing this proposal the licensee and the contractor are aware of the adverse effects associated with logging and, therefore will adopt a strategy that identifies and protects the special values of the forest, while simultaneously maintaining a sustainable level of human use.

The main purpose of this PER is to assess the environmental impacts of the planned forestry activities by Maximus International in its concession and to propose measures to mitigate adverse effects of the operations. It addresses the requirements of the Environment Act 1998, particularly Part III on Development Control, Environmental Impact Assessment, Review and Monitoring. Public consultations with resource owners and local communities are an important aspect of the planning process for this PER. This statement helps to define areas for harvesting operations and assists with sustained yield activities.

Major project activities anticipated from the operations include site preparation involving road construction, construction of camps and land clearing and forestry operations comprising mainly harvesting system and log transportation. In terms of road construction, use and maintenance the proponent will embark on creating new access roads as operable areas become available for harvesting. These new roads are additional to any existing roads already constructed during previous logging operations in the area. Minor, temporary access roads will be required as part of harvesting operations. Any existing roads will be maintained as necessary.

In conformity with good forest practices as set out in applicable regulatory frameworks, timber harvesting operations will be undertaken to ensure harvested stands contain adequate numbers of actively growing trees to maintain the log production potential of the forests. It is anticipated that log production will yield approximately 40,000 cubic meters based on current estimates of net productive area. The concession covers an estimated total area of 2,000 hectares. Sustainable timber yields are governed by a number of factors, including the area available for harvesting, distribution of tree sizes and quality on that area and growth rates of the

trees. Data to assess the timber volumes in the area is available from Ministry of Forestry and this will be complemented with information to be provided by the company. It is through this data that the annual allowable cut will be determined.

Certain potential adverse effects are expected to occur during site preparations and timber harvesting operations particularly on the soil, aquatic environment, flora, fauna, socio-economic and cultural environment. Three levels of measures will be pursued by the licensee and its contractor to manage the potential adverse significant impacts, including pre-emptive measures, mitigation measures and ameliorative measures. For the design and location of roads and bridges, pre-emptive measures will be applied here to ensure any adverse significant impacts are avoided at the first place. Where impacts cannot be avoided, efforts will be made to mitigate and ameliorate the effects in terms of reduction and rehabilitation, as the next resorts.

An environmental management plan (EMP) has been developed to cater to this requirement, to make the operations ecologically sustainable. The EMP outlines the measures considered appropriate to deal with the identified potential impacts and levels of responsibility to ensure the measures are effectively implemented. This is identified as part of environmental monitoring plan, which is integral to the EMP. The EMP is based on the interaction matrix for components of the timber harvesting operations and selected environmental parameters.

With the mitigation measures defined in the EMP and considering the adverse effects of adopting a do nothing option to the economy, it is recommended for the operations to commence.

Chapter 1

Introduction

1.1 Project proponent

The project proponent is Jorio Timber Corporation Limited, a locally owned and incorporated company with valid business registration in Solomon Islands. It is also the license holder. The proponent has an agreement with Maximus International to harvest its logs and ensure the logs are sold. It has been the primary goal of Jorio Timber to assist resource owners derives maximum benefit from their forest resource through commercial logging. The planned timber harvesting operations is made possible through timber felling license number A10618.

A technology agreement is being concluded between Jorio Timber and Maximus International including representatives of resources owners to enable Maximus International to provide equipment, machinery operators and other services such as round logs export on behalf of the resource owners. Being the contractor, Maximus International for the most part deals with logging and international trade in round logs while resources owners' trustees will be responsible for the welfare of resource owners. The logging operations should be set in motion once the development consent is secured from the Ministry of Environment.

1.2 Nature of project

The timber felling license obtained by the proponent together with the technology agreement concluded with Maximus International for the forest resource clearly explains the nature and type of the development action to be undertaken. Logging operation involves various activities and use of range of heavy machinery for these various activities. Major project activities include site preparation involving road construction, construction of camps and land clearing and forestry operations consisting mainly of harvesting system and log transportation. These are described in adequate detail later in the report under description of project activities.

1.3 Location of project

The timber concession is in the western part of Vella La Vella Island and covers numerous customary land areas. It is essentially a re-entry area. Gizo, the provincial capital of Western province is located just to the south east, with Ranongga Island found within the vicinity to the south. The concession occupies an area which has been previously logged and, hence not in virgin state. The entire concession covers an area of approximately 2,000 hectares. An estimated net

volume of 40,000 cubic meters of all exploitable commercial tree species combined have been calculated for the concession.

1.4 Need for the Project

Solomon Islands is a country dominated by rural population, with approximately 86 per cent of the country's total population living in rural areas and, largely dependent on the subsistence sector. With very limited economic opportunity and meager and unreliable cash income from sale of agricultural products and marine resources it can be a major challenge to get basic household necessities and afford school fees for children. The increase in cost of living with rising price of basic food items has played a catalytic part in leading resource owners to explore other alternative sources of income from their resources. Logging is rampant in the country and the landholding groups view this as the only viable alternative to generate income for their communities and respective families.

Harvesting of natural forest for log exports contributes significantly to the foreign earnings and revenue base of the government of Solomon Islands. This is through export duties and royalties to landowners. Over the recent past, the logging and timber industries have been the major source of income for the government and the country at large, in contrast to other sectors such as fisheries and agriculture. The government at present heavily depends on the logging and timber industries to sustain the economy.

1.5 Institutional and Legal Framework

1.5.1 Environment Act 1998

All logging operations pursuant to the Second Schedule of the Environment Act are prescribed development. For any such operations to commence, a public environment report (PER) or an environmental impact statement (EIS) is a prerequisite. A development consent is required by the developer from the Environment and Conservation Division in order for logging operations to commence. Established mechanisms are in place for this.

The environmental report identifies all potential adverse consequences associated with the operations and defines appropriate mitigation measures to ameliorate the impacts. The Act requires a set of criteria to be used in the environmental impact assessment (EIA) process in assessing the impacts of logging on the environment. It is the responsibility of development proponent to prepare the environmental report, at its own expense.

1.5.2 Solomon Islands Environmental Impact Assessment Guidelines

These guidelines provide useful checklists for undertaking preliminary environmental assessment of certain sectoral activities to realize the objectives of Environment Act. The Environment and Conservation Division administers this set of guidelines. The checklists and the environmental appraisal summary form clearly indicate the types of information that are required to accompany the development application, the initial stage in the process of acquiring the development consent. Different sectors covered under the checklists include coastal zone and marine, forest, construction, infrastructure, agriculture and mining projects due to their potentials to cause environmental degradation.

1.5.3 National Environmental Management Strategy

The National Environmental Management Strategy (NEMS) provides the strategic approach and blueprint for sustainable environmental and natural resource management and conservation in Solomon Islands. A wide range of strategies and programmes has been identified in the NEMS to address the problem of environmental degradation in the country.

Integration of environmental considerations with policies and economic development projects was among the top priority areas identified to control and manage environmental issues faced by the country. The requirement to submit an environmental report as part of the logging operations to address the environmental and social dimensions of the project is consistent with this priority.

1.5.4 Forest and Timber Utilisation Act 1990 (CAP 40, as amended)

Section 5 of the Act on licensing, which deals with issues involving felling and removing of trees sets out the rights and conditions the company needs to adhere to in undertaking its harvesting operations. The standard logging agreement *(Forest and Timber (Prescribed forms) (Amendment) the Regulations* has provisions and procedures relevant to environmental protection.

According to 1984 amendment, it is binding on the developer, for example, to ensure river catchment areas are conserved and soil erosion prevented, among other environmentally sound provisions. The 1990 amendment further emphasized the need for environmental protection, for example, by requiring developers to carry out such investigations to identify and describe any areas which should be excluded from the application on grounds of environment or social values.

1.5.5 Solomon Islands Code of Logging Practice

The code of logging practice complements and simplifies the complicated requirements in Schedule C and Form 4 of the *Forest and Timber Utilisation Act.* It provides guidelines for planning and monitoring of logging operations to improve logging practices in Solomon Islands thereby minimizing potential adverse environmental consequences associated with logging. The guidelines identify several key standards for purposes of environmental protection, among which, are Key Standard 1 on Protected and Exclusion Areas, Key Standard 2 for Location of Roads and Landings and Key Standard 7 on Temporary Crossings. Other important key standards are also available in these guidelines.

1.5.6 National Forest Policy

Four implementation strategies have been identified in this policy document, as crucial for sustainable utilization and management of the country's forest resource. Of these strategies, the two that have direct relevance to logging are the promotion of increased local level participation in forest management and provision of support for the protection of the environment and ecological sustainability.

The ecological services provided by forest as non consumptive forest uses are given due attention in the policy document. Protecting the forest as recognized in the policy document plays a greatly significant role in protecting the rivers, soil and other organisms whose livelihood depend on the forest ecosystem.

1.6 Scope of Report

The main purpose of this PER is to describe and assess the potential environmental impacts associated with the forestry activities of Jorio Timber and Maximas International in its timber concession. Additionally the report helps to identify relevant measures to deal with the potential adverse environmental effects resulting from the operations. The report addresses the requirements of the Environment Act 1998, particularly Part III on Development Control, Environmental Impact Assessment, Review and Monitoring. Since logging operations is among the list of developments classified as prescribed development in the Second Schedule of the Environment, production of this report also fulfils that provision.

1.7 Study Approach

Information contained in this document has been obtained during field assessment undertaken within the forest concession by the company's surveyor and representatives of the licensee. The field surveys covered specific areas of interest including the forest stands, topography, surface water systems, coastal zone and areas of cultural significance, among others. Identifying such environmental

characteristics earlier is vital for the company due to the need for the log pond, logging camp, primary access road, river or stream crossings and timber harvesting areas.

Interviews and public consultations with key community elders and resource owners were also used in getting relevant information about the operations and environmental characteristics such as land form, land use patterns, catchments and forest types of the timber concession area. Site visits were conducted prior to producing the report. It was through the site visits that interviews and public consultations were held.

Chapter 2

Description of Major Project Activities

2.1 Roading

There are primary access roads already built within sections of the timber concession during previous logging operations by Glengrow. The developer intends to use these existing road networks for its logging operations. The poor surface conditions of old logging roads will be rehabilitated by conducting necessary earthworks and land clearing to improve the drainage. They will be compacted to maintain proper drainage of the pavement. The proponent plans to construct further road networks within the entire concession to access new forest areas as they become available. The proposed primary road is important for the company as it enables machinery and operators to gain easy access to the coupes demarcated within the concession. The harvesting plan has specific details on this.

Due to the different landform features within the concession, the proposed main access roads (primary, secondary, feeder) that require major earthworks will be surveyed and designed accordingly in terms of location, cross sectional dimensions, and major drainage structures. However, most roads will be constructed on ridge tops, limiting the need for major cut and fill earthworks including side-cutting across slopes. Side cuts, unstable soil types and stream crossings will be avoided, where possible, Shorter, temporary harvesting spur roads will be drained and left to revegitate after harvesting and, maintained as necessary.

2.2 Skid tracks

Skid tracks are a network of tracks along which skidding equipment (see Machinery for equipment) travels by pulling of logs from point of felling to the log landing. The main skid tracks will be established within the concession on ridges. The number of skid tracks to be established largely depends on the size of the coupe, its expected yield and environmental conditions. Skid tracks enable felled logs to be directly brought to the log landings or to the spur roads before being transported to the landings. The company recognizes and emphasizes safe environmental procedures in skidding to avoid excessive damage to the soil, groundcover and soil erosion during skidding operations. Skid tracks involve minor, temporary access roads which form part of harvesting operations. The harvesting plan can also be consulted for specific details on this.

2.3 Gravel borrow pits

Quarries are planned to be established as close as possible to the road networks to reduce cost of haulage. Gravels borrow areas have been identified in various areas within the concession but close proximity to roads is an important consideration in their establishment. It is equally important to establish quarries clear of any stream or water body. The company intends to make the road weather proof and also provide adequate natural gravel for construction and maintenance of all roads. It is anticipated for an individual quarry to service specific section of roads up to several kilometers from the pit. Gravel pits will be rehabilitated in a way that minimizes adverse environmental impacts.

2.4 Log landings

Major log landings will be established at convenient locations along designated sections of the primary road networks. Clearings for log landings will be carried out to adhere to specifications although it is anticipated for some landings to vary in sizes, yet not exceeding the recommended standard size. This is largely due to topographic features, where generally flat landform with broader ridges should have wider landings. Conversely on narrow ridges with unstable slopes landings are designed to be compatible with the topography.

The number of landings per coupe in many cases is dependent on the productivity of the coupe but as well as on topographic features. An important consideration in designing log landings is availability of enough space for loaders and operators to maneuver. Old log landings formerly used during logging in the concession are to be maintained for use again.

2.5 Machinery

The table below provides insight into the types of equipment and machinery the company uses in its operations. Administratively, the operations have been divided into administration, workshop, production and roads department.

Equipment	Model	Units
Bulldozer	Komatsu D70 LE	8
Bulldozer/ripper	Komatsu D155	1
Motor grader	Caterpillar 12G	1
Dump truck	Nissan CW 53 H	3
Excavator	Ex 200 Hitachi	5
Chainsaw	070 STIHL	1
Log truck	Nissan CWA 52	4
Wheel loader	Caterpillar 966 C	1
Chainsaw	070 STHIL	8

Hilux	LN 106 Toyota	1
Land cruiser	HZJ 75 RP Toyota	3
Welding machine	Deutz diesel	1
OBM	40 HP Yamaha	2
Generator	Wilson	1

2.6 Workshop

A workshop will be constructed onsite at the logging camp for defective machinery to be serviced. To be constructed of a mixture of locally extracted materials and roofing irons, the outside part of this temporary structure will have no walling. The workshop left open to allow easy passage of machinery for maintenance. Adequate open space for garaging of machinery should available adjacent to the workshop. The workshop will be clear from any river, wet land or streams.

2.7 Log pond and wharf

A suitable space has been identified between Vuaso and Leona settlements and will be cleared for the log pond to be accommodated. The site is within Vatoro bay. Site selection for log pond largely depends on the area having sufficient log storage capacity. Necessary earthworks and land clearing activities are required to create this new log pond. Directed drainage will be provided to prevent inflow of surface water from the log pond during rainfall events. Wharf and log pond location should be adjacent to waters deep enough for the company barge to come into berth for loading of processed logs.

The wharf will only be temporary and the wooden structure will be placed on a piece of reclaimed land, to be raised above the high water mark and connected by a causeway to the coastline. Gravels will be applied on the platform surface and then compacted to ensure the loading area does not experience swampy condition during and following prolonged wet weather events. Platform for fuel storage tanks will also be accommodated at the log pond within easy reach of the coastline.

2.8 Housing/logging camp

The camp is expected to be constructed not far from the log pond. Most of the accommodations are expected to be mostly constructed of timber and sago palm thatch roof. By local standard the accommodation can be considered decent for local work force. There will be some buildings with corrugated roofing iron and these are used to accommodate the expatriate personnel working for the contractor. Separate quarters with adequate lighting system and water supply are provided for the local labour force and the expatriates. Water supply at the camp is extracted from tank catchments or rain. Ventilated improved pit toilet is commonly used at the camp for all employees.

2.9 Bridges

The proponent is expected to construct wooden bridges with log decking and earth filling across major surface water systems where necessary and as appropriate. Nonetheless the concession appears not to have any appreciable river systems with the exception of a major river running along the eastern boundary of the concession. Where bridges are necessary, the crossing structures will be so designed to meet specifications taking into consideration hydrological conditions and other environmental factors such as the river ecology.

The location and design of bridges are important factors in selecting sites for the bridges to be erected. Generally bridges are built at river sections with higher river banks to ensure they are not washed away during floods caused by prolonged wet weather events. Temporary crossing structures are also planned for certain streams, which are expected to be removed after operations cease.

2.10 Timber harvesting

Harvesting is planned and undertaken using the compartment or coupe as the basic operating unit. Compartments vary in size but the percentage of a compartment that is harvested depends on the forest types, stand conditions, slope conditions and access. All harvesting activities are to be undertaken in accordance with the coupe plan for the compartment. The company employs selective harvesting system for its operations through use of specific machinery during harvesting. Activities such as harvesting roads and access to log dumps are clearly identified in the plan.

In general topographic features, easy and quick access to coupes heavily influence site selection for new log dumps. Harvesting plan consists of information on area (location, size of coupe, area of different forest types, condition of the forest, physical features and predicted volumes of the products to be harvested; harvesting details (type of operation, product specification, tree marking procedures and tree retention requirements (e.g habitat trees); and operational procedures (order of working, location of log dumps, snig tracks, creek crossings, critical boundaries (flora reserves), exclusion areas and wet weather controls. The harvesting system employed recognizes the need to maintain ecological sustainability and log production in the longer term.

Chapter 3

Description of Environmental Setting

3.1 Physical Environment

3.1.1 Geology and soil

The geology of the forest concession derived from volcanic detritus, riverine and lagoonal sediments with organic accumulations, coastal and estuarine alluvium and limestones and calcareous mudstones. These geologic processes are closely associated with the landform and land system identified within the timber concession. In terms of soil sand, saline peat, clays and loams dominate the soil textures identified within the concession. Clays and loams are commonly found across all these soil types.

These textural properties are influenced by the various dominant landforms within the concession, which in turn are influenced by the parent materials of the soil types that occur there. For example, adjacent to the coast saline peat is widely distributed there and this is directly influenced by swampy landform together with the estuarine alluvium and organic accumulations, constituting the parent material.

3.1.2 Topography and landform

The landform within the concession consists of different landform features and, this varies between areas within close proximity to the coast and areas upland. Adjacent to the coast narrow bay head beaches and saline swamps are the dominant landform. Generally, the topography is flat in these areas. Freshwater swamps along valleys are the next landform and are flanked by low dissected ground surfaces and ridges. As this landform type occur further inland, the topographic characteristics displayed here are more of moderately steep slopes.

While within the coast the land is characteristically flat, topographic changes become apparent upland, with the physiographic features ranging progressively from zero to forty meters relief from the coastal areas to narrow ridges and unstable slopes in the interior.

3.1.3 Surface and groundwater hydrology

There are two river systems that provide the water that drains the concession. A number of streams whose sources are in the foothills contribute to the river system within the concession. The major river borders the concession to its southern boundary. It drains into the ocean near Leona settlement and its source is found in the hills and from the entire surface within the outer divide or ridge of the drainage basin. Another river drains the lower section of the concession and its estuary is

within the vicinity of Vatoro settlement. Certain crossing structures are expected to be provided across these surface systems. The drainage system of these surface water systems including the four streams is supplied through overland flow, interflow and groundwater flow.

During moderate to high rainfall events, overland flow provides most water to these water systems. The presence of ground cover heavily influences the downslope volume of overland flow that is likely to enter the natural drainage. In protracted periods of little or no rain interflow and groundwater flow tend to be the main sources of supply for the river system through water retained in the soil or ground water after rainfall. Because surplus water is always available in the catchments during high intensity rainfall, this contributes significantly to the flow regimes of the rivers and streams. Rainfall patterns and undisturbed areas where the vegetation acts as a filter strongly control overland flow and subsurface water flow.

3.1.4 Climate

Rainfall for Solomon Islands varies year round from January to December. From January to April there is always a lot of rainfall whereas the months from May through October the rainfall tends to be lower. There are also some variations in the number of rainy days per month for the entire country. For example, the rainfall pattern for Honiara is such that the period between November and April always receives most rain and May to October shows less rainfall occurrences. This is influenced by prevailing trade winds. The northwest wind usually prevails towards the end and start of the year whereas the south easterlies occur throughout the year.

Unlike rainfall, the temperature for the entire country is almost consistent all year round. Unfortunately, records are not available for air quality not only in Honiara but the rest of the country. While industrial air pollution is not a concern for Solomon Islands, emissions from shifting cultivation and burning of wastes can be a problem in the rural communities.

3.1.5 Land use

Land use within the forest concessions obviously shows no distinctive pattern. The area generally does appear not to have any cash crop farming within or immediately adjacent to the timber concessions. This could be due to lack of major human settlements or habitations within close proximity to the concessions. Only very recently did people from nearby villages start clearing the area for new settlements to accommodate the growing population.

The logging operations will be carried out in areas part of which has been formerly disturbed during previous logging operations. These are logged over areas.

Undisturbed primary forested areas will be cleared during the felling operations with new access roads anticipated. Old logging roads already built will be maintained for use during the operations. It is likely that adjacent areas to the proponent's forest concession have already been assigned to other timber license holders. The logging camp is the only major coastal development undertaken by the company that has some impact on the landscape. A reforestation project and rice project have been established in the logged over areas that constitute other land use changes within the concession.

3.2 Biological Environment

3.2.1 Flora and forest types

Several forest types occur and are distributed within the forest concession. Within the coastline are saline swamp forests dominated primarily by mangroves which are subject to tidal and supra tidal influences. The concession supports freshwater swamp and riverine forest as well, where *terminalia brasii* species is abundantly available. Besides freshwater swamp forest, the company's timber extraction activities are expected to be heavily concentrated within lowland rainforest and hill forest. Freshwater swamp forest is associated with valley floor landform.

The timber inventory carried out by the company within the concession shows that *pometia* is more dominant in lowland rainforest and hill forest, followed by *dillenia, callophyllum* and other mixed species whereas *terminalia brasii* occurs in great quantity in freshwater swamp forest. Accordingly, the total volume of identified commercial tree species in the concessions has been estimated at 40,000 cubic meters.

3.2.2 Description of fauna

No detail studies have been conducted to determine the occurrence, abundance and distribution of the different animals within the concessions. Several parrot species in cardinal lorry and yellow-bibbed lorry have been sighted within the concessions. Cockatoos, fruit doves, pigeons and starlings are also quite common upland in the concessions. The varied forests provide on the island provide good habitat for other forest-depended birds and other animals. Some bird species which are endemic to Solomon Islands that are recorded from the island are hawks, eagles, rails, owls, kingfishers, monarchs and honey eaters. Crocodiles have been sighted within the bay not far from the log pond.

A good part of the forest areas of the island have been affected by commercial logging till now. Part of the forest concessions now being exploited can be considered as logged over areas. While the impacts of the forest disturbance on the wildlife are not properly known, the level of terrestrial biodiversity in areas close to the coast should be low. This may not be the same in upland areas, where disturbance is minimal.

3.2.3 Description of fisheries

The northwestern part of Vella la Vella is surrounded by smaller islands, islets, reefs and sand bars. In the sheltered areas of the archipelago are large areas of mangrove forest. Reefs and mangroves are important habitats for different fisheries. The surrounding swampy mangrove forest within the log pond support mud crabs, shell fish but, also saltwater crocodiles, which prefer brackish waters. Beyond the bay towards the reefs in clear waters are important habitats for deep sea dwelling fisheries. World Fish is working with the local communities to establish a marine managed area offshore of Leona settlement.

3.2.4 Ecologically sensitive areas

Certain ecologically sensitive areas occur within and adjacent to the concession. Coastal zones, watercourses and primary rainforest support diverse life forms. In coastal areas, for example, these are important for spawning and breeding for certain aquatic animal species. Undisturbed forest likewise provides habitats and breeding places for diverse animal life including birds, reptiles, and various other organisms. Removal of forest can have adverse impacts on such ecologically fragile regions due to destruction of habitats, sediment deposition in swamps and smothering of coral reefs from silt runoffs. World Fish is working with the local communities to establish a marine managed area offshore of Leona settlement, which demonstrates the ecological significance of surrounding areas.

3.3 Socio-economic Environment

3.3.1 Education

There is a school in a registered block of land just outside the concession at Vatoro settlement, within Vatoro bay. The concession runs adjacent to these coastal registered blocks of land. Another school is in Leona settlement but this is outside of the concession beyond the river. Human settlements by local people, who incidentally come from nearby village communities, are only of recent origin and the population is relatively very small. School age children are mostly sent to big villages for their education. They remain in the village during week days for classes and only visit their parents or relatives during the week ends and school holidays. The schools are operated by the province.

3.3.2 Public health

Leona settlement has a clinic and such a proper health facility is only available in larger communities. The other settlements within the vicinity of the concession rely for medical attention on this rural health centre and clinic. The clinic is provided and built by the provincial government. The logging proposed operations can also

benefit from the services offered at the health facility, which can be easily accessed even by walking. A basic health facility will be made available at the proposed camp to ensure company employees have access to treatment of simple ailments such as malaria and others. Otherwise more serious health conditions will be referred to the clinic or Gizo hospital for proper medical advice and attention.

3.3.3 Economic situation

Major economic activities dominantly practiced in rural Solomon Islands from which people get some income are agricultural and fishing activities. Agricultural activities mostly involve copra and cocoa production and sale of garden produce such as potato, yam and taro. With irregular and unreliable transportation services to these areas, easy access to markets is also quite difficult. Shipping services to the province has been poor since the national government sold and privatized its fleet. The logging operations are expected to create wage employment opportunities for the local population but, as well as markets for their local produce.

The limited economic opportunities available in the rural areas make wage employment very difficult. Those who are able to find work are mostly self employed farmers in the informal sector. It is these economic hardships and limited employment opportunity that drives people to look for alternative income sources besides farming. The decision by resource owners to harvest their forest resource for export can be attributed to this, given the huge cash income expected to be derived from log exports. Resource owners will receive their money by way of royalty payment.

3.3.4 Population and demography

The total population of Western Province was 62,739 people according to the 1999 national Housing and Population census. Of this, 9,174 people were recorded for Vella la Vella island. This accounts for 14.6 per cent of the total population of the province. In terms of the size of the productive age group, namely between 15 to 40 years, this dominated the population structure. Males were dominant for all age group. There were 9,992 households recorded for this area. The urban population of Western province was only 6,442 at the time of the census.

Where wage employment is scarce and hardly non-existent and, considering the active age group of the population and, given the large proportion of the population residing in rural setting, this is of concern as urban drift and social disorder in the communities are a likely problem. The logging operations will enable many of the young people to get some wage employment with the logging company.

3.3.5 Water and sanitation

Within the logging camp water supply will be provided to resident employees by the company. Where surface water of good quality exists closer to the camp, water supply is going to be extracted from the nearby stream. Water tank catchments are planned for all quarters, irrespective of whether water supply is made available for residents at the camp.

At the residential quarters of the expatriate personnel, flash toilets are installed within their quarters and septic tanks constructed outside. Ventilated improved pit toilets are provided at the married and single quarters where the local labour force is accommodated. Household wastes such as kitchen remains are disposed of in pits as a means to manage wastes generated at the camp. The pits will be buried when they are no longer needed.

3.3.6 Roads

There is limited infrastructure such as proper roads and bridges currently available around the entire island, with the exception of areas in which logging operations have been undertaken in the past. It is only in areas of logging operations that logging roads and bridges have been provided. The concession acquired by Maximas has been previously logged by Glengrow and, therefore, has existing roads. These road networks will be maintained for use by the proponent during its timber felling operations. Construction of new access and shorter, temporary harvesting spur roads are anticipated in areas identified for harvesting as they become available.

3.3.7 Cultural/archeological sites

There are known areas of cultural significance within the concessions. These cultural sites are remains from old villages, sacrificial sites to worship ancestors and graves of ancestors. All these areas have been identified and special marking has been placed around the sites, at least thirty meters on all sites. The markings on the trees indicate that these are exclusion areas.

Chapter 4

Potential Significant Environmental Impacts

4.1 Negative Impacts

4.1.1 Coastal degradation

The area in which the log pond and wharf have established is adjacent to the coast in a bay. Removal of vegetative cover by heavy machinery can have detrimental impacts on the coastal zone. Such habitats or ecosystems tend to support a range of ecological services, for example, spawning grounds for certain fish species and provisioning services such as food supplies.

Land clearing and associated earthworks for the log pond and wharf can be harmful to the organisms that exclusively depend on this type of land form and ecosystems for their survival and livelihood. This is likely due to increased surface runoffs and subsequent siltation of the beach with sediments created during earthworks. In situations where sediment runoffs are not properly controlled, this can result in decreased productivity of the ecosystems.

4.1.2 Siltation and sedimentation

Siltation and sedimentation are caused by the delivery and deposition of sediment or silt runoffs from disturbed soils. The loose soil particles are transported into the surface water system via surface runoffs or overland flow, which depends on various factors. This is more evident at the approaches to the stream crossing sites as sediments are generated next to the stream bank and enter the stream relatively easily. Road usage certainly affects sediment production whose mobilization and transportation to varying degrees downslope is a function of particle size and volume, velocity of overland flow due to high intensity rainfall events and existence of roadside table drains.

The fate of sediments derived from road construction is largely determined by overland flow characteristics following rainfall. While a large proportion of coarser fractions of the sediment are expected to be retained within the forest floor in depressions and drainage lines close to the sites of erosion along the new road alignment, the finer fractions will be more mobilized and transported downslope. This appears to be the general observation at the valley side slope along a section of the road alignment as a result of the buffer rendered by the undisturbed forest

cover, which helps to disperse surface runoff carrying the sediments and also acts as a filter to entrap sediments.

Surface runoffs or overland flow in which loose soil particles are transported into the surface water system are likely to cause water turbidity and impairment of water quality. Siltation and sedimentation are caused by the delivery and deposition of sediment or silt runoffs from disturbed soils, which can be heavy at the approaches to the stream crossing sites as sediments are generated next to the stream bank and enter the stream relatively easily. In the streams, the coarse sediments usually form part of the bed load which are transported downstream in suspension, causing water turbidity and water pollution. Sediment production from road construction varies with catchment geology, microclimate, vegetation, soil stability and slope. Siltation is also caused by unconsolidated soils from freshly exposed cut and fill batters.

4.1.3 Water quality impairment

Sediments that do reach forest streams are expected to enter in an episodic manner, being transported in surface runoff associated with moderate to high rainfall events, with bulk of sediments transported during storm events. In the streams, the coarse sediments are expected to form part of the bed load and be transported downstream in suspension. However, where the sediment carrying capacity of streams draining the disturbed forest catchment is exceeded, sediment deposits are expected to develop in the short term.

It is these suspended sediment loads and silts derived from in-stream sedimentation and stream bank that are responsible for water pollution of the surface water system. Catchment areas with higher rainfall frequency tend to experience greater degree of water turbidity from suspended sediments in the water column. In events that sedimentation occurs, this will be highly localized with sedimentation impacts expected in the short term, only at the site scale.

4.1.4 Risk of accident

Use of heavy machinery at the log pond to move logs between log stockpiles and the fact that log trucks are allowed to transport logs through the camp pose serious safety risks for the employees but more so to their younger children. Within the log pond the risks are quite high for the children of local employees whose accommodations are within easy reach of the log pond area. While there is no local community within immediate vicinity of the logging camp, the safety of locals visiting the camp to sale their agricultural produce also is at risk, if appropriate measures are not in place.

4.1.5 Redundant machinery

Logging companies heavily depend on machinery for almost every activity inherent in the operations. Machinery are serviceable and defective ones can be maintained but their working conditions cannot always be guaranteed. Heavy equipment like bulldozers and others are not always easy to handle when repair works are beyond ones' ability. There is therefore a high possibility that such malfunctioned equipment can be discarded on site because of the difficulties in maintaining them. This is a form of environmental pollution but redundant machinery also poses safety risks for curious rural village children who may take advantage of the situation to climb up and down on the abandoned equipment. Such actions create opportunities for accidental risks to occur.

4.1.6 Oil spillage

There is a general inclination for logging companies to establish fuel storage tanks within the immediate vicinity of the coastline as it is convenient to refuel them when the tanks are empty or low in fuel. In many cases, these tanks are firmly established and cannot easily be relocated. This practice is acceptable only if appropriate management plan is in place to deal with accidental spills from the tanks. Spills can easily reach the sea because of the location of the tanks if proper bunding is not provided for the tanks to sit on. The importance of the bunding structure is to contain any accidental spills that may occur while refueling or during the supply of fuels to the machinery.

4.1.7 Damage to non-timber products

Timber harvesting operations generally involve removal of identified trees by felling them with chainsaws. During felling operations other unwanted trees such as undergrowths can be affected and this is particularly true for rainforest with complex canopy structures. Use of heavy machinery commonly identified with logging in skidding and road construction involves a lot of soil disturbance in localized areas. Not only that skidding and road construction destroys the soil but, soil compaction and erosion can lead to the loss of good gardening sites rendering it unproductive. Soil texture, structure, profile depth and profile drainage all contribute to soil fertility and are most relevant to determining susceptibility to erosion and compaction processes.

Land clearing for roads and associated earthworks are activities inherent in logging that can result in loss of building materials and properties. In most rural village settings, construction materials for housing are supplied almost entirely by the rainforest. Forest not only provides necessary building materials but further enriches the soil through soil nutrients supplied by the forest. Traditional building

materials supplied from the forest, for example, for housing are exposed during felling operations.

4.1.8 Forest fragmentation

The opening up of the forest due to felling operations is a concern as felling leaves the forest dissected. In areas with highly dense commercial tree stands this is especially noticeable. The concentration of timber harvesting in such areas with more timber trees, as opposed to other areas with low timber yield, obviously can make the forest highly fragmented. With clearance for road construction and log landings, this only adds to the problem. Negative impacts associated with dissection of a viable forest into fragments are in many cases related to the ecological and hydrological processes of the forest as habitats and water retention capability of the exposed soils are threatened. Forest fragmentation also affects the regeneration dynamics of forest stands due to altered soil conditions and light regimes created by harvesting.

4.1.9 Accelerated soil erosion

Soil erosion through water agent is unavoidable where the ground has been denuded of vegetation cover and the greatest potential impact from soil erosion is directly related to water quality and stream ecosystems. Soil physical properties that affect the susceptibility of the soil to erosion are texture, structure and profile depth including climate, slope and land use factors. Although soil erosion is a natural process and occurs in undisturbed terrestrial ecosystems, it is more pronounced when land is disturbed and vegetative cover removed and the amount of exposed forest soils and amount of bare compacted soils exposed to rainfall and runoff.

In undisturbed forest ecosystem, surface erosion is generally very low as a result of vegetation and litter layers protecting the soil surface. Taking into consideration the limited scale of the access road and the undisturbed nature of the forest cover providing the buffer for the stream, soil erosion impacts including loss of soil fertility can be considered as localized and minimal. High intensity rainfall events are expected to present critical periods of high erosion risk, with accelerated rates of surface erosion anticipated to prevail during and after road construction.

4.1.10 Loss of garden sites

Earthworks and land clearing associated with road construction, timber harvesting and soil compaction due to trampling of machinery can result in destruction to arable land and productive garden sites. Primary access roads aligned through potential agricultural land due to environmental conditions can be destructive to the land. Not only that this leads to decreased productivity of the soil through removal

of the productive layer of the soil but, changes in soil structure through compaction, changes in soil texture and changes in stability of slopes are likely consequences.

This poses serious concern for women whose routine outdoor activity involves cultivating the land for gardens to feed the family. As fertile land is destroyed and becomes scarce, new gardens will certainly be cultivated further inland. Women as a result will have to bear the cost of this loss by walking long distances to get to the garden site.

4.1.11 Soil compaction

Soil physical properties most relevant to forest management are texture, structure, profile depth and profile drainage. All these contribute to soil fertility and are most relevant to determining susceptibility to erosion and compaction processes. Soils with high silt plus clay content, low organic matter, poor structure and poor drainage are the most susceptible to compaction impacts. Sandy soils have also been reported as having a high compaction risk. Poor drainage will also predispose soil to compaction and disturbance since soil strength is lowest at high moisture contents. Use of heavy machinery in logging creates compaction and loss of organic matter thereby altering soil structure and reducing infiltration, water holding capacity, aeration and root penetration.

4.2 Positive Impacts

4.2.1 Employment opportunities

Lack of employment opportunities in most rural areas of Solomon Islands is a huge challenge not only for government but, for rural people, as well. Logging offers rural people with limited opportunities to be engaged in wage employment to support their families by providing for basic needs and school fees. Although the security of tenure of the employment may be temporary, access to steady income from being employed provides rural people with something to look forward to.

4.2.2 Income generation through spin-offs

Apart from wage employment provided by the company, other income opportunities are also available to the local communities to exploit. It is a common practice for local communities to take advantage of the operations by selling to company employees' garden produce and marine products. Such spin-offs contribute in many ways to the livelihood of families in meeting their basic household needs. This is an additional income source for family if member(s) of the same family is working for the company. For some logging operations, even a proper market house has been built to enable local communities to sell their produce and products.

4.2.3 Improved livelihood

The economic difficulties often severely experienced in rural communities, due to limited opportunities, undermines efforts by local communities to improve their lifestyle. Cash income from wage employment and spin-off effects of logging operations can be a benefit to the communities. As basic household items are always not available on a daily basis to some families, wise use of money obtained through sale of labour and cash crops should help in improving rural livelihood.

4.2.4 Access to market

Sale of cash crops such as root crops and marine products in rural communities can be difficult due to inaccessibility to markets. In almost all logging operations markets are provided by the company for local residents to sell their produce. The market can be in the open or in a proper market house built by the members of the communities themselves. Easy access to markets plays an important part in improving rural economy and rural livelihood.

Chapter 5

Environmental Management Plan

5.1 Mitigation Measures

Three levels of measures will be pursued by the contractor to manage the potential adverse significant impacts likely to be caused by the logging operations. These include pre-emptive measures, mitigation measures and ameliorative measures. For the design and location of roads and bridges, pre-emptive measures will be applied to ensure any adverse significant impacts are avoided at the first place. Where impacts cannot be avoided, efforts will be made to mitigate and ameliorate the effects in terms of reduction and rehabilitation, as the next resorts. The proposed mitigation measures will be applied in conjunction with relevant key standards in the Code of Logging Practice.

5.1.1 Directed drainage

Appropriate measures will be applied to address adverse impacts of timber harvesting. Proper drainage engineering is part of the company's planning policies to reduce the amount of sediments transported and discharged to the marine environment or river system. Instead of drains channeled directly into the water course, drain turnouts are important to divert sediment-laden water from direct deposition into the water course.

Since sediments are more likely to enter the stream channel at approaches to bridge crossings and through harvesting closer to the stream banks proper drainage and sediment traps are important measures to minimize siltation of the water course and eventual deposition in vulnerable marine ecosystems. The post-harvesting construction of water diversion bars across snig tracks is always emphasized in the company's operation to control erosion prior to re-vegetation.

5.1.2 Buffer and protection strips

To minimize the amount of sediments entering the stream channels via surface runoffs establishment of buffer strips is essential. It is vital to comply with necessary specifications in forestry regulations, not to operate in buffer strips, except where roads are expected to cross streams. Roads intended to be constructed in buffer strips and cross streams should be in a perpendicular position to the watercourse, rather than run parallel to the watercourse.

This is a form of a sediment trap to reduce sediment-laden water directly transported into the stream. The forest floor acts as a filter for the sediments that only fine sediments can be able to enter the channel during prolonged wet weather events or high intensity rainfall events.

5.1.3 Bunding

Bunding is an important measure to control oil spills on land regardless of whether the tanks are situated on the coast or inland. Bunding involves building structures impermeable to either water or oil and it serves the purpose of containing any accidental spillage from escaping into the soil. Oil can easily infiltrate the soil in incidents of spillage and bunding provides an effective way of containing the spills for easy collection. Without appropriate structures or management plan to address oil spill incidents, it is not an easy task to control oils when they infiltrate the soil.

5.1.4 Seasonal closure

Operations during periods of prolonged wet condition are not encouraged and will be prohibited. It is during wet conditions when excess or surplus water is available on the ground surface that surface runoffs tend to be higher. Water erosion is responsible for most sediments going into the surface water systems.

In denuded forested areas water erosion can be a huge problem and this can be compounded if heavy machinery are allowed to trample on the wet ground surface. Not only that soil erosion will be accelerated but the ground surface becomes hardened leading to other environmental concerns such as loss of the productive capacity of the soil through soil compaction including loss of soil nutrients.

5.1.5 Location and design of roads and bridges

Pre-emptive measures will applied in the design and location of roads and bridges within the concessions. This is to prevent the impact by identifying and isolating specific areas from exposure to adverse impacts. The company will be using planning techniques to identify the most suitable road alignments and impose maximum slope constraints to address erosion hazard. Erosion hazard is the key factor in determining the need for the specified measures.

As alternative mitigation measures, all major primary roads will aligned and built on ridge tops where topographic conditions permit. Side cutting of hilly slopes is an option and this can only be entertained if its creation does not affect any streams within the vicinity. At least there should be sufficient buffer for deposition of sediment runoffs during wet conditions. The location of bridges is to be restricted to sections of the river that will allow only minimal sediments into the water course. In

any case all bridges are to be established in areas where the terrain is generally flat or gently sloping towards the streams or rivers.

5.1.6 Exclusion areas

Specific areas or exclusion areas within the timber concession will be reserved for either their cultural or ecological or environmental significance or values as one of its pre-emptive measures. This is to deal with loss of old cultural sites and reduce adverse environmental impacts on environmental sensitive areas and ecological fragile ecosystems. While it is unlawful to harvest mangrove forest, destroy traditional building materials and operate in steeper terrains, the company will ensure chain and machinery operators strictly keep clear from such areas.

Such exclusion areas are important to maintain the quality of these ecosystems and environmental values. Where important ecological habitats exist, every effort will be made to ensure reduction in damage to the ecological functioning of these habitats in developing the roading network.

5.1.7 Selective harvesting system

In efforts to minimize impacts on forest ecosystem through fragmentation and destruction of non-forest products, the company has a strict policy to conduct selective and directional felling in its harvesting operations. This means that only identified, selected trees will be felled so that the forest structure is not unnecessarily tampered with. Selective harvesting system will be practiced and emphasized but it is also important to ensure trees felled do not interfere with the functioning of surrounding environs. Selective and directional felling practices are necessary to keep important habitats and ensure important ecosystem services are maintained.

This is an integral feature of Reduced Impact Logging (RIL). The company recognizes the important functions of forests and as such always strives to practice internationally recognized Reduced Impact Logging techniques in its harvesting operations. These practices reduce the effects of the company's activities on the environment, which ensures continued benefit for our future generations as it leaves the environment in good condition. RIL in practice brings with it environmental and economic benefits.

5.1.8 Limited and controlled earth clearance

Road and log dump clearance and associated earthworks will be undertaken as specified in the Code of Logging Practice. Machinery operators are already made aware of the specifications and their activities will be given close attention by the company's operations manager. This is necessary to reduce impacts on habitats and ensure important ecosystem services are maintained and soil erosion controlled. Efforts in this endeavour will also see the company adopting planning techniques to

identify the most suitable road alignments and impose maximum slope constraints to address erosion hazard.

Summary of Potential Environmental Impacts and Mitigation

Actions affecting environmental components	Potential Impacts Identified	Magnitude (high, moderate, low, uncertain)	Long/short term	Significance (high, medium, low, uncertain)	Mitigation measures
Clearance of existing land, vegetation	1) Forest fragmentation 2) Loss of crown cover 3) Disturbance to forest structure 4) Displacement of certain plants or animals	Moderate	Short term	Medium	1) Selective felling 2) Directional felling 3) Setting aside and reserving representative areas or habitats within the forest 4) Identifying and setting aside unique occurrences of plants and animals 5) Directed and controlled earth clearance 6) Remove vegetation only in designated areas identified during planning phase
Creation of new land uses	1) Influx of people to the area either temporarily or permanently 2) Displacement of certain plants or animals 3) Ecological disruptions	Moderate	Short term	Medium	1) Setting aside and reserving representative areas or habitats within the forest 2) Identifying and setting aside unique occurrences of plants and animals
Construction works associated with housing of construction workers	1) Displacement of certain plants or animals 2) Ecological disruptions	Moderate	Short term	Low	1) Setting aside and reserving representative areas or habitats within the forest 2) Identifying and setting aside unique occurrences of plants and animals 3) Limited and controlled forest clearance
Earthworks including cut and fill or excavations for roads	1) Changes to the hydrology of watercourses	Moderate	Short term	Medium	1) Avoid site cutting of hills 2) Roads aligned on

	2) Changes in water bodies or land surface affecting drainage or runoff 3) Soil erosion 4) Water pollution				ridge tops 3) Sediment traps 4) Remove vegetation only in designated areas
Dredging	NA	NA	NA	NA	No dredging required
Facilities for storage of goods or materials	1) Displacement of certain plants or animals 2) Ecological disruptions 3) Oil spillage	Moderate	Short term	Medium	7) Setting aside and reserving representative areas or habitats within the forest 8) Use of concrete bunding for refilling platform 9) Limited and controlled earth clearance
Log pond and wharf	1) Sediment runoffs and sedimentation 2) Coastal erosion 3) Loss of fisheries reproductive potentials	Low	Short term	Low	1) Limited and controlled earth clearance 2) Directed drainage
Machinery	1) Soil compaction 2) Limited water infiltration	Moderate	Short term	Medium	1) Use of right type of equipment
Stream crossings	1) Sedimentation 2) Sediment load 3) Water quality impacts	Moderate	Short term	Medium	1) Proper culverts used 2) Restricted to designated crossing sites 3) Directed drainage
Gravel borrow pits	1) Increase vector borne disease 2) Displacement of certain plants or animals 3) Water pollution	Moderate	Short term	Medium	1) Back filling of pits 2) Setting aside and reserving representative areas or habitats within the forest 3) Limited and controlled earth clearance 4) Restricted to areas far from water bodies 5) Restricted to designated sites
Municipal wastes (household wastes)	1) Increase in solid waste 2) Coastal pollution	Moderate	Short term	Low	1) Limited burning of paper or plastic materials 2) Use of composting for biodegradable items

					3) Collection of metal wastes for reuse 4) Burying of certain metal wastes at designated sites
Timber felling	1) Forest fragmentation 2) Loss of crown cover 3) Disturbance to forest structure 4) Displacement of certain plants or animals	Moderate	Short term	Medium	1) Selective felling 2) Directional felling 3) Setting aside and reserving representative areas or habitats within the forest 4) Setting aside unique occurrences of plants and animals
Haulage and transport	1) Noise impacts 2) Effects on animals 3) Soil compaction	Moderate	Short term	Low	1) Roads not to be aligned within ecologically sensitive areas 2) Setting aside and reserving representative areas or habitats
Oil spills	1) Effects on coral reefs 2) Effects on coastal dwelling organisms 3) Effects on artisanal fishing areas	Low	Short term	Low	1) Use of bunding for refilling platform 2) Directed drainage for collection

5.2 Environment Monitoring Plan

5.2.1 Monitoring activity

Monitoring of company's operations will be conducted using different forms. Compliance and impacts monitoring will be undertaken to ensure the company complies with its environmental management plan and determine the extent of impacts on the socio-economic and bio-physical environments. Specific variables to be monitored and environmental indicators to be monitored for are identified here. This involves using some environmental auditing procedures. The monitoring plan is implemented at the company's expense.

5.2.2 Personnel

To be effective, monitoring systems need to identify the different people to be involved and what they should be monitoring. It is particularly important that those to be involved are designated including members of the community, company representatives and relevant government agencies.

5.2.3 Follow up action

Reporting plays a significant part in ensuring company complies with what has been indicated in the environmental management plan in terms of the identified mitigation measures. The follow up action is the second level of checks on the company's operations as opposed to the first level of checks to be conducted by resource owners and company representatives.

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Appendix

Part 1: Scoping Checklist:- Questions on Project Characteristics

No.	Questions to be considered in scoping	Yes/No	Which characteristics of the project environment could be affected	Is the effect likely to be significant? Why?
1. Will construction, operation or decommissioning of the project involve actions which will cause physical changes to the locality (topography, land use, changes in water bodies, etc)				
1.1	Permanent or temporary change in land use, land cover or topography including increases in intensity of land use?	Yes	Areas for log pond and logging camp	Yes, but localised
1.2	Clearance of existing land, vegetation and buildings?	Yes	Areas for log pond, roading and logging camp	Yes, but localised
1.3	Creation of new land uses?	Yes	Areas for log pond, roading and logging camp	Yes, but localised
1.4	Pre-construction investigations eg boreholes, soil testing?	No	NA	NA
1.5	Construction works?	Yes	Areas for logging camp involving residential quarters	No
1.6	Demolition works?	Yes	Logging camp	No
1.7	Temporary sites used for construction works or housing of construction workers?	Yes	Logging camp	No
1.8	Above ground buildings, structures or earthworks including cut and fill or excavations?	Yes	Forest and soils	No
1.9	Underground works including mining or tunneling?	No	NA	NA
1.10	Reclamation works?	Yes	Areas for the wharf and loading platform (reef)	No
1.11	Dredging?	No	NA	NA
1.12	Coastal structures eg seawalls, piers?	No	NA	NA
1.13	Offshore structures?	No	NA	NA
1.14	Production and manufacturing processes?	No	NA	NA
1.15	Facilities for storage of goods or materials?	Yes	Areas for the log pond and the camp	No
1.16	Facilities for treatment or disposal of solid wastes or liquid effluents?	No	NA	NA
1.17	Facilities for long term housing of operational workers?	No	NA	NA
1.18	New road or sea traffic during construction or operation?	Yes	Forest and soil	Yes but localized
1.19	Closure or diversion of existing transport routes or infrastructure?	No	NA	No, road infrastructure is a new development in the area
1.20	New or diverted transmission lines or pipelines?	No	NA	NA
1.21	Impoundment, damning, culverting, realignment or other changes to the hydrology of watercourses?	Yes	Water course	Yes but localised

1.22	Stream crossings?	Yes	Water course	Yes but localised
1.23	Abstraction or transfers of water from ground or surface waters?	Yes	Streams	No
1.24	Changes in water bodies or land surface affecting drainage or runoff?	Yes	Forest and water course	Yes but localized and seasonal
1.25	Long term dismantling or decommissioning or restoration works?	No	NA	No
1.26	Influx of people to an area either temporarily or permanently?	Yes	Logging camp	Yes but temporal
1.27	Introduction of alien species?	Yes	Water, forest	Yes and
1.28	Loss of native species or genetic diversity?	No	Unknown	Unknown
1.29	Any other actions?			

2. Will construction or operation of the project use natural resources such as land, water, materials or energy

2.1	Land especially undeveloped land?	Yes	Areas for harvesting, camps, roading and other activities	Yes but localised
2.2	Water?	Yes	Water supply for the residential quarters	No
2.3	Minerals?	No	Minerals will not be extracted	No
2.4	Aggregates?	Yes	Gravels for road surfacing	No
2.5	Forests and timber?	Yes	The main interest of the company in logging	Yes
2.6	Energy including electricity and fuels?	Yes	The company has its own electricity and fuel supplies	No

3. Will the project involve use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health?

3.1	Will the project involve use of substances or materials which are hazardous or toxic to human health or the environment (flora, fauna, water)?	Yes	Fuel requirements for machinery	No
3.2	Will the project result in changes in occurrence of diseases or affect disease vectors (insect or waterborne diseases)?	Yes	Mosquitoes may breed in ponds or stagnant waters created during land clearing	No
3.3	Will the project affect the welfare of people eg by changing living conditions?	Yes	Creates employment and income for people for basic needs	Yes although temporal
3.4	Are there vulnerable groups of people who could be affected by the project eg hospital patients, elderly, school children?	No	No schools or clinics are in the area	No
3.5	Any other causes?			

4. Will the project produce solid wastes during construction or operation or decommissioning?

4.1	Spoil, overburden or mine wastes?	No	NA	NA
4.2	Municipal wastes (household and/or commercial wastes?	Yes	Household wastes from residential quarters	No
4.3	Hazardous or toxic wastes?	Yes	Redundant machinery and waste oils	Yes but localized
4.4	Other industrial process wastes?	No	NA	NA
4.5	Surplus products?	No	NA	NA

4.6	Sewage sludge or other sludges from effluent treatment?	Yes	Sludge from septic tanks	Yes but localised
4.7	Construction or demolition wastes?	Yes	Certain biodegradable wastes after demolition of the camp	Yes but localized and temporal
4.8	Redundant machinery or equipment?	Yes	Disused machinery is a concern	Yes as they are non-biodegradable
4.9	Contaminated soils or other materials?	Yes	Within the workshop compound	No
4.10	Agricultural wastes?	NA	NA	NA
4.11	Any other solid wastes?			

5. Will the project release pollutants or any hazardous, toxic or noxious substances to air?

5.1	Emissions from combustion of fossil fuels from stationary or mobile sources?	NA	NA	NA
5.2	Emissions from materials handling including storage or transport?	NA	NA	NA
5.3	Emissions from construction activities including plant and equipment?	Yes	Emissions from machinery are unavoidable	No
5.4	Dust or odours from handling of materials including construction materials, sewage and waste?	Yes	Dusts from road during dry weather conditions	No
5.5	Emission from incineration of wastes?	NA	NA	NA
5.6	Emission from burning of wastes in open air (construction debris, slash materials)?	No	Log offcuts are not burnt	No
5.7	Emissions from any other sources?			

6. Will the project cause noise and vibration or release of light, heat energy?

6.1	From operation of equipment eg engines, crushers?	Yes	In the workshop	No
6.2	From industrial processes?	No	No industrial activities is envisaged	No
6.3	From blasting or piling?	No	These are not envisaged	No
6.4	From construction o demolition?	Yes	During construction and demolition of residential quarters	No
6.5	From construction or operational traffic?	Yes	At the log pond and at the workshop	No
6.6	From lighting or cooling systems?	Yes	In the workshop and at the residences	No
6.7	From any other sources?			

7. Will the project lead to risks of contamination of land or water from releases of pollutants onto the ground or into sewers, surface waters, groundwater, coastal waters or the sea?

7.1	From handling, storage, use or spillage of hazardous or toxic materials?	Yes	At the fuel storage site during refueling	No
7.2	From discharge of sewage or other effluents (whether treated or untreated) to water or land?	Yes	Effluents can enter the water system	No
7.3	By deposition of pollutants emitted to air, onto land or into sea?	Yes	Discarded machinery can be a problem	Yes
7.4	From any other sources?			

7.5	Is there a risk of long term build up of pollutants in the environment from these sources?	No	All equipments and wastes are retrievable and disposed of safely	No

8. Will there be any risk of accidents during construction or operation of the project which could affect human health or the environment?

8.1	From explosions, spillage, fires etc from storage, handling, use or production of hazardous or toxic substances?	Yes	Use of cutting or wielding equipments in the workshop	No
8.2	From events beyond the limits of normal environmental protection eg failure of pollution control system?	No	The operations involve mostly logging related activities	No
8.3	Could the project be affected by natural disasters causing environmental damage eg floods, earthquakes, landslips	Yes	Solomon Islands is vulnerable to earthquakes and cyclones	No
8.4	From any other causes?			

9. will the project result in social changes, for example, in demography, traditional lifestyles, employment?

9.1	Changes in population size, age, structure, social groups etc?	No	Not in the local communities	No
9.2	By resettlement of people or demolition of homes or communities or community facilities eg schools, hospitals, social facilities?	No	Efficient social services are rarely available in the camp	No
9.3	Through in-migration of new residents or creation of new communities?	No	As soon as soon as the operations close, all employees are also expected to leave	No
9.4	By placing increased demands on local facilities or services eg housing, schools, health?	No	The company provides housing for its labours	No
9.5	By creating new jobs during construction or operation or causing the loss of jobs with effects on unemployment and the economy?	Yes	The company employs many local people in its labour force	No
9.6	Any other causes?			

10. Are there any other factors which should be considered such as consequential development which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality?

10.1	Will the project lead to pressure for consequential development which could have significant impact on the environment eg more housing, new roads, new supporting industries or utilities?	No	If the locals can develop the site there is going to be environmental problems	No
10.2	Will the project lead to development of supporting facilities, ancillary development which could have impact on the environment eg: - roads, power supply, waste treatment, etc) - housing development - extractive industries	No	As soon as logging is complete the company will be leaving the area	No

10.3	Will the project lead to after use of the site which could have impact on the environment?	Yes	Establishment of residences by locals	No
10.4	Will the project set a precedent for later development?	Yes	It is most likely	No
10.5	Will the project have cumulative effects due to proximity to other existing or planned projects with similar effects?	No	There is no major development action within the vicinity	No

Matrix of interactions between project activities and environment

Project Activities	Roading	Skid tracks	Land clearing	Workshop	Log pond	Logging camp	Wharf construction	Log landings	Harvesting	Fuel storage	Haulage
Environmental Parameters											
A. General											
i. General climate	--	--	---	-	-	-	-	--	---	-	-
ii Landform and topography	--	--	---	-	-	-	-	-	--	-	
B. Biological environment											
Flora											
Terrestrial habitats	--	--	--	--	--	--	--	--	--	--	--
Forest understorey	--	--	---	--	--	--	--	---	---	--	--
Forest overstorey	--	--	---	--	--	--	--	---	---	--	--
Rare/threatened plants	--	--	--	--	--	--	--	--	--	--	--
Fauna											
Ground mammals	--	--	--	--	--	--	--	--	--	--	--
Arboreal mammals	--	--	---	--	--	--	--	--	---	--	--
Ambhibians	--	--	---	--	--	--	--	--	--	--	--
Reptiles	---	--	---	--	--	--	--	--	--	--	--
Birds	--	--	---	--	--	--	--	--	---	--	--
Bats	--	--	---	--	--	--	--	--	---	--	--
Rare/threatened fauna	--	--	--	--	--	--	--	--	--	--	--
Aquatic											
In-stream habitats	--	--	--		--	--	--	--	--	--	
Riparian habitats	---	---	--	--	--	--	--	--	---	--	--
Swamp habitats	--	---	---	--	--	--	--	--	--	---	--
Coastal wetlands	--	--	---	--	--	--	--	--	--	--	--
Fish	--	--	--	--	--	--	--	--	--	--	--
Aquatic flora	--	--	--	--	--	--	--	--	--	--	--
Threatened aquatic wildlife											
Physical environment											
Water											
Water yield	--	--	---	--	--	--	--	--	---	--	--
Stream flow	---	--	---	--	--	--	--	--	---	--	--
Sediment load (suspended)	---	--	---	--	--	--	--	--	---	--	--
Sedimentation (bed load)	---	--	---	--	--	--	--	--	---	--	--
Water quality	---	---	---	--	--	--	--	--	--	---	--

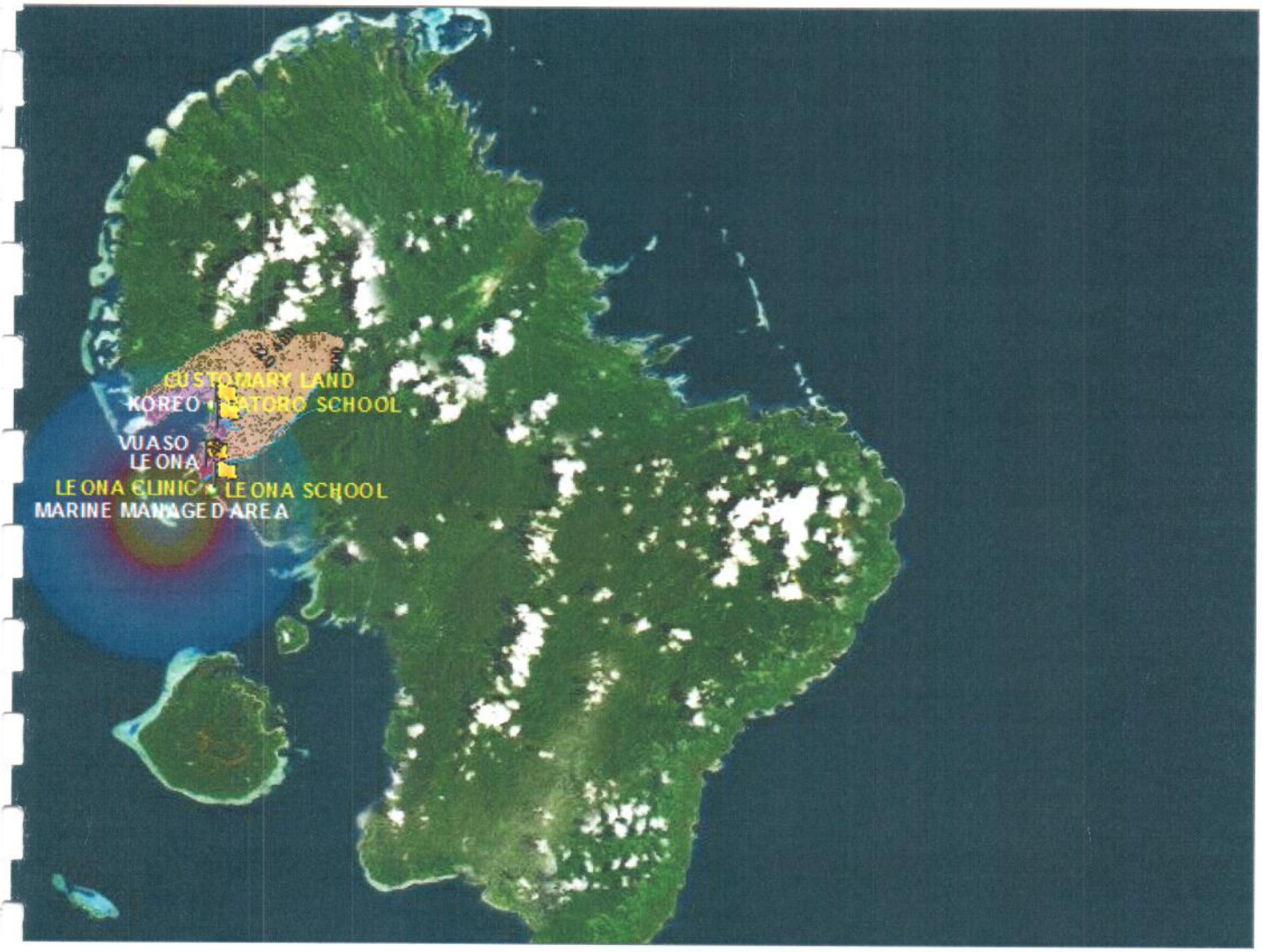
Ground water	--	--	---	--	--	--	--	--	---	--	--
Land											
Slope stability	---	--	---	--	--	--	--	--	---	--	--
Soil erosion	---	---	---	--	--	--	--	--	---	--	--
Soil compaction	---	---	---	--	--	--	--	--	---	--	--
Land sediment deposition	--	--	---	--	--	--	--	--	---	--	--
Soil nutrients	---	---	---	--	--	--	--	--	---	--	--
Social/economic											
Employment	++		++	++		++			++		
Income	++		++	++		++			++		
Tourism & recreation			++			++					
Community services	++		++	++		++			++		
Regional economy	++		++	++		++			++		
Archaeology sites	--	--	--	--	--	--	--	--	--	--	--

Legend

++	Potential minor positive impact	Localized, temporal, seasonal
+ + +	Potential major positive impact	Localized, temporal, seasonal
- -	Potential minor negative impact	Localized, temporal, seasonal
-- -	Potential major negative impact	Localized, temporal, seasonal

Concession Map, Northwest Vella La Vella Island

The Map shows the locations of villages, schools, clinic, Rivers and Marine Managed Area in relation to the proposed logging concession area. This map was produced by MECDM GIS based on the available data to support decision making.



Earthstar Geographics, CNES/Airbus DS