



ENVIRONMENTAL IMPACT ASSESSMENT GUIDELINES FOR FORESTRY



Department of Environment
Ministry of Environment and Water, Malaysia



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The Department is also grateful to all DOE staff for their efforts and passion in steering the Guidelines into reality for the benefits of streamlining and improving EIA report preparation in the country.

Finally, DOE also hopes that the Guidelines will be used in the context of EQA 1974 for the betterment of Environmental Management in the country

PREFACE

The **Environmental Impact Assessment Guidelines for Forestry** have been prepared to account for the latest amendments in the **Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015**, a subsidiary legislation of the **Environmental Quality Act (EQA) 1974 (Act 127)**.

Projects that are deemed prescribed activities are listed in the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 and will require an Environmental Impact Assessment (EIA) to be undertaken by qualified persons, i.e. EIA Consultants, and approved by the Department of Environment (DOE).



The DOE has been streamlining the EIA process to align with the scope, functions, and vision of its Environmental Management Strategic Plan. As part of this plan, the DOE issued the **Environmental Impact Assessment Guidelines in Malaysia (EGIM)** in 2016, to guide industries, project developers and EIA consultants on the general requirements of the EIA. EGIM also stresses the early adoption of Environmental Mainstreaming and Guided Self-Regulation principles in project planning. Similarly, this guideline, to be read in conjunction with the complementary EGIM, shall aid in the undertaking of EIA studies pertaining to Forestry projects.

Land-based projects such as Forestry activities could have devastating environmental impacts including, but not limited to, indiscriminate primary and secondary forest removal that could lead to loss of livelihoods of people dependent on forest-based economies and increase in human-wildlife conflict. Apart from these, there could be impacts due to erosion, additional pollutant loads on rivers and other water bodies, soil contamination, improper waste disposal, and dust and noise due to vehicular movement. Therefore, identifying and quantifying the relevant impacts must be an integral part of the assessment process and proposing the mitigation measures. This will establish the basis for the commitment of the Project Proponent to ensure that

mitigating measures are adhered to during the implementation of the project and not to adversely affect the ecology or the surrounding human environment. The objectives of this guideline are:

- ❖ Defining environmental requirements for managing the project.
- ❖ Providing relevant tools and methods to avoid and/or to reduce and minimise the sources of environmental pollution to an acceptable level.
- ❖ Guiding the selection and application of these tools and methods to maintain a healthy environment during different phases of project implementation.

The Guideline shall provide guidance to various stakeholders such as Government Agencies, approving authorities, Project Proponents, Qualified Persons including DOE-registered EIA Consultants, Subject Specialists, and other EIA-related practitioners in the preparation and submission of EIA reports for Fisheries activities.

The Guidelines shall only be used within the framework of the EQA 1974 including its future updates and its subsidiary regulations. Although it is not legally applicable to the states of Sabah and Sarawak, the Guidelines can still be used as a reference and guide for similar projects in these two states.

NORLIN BINTI JAAFAR

Director General

Department of Environment, Malaysia.

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LIST OF ABBREVIATIONS

APCS	Air pollution control system
AN	Ammoniacal Nitrogen
BOD	Biochemical Oxygen Demand
CFS	Central Forest Spine
CAO	Conditions of Approval (EIA)
Cd	Cadmium
Cl₂	Chlorine
CN	Cyanide
COD	Chemical Oxygen Demand
CO	Carbon monoxide
CO₂	Carbon dioxide
Cr³⁺	Chromium Trivalent
Cu	Copper
dB	Decibel
dB(A)	A-weighted decibel
DID	Drainage & Irrigation Department (JPS)
DO	Dissolved Oxygen
DOA	Department of Agriculture
DOE	Department of Environment
DOF	Department of Forestry / Jabatan Perhutanan
DTCP	Department of Town & Country Planning
DVS	Department Of Veterinary Services Malaysia
DWNP	Department Of Wildlife and National Parks Malaysia
EIA	Environmental Impact Assessment
EIATRC	EIA Technical Review Committee
EGIM	Environmental Impact Assessment Guideline In Malaysia
EM	Environmental Mainstreaming
EMP	Environmental Management Plan
EQA 1974	Environmental Quality Act 1974
ESA	Environmentally Sensitive Area
ESCP	Erosion and Sedimentation Control Plan
ESI	Environmental scoping information
FAO	Food & Agricultural Organisation of the United Nations
Fe	Iron
FPIC	Free, Prior and Informed Consent ()
FRIM	Forest Research Institute of Malaysia
GAs	Government Agencies
GIS	Geographical Information System
GTM	Geological terrain mapping
HEC	Human-elephant conflicts
Hg	Mercury

HRA	Health Risk Assessment
HWC	Human Wildlife Conflict
IUCN	International Union for Conservation of Nature
JAKOA	Jabatan Kemajuan Orang Asli
JKR	Jabatan Kerja Raya (Public Works Department)
JPBD	Jabatan Perancang Bandar & Desa / PLANMalaysia
JPS	Jabatan Pengairan dan Saliran (DID)
JPSM	Jabatan Perhutanan Semenajung Malaysia / Forestry Department of Peninsular Malaysia
kg	kilogram
km	kilometer
KSAS	Kawasan Sensitif Alam Sekitar / Environmentally Sensitive Areas
Ldn	Day-night Sound Level (for assessing 24-hour exposure)
Leq	Equivalent Sound Level (used to describe 8-hour exposure)
LO	Land Office
m	meters
m³	cubic meters
MAAQS	Malaysian Ambient Air Quality Standard
mg/l	milligram per liter
min	Minimum
Mn	Manganese
MOA	Ministry of Agriculture
MOH	Ministry of Health
MOSTI	Ministry of Science, Technology and Innovation
MPFN	National Physical Planning Council of Malaysia
MPI	Ministry of Primary Industries
MPIC	Ministry of Plantation and Commodities
MPOB	Malaysian Palm Oil Board
MSL	Mean Sea Level
MSMA-2	Manual Saliran Mesra Alam Edisi-2
MSPO	Malaysia Sustainable Palm Oil
NGO	Non-Government Organization
NO₂	Nitrogen Dioxide
NPP-3	National Physical Plan 3
NRE	Ministry of Natural Resources
NWQS	National Water Quality Standard
O&G	Oil and grease
PM	Performance monitoring
ppm	parts per million
PBT	Pihak Berkuasa Tempatan / Local Authority
PTD	District and Land Office
PRF	Permanent reserved forest
PSF	Peat swamp forest

PTG	Pejabat Tanah Dan Galian
ROW	Right of Way
S²⁻	Sulphide
SIA	Social Impact Assessment
SMA	Special Management Area
Sn	Tin
SO₂	Sulphur Dioxide
SPC	State Planning Committee
SPE	Sistem Pengolahan Effluent
STS	Sewage Treatment System
SS	Suspended Solids
SSA	Site suitability assessment
TOR	Terms of Reference
TSS	Total Suspended Solids
UNDRIP	UN Declaration on the Rights of Indigenous Peoples.
USLE	Universal Soil Loss Equation
VOC	Volatile Organic Compounds
°C	degree Celcius
µg/l	microgram per liter
ZOI	Zone of Impact
ZOS	Zone of Study



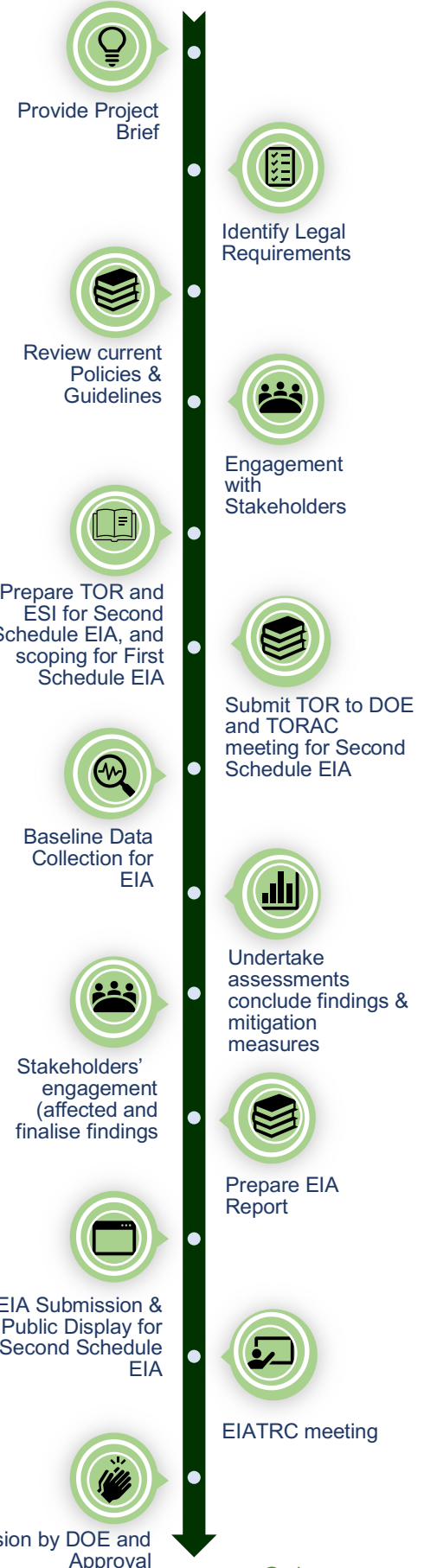
PURPOSE OF THE GUIDELINE

To provide clear and concise guidance on the preparation of Environmental Impact Assessments (EIA) for forestry projects and activities defined as **prescribed activity** in the EIA Order 2015.

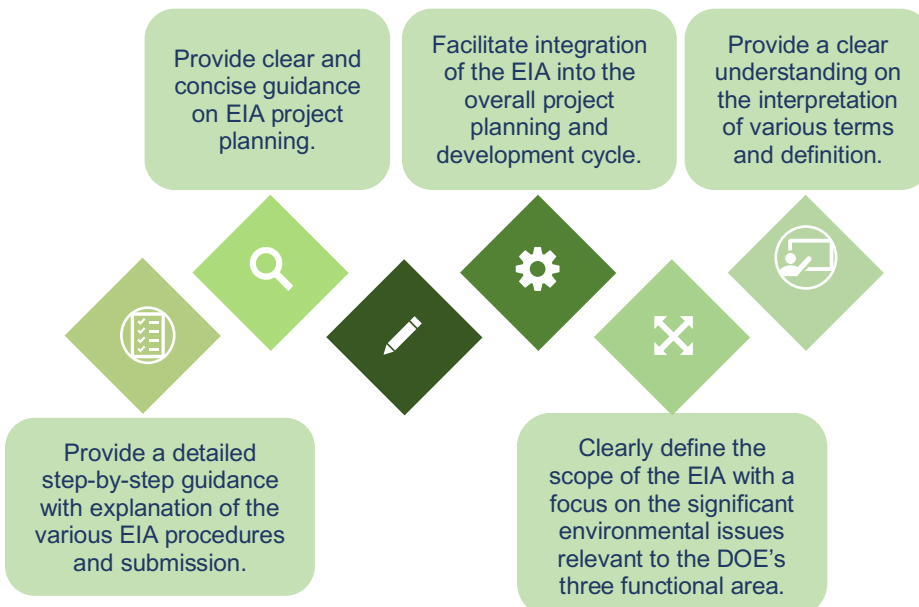
APPLICABILITY

- ❖ Applicable to Forestry projects that qualify as a **prescribed activity** in Peninsular Malaysia
- ❖ Use this document as a guide for non-prescribed activities.
- ❖ Guidelines to be read with EGIM 2016.

OVERVIEW OF THE EIA PROCESS

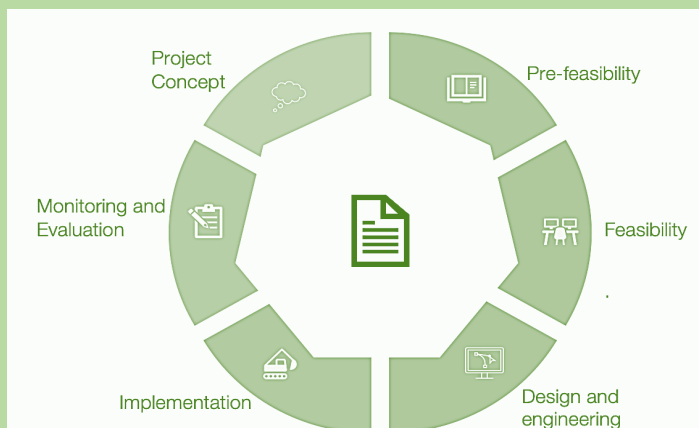


OBJECTIVES



Project Phases in EIA

Incorporation of EIA study at an early of project planning at the Project Concept and Pre-feasibility stages provides significant benefits.





FOREST DEFINITION

Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.

Logging is only allowed within the de-facto class [(a) Timber production under sustained yield] whereas all of the other classes are generally considered to be “protection forest” where logging is not allowed or allowed under strict conditions.

National Forestry Act 1984

Section 10(1)

- (a) timber production forest under sustained yield;
- (b) soil protection forest;
- (c) soil reclamation forest;
- (d) flood control forest;
- (e) water catchment forest;
- (f) forest sanctuary for wild life;
- (g) virgin jungle reserved forest;
- (h) amenity forest;
- (i) education forest;
- (j) research forest;
- (k) forest for federal purposes

GOVERNING LAWS ON FORESTRY AND FOREST MANAGEMENT

NATIONAL FORESTRY ACT 1984 (and subsequent amendments)

State Forestry Enactments

FOREST GOVERNANCE

Under Article 74(2) of the Federal Constitution, forest is under the jurisdiction of the state government.

Each state has the power and freedom to enact own laws and manage forestry policies in their respective states.

The executive authority of the federal government is limited to providing advice, technical assistance, training, research and development in the forestry sector to the state.

Waters Act 1920

Aboriginal Peoples Act 1954, including relevant decisions of the Civil Courts

Land Conservation Act 1960

National Land Code 1965

Environmental Quality Act 1974 and subsidiary legislation

Pesticides Act 1974

Town and Country Planning Act 1976

Local Government Act 1976

National Parks Act 1980

Fisheries Act 1985

Mineral Development Act 1994

Occupational Safety and Health Act 1994

International Trade In Endangered Species Act 2008

Wildlife Conservation Act 2010

Wood-based Industries Act 1984

Forestry Manual / Manual Perhutanan by FDPM (2003) [Administration, Operations, Development]

Forest Road Guidelines / Garis Panduan Jalan Hutan by FDPM 2010 (Amended 2013)

Guidelines for Reduced Impact Logging in Peninsular Malaysia, by FDPM (2003)

Field Manual of Selective Management System, by FDPM (1997)

Guidelines for Forest Harvesting, by FDPM (1984)

Panduan Had Tebangan dan Maklumat-Maklumat Inventori Sebelum Tebangan, by FDPM (1984)

Guidelines for Logging in Hill Forest of Peninsular Malaysia, by FDPM (1988)

Panduan Amalan Baik Hutan (Good Forest Practices) Untuk Pengusahaan Kayu Kayan Tanah Kerajaan, FDPM (2016)

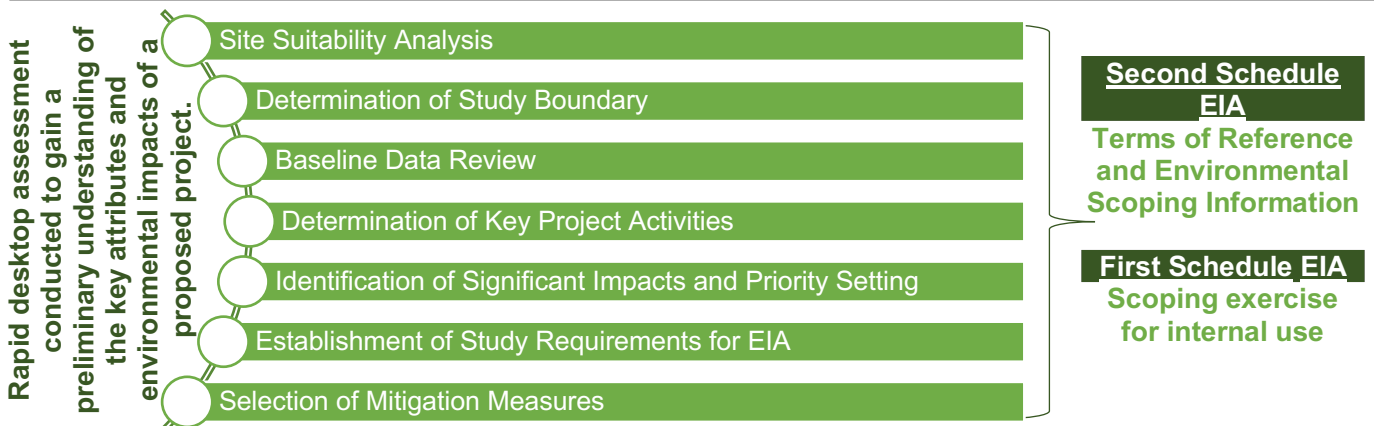
Malaysian Criteria and Indicators (MC&I) for Forest Management Certification, by MTCC



ENVIRONMENTAL QUALITY (PRESCRIBED ACTIVITIES) (ENVIRONMENTAL IMPACT ASSESSMENT) ORDER 2015

FIRST SCHEDULE	SECOND SCHEDULE
5. FORESTRY	5. FORESTRY
(a) Conversion of forest at 300 meters or more above mean sea level to other land use covering an area of 20 hectares or more but less than 100 hectares .	(a) Conversion of forest at 300 meters or more above mean sea level to other land use covering an area of 100 hectares or more.
(b) Logging, or cutting or taking of timber for the purpose of conversion from forest to other land use covering an area of 100 hectares or more but less than 500 hectares .	(b) Logging or conversion of forest to other land use within: (i) a catchment area of reservoirs used for municipal water supply, irrigation or hydro power; (ii) an area adjacent or near to any state park, national park or national marine park ; (iii) any state park, national park or national marine park; or (iv) an area gazetted as water catchment forest under the National Forestry Act 1984.
(c) Logging, or cutting or taking of timber from forest at less than 300 meters above mean sea level covering an area of 100 ha or more, outside permanent reserved forest.	(c) Logging, or cutting or taking of timber from forest at 300 m or more above mean sea level covering an area of 100 ha or more, outside permanent reserved forest.
(d) Conversion of an area of — (i) mangrove forest; (ii) peat swamp forest; or (iii) fresh water swamp forest, for industrial, housing or agricultural use covering an area of 20 ha or more but less than 50 ha.	(d) Logging, or cutting or taking of timber covering an area of 500 ha or more.
(e) Development of planted forest covering an area of 100 hectares or more but less than 500 hectares.	(e) Development of planted forest covering an area of 500 ha or more.
	(f) Conversion of an area of: (i) mangrove forest; (ii) peat swamp forest; or (iii) freshwater swamp forest, for industrial, housing or agricultural use covering an area of 50 ha or more.
	(g) Clearing of mangrove forest, peat swamp forest or freshwater swamp forest on island adjacent to any national marine park.

ENVIRONMENTAL SCOPING





DETERMINING ENVIRONMENTAL BASELINE CONDITIONS

To document the existing environment within Project site and its Zone of Study (ZOS) prior to Project development, and to determine suitable approaches & methodologies for impact assessments.

Primary Data :
Ground truthing, field sampling and monitoring, site survey & investigations



Secondary Data :
Published plans, maps, data, reports, research and statistics from reliable sources, data from DOE monitoring stations.

Baseline Data Collections

Physico-chemical	Human	Biological
Topography, Terrain	Land Uses, Zoning	Habitat Mapping
Geology, Soil types & classes	Land Tenure & Classifications	Species Inventory, noting presence of rare, threatened or endemic (RTE) species
River Network, River Basins & Hydrology	Settlements and demographic profile	Species occupancy model
Water Catchment	Displacement of People	Abundance & Diversity Assessment
Water Quality	Awareness & Perceptions	Forest condition /stratification map
Climate and meteorology	Cultural or religious sites to local indigenous communities	Reserves & Sanctuaries
Air Quality	Forest resources for local indigenous communities	Terrestrial Fauna
Waste	Public health	Terrestrial Flora
Noise	Traffic	Aquatic Flora
	Heritage, Culture	Aquatic Fauna
	Archaeology Sites	



☑ Collecting existing data is first step in the collection of baseline information.

☑ Must review for its relevance to the proposed site, its accuracy, and used as a basis for determining what primary field investigations may be required to 'fill the gaps'.

☑ Baseline data collection should be carried out at appropriate time of year.



PREDICTING AND EVALUATING IMPACTS

To predict and evaluate how the project will affect the physio-chemical, ecological, and human components within the landscape.

Typical Impacts from Forestry Projects

Ecology

- ❖ Biodiversity loss
- ❖ Loss of habitat
- ❖ Loss of forest cover
- ❖ Changes in forest composition
- ❖ Increased stress on adjacent habitats
- ❖ Habitat fragmentation
- ❖ Residual damage
- ❖ Increased edge effects
- ❖ Degradation of aquatic habitats
- ❖ Increase hunting pressure
- ❖ Invasive alien species

Physical-Chemical

- ❖ Soil erosion
- ❖ Landslides
- ❖ Stream sedimentation
- ❖ Flash floods
- ❖ Water pollution
- ❖ Biomass, Solid waste
- ❖ Soil compaction
- ❖ Reduced water tables and soil nutrients
- ❖ Increased risk of forest fires
- ❖ Air pollution, greenhouse gas
- ❖ Loss of soil microbial communities

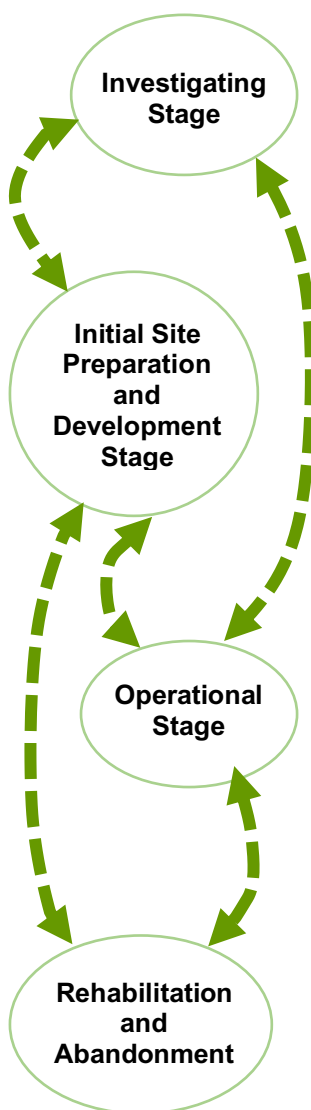
Socio

- ❖ Loss of forest resources
- ❖ Water security
- ❖ Loss of access to sites of cultural or religious significance
- ❖ Loss of access to customary land
- ❖ Loss of assets
- ❖ Human-wildlife conflicts
- ❖ Public health
- ❖ Degradation of tourism and recreational areas

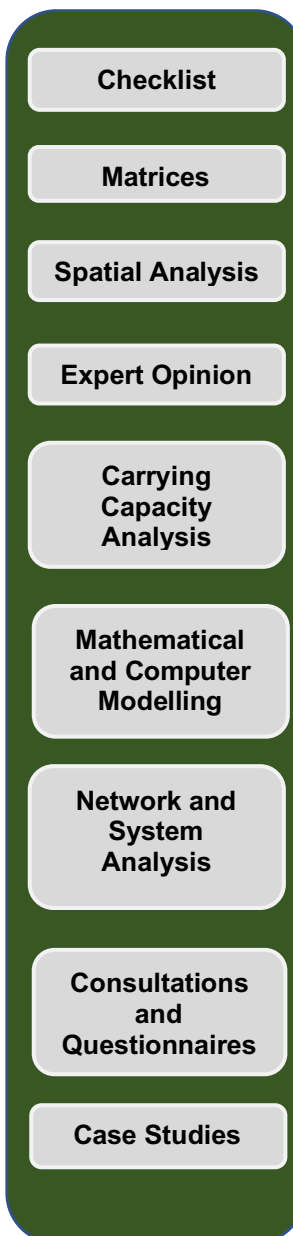
Other Impacts

- ❖ Traffic
- ❖ Noise

Typical Breakdown of Project stages



Predictive Methods

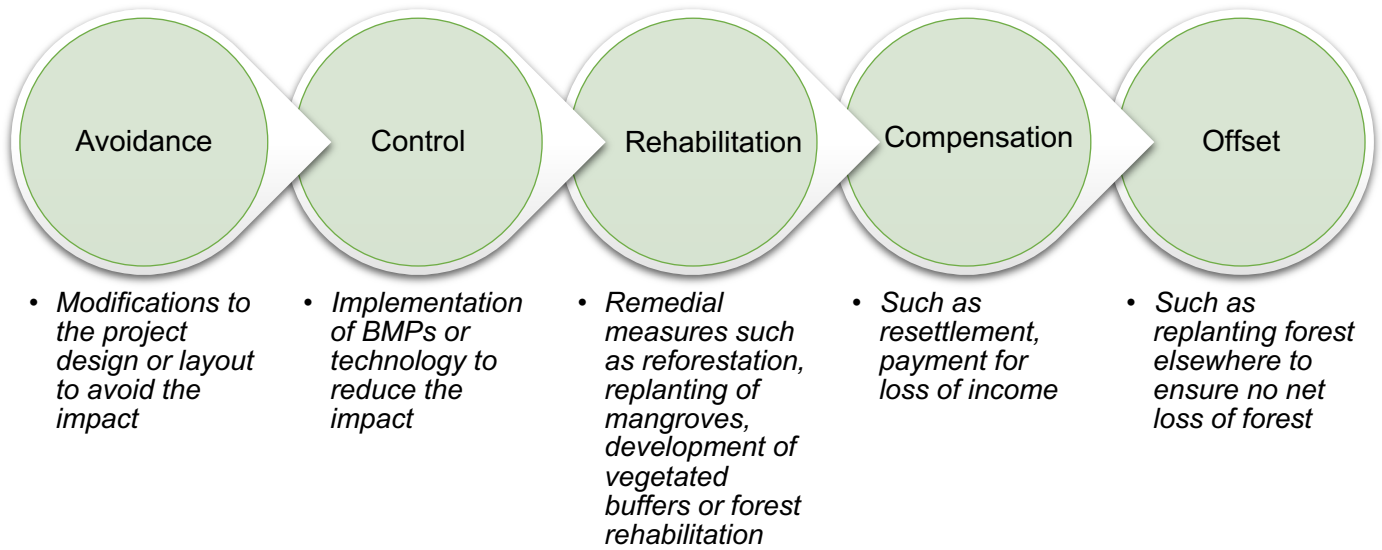


Criteria and Standards

- ❖ Relevant laws or regulations
- ❖ Accepted national or international standards and limits
- ❖ Relevant policies and plans
- ❖ Consultation with subject experts and acceptability with relevant decision makers
- ❖ Consultation with stakeholders – impact receptors



ADDRESSING IMPACTS



KEY MITIGATION MEASURES

Objectives

Avoidance of negative impacts through selection of best options /alternatives

When an impact cannot be avoided, to adopt appropriate preventive measures and best management practices (BMPs) to reduce and minimise the impacts

Ensure residual impacts are kept within acceptable levels

Enhanced and amplify the beneficial impacts

Mitigation Considerations

Ecological Impacts

- Work Operation - phasing logging, land clearing, harvesting, etc.
- Buffer Zones for Protected Areas
- Conservation Areas (riparian zones)
- Wildlife / ecology corridor
- Wildlife management
- Project Boundary with Water Catchment Boundary
- Reforestation / Afforestation

Physical - Chemical Impacts

- Zoning of High Soil Erosion Areas
- Zoning of River Reserves
- Soil Erosion Management
- Zoning of Flood Prone Areas
- Maintenance of Waterways
- Air Quality, Dust
- Water Quality

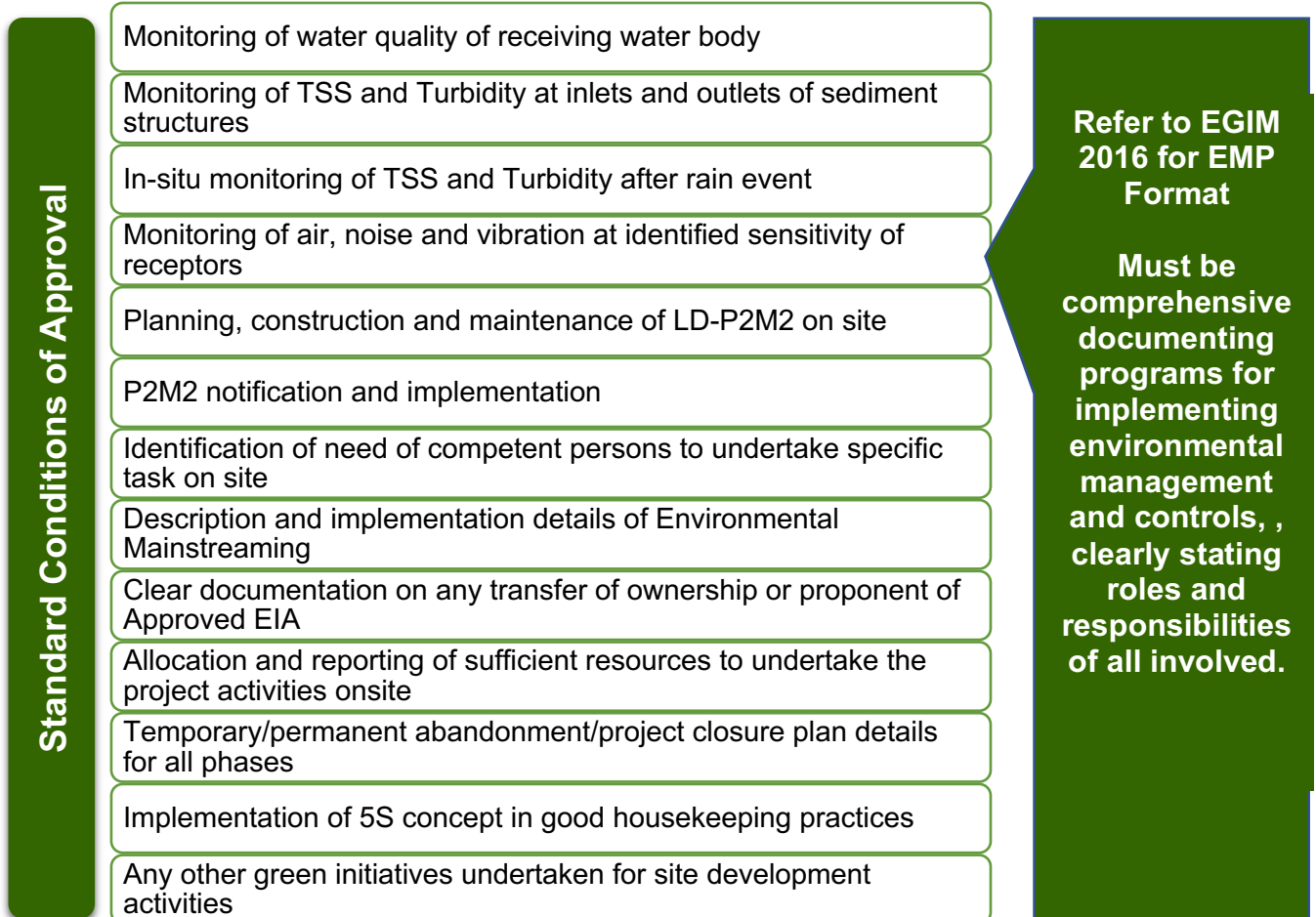
Socio Impact

- Area conservation for indigenous communities
- Accesibility & Traffic management
- Water resources
- Noise
- Economic remuneration

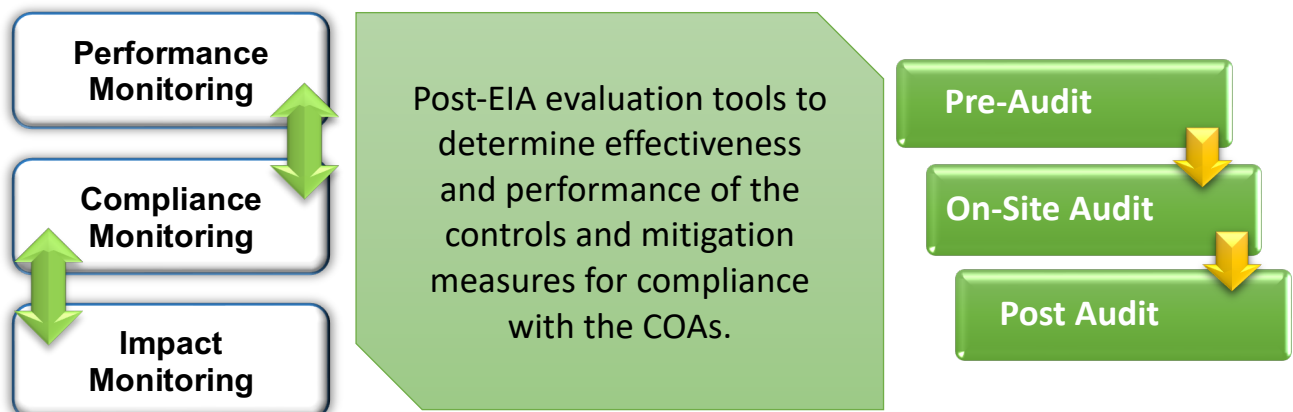


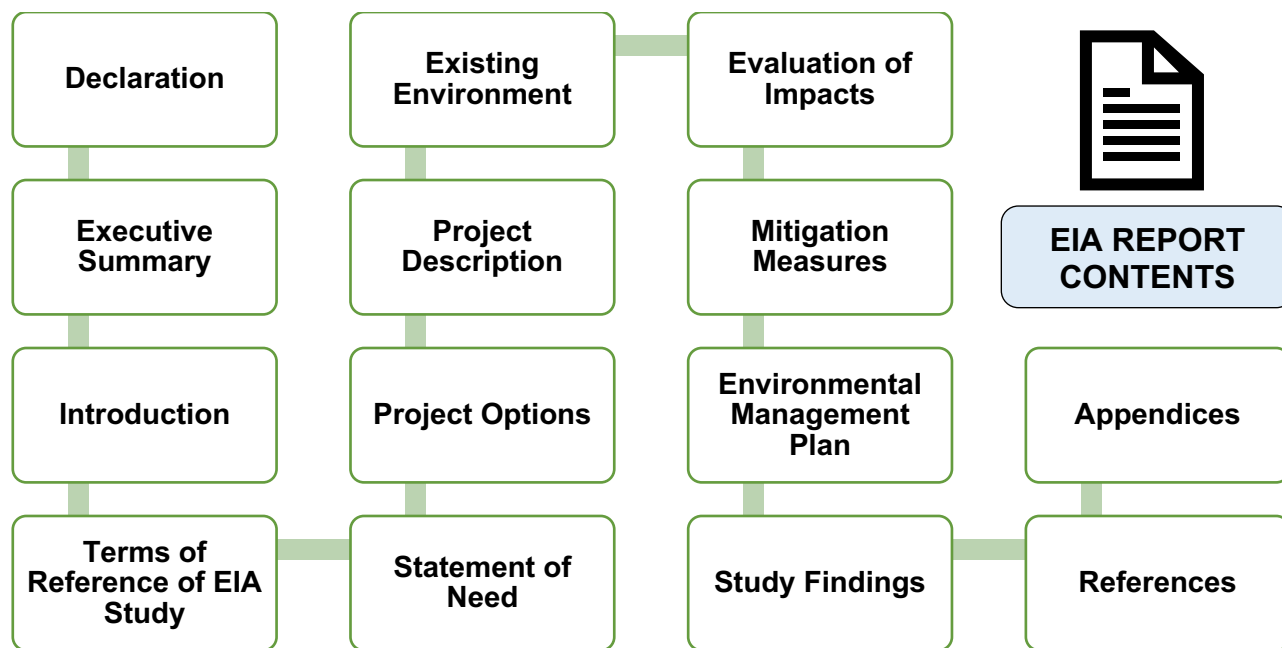
DEVELOPING OUTLINE OF ENVIRONMENTAL MANAGEMENT PLAN

EMP is a legal document prepared by the Project Proponent incorporating pollution prevention and mitigation measures and best management practices stipulated in the Conditions of Approval by the Department of Environment



Environmental Monitoring & Auditing





Data Deliverables

- ☑ All relevant data collected during the EIA should be made available.
- ☑ Sampling results, modelling databases, baseline data, metadata

Conclusion to EIA Report

- ☑ When concluding the report, Qualified Person should provide fair and unbiased conclusion of the EIA study based on the expert opinion of the impact assessment for the purpose of informed decision-making.

Stakeholder Engagement & Public Display

Engagements should be ongoing from planning stage until Project development.

Second Schedule EIA

- | | |
|---|--------------------------|
| ❖ Public Briefing | ❖ Online Display |
| ❖ Public Display & Review of EIA Report | ❖ Additional Engagements |
| ❖ Display Locations | ❖ Documentation |



Good Practices in Stakeholder Engagements

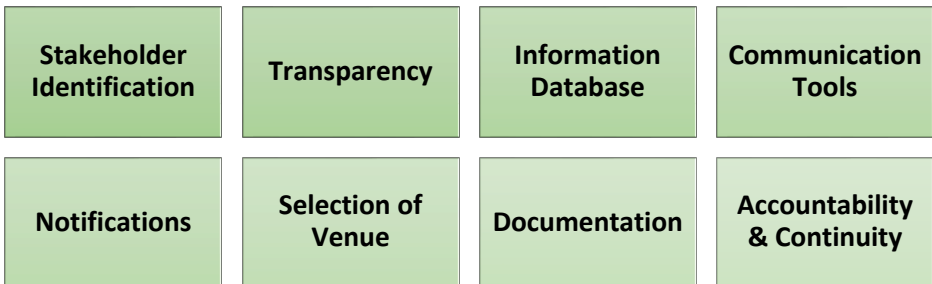




Photo Source: Forest-Research-Institute-Malaysia (FRIM)

INTRODUCTION

CHAPTER 1. INTRODUCTION

1.1 PURPOSE OF THE EIA GUIDELINE FOR FORESTRY PROJECTS

The purpose of the EIA Guideline for Forestry Projects is to provide clear and concise guidance on the preparation of Environmental Impact Assessments (EIA) for forestry projects. The guideline is a subset of the ***Environmental Impact Assessment Guideline in Malaysia (EGIM) (DOE, 2016)***.

The main target audience of this guideline are Project Proponents, Department of Environment (DOE) - registered EIA consultants (hereinafter referred to as 'Qualified Persons') and other EIA-related practitioners.

1.2 APPLICABILITY OF THE EIA GUIDELINE FOR FORESTRY PROJECTS

This guideline is applicable to forestry projects that qualify as a prescribed activity under the ***Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015***. Prescribed activities that require an EIA are listed under the First and Second Schedules of the ***Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order (EIA Order) 2015***. Forestry projects are prescribed under ***Activity 5 (Forestry)*** for both Schedules, though other prescribed activities such as agriculture and fisheries may also involve forest conversion.

If a project falls under more than one prescribed activity and if one of the prescribed activities falls under the Second Schedule, then the project is deemed to fall under the ambit of the Second Schedule. The prescribed activities for forestry activities are as follow:

FIRST SCHEDULE

Activity 5 FORESTRY

- (a) *Conversion of forest at 300 meters or more above mean sea level to other land use covering an area of 20 hectares or more but less than 100 hectares.*
- (b) *Logging, or cutting or taking of timber for the purpose of conversion from forest to other land use covering an area of 100 hectares or more but less than 500 hectares.*
- (c) *Logging, or cutting or taking of timber from forest at less than 300 meters above mean sea level covering an area of 100 hectares or more, outside permanent reserved forest.*
- (d) *Conversion of an area of —*
 - (i) *mangrove forest;*
 - (ii) *peat swamp forest; or*

- (iii) *fresh water swamp forest, for industrial, housing or agricultural use covering an area of 20 hectares or more but less than 50 hectares.*
- (e) *Development of planted forest covering an area of 100 hectares or more but less than 500 hectares.*

SECOND SCHEDULE

Activity 5 FORESTRY

- (a) *Conversion of forest at 300 meters or more above mean sea level to other land use covering an area of 100 hectares or more.*
- (b) *Logging or conversion of forest to other land use within —*
 - (i) *a catchment area of reservoirs used for municipal water supply, irrigation or hydro-power;*
 - (ii) *(ii) an area adjacent or near to any state park, national park or national marine park;*
 - (iii) *any state park, national park or national marine park; or*
 - (iv) *an area gazetted as water catchment forest under the National Forestry Act 1984 [Act 313].*
- (c) *Logging, or cutting or taking of timber from forest at 300 meters or more above mean sea level covering an area of 100 hectares or more, outside permanent reserved forest.*
- (d) *Logging, or cutting or taking of timber covering an area of 500 hectares or more.*
- (e) *Development of planted forest covering an area of 500 hectares or more.*
- (f) *Conversion of an area of—*
 - (i) *mangrove forest;*
 - (ii) *peat swamp forest; or*
 - (iii) *fresh water swamp forest, for industrial, housing or agricultural use covering an area of 50 hectares or more.*
- (g) *Clearing of mangrove forest, peat swamp forest or fresh water swamp forest on island adjacent to any national marine park.*



Refer to **Chapter 3** for definition, description and applicability for Forestry project.

The legal adherence to the EQA 1974 is based on the following sub-sections:

Section 34A (1)	The Minister, in consultation with the council, may by order prescribe any activity, which may have significant environmental impacts as prescribed activity
Section 34A (2)	Any person intending to carry out any prescribed activity shall appoint a Qualified Person to conduct an EIA and submit a report thereof to the Director General in the manner as the Director General may prescribe.

The Department of Environment (DOE) has rationalised the EIA process to make it more reflective of the scope, functions and visions of the Department in line with its Environment Strategic Plan, with a focus on **Environmental Mainstreaming Tools (EMT) to achieve Self-Regulation (SR)**.

The proposed terms and definitions that will be adopted in the guideline is based on any interpretation and relevant documents published or to be published by DOE and other related government agencies, registered bodies and institutions. The legal definitions and interpretations shall be based on the ***Interpretation Acts 1948 and 1967 (Act 388)***.



- ❖ **Activity 5: Forestry** under the EIA Order 2015 only applies to forestry projects in Peninsular Malaysia.
- ❖ It does not apply to Sabah and Sarawak, where EIAs for forestry are subject to the respective State legislations. In Sabah, EIAs for forestry activities are prescribed under the ***Environment Protection Enactment, 2002 (Enact. 12/2002)*** and approved by the Environmental Protection Department (EPD). In Sarawak, EIAs forestry activities are prescribed under the ***Natural Resources and Environment Ordinance, 1993*** and approved by the Natural Resources and Environment Board (NREB).

1.3 USING THIS GUIDELINE

This guideline **should be read together with the Environmental Impact Assessment Guideline in Malaysia (EGIM)** (DOE, 2016). The EGIM sets out in greater detail, the procedures and requirements to be complied with at each stage of the EIA process, for all prescribed activities, whereas this guideline provides specific additional guidance on prescribed activities pertaining to forestry projects. This Guideline is to assist the Project Proponent when planning and developing new or expanding existing projects.

As per the EGIM, there are 10 main steps involved in the EIA process (**Table 1-1**). This guideline expands on the 10-step process, by providing further detailing pertaining to forestry projects.

Table 1-1 Quick Reference Of The Main Steps In The EIA Process

No.	Step	Refer to:	
		Chapter in EGIM	Chapter in EIA Guideline for Forestry
1	Screening	Chapter 3,4	Chapter 3
2	Scoping Towards Formulation of Terms of Reference	Chapter 3,4	Chapter 3
3	Baseline Study	Chapter 3,4	Chapter 4
4	Impact Assessment and Evaluation of Significance	Chapter 3,4	Chapter 5
5	Identification of Mitigation Measures	Chapter 3,4	Chapter 6
6	EIA Report Preparation	Chapter 3,4	Chapter 8
7	EIA Report Review	Chapter 5	-
8	Decision Making	Chapter 5	-
9	Project Implementation and Environmental Monitoring	Chapter 6	Chapter 7
10	Environmental Audit	Chapter 6	Chapter 7

1.4 OVERVIEW THE ENVIRONMENTAL ASSESSMENT PROCESS

The step-by-step guide of the environmental assessment process is as follows:



STEP 1: PROVIDE THE PROJECT BRIEF

- The Project Proponent must provide sufficient information about the Project to enable the Qualified Person to understand and carry out screening and initial assessment.
- This is to assist in determining which prescribed activity the project falls under (First or Second Schedule) based on the ***Environmental Quality (Prescribed Activity) (Environmental Impact Assessment) Order 2015***.



STEP 2: IDENTIFY THE LEGAL REQUIREMENTS

- During the Environmental Screening Process, the Qualified Person shall identify the legal requirements of the project based on the information provided by the Project Proponent
- Qualified Person to advise the Project Proponent on the standards and limits for compliance for the pollution generation by the project.



STEP 3: EXISTING POLICIES AND GUIDELINES

- (a) The Project Proponent is required to clear all policy matters related to the project prior to submitting the EIA report has been adhered to.
- (b) Qualified Person can advise Project Proponent on the current policy matters related to project development and requirements for EIA study.



STEP 4: ENGAGEMENT WITH STAKEHOLDER

- (a) Early on in the EIA process, the Project Proponent and the Qualified Person should engage with the DOE (via the designated officer in charge) and the relevant Government Agencies (GAs) to determine the requirements to be included in the TOR and EIA.
- (b) The Qualified Person can also engage with other relevant stakeholders to obtain site information and data for the scoping.



STEP 5: PREPARATION OF THE TOR AND ESI

- (a) Upon determining that the project requires either a First or Second Schedule EIA, the Environmental Scoping Information (ESI) and TOR must be prepared.
- (b) The Qualified Person shall obtain secondary data to assist in the Environmental Scoping. At this point of the study, qualitative data is sufficient for scoping of significant impacts for the TOR.
- (c) Relevant information required for the TOR and ESI that the Qualified Person is required to furnish includes:
 - ✓ Site Suitability Assessment (SSA).
 - ✓ Determination of the study boundary (Zone of Study) and anticipated Zone of Impact (ZOI)
 - ✓ Overview of baseline data required
 - ✓ Identification of key project activities
 - ✓ Identification of significant impacts and priority setting
 - ✓ Selection of mitigation measures.



STEP 6: SUBMISSION AND REVIEW OF THE TOR

- (a) The Qualified Person shall review all data obtained during scoping to prepare the TOR report based on DOE requirements in the EGIM (DOE, 2016).
- (b) The TOR and ESI shall be submitted to DOE State/HQ for review and endorsement.
- (c) A TOR Adequacy Check (TORAC) meeting will be carried out (based on needs) for further clarification and endorsement of TOR.
- (d) Once approved, the TOR has a validity of 1 year from date of endorsement for EIA report to be submitted.



STEP 7: BASELINE DATA COLLECTION FOR EIA

- (a) After the TOR endorsement, baseline data collection, either primary or secondary data, shall be carried out to obtain detailed information of the existing environment of the project site and its surroundings.



STEP 8: COMPLETION OF EIA STUDY

The major studies and components of the EIA report shall cover the following:

- (a) Identify and predict the significant environmental issues and impacts.
- (b) Carry out the detailed environmental assessment on the most significant issues only.
- (c) Identify the suitable pollution prevention and mitigation measures (P2M2s) to minimize any negative impacts arising from the development of the projects.
- (d) Provide the Environmental Management Plan (EMP) framework in line with the Self-Regulation concept.



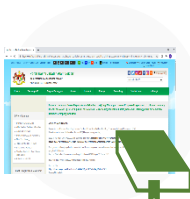
STEP 9: PREPARING EIA REPORT

- (a) All assessments and findings must be included in the EIA report. Take note that the results of studies required by other GAs must be incorporated into the EIA report but not to append the individual reports. These reports must however be reviewed and approved by the respective GAs.
- (b) The EIA report must be thoroughly reviewed by the Project Proponent and with agreement to undertake the proposed P2M2 and EMP. By signing the Declaration in the EIA report, the Project Proponent shall undertake the responsibility in implementation of the P2M2 and adhere to EQA 1974.



STEP 10: STAKEHOLDER ENGAGEMENT

- (a) During preparation of the EIA report, the Project Proponent and Qualified Person shall undertake an engagement with the relevant stakeholders (those who will be affected by the project, e.g. communities or institutions, businesses, etc.).
- (b) The objective is to brief these stakeholders about the project, what it entails, the potential environmental issues, and the proposed P2M2s, with the aim to seek their thoughts and feedback. All findings from the stakeholder's engagement shall be incorporated into the EIA report.



STEP 11: EIA SUBMISSION AND PUBLIC DISPLAY

- (a) The EIA report shall be submitted to DOE State/HQ for review.
- (b) The Qualified Person shall note the difference in requirements for a First Schedule and Second Schedule EIA and follow the required procedures.
- (c) The major difference to note is that the Second Schedule EIA shall require a public display of the EIA for the public to provide comments and feedback within the review period to DOE HQ.



STEP 12: PRESENTATION EIA TO DOE

- (a) The EIA report must be presented to DOE State/HQ by the EIA Team Leader with attendance of Project Proponent.
- (b) In the meeting, arising concerns will be discussed and decided on need for additional information or assessment, or improvements of the overall EIA Report. Resubmission of the EIA may be required within the time frame provided, normally within the Client Charter.



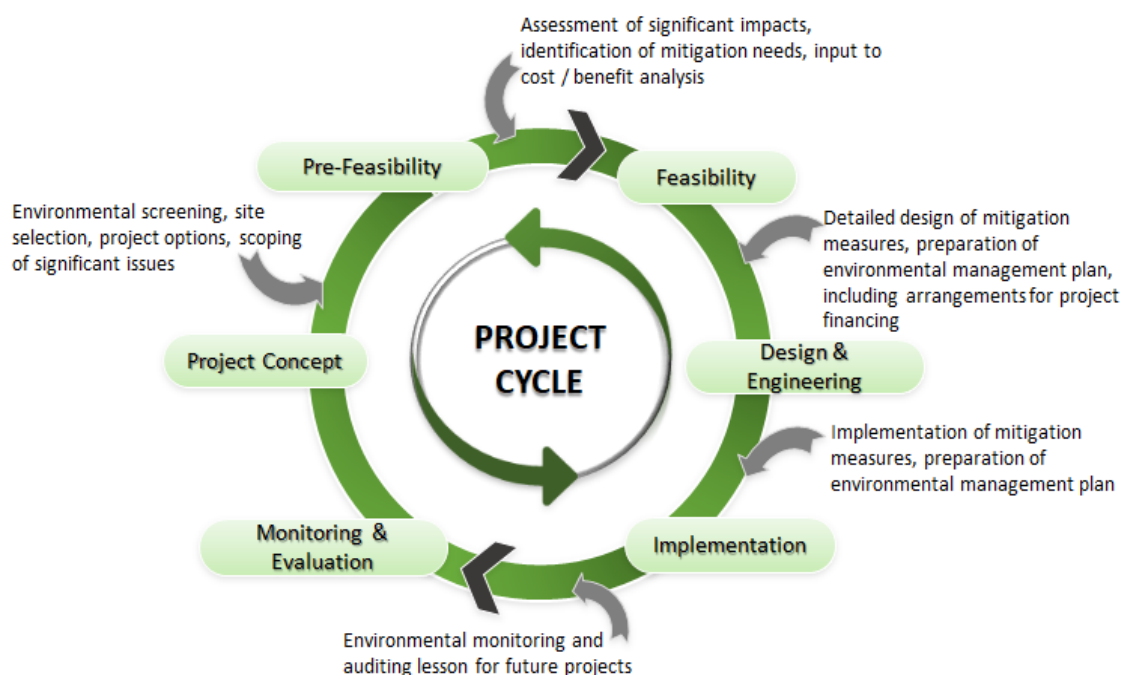
STEP 13: DECISION BY DOE AND EIA APPROVAL

- (a) Decision will be made by the DOE on the EIA Report once the information, assessment and concerns are satisfactorily met and in line with the EQA 1974.
- (b) EIA Approval letter will be issued by the DOE accompanying with EIA Approval Conditions which is mandatory compliance for the Project.
- (c) Project Proponent must proceed with implementation of the EIA Approval Conditions in all Project stages prescribed.

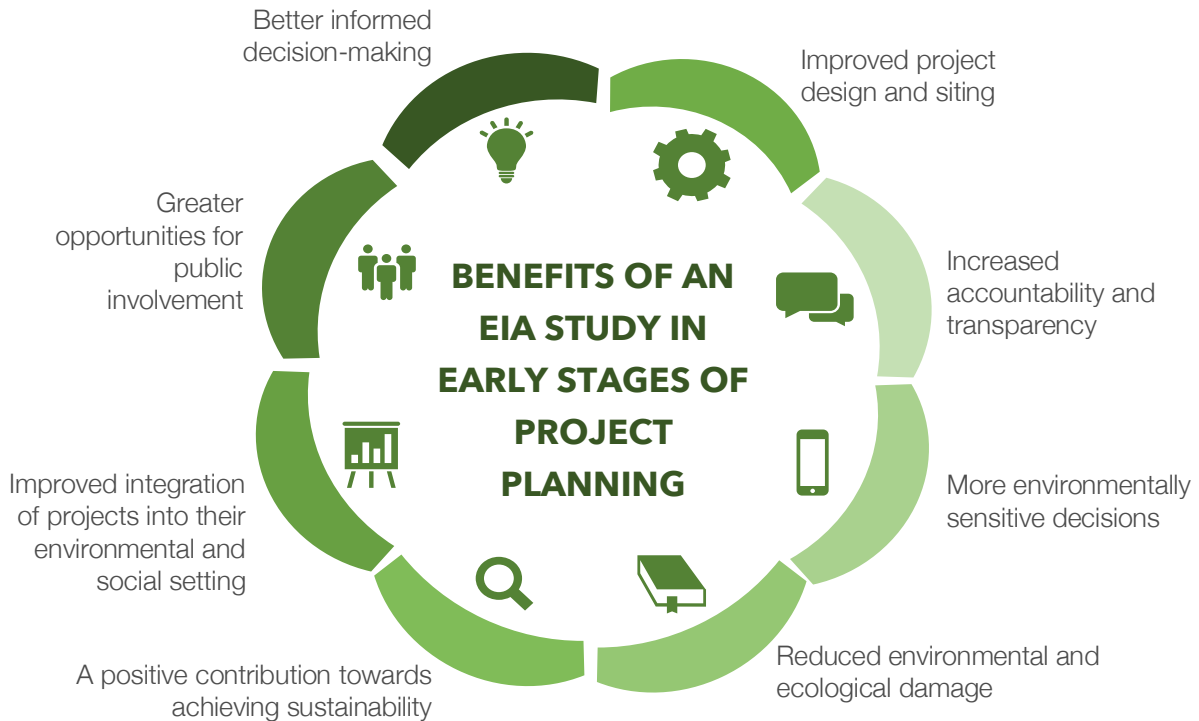
1.5 INCORPORATING EIA INTO THE PROJECT PLANNING FRAMEWORK

A project cycle generally has six major phases, i.e. Project Concept, Pre-feasibility, Feasibility, Design and Engineering, Implementation, Monitoring and Evaluation. The EIA should be viewed an integral part of the project planning and development process, with the appropriate steps of the EIA undertaken in each phase (**Figure 1-1**).

Figure 1-1 Project Phases And Integration Of Environmental Activities



Incorporation of an EIA study at an early of project planning at the Project Concept and Pre-feasibility stages will have significant benefits and value add to the project and is as illustrated in the Figure in the overleaf.



A typical project cycle involves many phases requiring inputs from various technical specialists and consultants to provide reports for submissions to the approving authorities. Throughout the ambit of this project cycle, incorporation of environmental compliance can be carried out in three phasing steps as follows:

- Step 1:**
 - Planning Phase**

The Project Proponent is surmised to have an initial feasibility assessment of suitable sites for development. Once a suitable site has been identified and selected, the Project Proponent will need to request for land alienation (if state or federal land) or through acquisition of private land for development of the project. The Project Proponent must ensure all national and state policies and administrative matters relating to the project are addressed with the relevant authorities.

Environmental Screening: The Project Proponent, working closely with the Qualified Person, shall carry out a screening exercise to determine which prescribed activities and under which Schedule, the project will fall under, within the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015, or not at all.

Environmental Scoping: After the screening exercise, there is a need to gauge the potential environmental significance of the project to the site and the surrounding areas; and to identify potential Pollution Prevention and Mitigation Measures (P2M2s) that can be incorporated into the project design early to avert any serious environmental and engineering problems/damage later on, such as from coastal erosion, water pollution, coastal flooding, etc. These findings, termed the Environmental Scoping Information (ESI) forms the basis to develop the Terms of Reference (TOR) for the Department of Environment (DOE) endorsement

Step 2:

Feasibility and Detailed Project Design Phase

The technical engineering designs of the Project would need to be submitted to the relevant approving authorities for approval, e.g. via the One Stop Centre (OSC). Often, various Government Agencies (GAs) may require additional technical studies and reports to be submitted as part of the technical submissions. In the case of DOE, this may include the EIA report.

Environmental Impact Assessment (EIA): If a project is a prescribed activity under the *Environmental Quality (Prescribed Activities) (EIA) Order 2015*, an EIA is mandatory for approval by the DOE before a project can proceed for development. The Project Proponent and the Qualified Person would need to carry out the EIA based on the endorsed TOR. The EIA must incorporate major findings from the relevant sectoral studies, such as forestry resource mapping, ecology survey and mapping, forest management plan (details on logging method and mitigation); Social Impact Assessment (SIA); tourism surveys, etc., as required by the other GAs.

The recommendations to manage the significant environmental impacts espoused in the EIA would need to be incorporated in the project design. For example, clearing of forests will cause erosion and would need mitigation to reduce the impacts in denuded areas.

Step 3:

Construction and Operational Phase

Construction and operational activities have to comply with the Conditions of Approval (COA) issued by the DOE on approval of the EIA. The COA would contain mitigation requirements for activities that may include site access establishment, mobilisation of machineries and equipment, setting up base camp, land clearing, earthworks and structural works (if any).

Post-EIA: Environmental controls and management would be done through the Environmental Management Plan (EMP). The EMP and the plans for environmental monitoring and auditing have to accompany all construction and operation works. These plans provide the integrative elements to ensure least degradation and/or avoidance of detrimental

impact especially on slope failures, land slides, erosions, etc. during work activities.

Specifically, the monitoring section of the EMP will set out the following.

- | | |
|--|---|
| <p>(a) specific monitoring measures, including the parameters to be measured and methods to be used, sampling locations, frequency of measurements, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions;</p> | <p>(b) monitoring and reporting procedures to ensure early detection of conditions that necessitate mitigation and furnish information on the progress and results of the mitigation.</p> |
|--|---|

1.6 KEY NOTES

Reclassification of Projects

The classification of a project may need to be changed as circumstances dictate. For example, if there is a major modification to the project design or a new activity is added, then a change in category (either upward or downwards) may be warranted. It is also possible that new information arrives after initial project identification work. For example, a First Schedule project may be reclassified as Second Schedule if new information reveals that the project involves a bigger area and an activity may have significant adverse environmental impacts.

Furthermore, the original project implementation schedule may be delayed, especially if assessment activities must be undertaken after project implementation has started.

Participatory Consultations

As early as possible in the project formulation process, all efforts must be made to engage project stakeholders and beneficiaries, including indigenous people and vulnerable groups, in analysis and decision making with respect to potential environmental and social impacts of the project. Stakeholders' participation including indigenous people and vulnerable groups will be ensured in designing, implementing, and monitoring avoidance and mitigation measures and compensation & benefits including establishing appropriate and accessible grievance mechanisms.

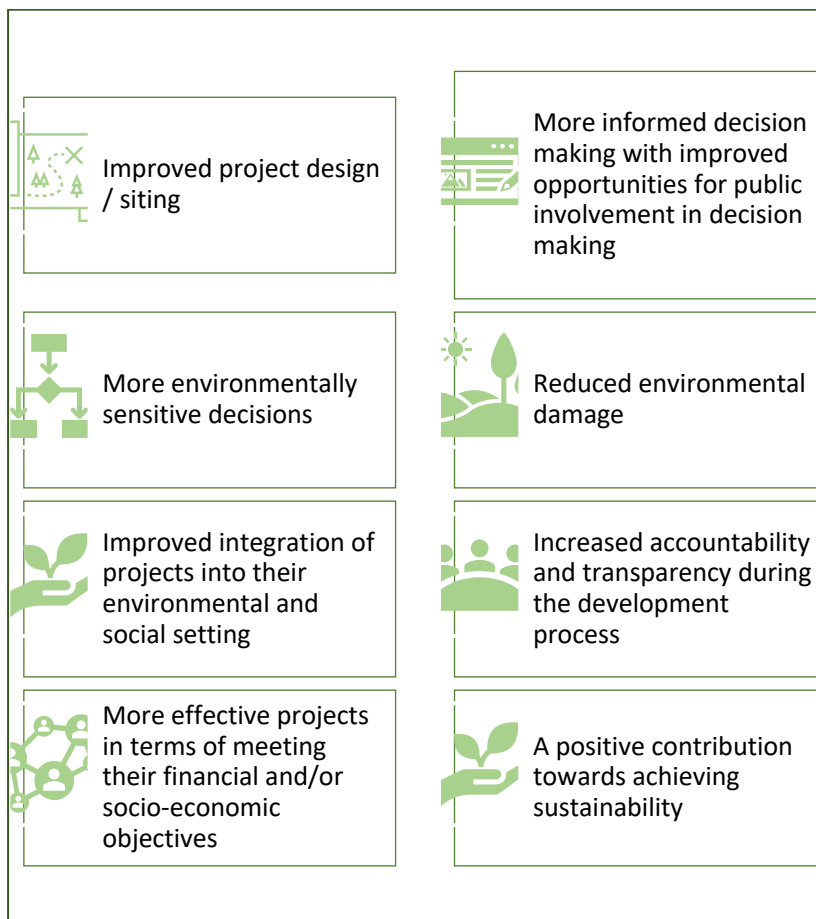
Requirements for Public Disclosure

Second Schedule projects require public disclosure. During the formulation process, the Project Proponent will arrange for timely provision of information on potential environmental and social impacts as well as of draft EA/EIA (including EMP and IPP) to stakeholders and beneficiaries – with particular attention to indigenous peoples and vulnerable groups – in a language and format to be accessible and understandable.

This consultation will be governed by the “free, prior and informed consent principle”. Once the pertinent documentation has been completed (i.e. the environmental analysis for **Second Schedule** projects, the Project Proponent will ensure that it is made available to the public, The Project Proponent will ensure stakeholders involvement and public disclosure of relevant documentation during all the phases of the project and EIA Cycle

1.6.1 Benefits of the EIA Process

The EIA process entails studies to identify, predict, evaluate, and quantify the impacts (both beneficial and adverse) on the environment of a proposed project or development and to communicate the said information to those concerned. The EIA study process to facilitate decision-making for both the DOE and the Project Proponent from an environmental perspective. The EIA report shall assist stakeholders in identifying significant environmental impacts; appropriate abatement and mitigating measures; programmes for monitoring environmental compliance; within the development plan before and/or during project implementation. The main benefits of conducting the process of an EIA study include the following.



The results of all studies are compiled into a comprehensive, coherent, balanced, impartial and technically acceptable report for the submission to the authorities. The EIA report will contain important information for

- The DOE and other authorities to make an informed decision on the project, including preparation of the conditions of approval (COA)
- The Project Proponent to implement the mitigation measures in an environmentally and socially responsible manner.
- The public to understand the project and its potential impacts on the environment.

It is also important to highlight that there were weaknesses in some EIA studies that both the Project Proponents and the EIA consultants must be aware of. Some of the failings include:

- ❖ Difficulties in ensuring adequate and useful public involvement or stakeholder participation;
- ❖ Insufficient integration of EIA work at key decision points in relation to feasibility and similar studies in the project cycle; with some major decisions being made even before EIAs are completed;
- ❖ Lack of consistency in selection of developments requiring specific environmental impact assessment studies;
- ❖ Inadequate understanding of the relative roles of baseline description and impact prediction;
- ❖ Poor integration of biophysical environmental impacts with social, economic and health effects also added to the problems in Environmental Impact Assessment;
- ❖ Production of EIA reports that are not easily understood by decision makers and the public because of their length and technical complexity;
- ❖ Lack of mechanisms to ensure that EIA reports are considered in decision making;
- ❖ Weak linkages between environmental impact assessment report recommendations on mitigation and monitoring and project implementation and operation; and
- ❖ Limited technical and managerial capacities to implement EIAs result in problems in carrying out Environmental Impact Assessment.

Both the Project Proponent and EIA consultant can overcome these failings if they conduct the EIA study early in the project cycle, incorporating all the requirements of the EGIM, EESIM, and this Guideline.

1.7 OBJECTIVES OF THE EIA GUIDELINES

OBJECTIVES	<input checked="" type="checkbox"/> Provide clear and concise guidance on EIA project planning and preparation to the stakeholders, Project Proponents, Qualified Persons (i.e. DOE-registered Environmental Consultants), Government Agencies (GAs), Enforcement Officers and other EIA-related practitioners.
	<input checked="" type="checkbox"/> Facilitate integration of the EIA into the overall project planning and development cycle in order to ensure compliance with and adherence to legal environmental requirements and the framework on environmental sustainability.
	<input checked="" type="checkbox"/> Provide a detailed step-by-step guide with an explanation of the various EIA procedures and submissions, comprising of: (a) Environmental Scoping Information (ESI), (b) Terms of Reference (TOR), and (c) EIA Report.
	<input checked="" type="checkbox"/> Clearly define the scope of the EIA with a focus on the significant environmental issues relevant to the DOE’s three functional areas (water, air and wastes), whilst also taking into consideration the environmental requirements by other authorities or agencies, to facilitate overall decision making and project approval.
	<input checked="" type="checkbox"/> Provide a clear framework for DOE to assess and approve the EIA reports.
	<input checked="" type="checkbox"/> Provide a clear understanding on the interpretation of various terms and definitions as contained in the prescribed activities pertaining to Agriculture and to determine whether the Project falls under any prescribed activity based on the <i>Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015</i>

1.8 STRUCTURE OF THE GUIDELINES

The EIA Guidelines for Forestry are structured according to the step-by-step procedures highlighted in Section 1.6, divided into 8 Chapters with their supporting sections below:

CHAPTER	1	<i>Introduction</i>	<ul style="list-style-type: none"> • Introduction to the Guidelines covering the objectives, scope, and structure.
	2	<i>Policies, Legislations, And Other Instruments</i>	<ul style="list-style-type: none"> • Provides a concise review of legislation, policies, and guidelines relevant to the development of sustainable forestry and how they relate to the EIA process
	3	<i>Screening, Scoping & Preparation of TOR</i>	<ul style="list-style-type: none"> • Provides the terms and definitions associated with forest area development and their interpretations. • Outlines the necessary requirements for the project to undergo initial screening and assessment. • Provides the procedures to conduct screening and scoping of significant issues.
	4	<i>Determining Baseline Conditions</i>	<ul style="list-style-type: none"> • Provides an outline of the relevant baseline information required for incorporation into the EIA report.
	5	<i>Predicting and Evaluating Environmental Impacts</i>	<ul style="list-style-type: none"> • Provides the methodology and tools to identify, predict, evaluate, and assess the significant environmental impacts.
	6	<i>Proposing Measures to Mitigate Impacts</i>	<ul style="list-style-type: none"> • Identifies appropriate P2M2s to minimise any negative impacts arising from the development of the project; and the types of measures to manage any residual impacts.
	7	<i>Developing Outline for The Environmental Management Plan</i>	<ul style="list-style-type: none"> • Provides an EMP framework for post-EIA. • Details out the GSR process for a project. • Provides environmental monitoring and audit programmes for post-EIA.
	8	<i>Preparing the EIA Report and Review Process</i>	<ul style="list-style-type: none"> • Presents the structure and content for EIA reporting, including an overview of the review and approval process.



2

Photo Source: Unsplash - Eutah-Mizushima- (Balok Malaysia)

POLICIES, LEGISLATIONS, AND OTHER INSTRUMENTS

CHAPTER 2. POLICIES, LEGISLATIONS, AND OTHER INSTRUMENTS

2.1 FORESTRY POLICY

Based on Article 74(2) of the Federal Constitution of Malaysia, land and forests come under List II (State List) of the Ninth Schedule. As such, the respective State Authorities have jurisdiction over the legislation and management of forests, whereas the role of the Federal Government only extends to the provision of advice and technical assistance to the States.

The **National Forestry Policy (NFP)**, which was approved by the National Land Council (NLC) in 1978 (and revised in 1992) is adopted by all States in Peninsular Malaysia. The NFP provides the policy directives towards achieving **Sustainable Forest Management (SFM)** for continued social, economic and environmental benefits to the country. The policy directives include, for example:

- ❖ the maintenance of a **Permanent Forest Estate (PFE)** comprising of **Permanent Forest Reserves (PRF)**;
- ❖ the implementation of **silviculture practices** to ensure optimal productivity;
- ❖ the development of **timber based industry** and Bumiputra participation;
- ❖ the establishment of **forest plantations** to sustain timber supply;
- ❖ the implementation of programmes to **conserve biodiversity**.

National Forestry Policy 1978 (revised 1992)



The national agenda set by NFP is driven by the **National Forestry Council (NFC)** that was formed in 1972 under the auspices of the National Land Council. Chaired by the Deputy Prime Minister with members including the Chief Ministers of all States, the main role of the NFC is to harmonise forestry policies between Federal and State governments.

While not explicitly mentioned in the policy, Malaysia is committed to maintain at least 50 percent of her land area under forest cover in perpetuity, as first pledged by the Prime Minister at the 1992 Rio Earth Summit.



Project Proponent and Qualified Person undertaking the EIA Study should ensure that the latest governing policy and global commitment is referred to during the EIA study period.

Box 1 Forest definition

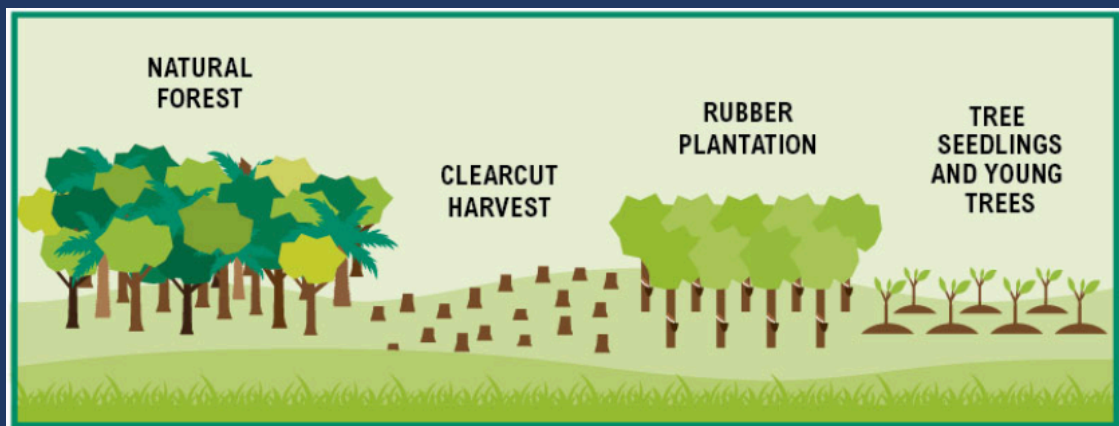
There are many different definitions of “forest” in use worldwide, each developed in relation to a specific objective. The most widely accepted definition, which is adopted by Malaysia was developed by the United Nations Food and Agriculture Organization (FAO) in 2000 for the purpose of its global forest inventory.

FAO Definition of “forest” (FAO 2015):

Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.

Explanatory notes

1. Forest is determined by the presence of trees and absence of other predominant land uses.
2. Includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of at least 10 percent and tree height of 5 meters or more.
3. Includes areas that are temporarily unstocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within 5 years.
4. Includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific environmental, scientific, historical, cultural or spiritual interest.
5. Includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectares and width of more than 20 meters.
6. Includes abandoned shifting cultivation land with a regeneration of trees that have, or are expected to reach, a canopy cover of at least 10 percent and tree height of at least 5 meters.
7. Includes areas with mangroves in tidal zones, regardless whether this area is classified as land area or not.
8. Includes rubber wood, cork oak and Christmas tree plantations.
9. Includes areas with bamboo and palms provided that land use, height and canopy cover criteria are met.
10. Excludes tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations, olive orchards and agroforestry systems when crops are grown under tree cover.



Source: Harris, et al

All of the above scenarios fall under the FAO definition of “forest”

2.2 FORESTRY LEGISLATION

The **National Forestry Act (NFA) 1984** (and its subsequent amendments) provides the basic legal framework for the management, development and conservation of forests in Peninsular Malaysia.

All States in Peninsular Malaysia have passed **State Forestry Enactments** that are adopted versions of the NFA 1984. State Forestry Departments are responsible to advise the State Authority as well as undertake all matters pertaining to the administration, planning, management, and development of forests, in accordance with the respective State Forest Enactments.

Section 7 of the NFA 1984 (and subsequent State Forest Enactments) enables State Authorities to constitute any land as a **Permanent Reserved Forest (PRF)** via gazette notification. Other matters covered in the NFA 1984 include the issuance of permits and licences, collection of royalty or premiums, as well as law enforcement against illegal or prohibited activities.

The NFA 1984 defines the powers of the State Forestry Directors and Forest Officers to enforce various sections of the enactment. State Forestry Directors are also required to formulate a Forest Management Plan (FMP)(which usually has a 10-year timeframe) based on rational land use and multiple functions of the forests. Although not a legal requirement, so-called EIAs are also produced for each FMP.

More specific operational details are described in the respective **State Forest Rules**. This includes for example, standard formats for forest management or harvesting plans, procedures for investigating illegal activity or removing forest produce, rates for calculating royalty, premiums and fees of major and minor forest products, as well as standard forms for registration of contractors, issuance of compounds, etc.

Other laws that are relevant to sustainable forest management include:

- Waters Act 1920 (Act 418) & Water Supply (Federal Territory of Kuala Lumpur) Act 1998 (Act 581)
- Aboriginal Peoples Act 1954, including relevant decisions of the Civil Courts
- Land Conservation Act 1960
- National Land Code 1965
- Environmental Quality Act 1974 and subsidiary legislation
- Pesticides Act 1974
- Town and Country Planning Act 1976
- Local Government Act 1976
- National Parks Act 1980
- Fisheries Act 1985
- Mineral Development Act 1994

- Occupational Safety and Health Act 1994
- International Trade In Endangered Species Act 2008
- Wildlife Conservation Act 2010
- Wood-based Industries Act 1984

Zoning for Forestry projects and activity shall be referred to the gazetted State Structure Plans and Local Plans, where it has been specified land use zoning. These plans are available at respective State Government websites and offices as well as at the Local Authorities website and offices (online accessed from IPLAN web portal (<https://iplan.planmalaysia.gov.my/>)).

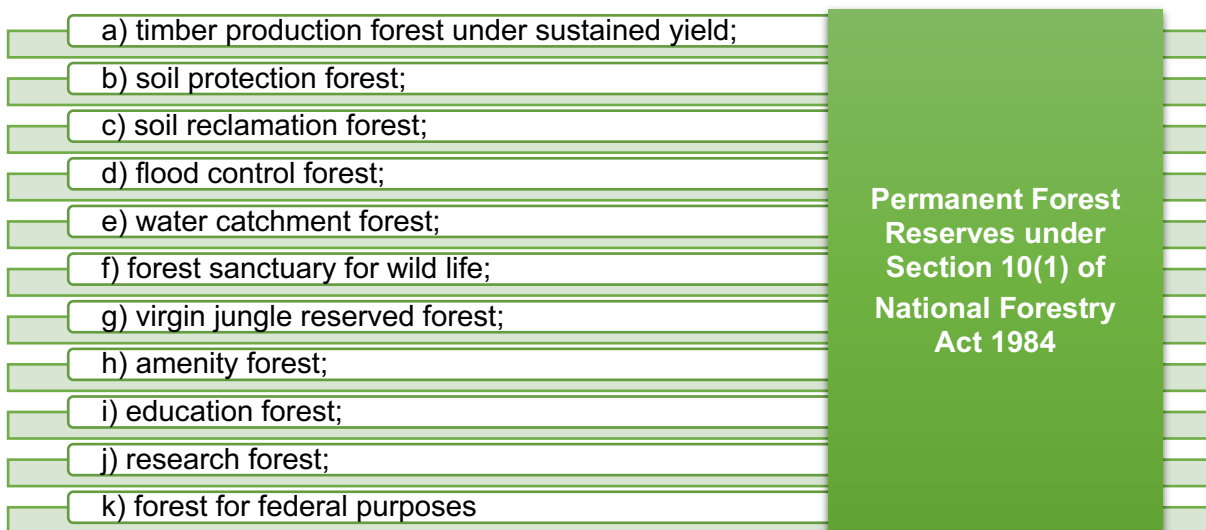
In line with the Forest Governance, gazetted forested areas are under State jurisdiction and hence direct engagement with is required.

FOREST GOVERNANCE

Under Article 74(2) of the Federal Constitution, forest is under the jurisdiction of the state government. Therefore, each state has the power and freedom to enact laws and manage forestry policies in their respective states. The executive authority of the federal government is limited to providing advice, technical assistance, training, research and development in the forestry sector to the state.

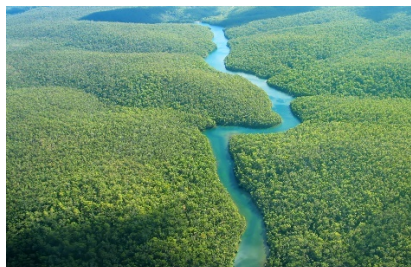
2.3 LAND STATUS

The bulk of the forests in the country are located within **Permanent Reserved Forests (PRF)**, which together constitute the PFE. The PRFs are planned and managed by the State Forestry Departments to serve multiple-uses, including sustained timber yield. To enable this multiple-use, PRFs (or parts thereof) are zoned, via gazette notification, under one or more functional classes as per Section 10(1) of the NFA:



It is important to note that logging is only allowed within the de-facto class [(a) Timber production under sustained yield] whereas all of the other classes are generally considered to be “protection forest” where logging is not allowed or allowed under strict conditions.

Beyond the PRFs, forests may also occur within other categories of land, including:



- ❖ State land;
- ❖ Land reserved for specific purposes under the National Land Code or other laws such as Aboriginal reserves, Wildlife Reserves, National Parks and State Parks;
- ❖ Alienated land;
- ❖ Mining land;
- ❖ Land held under a temporary occupation licence (TOL).

While all forest produce is the property of the State Authority (except in situations where the rights have been disposed of), the status of the land on which a forests occurs has a bearing on the legal and management procedures entailed for the removal of forest produce and land conversion.

For example, Chapter 2 of the NFA 1984 enables the State Authority to grant through invited tenders, negotiated agreements or other means, **licences to take forest produce** from PRF or State land. Among the requirements to be satisfied by applicants include preparation of forest management, harvesting and reforestation plans. On the other hand, a **removal license** (with less conditions attached) is required for the removal of forest produce from reserved land, alienated land, land held under TOL and mining land.

2.4 TIMBER PRODUCTION

The role of production forests in the PRFs of Peninsular Malaysia is provide a continuous supply of timber for the country’s wood industry. This is done either by selective harvesting from natural forests or conversion of natural forests to forest plantations.

Since the 1980s, selective harvesting in most of the production forests (especially the hill forests) has been done using a forest management regime called the **Selective Management System (SMS)**. The SMS is designed to achieve an economic harvest, leaving the forest structure intact for the next cutting cycle.

Key Elements of Selective Management System (SMS)

selection of optimum felling regimes based on a pre-felling forest Inventory

retention of at least 32 commercial trees per hectare for diameter class 30-45 cm

a cutting cycle of approximately 25-35 years

silviculture and replanting with selected dipterocarp species for the next cut

Reduced Impact Logging (RIL) involves the strict implementation of various Best Management Practices (BMP) for pre-harvest planning, vine cutting, directional felling, long removal, and post-harvest site closure, etc. to ensure the least possible damage on the forest stand. RIL is not always imposed on all logging concessions, but only in cases where it is deemed to be economically feasible or critical to implement.

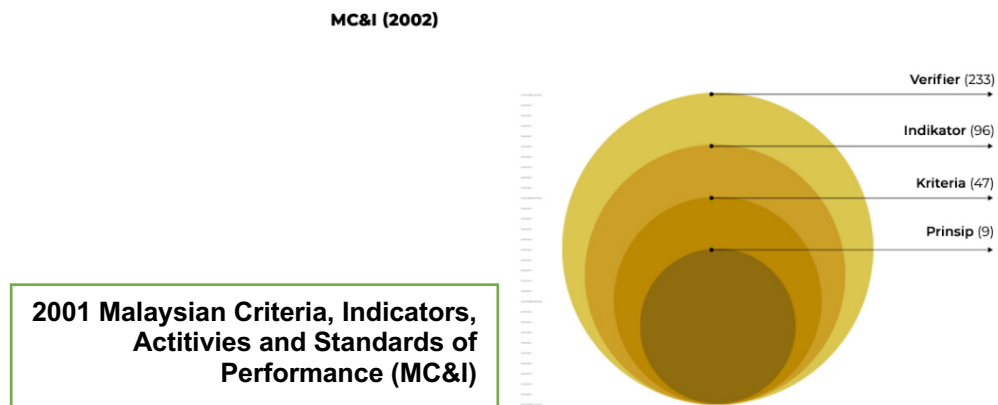
A portion of the PRF and Stateland forests are converted to **forest plantations** to ensure a continuous timber supply and reduce pressure on natural forest. The plantations typically utilise fast-growing species that can be harvested within 10-15 years after planting. A number species are utilised, such as rubber (Timber Latex Clone), Sentang (*Azadirachta excelsa*), *Acacia* spp. (mangium/hybrid) and bamboo (various commercial species).

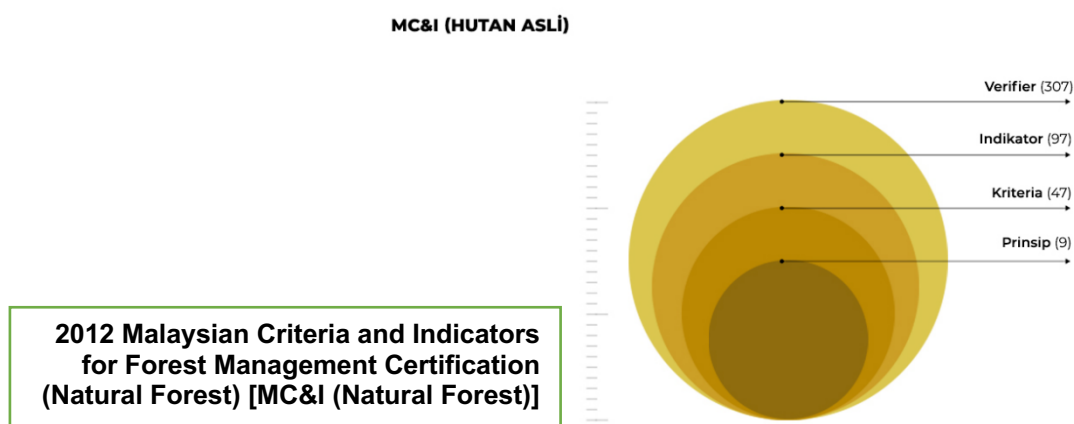
While considered to be a type of forest under the FAO definition, from a biological perspective, forest plantations have a much lower value in terms of biodiversity and ecosystem services compared to natural forest formations that they replace. On the other hand, the conversion of forest to non-forest landuse (agriculture, industrial, residential, etc.) which usually occurs on State land, is considered to be deforestation.

2.5 SUSTAINABLE FOREST CERTIFICATION

The main forest certification scheme in use in Peninsular Malaysia is the Malaysian Timber Certification Scheme (MTCS), a voluntary national certification scheme that provides for third-party assessments of forest management practices and supply chain to ensure that timber products are sourced from sustainably managed forests. Conducted by independent Certification Bodies (CBs), the assessments are based on the Malaysian Criteria and Indicators for Forest Management Certification (MC&I).

Certification is typically done for a clearly-defined area called a Forest Management Unit (FMU). While not defined in the **National Forestry Act 1984 (NFA)**, for the purpose of the MTCS in Peninsular Malaysia, the PFE (all of the PRFs) of each State is considered to be a State FMU, with the respective State Forestry Directors serving as FMU managers.

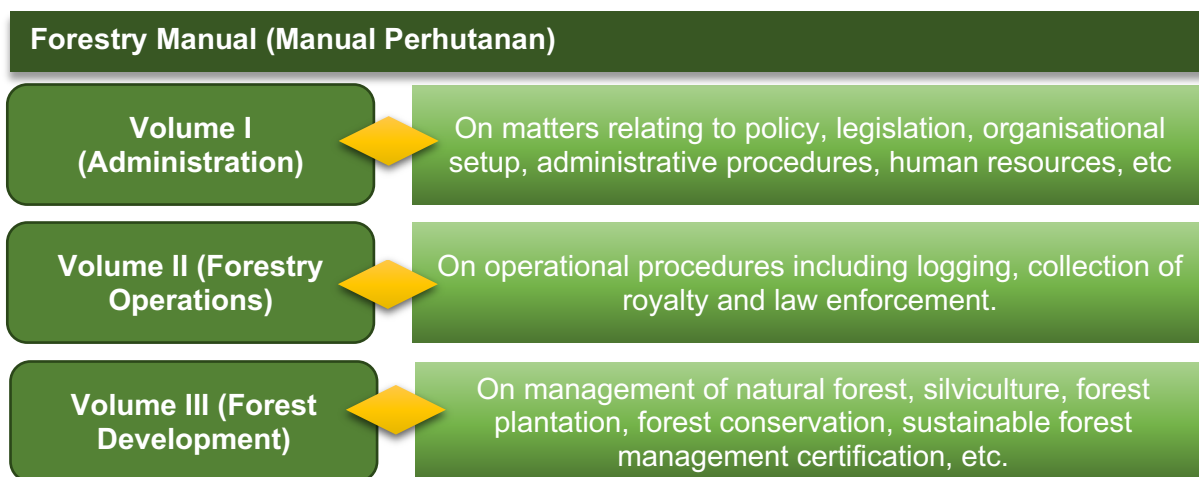




Source: <https://www.forestry.gov.my/en/pensijilan-pengurusan-hutan-di-semenanjung-malaysia>

2.6 GUIDANCE DOCUMENTS FOR FORESTRY

There are many guidelines in place for forestry, especially pertaining to procedures and specifications for SMS and RIL. For a comprehensive account of these guidelines, refer to the **Forestry Manual (Manual Perhutanan)** published by the Forestry Department of Peninsular Malaysia (FDPM) in three volumes:



EIA studies should refer to other relevant guidelines issued by the Forest Department Peninsular Malaysia (FDPM) pertaining to sustainable forest management as well as those issued by DOE and other Government Agencies pertaining to environment-related system and management. The most relevant guidelines and guidance documents are listed in **Table 2-1**, of which needs to be checked and ensured that the latest guidelines and guidance documents are used at the time of EIA Study.

Table 2-1 Relevant Guidelines Related To Forestry Activities

Document	Notes
Forest Road Guidelines / <i>Garis Panduan Jalan Hutan</i>	Published by FDPM in 2010 and amended in 2013
Guidelines for Reduced Impact Logging in Peninsular Malaysia	Published by FDPM (2003)
(Guidelines for Forest Roads, 2010) (Revised 2013)	Published by FDPM (2003) Revised 2013
Field Manual of Selective Management System / <i>Manual Kerja Luar Sistem Pengurusan Memilih</i>	Published by FDPM (1997)
Guidelines for Forest Harvesting	Published by FDPM (1984)
<i>Panduan Had Tebangan dan Maklumat-Maklumat Inventori Sebelum Tebangan</i>	Published by FDPM (1984)
Guidelines for Logging in Hill Forest of Peninsular Malaysia	Published by FDPM (1988)
<i>Panduan Amalan Baik Hutan (Good Forest Practices) Untuk Pengusahaan Kayu Kayan Tanah Kerajaan</i>	Published by FDPM (Pekeliling KPPSM Bil 1 Tahun 2016)
Malaysian Criteria and Indicators (MC&I) for Forest Management Certification	Published and updated from time to time by MTCC
Panduan Kerja Luar Inventori Selepas Tebangan	FDPM (1986)
Panduan Had Tebangan dan Maklumat-Maklumat Inventori Sebelum Tebangan	FDPM (1984)
Guidelines On Occupational Safety And Health In Logging Operations	DOSH (2004)

Note: The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance. Also ensure that the latest guidelines and guidance documents are referred to during the EIA Study period.

2.7 FORESTS, BIODIVERSITY AND THE ENVIRONMENT

As espoused in the National Forestry Policy, Malaysia's forests are managed ensure that they continue to provide multiple goods and services (known as "ecosystem services") for the benefit of society, apart from sustainable timber production. For instance, hill forests are important to ensure a continued supply of clean water and to prevent erosion, wetland forests help alleviate flooding, coastal mangrove belts shelter coastal settlements from storm surge.

Forests harbour the bulk of the country's terrestrial and aquatic biodiversity, thus contribute to Malaysia's status as Megadiverse country. As such, the conservation and sustainable use of forests is critical towards meeting the global environmental treaties that Malaysia has ratified, as well as a number of relevant national policies and plans.

Relevant Global Treaties That Malaysia Has Ratified

- **Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar) 1971.**
- **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 1973.**
- **Convention on Biological Diversity (CBD) 1992.**
- **United Nations Framework Convention on Climate Change (UNFCCC) 1992.**
- **International Tropical Timber Agreement 1994.**
- **Cartagena Protocol on Biosafety to the Convention on Biological Diversity 2000.**
- **ASEAN Agreement on Transboundary Haze Pollution 2002.**
- **United Nations Declaration on Rights of Indigenous Peoples (UNDRIP) 2007.**

- **National Policy on the Environment (2002)**
- **National Wetlands Policy (2004)**
- **National Policy on Climate Change (2009)**
- **National Timber Industry Policy 2009-2020**
- **National Water Resources Policy (2012)**
- **National Policy on Biological Diversity 2016-2025 (2016)**

Relevant National Policies

Relevant Plans

- **National Tiger Conservation Action Plan 2008-2020 (2008)**
- **A Common Vision on Biodiversity: In government and the development process – Reference document for planners, decision-makers & practitioners (2008)**
- **National Strategy for Plant Conservation (2009)**
- **Central Forest Spine: Master Plan for ecological linkages (2009)**
- **National Action Plan on Peatlands (2011)**
- **National Elephant Conservation Action Plan (2013)**
- **National Physical Plan 3 (2016)**



3

Photo Source: Large dipterocarpaceae tree - borneo (WWF)

SCREENING AND SCOPING

CHAPTER 3. SCREENING AND SCOPING

3.1 INTRODUCTION

The two main activities that should be undertaken during the Pre-submission stage before the EIA study proper is carried out, namely **Screening** and **Scoping** are described in the chapter.

In order to facilitate the screening and scoping, the Project Proponent should provide the Qualified Person a **Project Brief** that contains basic details of the proposed project, such as concept, objectives, main activities, location, layout plan, etc. In forestry terms, this document should include the Forest Management Plan or Forest Harvesting Plan that the Project Proponent is required to prepare as a condition of license.

3.2 SCREENING PROCEDURES

The Qualified Person shall carry out a screening exercise to determine whether the proposed project qualifies as a prescribed activity under the EIA Order 2015; and if so, whether it falls under the First or Second Schedule.

Environmental Screening is carried out to determine whether a proposed project is a prescribed activity under the ***Environmental Quality (Prescribed Activity) (Environmental Impact Assessment) Order 2015***.

Screening is important as there are a large number of projects and activities that are potentially subjected to an EIA. It is also important that any project shall be screened to have complied with all Federal and/or state policy matters before proceeding with an EIA.

If the proposed project has components falling within both First and Second Schedule prescribed activities, the Second Schedule EIA shall prevail and shall encompass all EIA requirements required of those activities. In which case, all other relevant EIA Guidelines must be referred to.

3.3 PRESCRIBED ACTIVITIES FOR FORESTRY

There are five prescribed activities for forestry projects listed under **Activity 5 (Forestry)** in the First Schedule, and seven prescribed activities in the Second Schedule of the EIA Order 2015 (**Table 3-1**). In general, these pertain either to selective harvesting, or clear-felling of forest for conversion to forest plantation or other land use.

Table 3-1 Schedule of Prescribed Activity 5: Forestry

First Schedule	Second Schedule	Applicability
5. FORESTRY	5. FORESTRY	
(a) Conversion of forest at 300 meters or more above mean sea level to other land use covering an area of 20 hectares or more but less than 100 hectares .	(a) Conversion of forest at 300 meters or more above mean sea level to other land use covering an area of 100 hectares or more.	<p>Forest at 300 meters or more above mean sea level – The 300m elevation generally marks the transition between lowland and hill dipterocarp forest. While greater importance is given to hill forests in the EIA Order 2015 presumably due to the higher proportion of steep slopes, it should be noted that compared to hill forest, the lowland forest harbours a higher biological diversity, is a more suitable habitat for large mammals, and a more threatened forest type, since much of the lowland forest has been lost to development. (Figure 3-1, Figure 3-2)</p> <p>Definition: Conversion of forest focus on proposed activity, e.g. development of transmission line, agriculture, housing, etc., For logging activities prior land conversion, should be referred to Forestry Department.</p> <p>“Forest” – as defined under <u>Section 10(1)</u> of the National Forestry Act 1984 and State Enactments</p> <ul style="list-style-type: none"> (a) timber production forest under sustained yield; (b) soil protection forest; (c) soil reclamation forest; (d) flood control forest; (e) water catchment forest; (f) forest sanctuary for wild life; (g) virgin jungle reserved forest; (h) amenity forest;

First Schedule	Second Schedule	Applicability
5. FORESTRY	5. FORESTRY	
		<p>(i) education forest; (j) research forest; (k) forest for federal purposes (l) State Forest</p> <p><u>Department of Forestry – definition and category: of “Forest”:</u> (www.forestry.gov.my)</p> <p>Forests refer to areas overgrown with wild and mixed trees that are the natural habitat of flora and fauna. The forest is also a portion of land larger than half a hectare (5,000 square meters) and has trees with a height of more than five (5) meters and has a tree canopy cover of more than 10 percent or with trees that can meet these criteria.</p> <p>Forests are categorized into three (3) types, namely Permanent Forest Reserves under the administration of the Forestry Department, Government Land Forests under the administration of Local Authorities and Owned Land Forests under the administration of individuals / individuals.</p> <p>(Figure 3-1, Figure 3-2)</p>
<p>(b) Logging, or cutting or taking of timber for the purpose of conversion from forest to other land use covering an area of 100 hectares or more but less than 500 hectares.</p>	<p>(b) Logging or conversion of forest to other land use within:</p> <p>(i) a catchment area of reservoirs used for municipal water supply, irrigation or hydro power;</p>	<p>Second Schedule EIA required for logging or conversion of forest activity with land area more than 1 hectare.</p> <p>Definition:</p> <p>Logging – The act or process of felling and extracting timber from forest, especially in the form of logs</p> <p>Within – inside of Environmentally Sensitive Areas of Ranks 1, 2 and 3.</p>

First Schedule	Second Schedule	Applicability
5. FORESTRY	5. FORESTRY	
	<p>(ii) an area adjacent or near to any state park, national park or national marine park;</p> <p>(iii) any state park, national park or national marine park; or</p> <p>(iv) an area gazetted as water catchment forest under the National Forestry Act 1984.</p>	<p>Near : refers to land area directly at the boundaries of the forested area and/or sharing a boundary with Environmentally Sensitive Areas of Rank 1, 2 and 3.</p> <p>Adjacent : within 500m from the forested area and/or Environmentally Sensitive Areas of Rank 1, 2 and 3</p> <p><u>Environmentally Sensitive Areas</u> <i>Forested areas, catchment areas, state park, national park or national marine park and water catchment forest are usually categorised as Environmentally Sensitive Areas (ESAs). The National Physical Plan-3 (2010) defines ESAs in reference to a particular area that is sensitive to any forms of alteration to its ecosystem due to natural processes or activities within or around it, either directly or indirectly. The level of ESA’s sensitivity is determined based on integration of three features namely elements of disaster risk function, value of living support and value of the heritage and treasure of the area. Determination of the ESA shall be adopted from the definition set forth in the National Physical Plan which has categorised ESA into three (3) Ranks, i.e. ESA Rank 1, ESA Rank 2 and ESA Rank 3. Category of ESA and its location needs to be referred to the NPP-3 or the prevailing NPP.</i></p> <p>“catchment area” – The area determined by landform within which falling rain will contribute to runoff at a particular point such as a stream or river. Often, it is used synonymously with basin or watershed.</p> <p>Water catchment forest* – Section 10(1) of the National Forestry Act 1984 provides for a PRF to be gazetted under one or more functional classes. A</p>

First Schedule	Second Schedule	Applicability
5. FORESTRY	5. FORESTRY	<p>number of these classes, including (e) water catchment forest, are referred to as “protection forests”, where no logging is allowed.</p> <p>National Park* – National parks are established under Section 3 of the National Parks Act 1980 (Act 226) and/or under State Enactments. Under the said Act, the State Authority may, on the request of the Minister, reserve any state land within the state (including any marine area) for the purpose of a National Park, under a name to be assigned to it. This is a protected area that conforms to IUCN (International Union for Conservation of Nature) Category II (National Park). Refer to the Department of Wildlife and National Park for the latest list of National Park (DWNP).</p> <p>State Park* – Also refers to a protected area that conforms to IUCN Category II (National Park). A number of States (Kelantan, Penang, Perlis and Selangor) have amended their respective State Forestry Enactments to enable a PRF to be classified as a “State Park”. Johor, Perak have Terengganu have developed separate legislation for the establishment and management of State Parks.</p> <p>National Marine Park* – Refers to marine protected areas gazetted under the Fisheries Act 1985 (amended 1987) and managed by the Department of Marine Park Malaysia (DMPM). Marine Park boundaries generally begin two nautical miles from the lowest tide mark (except for Kapas island in Terengganu and Rusukan Besar and Rusukan Kecil islands in Labuan, which begin at 1 nautical mile from the lowest tide mark).</p> <p><i>* All of the above are among the various forms of protected areas that exist in Malaysia. IUCN defines protected areas as “an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity,</i></p>

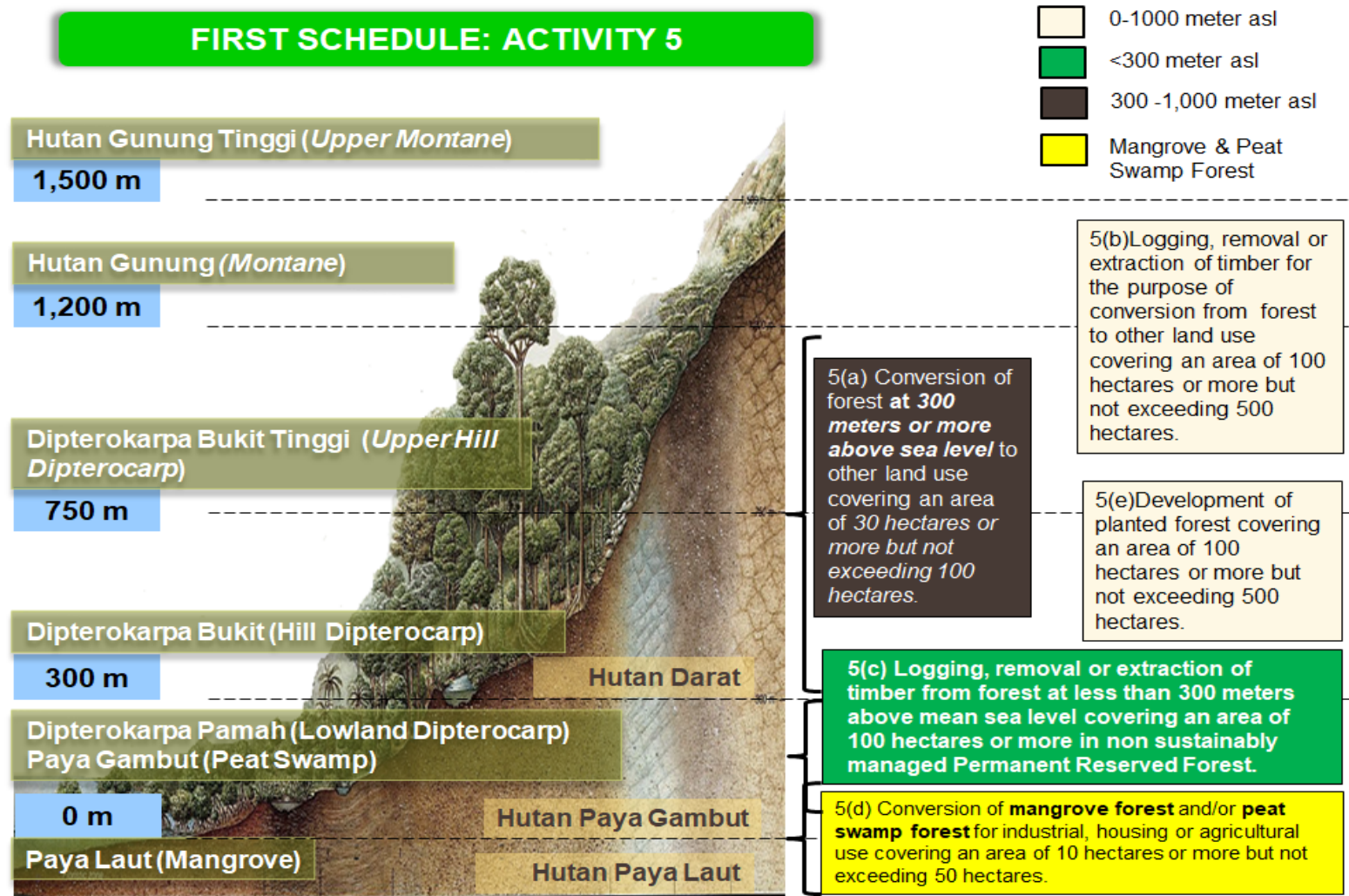
First Schedule	Second Schedule	Applicability
5. FORESTRY	5. FORESTRY	
		<i>and of natural and associated cultural resources, and managed through legal or other effective means.” Refer to the Master List of Protected Areas in Malaysia for the full list of accepted protected areas in Malaysia.</i>
(c) Logging, or cutting or taking of timber from forest at less than 300 meters above mean sea level covering an area of 100 ha or more, outside permanent reserved forest.	(c) Logging, or cutting or taking of timber from forest at 300 m or more above mean sea level covering an area of 100 ha or more, outside permanent reserved forest.	Forest at 300 meters or more above mean sea level – The 300m elevation generally marks the transition between lowland and hill dipterocarp forest. While greater importance is given to hill forests in the EIA Order 2015 presumably due to the higher proportion of steep slopes, it should be noted that compared to hill forest, the lowland forest harbours a higher biological diversity, is a more suitable habitat for large mammals, and a more threatened forest type, since much of the lowland forest has been lost to development. (Figure 3-1, Figure 3-2, Figure 3-4)
(d) Conversion of an area of — (i) mangrove forest; (ii) peat swamp forest; or (iii) fresh water swamp forest, for industrial, housing or agricultural use covering an area of 20 ha or more but less than 50 ha.	(d) Logging, or cutting or taking of timber covering an area of 500 ha or more.	See above definition and category for “Forest” <u>Department of Forestry: Methods of harvesting/ logging in the Permanent Forest Reserve in Peninsular Malaysia</u> Logging activities are only allowed in the Permanent Forest Reserve which is categorized as Production Forest with the permission and approval of the State Authority. The method used in the harvesting/ logging of the Permanent Forest Reserve is using the Selective Management System (SMS). The SMS method is generally selective tree felling, which involves the felling of large or suitable trees only and then undergoing silvicultural treatment to restore the area that has been cultivated (Figure 3-4).
(e) Development of planted forest covering an area of 100 hectares or more but less than 500 hectares.	(e) Development of planted forest covering an area of 500 ha or more.	Planted Forest – FAO defines “planted forest” as <i>Forest predominantly composed of trees established through planting and/or deliberate seeding</i> . Planted forest can be planted with one or more native or non-native species

First Schedule	Second Schedule	Applicability
5. FORESTRY	5. FORESTRY	
		such as rubber (Timber Latex Clone), Sentang (<i>Azadirachta excelsa</i>) and Kelempayan (<i>Neolamarckia cadamba</i>). For species approved for forest planting, Project Proponent must ensure that proposed species is approved by the State Forestry Department. (Figure3-3)
	(f) Conversion of an area of: (i) mangrove forest; (ii) peat swamp forest; or (iii) freshwater swamp forest, for industrial, housing or agricultural use covering an area of 50 ha or more.	See above definition and category for “Forest”
	(g) Clearing of mangrove forest, peat swamp forest or freshwater swamp forest on island adjacent to any national marine park.	A minimum threshold in terms of the size of 1 hectare See above definition and category for “Forest” “Marine Park” is a sea zoned area that spans for a distance of two nautical miles from the lowest sea level, except in Kapas Island in Terengganu, Kuraman Island, Rusukan Besar Island and Rusukan Kecil Island in Labuan. These areas are zoned for a distance of 1 nautical mile from the lowest sea level. Marine Parks have been established to protect and conserve various habitats and aquatic marine life. Today, the waters around Malaysia’s 49 islands are gazetted as Marine Parks. (Department of Fisheries Malaysia)



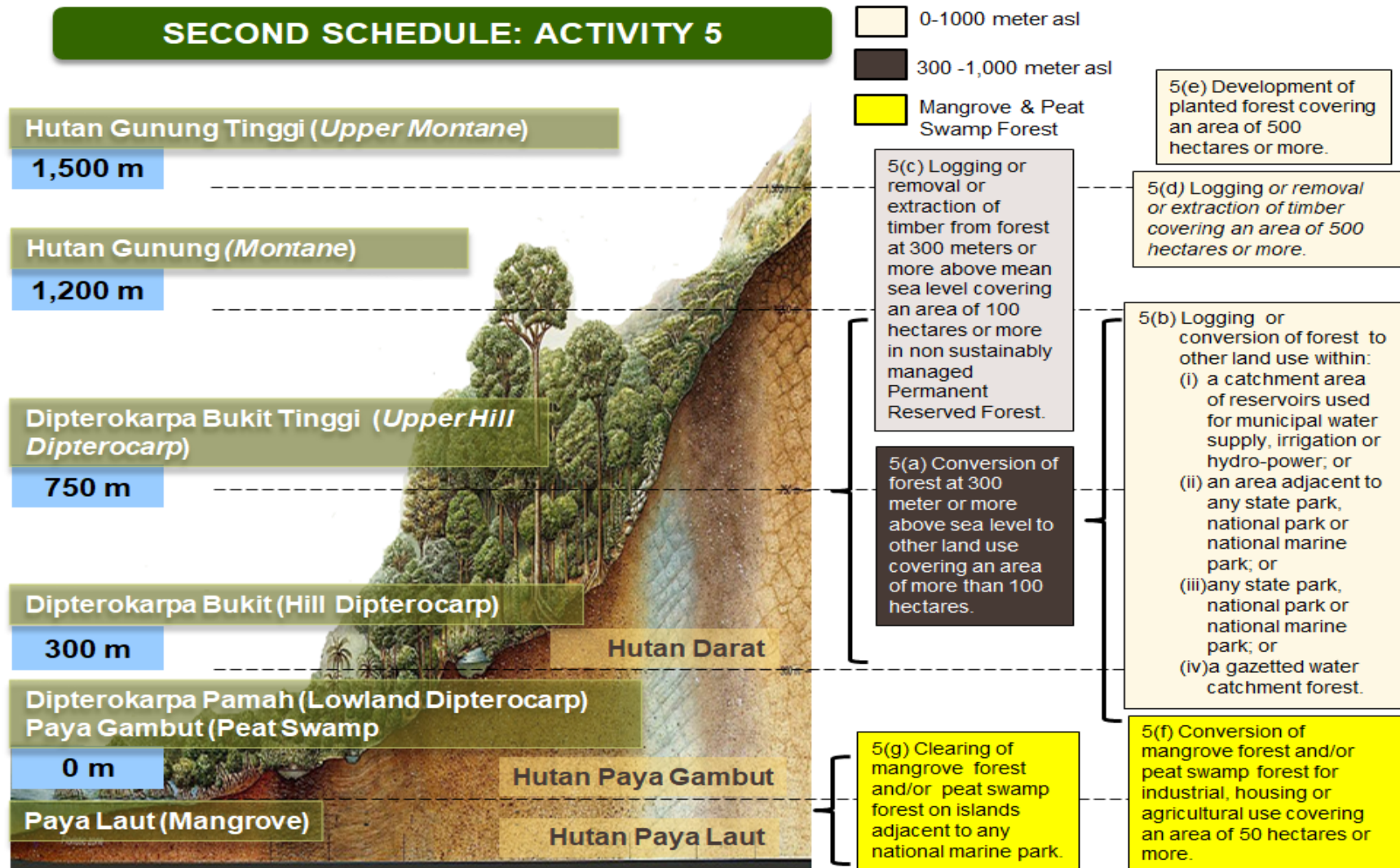
Project Proponent and Qualified Person undertaking the EIA Study should ensure that the latest governing requirements, definition and categories are referred to and used during the EIA study period.

Figure 3-1 First Schedule Prescribed Activity Based on Forest Classification



Source: Forest Classification from Department of Forestry (www.forestry.gov.my)

Figure 3-2 Second Schedule Prescribed Activity Based on Forest Classification



Source: Forest Classification from Department of Forestry (www.forestry.gov.my)

Figure 3-3 Planted Forest Species Approved by Forestry Department

	<p>Hevea brasiliensis (Getah) Timber Latex Clone (TLC)</p> <p>TLC is planted for the purpose of producing wood as the main product and latex as a by-product. Rubber species have a fast growth rate and high milk production. It can be used for the manufacture of furniture, chipboard and single-density boards</p>
	<p>Acacia mangium (Akasia)</p> <p>This species originates from Northern Australia, Papua-New Guinea and Eastern Indonesia (Maluku and Irian Jaya). It is commonly found in lowland areas that have an altitude of less than 100m above sea level. This species can grow to a height of 30m. Among its uses are for the manufacture of furniture and cabinets, door frames, timber, light construction and pulp and paper</p>
	<p>Tectona grandis (Jati)</p> <p>Teak is categorized as a fast growing species and can reach a maximum height of up to 85m. Teak is one of the most valuable woods in Southeast Asia. Its durable wood and attractive natural color make it suitable for high-quality furniture</p>
	<p>Azadirachta excelsa (Sentang)</p> <p>Sentang is a native plant from Malaysia, and the cultivation of sentang is suitable for the atmosphere or climate in Malaysia. Sentang wood is a medium or light hardwood that is also widely grown in Thailand, Malaysia, and Indonesia. This species can be used for light construction</p>
	<p>Khaya spp. (Khaya ivorensis/Khaya senegalensis)</p> <p>Khaya tree is hard wood and fast growing. This species can reach a height of 35m. The wood of the Khaya tree can be used for carpentry, joinery, furniture making, cabinet work, ship building and in the production of decorative veneers.</p>
	<p>Neolamarckia cadamba (Kelempayan/ Laran)</p> <p>This kelempaya is a fast-growing species and is suitable for reforestation. It is found in lowland areas 1000m above sea level. This species is a light wood and can be used for pulp and light construction.</p>
	<p>Paraserianthes falcataria (Batai)</p> <p>This species comes from Maluku, Irian Jaya and Papua-New Guinea. This tree is a fast growing species and can reach a height of up to 45m. This species can be used for plywood, matchsticks, boards, carving, pulp and paper</p>
	<p>Octomeles sumatrana (Binuang)</p> <p>This species can be found throughout Indonesia up to Malaysia (Sabah and Sarawak). It grows in lowland areas up to 1000 m and is suitable for planting in areas with alluvial soil, clay or sandy loam. It can be used for light construction and pulp since this species is a light wood species</p>

Source: Department of Forestry (www.forestry.gov.my)

Figure 3-4 Felling And Harvesting Techniques

Selective Logging / Reduced Impact Logging

selective tree felling, which involves the felling of large or suitable trees only and then undergoing silvicultural treatment to restore the area that has been cultivated

- single scattered trees
- trees above a specified girth
- selected group of trees



<https://teara.govt.nz/mi/photograph/17049/selective-logging>

Clear Cutting or Clear Felling









to cut down all of the trees or part of forest, or throughout an area of land, exposes soil and destroys understory.

- By block
- Patches
- Alternate / Clear Strips



<https://www.britannica.com/science/deforestation>

Basic Harvesting Techniques

	Ground-based		Cable-based	Airship-based	
Tree conversion					Source: Heilmann (2000)
	Skid trails	Skid roads	Cable roads	Flight paths	
Timber extraction					
Criteria	<35 % slope economical ecological		35-50% slope economical ecological		>50% slope economical ecological

Source: T. Pentek et al.(2008) Environmentally Sound Harvesting Technologies in Commercial Forests in the Area of Northern Velebit – Functional Terrain Classification. PERIODICUM BIOLOGORUM UDC 57:61.VOL. 110, No 2, 127–135, 2008



https://www.itto.int/sustainable_forest_management/logging



Engelbrecht, R.; McEwan, A.; Spinelli, R. A Robust Productivity Model for Grapple Yarding in Fast-Growing Tree Plantations. Forests 2017, 8, 396. <https://doi.org/10.3390/f8100396>

Helicopter Harvesting



Source: www.newwra4orangutan.blogspot.com

Underwater Harvesting



Source: <https://tritontimber.com/projects/malaysia-kenyir-lake>



If the proposed project has components falling within both First and Second Schedule prescribed activities, the Second Schedule EIA shall prevail and shall encompass all EIA requirements required of those activities. In which case, all other relevant EIA Guidelines must be referred to.

If the proposed forestry project does not fall under Activity 1, however, it may still require an EIA study under other prescribed activities in the EIA Order 2015. The Project Proponent is required to check with the latest policies and legislation requirements.

Project Proponents and Qualified Person preparing the EIA report must carry out screening to confirm the if the project intended falls under the “prescribed activity” list.

Potential outcome criteria of project screening are shown in **Box 2**.

Box 2:
Potential Outcomes from Project Screening

- i. No EIA is required: If the project does not fall within any prescribed activities under the First or Second Schedule, and/or has insignificant impacts on the environment.
- ii. EIA is required: If the project will have potentially significant environmental impacts and/or falls within the prescribed activity under the First or Second Schedule.
- iii. Further studies and clarification from DOE: If the potential impacts from the project are uncertain, indeterminate, ambiguous or may not fall neatly within any prescribed activities, i.e. involving new technologies, DOE shall be consulted upon on the need for an EIA.

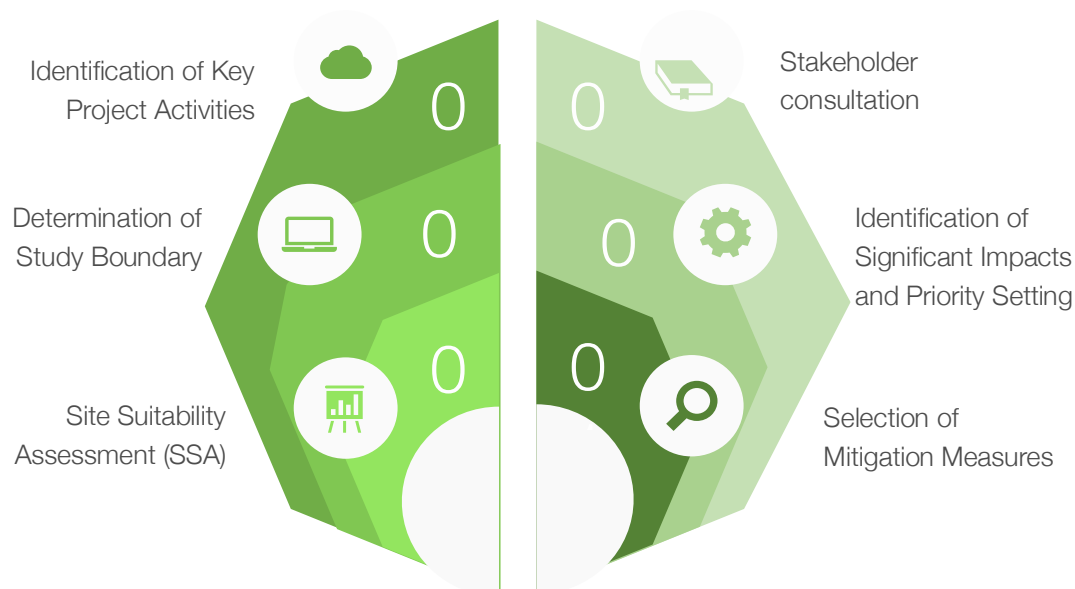
3.4 ENVIRONMENTAL SCOPING

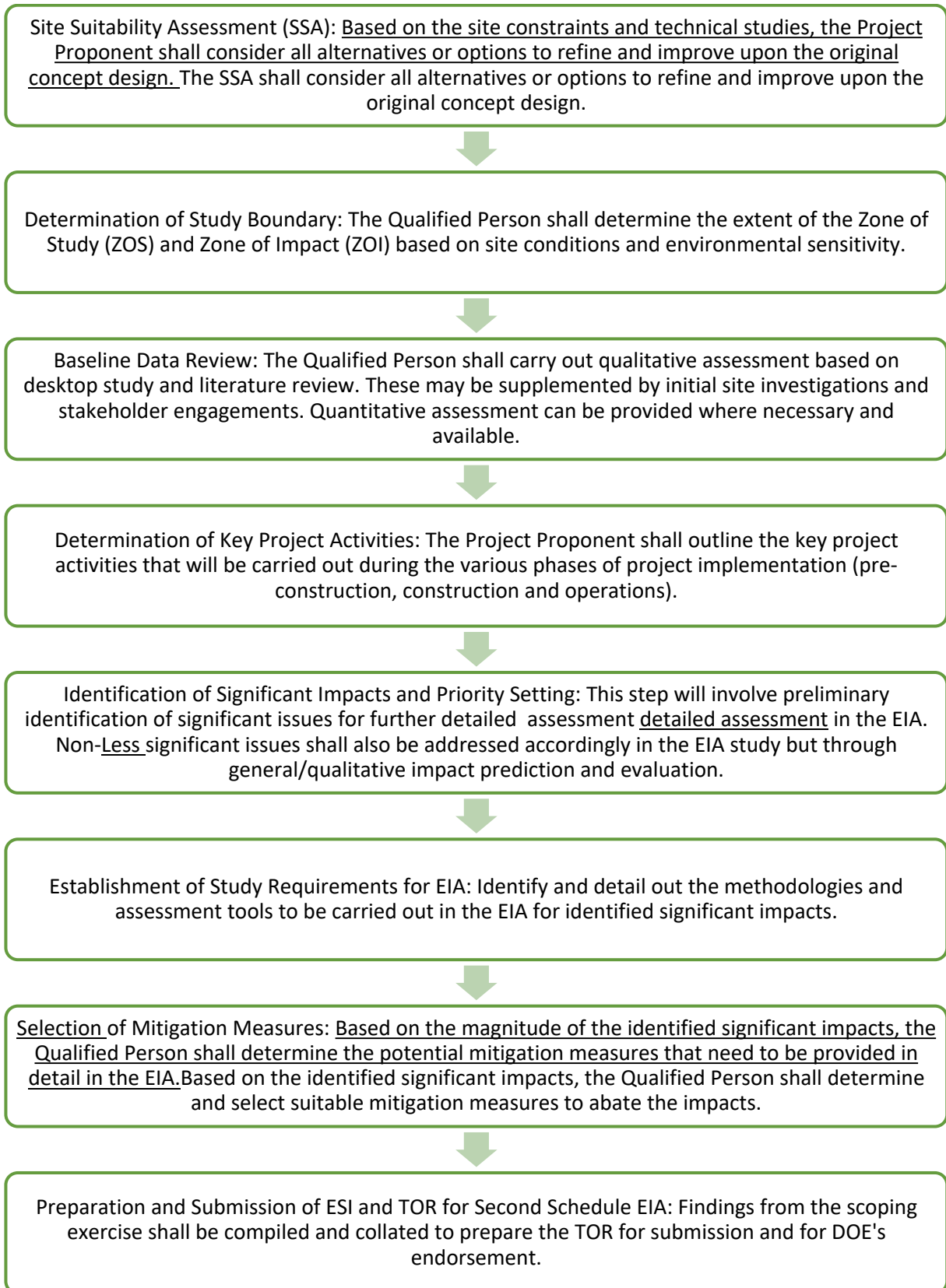
Scoping is essentially a rapid desktop assessment conducted to gain a preliminary understanding of the key attributes and environmental impacts of a proposed project. The scoping process is important because it determines the focus and depth of the EIA study, which in turn influences the study's time, personnel and cost requirements. Thus, it should be carried out at an early stage of the project cycle to enable the EIA to focus on the significant issues, impacts, and sensitive receptors.

The main objective of environmental scoping is to identify environmental attributes and issues to determine the focus, depth, and spatial and temporal boundaries of the EIA that are deemed significant and require evaluation in detail as part of the EIA process. Scoping shall encompass all environmental aspects (physico-chemical, biological and socio-economic) to enable an overall evaluation of the significant impacts. At the start of the scoping exercise, no attempt should be made to exclude or prejudge any issues of concern.

The collection of secondary data, as well as the preliminary discussion with the various stakeholders, may be conducted during the scoping. Although the scoping exercise is largely dependent on secondary data, a field visit is advisable to gain a better understanding of the proposed project site.

The main components of the scoping exercise are as follows and comprise of following steps:





3.4.1 Site Suitability Analysis

The Qualified Person shall assess whether the site is suitable for the proposed project, or if there are any constraints in relation to the relevant national and State policies and plans as well as directives and guidelines. Some of the key information for SSA are listed in **Table 3-2**.

While the background information on the proposed project should be provided by the Project Proponent, other relevant information may be obtained from various other sources such as FDP and other GAs, Non-government Organisations (NGO).

The scoping exercise will value add to this SSA through recommendations of pragmatic mitigation measures such as P2M2s and best management practices (BMPs), where potential environmental degradation is anticipated when developing forestry projects.

As the impacts of forest conversion are much more significant and permanent as compared to selective harvesting, greater emphasis should be given to SSA for this category of prescribed activity. In this, the design principles of managing biodiversity in the landscape level should be adhered to. This includes concepts such as ecological connectivity and edge effects, and the impacts of location and layout of projects on this - refer to the guideline **Managing Biodiversity in the Landscape** (NRE, 2010) for more information.

Table 3-2 Key Information For Site Suitability Analysis

Type	Key Information
Legal status of proposed project and project site	<ul style="list-style-type: none"> • Legal status and land ownership • Forestry licences and permits • Records of alienation and use rights • Concessionaire and/or lease agreements
Information on the forest setting, resource and forestry plan	<ul style="list-style-type: none"> • State Forest Management Plan • Plans and audits related to MTCS certification of the FMU • Project information – Site boundaries, harvesting plan, road development plan, etc. • History of logging activities – production figures, volume harvested, techniques used
Sensitive receptors	<ul style="list-style-type: none"> • Human settlements • Demographic • Health status • Water intake points and other beneficial uses of the rivers • Sites of cultural or religious significance to local indigenous communities • Forest resources utilised by local indigenous communities • Tourism attractions and recreational areas • Historical, heritage sites

Type	Key Information
Current and future land use	<ul style="list-style-type: none"> • Current land cover from satellite images • Current land use pattern based on the Local Plan, State Structure Plan • Future land use pattern based on from the Local Plan • Aerial or satellite images (latest) • Accessibility, road network • Transportation options • Utilities availability (water, electricity, telecommunications, sewage, waste management)
Topographical, terrain, hydrology	<ul style="list-style-type: none"> • Topographic maps, terrain, slopes information • Local and regional geology • Soil classification • Rivers and river basins, based on topographic maps • Water catchment areas • River water abstraction points • Flood prone areas • Downstream receptors (river dependent users) • Location of aquifer and groundwater abstractions
Climate & Air Quality	<ul style="list-style-type: none"> • Climate and meteorology (min 5 years) • Air quality data (nearest DOE station, published data) • Air pollution sources
Information on landscape-level biodiversity management	<ul style="list-style-type: none"> • Protected areas based on the Master List of Protection Areas (KATS, 2019) • Environmental Sensitive Areas (ESA) identified in the National Physical Plan, State Structure Plan, Local Plan or Special Area Plan. • Coastal Environmental Sensitive Areas (CESA) identified in the National Physical Plan for the Coastal Zone (NPPCZ/RFZPPN) • High Conservation Value Forests (HCVF) identified in the Forest Management Plan • HCVF assessment reports for the site or adjacent areas • Wildlife corridors, including those identified in the Central Forest Spine: Masterplan for Ecological Linkages. • Wetlands designated to be of international importance under the Ramsar Convention (Ramsar Sites) • Important Bird and Biodiversity Areas (IBAs) (BirdLife International)

Note: The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

3.4.2 Defining Study Boundary

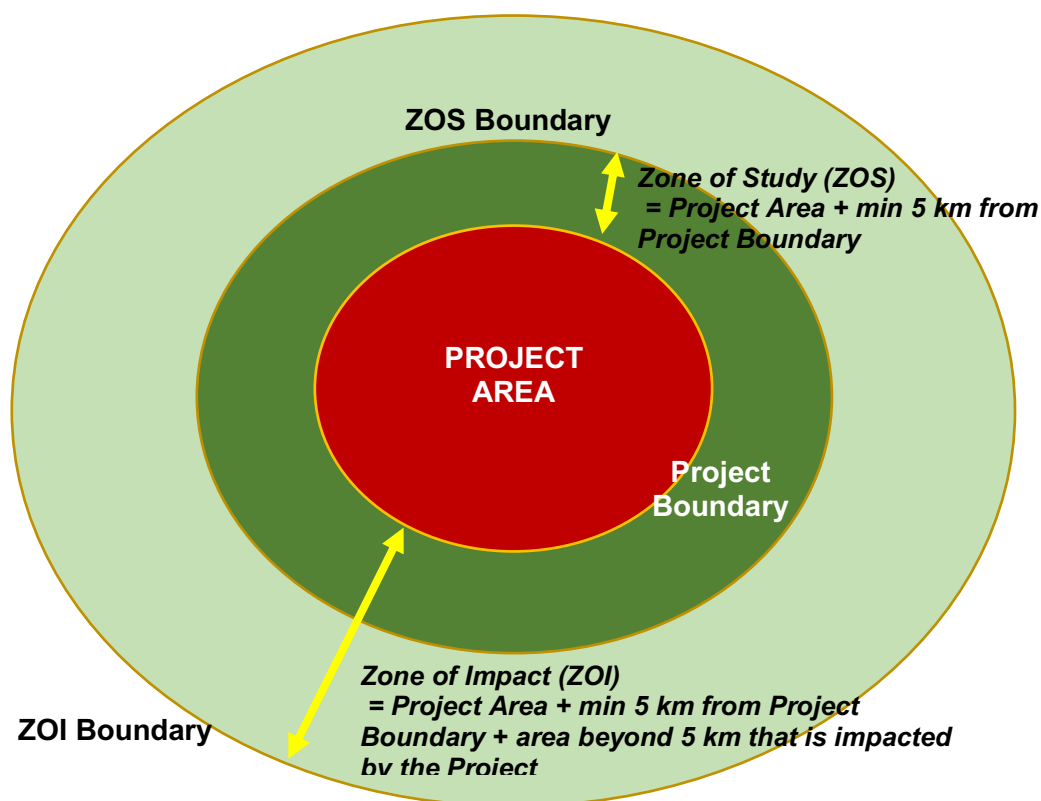
The Qualified Person shall determine the spatial extent of the EIA study area through a mapping exercise, using the findings from the SSA.

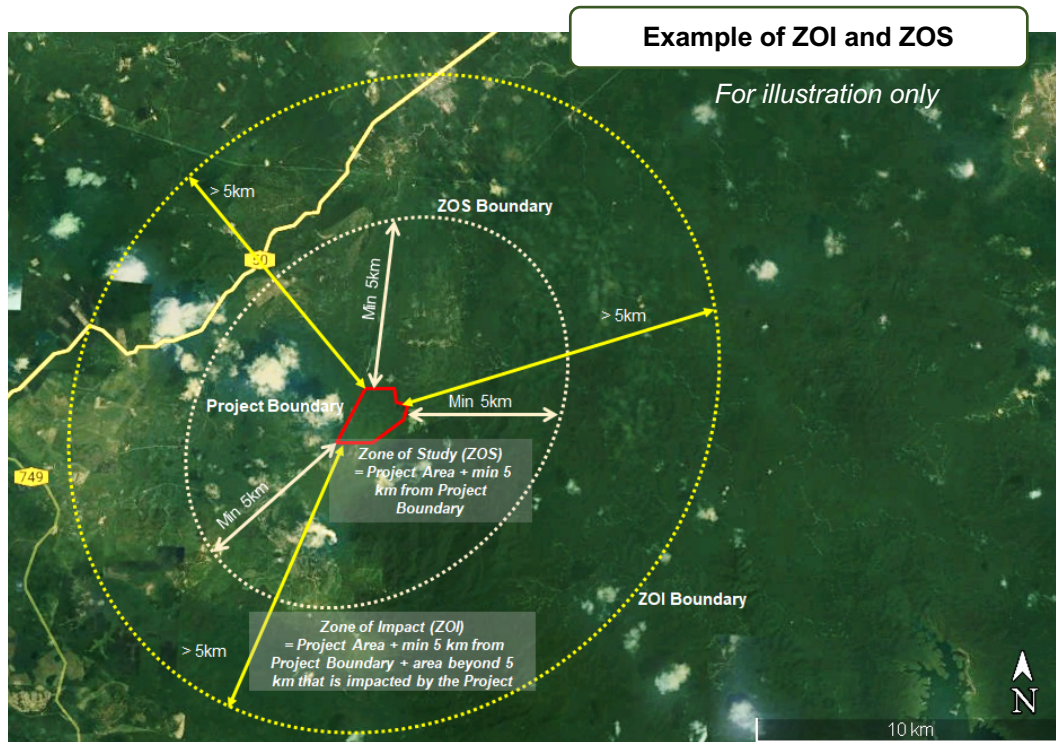
The EIA study area encompasses two categories (**Figure 3-3**):

- i) The **Zone of Study (ZOS)** is inclusive of the Project area and extends up to a 5-km radius from the Project boundary.
- ii) **The Zone of Impact (ZOI)** which is the additional area beyond the 5-km radius that, in the opinion of the Qualified Person, should be included in the EIA study. **The impact boundary**, which defines the spatial area of potential impacts to extend beyond the ZOS (refer to **Figures 3-5**). The ZOI may decrease or extend further afield, depending on the attributes of the river basin, terrain, alignment of hills and mountain ranges amidst deep valleys, among other factors.

Note that ZOI is usually determined when and after an impact assessment has been carried out and the extends of impacts is established. As such, baseline data collected should be reviewed at this point to ensure covers the affected receptors within the ZOI and baseline database must be updated. Proposal for controls and mitigations from the Project must include for the ZOI areas.

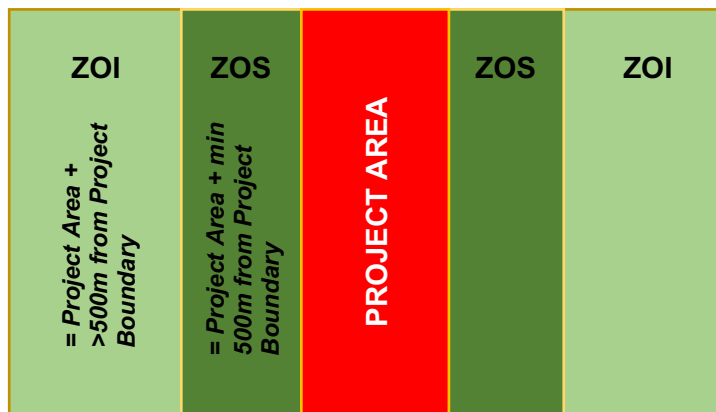
Figure 3-5 Project Study Boundaries – Zone of Study and Zone of Impact





For project component area that is in linear form, the ZOS and ZOI is as below (Figure 3-6).

Figure 3-6 Linear Project Study Boundaries – ZOS And ZOI

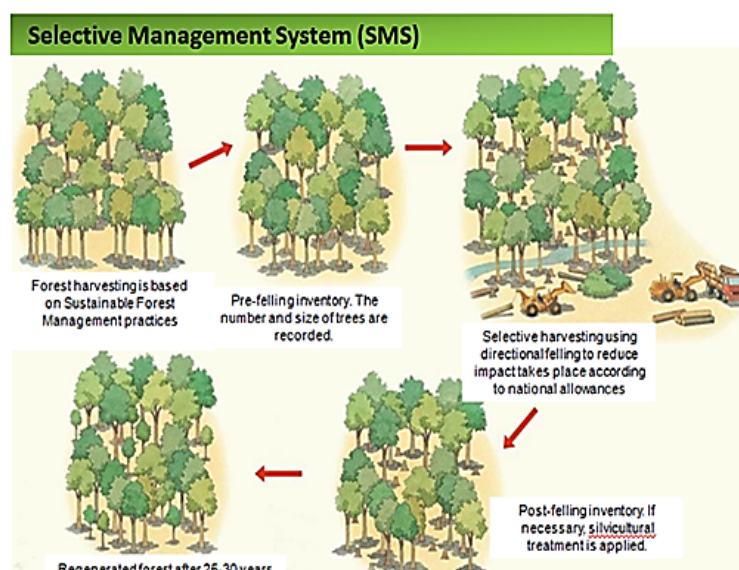


3.4.3 Identification of Key Project Activities

Project activities are a key basis for predicting and addressing the potential impacts of a project. As such, the Project Brief provided by the Project Proponent must include a description of all of the activities that will be carried out during the various stages of the proposed project. In general, the EIA Order 2015 divides forestry projects into two main categories, i.e. (1) selective harvesting; and (2) conversion of forest or development of planted forest. The former typically comprises four main stages while the latter has three:

Selective harvesting

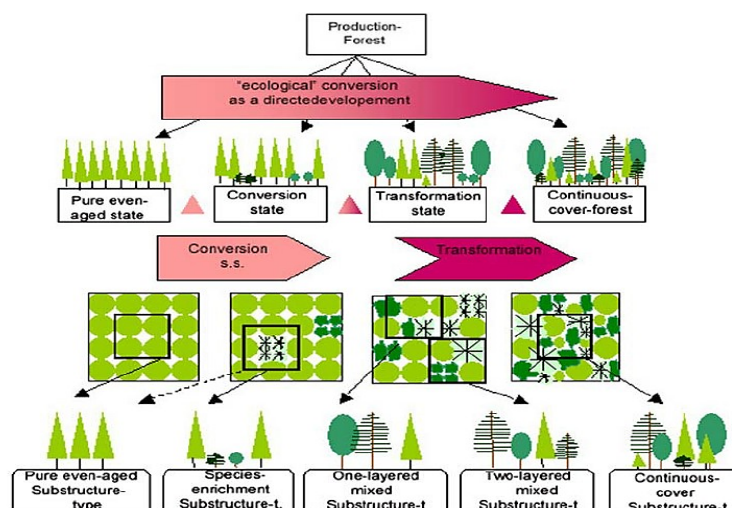
- 🌲 Site investigation,
- 🌲 Construction,
- 🌲 Felling and
- 🌲 Post-felling



Source: www.mtc.com.my

Conversion of forest or development of planted forest

- 🌲 Site investigation,
- 🌲 Land clearing,
- 🌲 Post-land clearing.



Source: Gärtner, Stefanie & Reif, Albert. (2005). The response of ground vegetation to structural change during forest conversion in the southern Black Forest. *European Journal of Forest Research*. 124. 221-231. 10.1007/s10342-005-0065-7.

The standard activities undertaken for each stage of selective harvesting are given in **Table 3-3** whereas the standard activities for forest conversion and development of planted forest are listed in **Table 3-4**. It should be noted that post-land clearing activities for conversion of forest may not be covered in the EIA for forestry and may require a separate EIA.

Table 3-3 Main Project Activities for Selective Harvesting

Stage	Activity	Potential Impacts
Site investigation	a. Establish access roads b. Establish temporary base camps (<i>kongsi</i>) c. Pre-felling survey: <ul style="list-style-type: none"> • Cut survey lines (rentice) • Pre-Felling inventory to assess timber volumes and mark harvestable trees d. Biodiversity surveys e. Permit application f. Project planning / design	<ul style="list-style-type: none"> • Erosion and sedimentation • Loss or disturbance to habitat and wildlife, • Loss of vegetation due to removal • Waste generation
Construction	a. Construct roads (upgrade existing roads / build new roads): <ul style="list-style-type: none"> • Slope cutting • Contouring • Stream crossing • Cross drains • Cut and fills • Waste disposal b. Construct log landings and log yards (<i>matau</i>) c. Establish permanent base camp (<i>kongsi</i>), d. Establish utilities and infrastructure: power supply, water, etc. e. Transport supplies and equipment	<ul style="list-style-type: none"> • Loss of vegetation and biodiversity / wildlife due to disturbance • Human-wildlife conflict (HWC) • Erosion due to bare ground and uncompacted soils, • Downstream economical losses due to sedimentation and erosion, water pollution (silt and debris, oil & grease, sewage) • Landform and hydrology changes • Water course obstruction and soil compaction causing localised ponding and stagnation can cause flash floods • Weak slope stability resulting in landslides, mudslips, etc. during wet / rainy seasons • Increased occurrence of non-commercial secondary species • Waste generation • Air quality • Noise pollution • Safety and health,

Stage	Activity	Potential Impacts
		<ul style="list-style-type: none"> • Fire risk • Visual
Felling (Operations)	<p>a. Timber felling:</p> <ul style="list-style-type: none"> • Felling • Bucking • Skidding and hauling • Landing • Loading • Waste disposal <p>b. Operate base camp</p> <p>c. Maintain roads</p> <p>d. Transport logs</p>	<p><u>Erosion and Sedimentation</u></p> <ul style="list-style-type: none"> • Downstream economic losses through erosion and sedimentation e.g. tourism, coral reefs, etc. • Disturbance of forest understorey and soil, increasing susceptibility to water erosion <p><u>Hydrology</u></p> <ul style="list-style-type: none"> • Natural regeneration of seedlings and saplings destroyed by sediment cover due to erosion • Increased peak and flood flows (extremes of flow) • Rainwater recharge of aquifer reduced due to increased run-off • Landform changes, water course obstruction and soil compaction causing localised ponding and stagnation can cause flash floods <p><u>Water Quality</u></p> <ul style="list-style-type: none"> • Loss of downstream beneficial uses • Water pollution from petroleum products, herbicides, organic waste Increased turbidity alters sunlight penetration affecting aquatic plants • Damaging fish species and habitat for other species • Probable elimination of one or more key species in the aquatic food chain • Toxic metal released from peat <p><u>Flora</u></p> <ul style="list-style-type: none"> • Species diversity decreased by selectively harvesting the best stems of valuable species • Opening of forest canopy results in invasion of secondary species such as weeds, thus impeding natural regeneration and reforestation efforts

Stage	Activity	Potential Impacts
		<ul style="list-style-type: none"> • Rare and endemic herbaceous and other medicinal or ornamental plants destroyed by increased light intensity • Adjacent seed trees may not survive mechanical damage and isolation shock <p><u>Fauna</u></p> <ul style="list-style-type: none"> • Disruption of habitat Increased mortality • Depletion of wildlife • Migratory routes of animals affected • Increased loss of succulent and aboreal species, cryptic fauna and other sensitive species due to loss of breeding, nesting sites, food resources and predators • Serious depletion or loss of rare / useful fish and wildlife species in terms of their regional or national status <p><u>Forest Stand</u></p> <ul style="list-style-type: none"> • The felling of a single tree may lead to multiple tree fall if they are interlinked by woody climbers especially on steep slopes • Hauling of logs out of the forest damages residual trees and affects natural regeneration on the forest floor. Timber yield from subsequent logging cycles may not be sustained in terms of quality and quantity. Excessive opening of canopy encourages growth of uneconomical secondary species Compacted areas (roads, skid trails, etc.) might result in permanent loss of forest vegetation <p><u>Soil Compaction and Fertility</u></p> <ul style="list-style-type: none"> • Decline in soil fertility • Compaction and loss of organic matter altering soil structure, reducing infiltration, water holding capacity, aeration and root penetration

Stage	Activity	Potential Impacts
		<p><u>Micro – Climate</u></p> <ul style="list-style-type: none"> • Removal of canopy / undergrowth increases temperature, killing soil organisms or drying the soil to the extent that regeneration is hindered • Water temperature increases in riparian areas • Reduction of relative humidity • Increases in wind blows can destroy large areas of natural vegetation • Degradation of waterways / fisheries <p><u>Air Quality</u></p> <ul style="list-style-type: none"> • Logging activities and timber transportation on dirt or laterite roads generate large amount of dust in dry season <p><u>Noise</u></p> <ul style="list-style-type: none"> • Disturbance to wildlife, indigenous people, <p><u>Waste</u></p> <ul style="list-style-type: none"> • Biomass generation • Sewage • Human domestic wastes • Scheduled wastes <p><u>Fire Hazards</u></p> <ul style="list-style-type: none"> • Haze • Lightning strikes causing fires <p><u>Road System</u></p> <ul style="list-style-type: none"> • Downstream economic losses by erosion and sedimentation • Increased runoff • Degradation of existing public roads by heavy timber loads

Stage	Activity	Potential Impacts
		<ul style="list-style-type: none"> • Accidents and destruction to wildlife <p><u>Log Flotation</u></p> <ul style="list-style-type: none"> • Impends navigation, can cause obstruction • Reduces water quality due to pollution e.g. naturally occurring wood preservatives • Interferes with commercial and subsistence fisheries • Bottom scarping may damage benthos • Bark and other organic debris may accelerate the eutrophication of water <p><u>Employment Opportunities</u></p> <ul style="list-style-type: none"> • Increased income to locals • Improved facilities e.g. roads, schools through newly created areas <p><u>Economic and Cultural Losses</u></p> <ul style="list-style-type: none"> • Traditional exploitation of forest resources disrupted • Pollution of water resources for domestic use • Inadequate waste disposal facilities at base camps can pollute waterways and environment • In-migration of forest workers and spontaneous settlers may increase violence, crime, disease, poaching, illegal settlements and inter-marriage • Impact to local communities <p><u>Archaeological, Cultural and Aesthetic</u></p> <ul style="list-style-type: none"> • Degradation of aesthetic values and recreational areas • Upland logging may affect water-based recreation downstream • Damage / affect archaeological site, burial site, sites of cultural / religious significance

Stage	Activity	Potential Impacts
Post-felling (Abandonment)	a. Post-felling inventory b. Silviculture c. Rehabilitate forest / soil d. Decommission timber camp (kongsi) e. Decommission log landings and log yards f. Remove machinery, vehicles and waste g. Post-closure environmental audit and monitoring	<u>Rehabilitation of tracks, log yards, disturbed areas</u> <ul style="list-style-type: none"> • Gradual reclamation of traditional forest uses • Gradual improvement of forest stand • Decreased erosion <u>Abandoned, No rehabilitation</u> <ul style="list-style-type: none"> • Changes to hydrology and drainage, increase runoffs • Downstream economical losses due to sedimentation and erosion, water pollution (silt and debris, oil & grease, sewage) • Landform and hydrology changes, obstructed water course obstruction • Weaken slope stability • Increased occurrence of non-commercial secondary species • Waste and sewage - poor aesthetics, fire hazards • Surface water pollution - spills and leaks • Dust / degraded air quality

Note: The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

Table 3-4 Main Project Activities for Land Conversion of Forest or Development of Planted Forest

Stage	Activity	Potential Impacts
Site investigation	a. Construct access roads b. Establish temporary base camps c. Timber stock inventory d. Permit application e. Project planning / design	<ul style="list-style-type: none"> Erosion and sedimentation Loss or disturbance to habitat and wildlife, Loss of vegetation due to removal Waste generation
Land clearing	a. Construct roads (upgrade existing roads / build new roads): <ul style="list-style-type: none"> Slope cutting Contouring Stream crossing Cross drains Cut and fills Waste disposal b. Construct of log landings and log yards (matau) c. Establish permanent base camp (kongsi) d. Transport supplies and equipment e. Timber felling: <ul style="list-style-type: none"> Felling Bucking Skidding and hauling Landing Loading Waste disposal f. Transport logs. g. Clear vegetation.	<p><u>Erosion and Sedimentation</u></p> <ul style="list-style-type: none"> Downstream economic losses through erosion and sedimentation e.g. tourism, coral reefs, etc. Disturbance of forest understorey and soil, increasing susceptibility to water erosion <p><u>Hydrology</u></p> <ul style="list-style-type: none"> Natural regeneration of seedlings and saplings destroyed by sediment cover due to erosion Increased peak and flood flows (extremes of flow) Rainwater recharge of aquifer reduced due to increased run-off Landform changes, water course obstruction and soil compaction causing localised ponding and stagnation can cause flash floods <p><u>Water Quality</u></p> <ul style="list-style-type: none"> Loss of downstream beneficial uses Water pollution from petroleum products, herbicides, organic waste Increased turbidity alters sunlight penetration affecting aquatic plants Damaging fish species and habitat for other species Probable elimination of one or more key species in the aquatic food chain Toxic metal released from peat

Stage	Activity	Potential Impacts
	h. Dispose of debris (waste)	<p><u>Flora</u></p> <ul style="list-style-type: none"> • Species diversity decreased by selectively harvesting the best stems of valuable species • Opening of forest canopy results in invasion of secondary species such as weeds, thus impeding natural regeneration and reforestation efforts • Rare and endemic herbaceous and other medicinal or ornamental plants destroyed by increased light intensity • Adjacent seed trees may not survive mechanical damage and isolation shock <p><u>Fauna</u></p> <ul style="list-style-type: none"> • Disruption of habitat Increased mortality • Depletion of wildlife • Migratory routes of animals affected • Increased loss of succulent and aboreal species, cryptic fauna and other sensitive species due to loss of breeding, nesting sites, food resources and predators • Serious depletion or loss of rare / useful fish and wildlife species in terms of their regional or national status <p><u>Forest Stand</u></p> <ul style="list-style-type: none"> • The felling of a single tree may lead to multiple tree fall if they are interlinked by woody climbers especially on steep slopes • Hauling of logs out of the forest damages residual trees and affects natural regeneration on the forest floor. Timber yield from subsequent logging cycles may not be sustained in terms of quality and quantity. Excessive opening of canopy encourages growth of uneconomical secondary species Compacted areas (roads, skid trails, etc.) might result in permanent loss of forest vegetation

Stage	Activity	Potential Impacts
		<p><u>Soil Compaction and Fertility</u></p> <ul style="list-style-type: none"> • Decline in soil fertility • Compaction and loss of organic matter altering soil structure, reducing infiltration, water holding capacity, aeration and root penetration <p><u>Micro – Climate</u></p> <ul style="list-style-type: none"> • Removal of canopy / undergrowth increases temperature, killing soil organisms or drying the soil to the extent that regeneration is hindered • Water temperature increases in riparian areas • Reduction of relative humidity • Increases in wind blows can destroy large areas of natural vegetation • Degradation of waterways / fisheries <p><u>Air Quality</u></p> <ul style="list-style-type: none"> • Logging activities and timber transportation on dirt or laterite roads generate large amount of dust in dry season <p><u>Noise</u></p> <ul style="list-style-type: none"> • Disturbance to wildlife, indigenous people <p><u>Waste</u></p> <ul style="list-style-type: none"> • Biomass generation • Sewage • Human domestic wastes • Scheduled wastes <p><u>Fire Hazards</u></p> <ul style="list-style-type: none"> • Haze • Lightning strikes causing fires

Stage	Activity	Potential Impacts
		<p><u>Road System</u></p> <ul style="list-style-type: none"> • Downstream economic losses by erosion and sedimentation • Increased runoff • Degradation of existing public roads by heavy timber loads • Accidents and destruction to wildlife <p><u>Log Flotation</u></p> <ul style="list-style-type: none"> • Impends navigation, can cause obstruction • Reduces water quality due to pollution e.g. naturally occurring wood preservatives • Interferes with commercial and subsistence fisheries • Bottom scarping may damage benthos • Bark and other organic debris may accelerate the eutrophication of water <p><u>Employment Opportunities</u></p> <ul style="list-style-type: none"> • Increased income to locals • Improved facilities e.g. roads, schools through newly created areas <p><u>Economic and Cultural Losses</u></p> <ul style="list-style-type: none"> • Traditional exploitation of forest resources disrupted • Pollution of water resources for domestic use • Inadequate waste disposal facilities at base camps can pollute waterways and environment • In-migration of forest workers and spontaneous settlers may increase violence, crime, disease, poaching, illegal settlements and inter-marriage • Impact to local communities

Stage	Activity		Potential Impacts
			<u>Archaeological, Cultural and Aesthetic</u> <ul style="list-style-type: none"> • Degradation of aesthetic values and recreational areas • Upland logging may affect water-based recreation downstream • Damage / affect archaeological site, burial site, sites of cultural / religious significance
Post-land clearing Activities after land clearing will depend on the intended purpose of the land.	Forest plantation / Agriculture	<ul style="list-style-type: none"> • Land preparation • Nursery establishment • Cover crops • Agrochemical application • Mulching 	<ul style="list-style-type: none"> • Soil erosion, poor soil conditions • Change hydrology and drainage patterns – increase runoffs, impact downstream • Water pollution to surface water • Alteration ground water • Loss of organic matter and nutrients by removal of vegetation and leaching • Planting exotic species or newly introduced species may carry a risk • Use of fertiliser, pesticides, and herbicides has negative impacts on site and on quality of local water bodies • Increased potential for massive loss by pests or pathogens (through simplification of natural ecosystem, provision of abundant food for pest, increased pest habitat, absence of natural controls e.g. in the case of introduced exotic tree species) • Spread of plantation species outside of plantation competing with native species • Weeds effect growth and compete with cover crops • Air quality from open burning • Human – wildlife conflicts • Human health – use of chemicals, pesticides • Wastes – agriculture wastes, human wastes, sewage • Traffic and transportation of goods • Employment opportunity

Stage	Activity	Potential Impacts
	Animal husbandry / Aquaculture <ul style="list-style-type: none"> • Access road • Drainage and irrigation • Hatchery / Pigsty / Aquaculture farm 	<ul style="list-style-type: none"> • Soil erosion exposed land / ground • Change hydrology and drainage patterns – increase runoffs, impact downstream • Water pollution to surface water • Air quality from open burning, • Odour • Human – wildlife conflicts • Human health – use of chemicals, pesticides • Livestock welfare - exposure to livestock diseases, vectors • Wastes – livestock wastes, human wastes, sewage, scheduled wastes • Traffic and transportation of goods • Employment opportunity
	Industrial/ Residential <ul style="list-style-type: none"> • Earthworks and piling • Access road • Plan facilities • Sewerage and drainage 	<ul style="list-style-type: none"> • Soil erosion exposed land / ground • Change hydrology and drainage patterns – increase runoffs, impact downstream • Loss of green / vegetated areas, more hardscapes • Water pollution to surface water • Air quality from human / industrial activities • Odour • Human – wildlife conflicts • Human health – exposure to air pollution, water pollution • Wastes – domestic wastes, sewage, scheduled wastes • Traffic and transportation s • Employment opportunity

Note: The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance

3.4.4 Selection of Scoping Method

There are many methods and tools by which to conduct the scoping exercise. These include checklists, matrices, or any other accepted methods, to assist in systematically organising, collating and analysing the data for the project. At the TOR stage, qualitative assessment is adequate but quantitative data can be provided to support the assessment.

Table 3-5 lists the advantages and disadvantages of the various common methods used. The list given is not exhaustive and any other suitable method can be used, if relevant.

A useful tool is the Environmental Scoping Matrix (ESM) that amalgamates the scores from a series of criteria; ranging them from major to minor negative and positive formats of environmental impacts (see Appendix for an example of the matrix used for forestry projects).

The Qualified Person and the Project Proponent's input is vital at this stage as their knowledge and experience would ensure appropriate weightage is given to the issues under assessment (see **Box 3**).

From the scoping outputs, a priority list of environmental impacts shall be determined for in-depth studies and assessments in the EIA.

Box 3: Criteria for Determining Significance of Environmental Impacts

- i. **Magnitude:** Defined as the degree and scale of an impact (may be detrimental or beneficial) towards sensitive receptors due to a proposed activity.
- ii. **Permanence:** Defined as to whether the effects are temporary in nature (e.g. only during certain work activities or only during the construction stage), or may result in permanent effects (e.g. landform alteration due to cut and fill)
- iii. **Reversibility:** A measure of whether mitigation measures can be implemented in rehabilitating the site back to its original state or better.
- iv. **Cumulative Effects:** A measure of whether the effects will be accumulative singly or in combination with other effects from nearby sites/activities (that may be detrimental or beneficial) over a time period.

Table 3-5 Advantages and Disadvantages of Impact Identification Methods

Method	Advantage	Disadvantages
Checklists	<ul style="list-style-type: none"> • Easy to understand and use. • Good for site selection and priority setting. • Simple ranking and weightages. 	<ul style="list-style-type: none"> • Do not distinguish between direct and indirect impacts. • Do not link action and impact. • The process of incorporation of values can be controversial.
Matrices	<ul style="list-style-type: none"> • Link action to impacts. • Good method for displaying EIA results. 	<ul style="list-style-type: none"> • Difficult to distinguish direct and indirect impacts. • Have potential for double counting of impacts.
Networks	<ul style="list-style-type: none"> • Link actions to impacts. • Useful in simplified form to check for second order impacts. • Handles direct and indirect impacts. 	<ul style="list-style-type: none"> • Can be very complex if used beyond simplified version.
Overlays	<ul style="list-style-type: none"> • Easy to understand. • Focus and display spatial impacts. • Good siting tool. 	<ul style="list-style-type: none"> • Can be cumbersome. • Poorly suited to address impact duration or probability.
GIS and Computer Expert Systems	<ul style="list-style-type: none"> • Good for impact identification and spatial analysis. • Good for experimenting. 	<ul style="list-style-type: none"> • Heavy reliance on knowledge and data. • Often complex and expensive.

Source: EIA Training Resource Manual Second Edition (UNEP, 2002).

Note: *The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.*

3.4.5 Stakeholder Consultation

Stakeholder consultations should begin during the scoping process. The purpose of this is to notify the relevant stakeholders about a proposed project prior to its development, and to obtain their initial feedback and concerns. These preliminary consultations will form the basis for further, and more focused consultations later on in the EIA process.

Stakeholder groups that should be consulted for forestry projects include the local community and community based organisations (CBO), as well as relevant researchers, NGOs as and Government agencies.

Depending on the target group, this initial stakeholder consultation may be done via town hall meetings, focus group discussions, e-mail and other relevant methods that enable effective consultation.

In any case, it is important that all relevant stakeholders should be provided sufficient opportunities to share their unbiased views, these views are recorded officially and given due consideration

For indigenous communities, the principles of Free, Prior and Informed Consent (FPIC) applies and must be upheld in the consultation process, as Malaysia is a signatory to the UN Declaration on the Rights of Indigenous Peoples (UNDRIP).

3.4.6 Identification of Significant Impacts and Priority Setting

Based on the findings from above steps, the Qualified Person shall now identify and prioritise the potentially significant impacts that warrant greater attention in the EIA study.

Note that less significant issues should also be assessed in the EIA study, but this may be done in a more general manner, using qualitative methods and secondary data.

3.4.7 Selection of Mitigation Measures

Depending on the nature of the site and the potentially significant impacts identified, the Qualified Person shall determine the type of mitigation measures that may be required. The mitigation measures only need to be outlined in general terms at this juncture, with further detailing to be added in the EIA.

3.5 TERMS OF REFERENCE AND ENVIRONMENTAL SCOPING INFORMATION

The scoping exercise shall produce two outputs, i.e. the Terms of reference (TOR), which defines the proposed scope, boundaries, methodology and schedule of the EIA study (among other things) and the Environmental Scoping Information (ESI), which contains supporting information collected from the scoping exercise.

The TOR (along with the ESI) is to be submitted to DOE for review. The TOR review procedures are different for activities falling under the First Schedule and Second Schedule of the EIA Order 2015. Refer to Chapter 4.2 of the EGIM for a description of the procedures and Appendix 8 for detailed guidance on preparing the TOR and ESI.

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Photo Source: Logging in Malaysia (www.mongabay.com)

4

DETERMINING ENVIRONMENTAL BASELINE CONDITIONS

CHAPTER 4. DETERMINING ENVIRONMENTAL BASELINE CONDITIONS

4.1 BASELINE STUDY REQUIREMENTS

EIAs are essentially studies to predict how a particular project will affect the physio-chemical, ecological and human components within the landscape. A strong understanding of the existing environment, otherwise known as the “baseline condition” prior to the implementation of the project, is crucial in order to make accurate predictions. Collecting existing data is always the first step in collecting baseline information and a combination of primary and secondary data is typically collected to develop the baseline. It must however be reviewed for its relevance to the proposed site, its accuracy, and used as a basis for determining what primary field investigations may be required to ‘fill the gaps’.

Primary field surveys are almost always required for most aspects of the environment, such as existing vegetation and habitats, wildlife, water quality, topography, socioeconomic and other factors. Field surveys are needed, either because published information often does not exist at a suitable scale or is not generally applicable to the project being assessed. Where primary field surveys are required, careful consideration must be given to the design of the field survey and sampling programme. Data collection must focus on the key issues needed to be examined for the environmental assessment (identified during the scoping process) and should be collected at the appropriate time(s) of the year. If seasonal changes is a factor, data collection must cover the different seasonal changes.

Data collection must cover three major environmental components:

Physico-chemical Environment

Biological Environment

Human Environment

The sampling and assessment area shall be bounded by the Zone of Study (ZOS). However, if the impact is much further away, then the Zone of Impact (ZOI) shall be part of the sampling and assessment area. This has to be clearly defined in the EIA. An example of this is hydrology, erosion, and water pollution, for which the impacts are felt much further away than the ZOS to the ZOI. Hence, the latter must be included in the assessment study.

An overview of standard baseline primary and secondary data requirements that should be included in the EIA is shown in **Table 4-1**.

4.2 PRIMARY DATA COLLECTION

Field surveys will be required to collect primary data for various physical and ecological parameters. While time and resources are limiting factors, the surveys must be designed to derive data that is reliable, robust and relevant. This entails, for example, selecting methodologies, tools, timing and layout of sampling points/plots that are appropriate to the site characteristics, including topography and size.

Biodiversity surveys are particularly important for forestry EIAs, and rapid biodiversity survey protocols may be used for this purpose. Keep in mind that flora and fauna surveys should not entail basic presence/absence to develop species checklists. Spatial information must be recorded in order to identify areas that have higher conservation values, whereas population estimates or occupancy modelling may be required for key species. Key references for setting biodiversity survey methodologies include the *Manual Inventori Biodiversiti* (DWNP, undated).

Baseline information on these three core aspects is needed to determine the state of the environment before, during and after project implementation when compared with the DOE standards. A baseline sampling plan, which includes locations, methods of sampling, frequency, and parameters to be sampled, shall be decided based on the project site, location and its surroundings sensitive receptors. Details of the sampling plan and schedule (person in charge, time, date, and location of sampling) must be clearly stated in the EIA.

For river water sampling and air quality measurement, **Table 4-2** provides a range of baseline items for sampling and studies and recommended parameters. All samples must be analysed by a *Skim Akreditasi Makmal Malaysia* (SAMM) accredited laboratory or equivalent. All test certificates and data shall be included in the Appendix of the EIA report as supporting evidence (DOE Notice 1/2012 dated 6 Jan 2012).

Primary data also is sourced from various stakeholder consultations and engagements. Stakeholder consultation methodology may include dialogues, rapid rural appraisal, focus group discussion, questionnaire survey and other methods that suit the situation. A combination of two or more of these methods may be applied, depending on the level of assessment required.

4.3 SECONDARY DATA COLLECTION

Secondary data may be available from previous studies or monitoring programmes conducted in the study site, if any. Sources of secondary data may include study reports (published or unpublished), scientific papers, statistical data and information from various sources, but mainly from official published reports, census, publications, and research papers, etc. These documents may be available in the collections of government agencies, research institutions, NGOs or online. In any case, the secondary data sources must be reliable as well as must be clearly referenced and acknowledged alongside the date of publication in the EIA. References for all maps, photos and diagrams will also need to be included in the EIA.

Table 4-1 Environmental Baseline information and Data Sources

Scope	Baseline Information	Primary Sources	Secondary Sources
Terrain, Geology and Soil	<ul style="list-style-type: none"> • Topographic map with appropriate contour intervals • Slope map • Local and regional soil and geology • Estimates of soil loss and sediment yield under natural conditions • Soil profile¹ • Hazard mapping 	<ul style="list-style-type: none"> • Geological Terrain Mapping • Soil investigation (SI)¹ • LiDAR survey if required¹ • Field survey of slope areas and hazards (as part of Geological Terrain Mapping). 	<ul style="list-style-type: none"> • GIS maps • Satellite images • Forest management / harvesting plan • JMG • JUPEM
Hydrology and Climate	<ul style="list-style-type: none"> • Description and map of hydrological system including rivers and catchments. • Long-term (minimum 5-year) climate data. • Flood risk analysis, if required. • Stream flow • Riverbed cross section 	<ul style="list-style-type: none"> • Stream flow measurement • Site survey to verify river system and drainage. • Stream gauging to ascertain flow and riverbed cross-section. • Identification of downstream sensitive receptors. 	<ul style="list-style-type: none"> • Topographic maps • DOE • DID • MET Malaysia • State Water Authorities
Land use	<ul style="list-style-type: none"> • Current landuse • Future and committed landuse • Sensitive receptors • Zoning and compatibility 	<ul style="list-style-type: none"> • Site surveys. • Mapping to update information within the ZOS and ZOI 	<ul style="list-style-type: none"> • PLANMalaysia • Forestry Department • State government • Local government
Air Quality	<ul style="list-style-type: none"> • Ambient air quality. • Existing sources of air pollution. • Climate change 	<ul style="list-style-type: none"> • Air quality sampling at site and sensitive receptors. (Table 4-2) 	<ul style="list-style-type: none"> • DOE • MET Malaysia
Water quality	<ul style="list-style-type: none"> • Water quality of main rivers and waterbodies • Location of water intake points, gravity feed systems and other beneficial uses of the water • Existing sources of water pollution 	<ul style="list-style-type: none"> • Water quality sampling at site and sensitive receptors² (Table 4-2) 	<ul style="list-style-type: none"> • DOE

Scope	Baseline Information	Primary Sources	Secondary Sources
Ecology	<ul style="list-style-type: none"> • Forest condition/stratification map • Forest types present, noting presence of threatened or unique habitats. • Landscape-level biodiversity analysis, e.g. habitat patch size, core and edge habitat, wildlife corridors, stepping stones. • Species list, noting presence of rare, threatened or endemic (RTE) species of plants and animals. • Species occupancy model (if required) • Identification of High Conservation Value Forests. • Identification (and valuation) of ecosystem services 	<ul style="list-style-type: none"> • Flora survey • Faunal survey³ • Ecosystem assessment • High Conservation Value Forest assessment • Rapid biodiversity assessment tools 	<ul style="list-style-type: none"> • Satellite images • Ecosystem map • Species distribution maps • Journals and reports • DWNP • DOF • FRIM • NGOs • Universities • International Union on the Conservation of Nature (IUCN) • Red List Wildlife Conservation Act 2010 (Act 317)
Socio-economy	<ul style="list-style-type: none"> • Demographic and socio-economic profiles of communities in the ZOI. • Level of dependence of the local community on the forest and forest resources. • Community maps or other documents showing locations of customary land, important cultural or religious sites, etc.⁵ • Human-wildlife conflict in the ZOI. • Traffic • Health profile 	<ul style="list-style-type: none"> • Local community consultation⁴ • Socio survey 	<ul style="list-style-type: none"> • Census data. • Records of aboriginal lands under the Aboriginal Peoples Act 1954. • Decisions of the Civil Courts pertaining to legal or customary tenure or use rights. • Records of past consultation with local community • Local authorities. • JAKOA • NGOs • Universities • Health profile / records

Scope	Baseline Information	Primary Sources	Secondary Sources
Noise	<ul style="list-style-type: none"> Ambient noise levels. Existing sources of noise pollution. 	<ul style="list-style-type: none"> Ambient noise measurement. Measurement of ambient noise levels at site and sensitive receptors. 	<ul style="list-style-type: none"> DOE
Waste	<ul style="list-style-type: none"> Estimation of Biomass. Potential waste (biomass, domestic, construction & demolition, scheduled wastes) generation 	<ul style="list-style-type: none"> Site surveys to ascertain existing site conditions, estimate of type and volume of biomass 	<ul style="list-style-type: none"> DOE PBT
Heritage, Culture and Archaeology	<ul style="list-style-type: none"> Identify and determine significance of value of such sites within or near to project site. 	<ul style="list-style-type: none"> Site surveys and interviews with authorities and locals. 	<ul style="list-style-type: none"> National Heritage Register National Heritage Department. Department of Museum. Jabatan Kemajuan Orang Asli (JAKOA).

Notes

¹ Soil investigation and LiDAR surveys are more critical for forest conversion compared to selective harvesting.

² Water quality samples collected must be analysed by a *Skim Akreditasi Makmal Malaysia* (SAMM) accredited laboratory. Details of sampling (person in charge, time, date and location of sampling) must be clearly stated. All certificated and data shall be included.

³ Ensure that all necessary permits are obtained from DWNP before wildlife surveys are conducted, especially if it entails netting or trapping of wildlife. As far as possible, the timing of surveys should be planned to take into account seasonal variations. A combination of survey methods including camera traps, point counts, line transects, mist nets, pitfall traps, bat detectors, pond nets and fishing may be utilised to detect the different taxonomic groups present. Apart from direct observation, secondary signs such as scratch marks, tracks, calls and scat may provide confirmation of the presence of a species. Note, however that the non-detection of the species does not imply the species is genuinely absent.

⁴ For local indigenous communities, the principles of Free, Prior and Informed Consent (FPIC) principles should be incorporated into the consultation process, because Malaysia is a signatory to the UN Declaration on the Rights of Indigenous Peoples (UNDRIP).

⁵ While not official or professional maps, community maps produced by the Orang Asli may be admitted as a rough visual guide to the spatial extent of the ancestral lands.

Note: *The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.*

Table 4-2 Baseline Items for Sampling & Studies and Recommended Parameters

Recommended Parameter	Guidelines/ Standards	Recommended Requirements	
River Water Quality			
<p>In-situ Measurements</p> <ul style="list-style-type: none"> • Dissolved Oxygen (DO) • Temperature • Conductivity • pH <p>Ex-situ Analysis</p> <ul style="list-style-type: none"> • Biochemical Oxygen Demand (BOD) • Chemical Oxygen Demand (COD) • Total Suspended Solids (TSS) • Ammoniacal Nitrogen (AN) • Mercury (Hg) • Cadmium (Cd) • Chromium Trivalent (Cr³⁺) 	<ul style="list-style-type: none"> • Chromium Hexavalent (Cr⁶⁺) • Arsenic (As) • Cyanide (CN) • Lead (Pb) • Copper (Cu) • Manganese (Mn) • Nickel (Ni) • Tin (Sn) • Zinc (Zn) • Boron (B) • Iron (Fe) • Phenol • Free Chlorine (Cl₂) • Sulphide (S²⁻) • Oil and Grease (O&G) • Total coliform • Faecal coliform 	<p>National Water Quality Standards of Malaysia (NWQS)</p>	<ul style="list-style-type: none"> • One-time composite sampling. • Upstream and downstream of the main rivers and streams within the ZOI. • Minimum two sampling locations (depending on river type) • Multi-depth sampling for deep rivers (>1 m deep). • Heavy metal testing required if activity involves industrial projects. • Pesticide testing required for agricultural and/or forestry projects. • Water quality parameters shall be selected based on the site conditions.

Recommended Parameter	Guidelines/ Standards	Recommended Requirements
Air Quality		
<ul style="list-style-type: none"> • PM_{2.5} • PM₁₀ • Carbon Monoxide (CO) • Sulphur Dioxide (SO₂) • Nitrogen Dioxide (NO₂) • Ozone (O₃) Source: DOE Notice 1/2015 dated Mar 2015 * • Methane 	Malaysian Ambient Air Quality Standards (MAAQS)	<ul style="list-style-type: none"> • Parameters to be sampled are dependent on-site conditions. • One-time sampling at minimum two stations (upwind and downwind). • Project boundary and nearest receptors.

Note:

The list is not exhaustive and to be suited according to the project. The Project Proponent and Qualified Person shall include and provide any additional baseline sampling, including parameters, as required by DOE, other Gas and/or deemed necessary for the project.

** Ozone needs to be measured only for selected projects. Justification for its omission must be provided.*



Photo Source: Photo by Mr Dylan Jefri Ong, Mr. Zaharil Dzulkafly

PREDICTING AND EVALUATING IMPACTS

CHAPTER 5. PREDICTING AND EVALUATING IMPACTS

5.1 IMPACT ASSESSMENT AND EVALUATION OF SIGNIFICANCE

At this stage of the study, the physical and ecological characteristics of the study site, as well as the sensitive receptors present will be known following the collection and analysis of baseline data. At the same time, details of key project activities would also be confirmed from discussions with the Project Proponent.

The next step is to predict and evaluate the environmental impacts that are likely to occur due to the implementation of the particular forestry project in that particular landscape. An accurate and balanced evaluation will enable appropriate measures to be prescribed to mitigate the impacts to acceptable levels, as well as compensation mechanisms for permanent significant impacts which cannot be mitigated.

The spatial and temporal attributes of each impact should be described. This includes the location, spatial extent, duration, permanence and magnitude. As far as possible, the cumulative impacts that factor in adjacent developments as well as secondary / derivative impacts should also be evaluated.

There are many methods to assess the environmental impacts. Generally, all methods of impact assessment seek to compare the existing environment against a predicted future environment caused by various project activities during different phases of project implementation.

Predictions and assessments are made through qualitative or quantitative approaches and methods that form the basis of evaluation. While there is no one method that fits all requirements, the predictive and assessment method chosen must have at least the following attributes:

<p>Established and proven methods and models</p>	<p>Adequate, accurate and up-to-date data for assessment</p>	<p>Results can be replicated and is reproducible by independent evaluators</p>	<p>Cost-effective and for any software, it can be purchased (proprietary software and tools can also be used). If possible, widely accepted freeware is encouraged</p>
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The most significant environmental impacts of forestry activities are typically related to ecology, hydrology and water quality. Socio-economic impacts can also be significant in areas where local or indigenous communities have outstanding claims on the land, or are highly dependent on the ecosystem services that the forest provides. In general, the impacts of forest conversion

are more severe and permanent as compared to selective logging. It should also be noted that some impacts also have national or global consequences – for instance, conversion of forest adds to the reduction in total forest cover of the country whereas conversion of peat swamp forest results in the release of carbon sequestered in peat soils into the atmosphere.

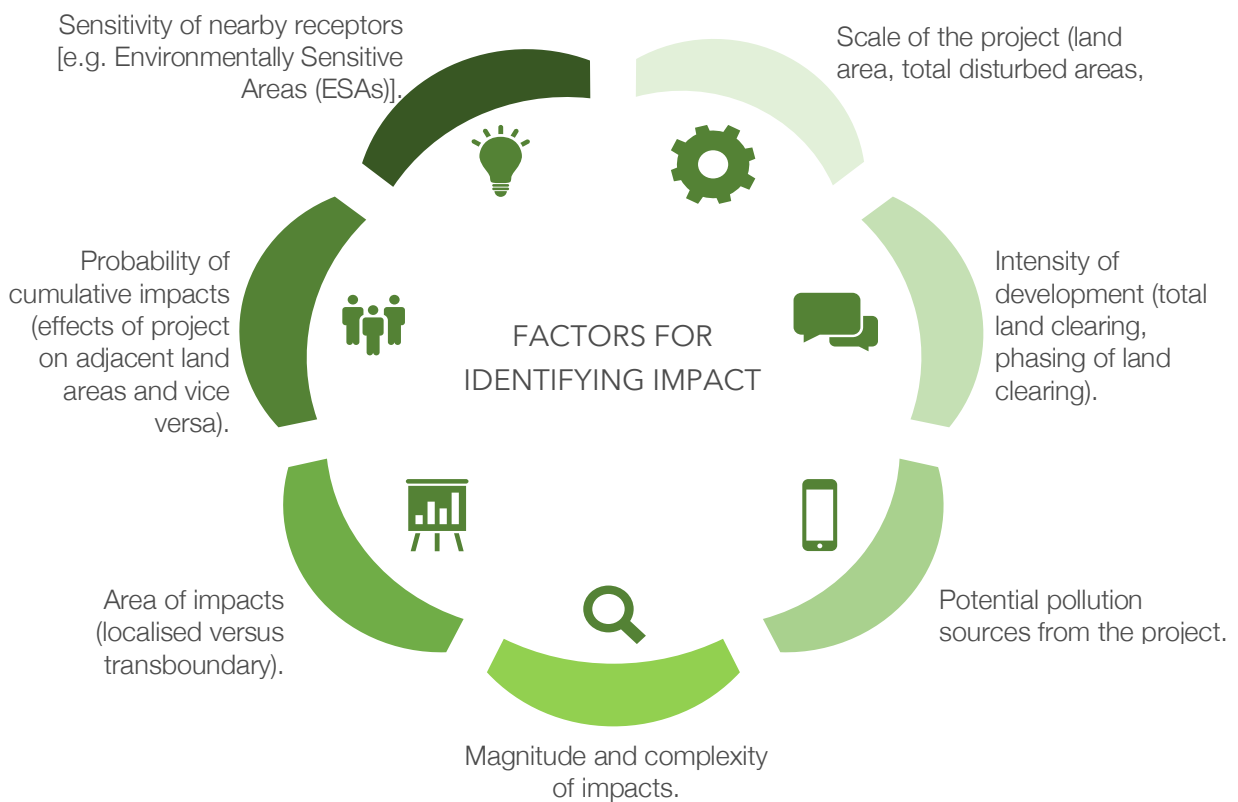
The Qualified Person must select the best method to conduct the assessments and/or generate practical scenarios from reliable datasets to ascertain the magnitude, extent and significance of impacts from the project. Only significant issues shall be assessed in detail in the EIA. Issues that are not significant shall only be addressed qualitatively.

5.2 TYPICAL IMPACTS OF FORESTRY PROJECTS

Some of the main environmental impacts of forestry projects are given below. Samples environmental assessment matrix to assist to identify significant impacts of projects are given in **Appendix 3** and **Appendix 4**.

5.2.1 Determining Impacts Due To The Prescribed Activity

The level of details in the impact identification shall commensurate with the following factors:



Typical Issues and impacts, and their respective issues of concern are discussed in the following sections.

5.2.2 Ecological Impacts

Tropical rainforests are among the most biodiverse and complex terrestrial biomes on Earth. The removal of standing trees – the basic building blocks of this ecosystem that provide food and shelter for many different species – can impact the forest ecology in many interrelated ways, at different spatial and temporal scales, including several that extend well beyond the affected area. Some of the ecological impacts of forest activities include:

<i>Biodiversity loss</i>	Conversion of forest to other land use (including forest plantation) will cause a reduction in biodiversity of the site, especially in terms of species diversity. This can be a significant issue especially if there are rare, threatened or endemic plants present in the affected area
<i>Loss of habitat</i>	The removal of trees equates to the loss or disruption of wildlife habitat especially for arboreal species. Each species may be affected in different ways, depending on their biology. Indiscriminate clear-felling can lead to loss of areas that are of critical importance to wildlife, such as salt licks and breeding grounds
<i>Loss of forest cover</i>	The conversion of forests to other land use contributes to a nett loss of national forest cover. Malaysia is committed to maintain at least 50 percent of its land under forest cover.
<i>Changes in forest composition</i>	Selective logging and silviculture focuses on the felling and replanting of commercially valuable species. Over time, this changes the natural distribution and growth patterns of plant populations, and consequently the animal populations of the forest.
<i>Increased stress on adjacent habitats</i>	Displaced animals that escape to adjacent forest patches will compete for limited food and space with the resident populations of those patches. This may upsetting the ecological balance, with grave consequences if the carrying capacity is breached
<i>Habitat fragmentation</i>	Loss of connectivity between forest patches can impede natural dispersal patterns of various species, thereby affecting biological processes such as pollination and seed dispersal, with long-term effects on the gene pool.
<i>Residual damage</i>	Due to the complex structure of the rainforest canopy where trees spaced closely together are connected by an network of climbing vines, the felling of even a single tree can cause residual damage on the adjacent trees
<i>Increased edge effects</i>	Because of their altered micro-climate (e.g. increased ambient temperatures, drying out and greater exposure to wind), forest

	edges are generally poorer habitats for both plants and animals as compared to deeper forests
Degradation of aquatic habitats	Benthic habitats and aquatic populations are affected by sedimentation, increased water temperatures and turbidity as well as reduced flow, dissolved oxygen, and so forth. Species with a low level of tolerance to pollution, such as the Kelah will be most affected
Increase in hunting pressure	The development of forest roads (especially if left unguarded) enhances access for poachers to reach deeper into the forest. Logging or plantation workers living in timber camps may also hunt for food or recreation
Invasive alien species	Forestry activities can result in the introduction of invasive alien species into the forest; either intentionally through planting of exotic species such as <i>Acacia mangium</i> , or through unintentional pathways as a result of disturbance (such as <i>Clidemia hirta</i>) (Appendix 5)

5.2.3 Physio-Chemical Impacts

Activities associated with logging and forest conversion exert a number of typical physio-chemical impacts on the land and streams. These include (but are not limited to):

Soil erosion	Exposure of topsoil as a result of slope cutting, road building, skidding and land clearing causes soil erosion and soil loss
Landslides	Removal of vegetation and erosion can cause slope failure, especially at steep slopes during the wet season
Stream sedimentation	The impacts due to soil erosion is not purely restricted to soil loss but also causes sedimentation downstream that affects potable use, aquatic life, productivity of the aquatic ecosystem and other related impacts
Flash floods	The removal of vegetation cover causes a significant increase in peak stream discharge over a shorter period. Coupled with sedimentation and debris, this can trigger flash floods in areas downstream
Water pollution	Apart from sedimentation, untreated sewage and greywater from timber camps, as well as oil and grease and other chemicals from vehicles and storage facilities can contaminate waterways and reduce the beneficial uses of the waterway
Solid waste Biomass	Large quantities of biomass is produced from land clearing, tree felling, access road development; etc. whereas solid waste is generated from the timber camps

Soil compaction	Natural forest regeneration is unlikely to happen on heavily compacted soils along logging roads, log yards and timber camps. Such areas often become overgrown with ferns, which further prevent the natural regeneration of the forest canopy
Reduced water tables and soil nutrients	The development of forest plantations using species that exert a high water demand and uptake of nutrient such as Eucalyptus has been documented to deplete water tables and strip soils of nutrients
Increased risk of forest fires	The development of planted forest using non-native fire-prone trees such as Acacia and Eucalyptus increases the risk of forest fires
Air pollution	Dust from roads kicked up by heavy vehicles can cause localised air pollution. The impacts of forest fires on the other hand can be severe and regional, especially if it occurs of peatlands
Loss of soil microbial communities	Removal of top soil during land clearing for forest conversion removes top soil along with nutrients and microbial diversity

5.2.4 Socio-Economic Impacts

Many of the socio-economic impacts of forestry projects are related to the loss “ecosystem services”, i.e. the goods and services that nature provides to society. This includes provisioning services (e.g. food and freshwater), regulating services (e.g. climate regulation and flood regulation), cultural services (e.g. areas important for spiritual or recreation purposes) and supporting services (e.g. soil formation and nutrient cycling). The degradation of ecosystems (and loss of biodiversity that underpin healthy ecosystems) can disrupt the provision of these services.

Some of the more common socio-economic impacts of forestry activities include:

Loss forest resources	Some communities may depend non-timber forest products (NTFP) for food, medicine, fibre and building material. Loss of access to NTFP is especially severe when forests are converted to other land use
Water security is compromised	Water catchments or gravity feed systems that supply water to rural villages can be damaged by sedimentation or landslides caused by logging or land clearing, decomposition of biomass entering water sources.
Loss of access to sites of cultural or religious significance	Sites that have cultural or religious significance to the local community, including burial grounds and sacred sites can be affected by logging or forest conversion

<i>Loss of access to customary land</i>	Because their lives are tied to the land in intricate ways, the loss of access to customary land can bring about long-term psychological and physiological impacts on entire indigenous communities
<i>Loss of assets</i>	This may include shifting cultivation and fruit tree groves traditionally maintained by local indigenous communities
<i>Human-wildlife conflicts</i>	Species displaced by habitat loss, such as elephants, macaques and snakes may encroach into areas of human use. The ensuing human-wildlife conflicts can have detrimental impacts on both human and animal alike
<i>Public health</i>	The opening of forests, degradation of the ecosystem and potential influx of foreign workers may cause outbreaks of vector borne diseases
<i>Degradation of tourism and recreational areas</i>	The physical and aesthetic quality of rivers, waterfalls and other landscapes can be degraded as a result of logging or forest conversion. This may also affect the businesses that are developed around the particular attraction

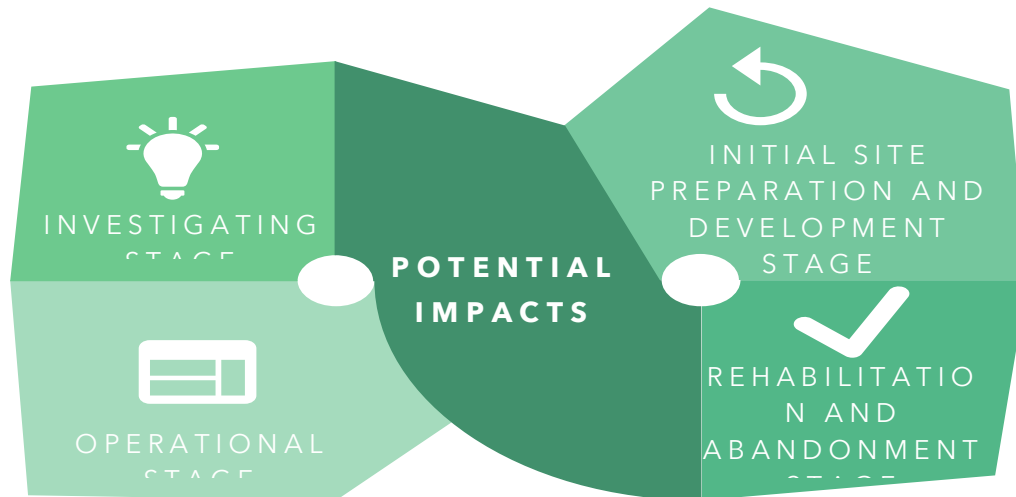
5.2.5 Other Associated Impacts

Other environmental impacts that may arise from sustainable logging or forest conversion include (but are not limited to):







<i>Air pollution</i>	Heavy machinery and lorries used in logging activities emit exhaust fumes that pollute the air. The use of fire to burn debris during land clearing activities also emits smoke
<i>Traffic</i>	Slow-moving trailers that use public roads to transport logs to the mills can cause traffic jams and pose safety risks especially when they pass through towns and villages
<i>Noise</i>	Noise generated from felling and land clearing operations, though this is limited to daytime, and usually far from human settlements
<i>Greenhouse gas emissions</i>	Forests play an important role in regulating the global carbon cycle. The conversion of forest to other (non-forest) land use inevitably results in the release of greenhouse gases from the decaying vegetation. This loss is especially significant in peatlands where there is a large amount of carbon in the soil. The draining of peat and forest fires that may occur in the drained peat soil will lead to the release of this sequestered carbon back into the atmosphere

5.3 TYPICAL IMPACTS AT VARIOUS STAGES OF FORESTRY PROJECTS

Breaking down a project into its basic components or activities is a systematic means of identifying the primary sources of environmental impacts. The impacts that typically occur during the various stages of forestry projects are detailed below.



The level of detail in the impact identification shall be commensurate with the following factors:

Factors to be considered in impact identification	
	Scale of the project (land area, total disturbed areas, etc.)
	Intensity of development (total land clearing, phasing of land clearing).
	Magnitude and complexity of impacts
	Area of impacts (localised versus transboundary)
	Probability of cumulative impacts (effects of project on adjacent land areas / river basin and <i>vice versa</i>)
	Sensitivity of nearby receptors [e.g. Environmentally Sensitive Areas (ESAs)].

The Qualified Person must, based on the information received from the Project Proponent, describe the activities that are likely to pose a risk of negative impacts on the environment or which are seen as an opportunity for environmental improvement. The description shall include technologies and methodologies chosen by the Project Proponent after consultation with the Qualified Person. If there are areas where the project description from the Project Proponent lacks detail, it must be clearly stated by the Qualified Person, and he must then later make appropriate proposals for technology selection and mitigation.

The Qualified Person can recommend changes in the project plan to better suit the site should the initial assessment indicate so. It should be highlighted in the Environmental Assessment report as “Project Options”.

5.3.1 Assess the Existing Environment

It is necessary to provide sufficient information to provide a brief but clear illustration of the existing environmental components. These components include, to the extent applicable (but are not necessarily limited to) the following:

Physical Environment	<input type="checkbox"/> Topography, slope and terrain features, <input type="checkbox"/> Soil features and suitability, <input type="checkbox"/> Geology (rock features, stability), <input type="checkbox"/> Hydrology and river basin (drainage and seasonal flow pattern, flood plains, swamps), <input type="checkbox"/> Climate (temperature, wind regime, rainfall), <input type="checkbox"/> Surface water quality (particularly for total suspended solids, dissolved oxygen, ph, temperature, phosphorus, nitrogen, coliform count and harmful pesticides), <input type="checkbox"/> Air quality <input type="checkbox"/> Noise level
Biological Environment	<input type="checkbox"/> Wildlife, <input type="checkbox"/> Forest types and forest cover present, noting presence of threatened or unique habitats. <input type="checkbox"/> Landscape-level biodiversity analysis, e.g. habitat patch size, core and edge habitat, wildlife corridors, stepping stones, <input type="checkbox"/> Rare, protected or endangered species (terrestrial and aquatic flora and fauna, elephant and rhinoceros home range) and area (mangroves, national parks, wildlife sanctuaries/ corridors, salt licks, peat swamp, freshwater swamp), <input type="checkbox"/> Fisheries, <input type="checkbox"/> Aquatic biology, <input type="checkbox"/> Wilderness or protected areas, <input type="checkbox"/> Key conservation value habitats or species
Human Environment	<input type="checkbox"/> Population and communities (including numbers, locations, compositions, employment and others), <input type="checkbox"/> Land use, <input type="checkbox"/> Location of important economic resources/ upstream and downstream activities (including plantations, river sand extraction, fish rearing, <i>Tagal</i> areas), <input type="checkbox"/> Infrastructural facilities (including water supply, electricity, sewerage, flood control), <input type="checkbox"/> Institutions (such as schools, clinics, and places of worship), <input type="checkbox"/> Water catchment areas, <input type="checkbox"/> Transportation (roads, navigation and others), <input type="checkbox"/> Archaeological, historical, and cultural values and aesthetic values.

Note: The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

The baseline study for the environmental assessment should focus on identifying those environmental components that may be significantly impacted by the proposed project. These

may be identified through ground observation, literature review, and stakeholder consultation. The description can be presented in the form of mapping, listing, or reports in the EIA Report.

5.3.2 Study Area and Zone of Impact

Generally, a study area for the preparation of an environmental assessment report covers a radius of 5 km from the project site boundaries. However, the study area should focus on what the Qualified Person deems to be the **Zone Of Impact** as described in **Section 3.4.2**. A clear delineation of the study area based on the actual ground survey conducted is important to define the area within which impacts should be considered.

There may be different zones of impact for physical (such as water quality, terrain features and hydrology), biological (such as wildlife species, habitat and diversity) and human (such as social issues affecting communities, cultural and aesthetic aspect and land use) environment. The Qualified Person should overlap these impact zones and decide which zone is particularly sensitive and where impacts are likely to be of some significance. Such zones may reach far downstream from the sites, particularly if there are sensitive areas downstream or locality concerns. The ZOI can be determined after understanding the concept of the proposed development and conducting ground observations to identify these sensitive areas.

The extent of the study area/ zone of impact must be mapped out, clearly defined and justified in the TOR document and agreed upon with DOE. This will particularly include human settlements that are to be included in the assessment surveys for the preparation of the EIA report.

5.3.3 Potential Impacts During the Site Investigation Stage

Only a few impacts are likely to occur during the Site Investigation stage (which is common to both sustainable harvesting and conversion of forest and/or development of planted forest), and these impacts are usually quite minor (**Table 5-1**). More importantly, however, the decisions made in project planning and design will have a major bearing on the overall impact of the project.

Table 5-1 Potential Impacts During Site Investigation Stage

Activity	Potential Impacts
a. Establish access roads (all access roads leading to work areas, base camp, etc. related to the Project)	<ul style="list-style-type: none"> • Soil erosion • Sedimentation of streams • Habitat loss and degradation • Biomass generation
b. Establish temporary base camps (kongsi)	<ul style="list-style-type: none"> • Soil erosion • Sedimentation of streams • Habitat loss and degradation • Water pollution

Activity	Potential Impacts
	<ul style="list-style-type: none"> • Solid waste • Human-wildlife conflicts
c. Pre-felling survey: <ul style="list-style-type: none"> • Cut survey lines (rentice) • Pre-Felling inventory to assess timber volumes and mark harvestable trees 	No significant impacts
d. Biodiversity surveys	No significant impacts
e. Permit application	No significant impacts
f. Project planning / design	Potentially long term impacts

Note: The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

5.3.4 Impacts During the Construction Stage

Significant environmental impacts begin to occur at the Construction Stage. The main activities that generate impacts at this juncture are the construction of forest roads and skid trails as well as log yards and base camp (**Table 5-2**).

The clearing of these areas causes forest / habitat loss and increase in forest edge habitat. Soil erosion, sedimentation of streams and potentially landslides also occur. The soils at these open areas will eventually become heavily compacted, thus preventing the natural regeneration of the forest (if soil remediation is not conducted) after the project is abandoned. Biomass will be generated at significant volume along and within the cleared area, sometime left to rot on the forest ground.

The logging roads leave a lasting impact by providing poachers with greater access deeper into the forest. This avenue can continue to be used years after the project has been abandoned, if the roads are not sealed off.

Table 5-2 Potential Impacts During Construction Stage

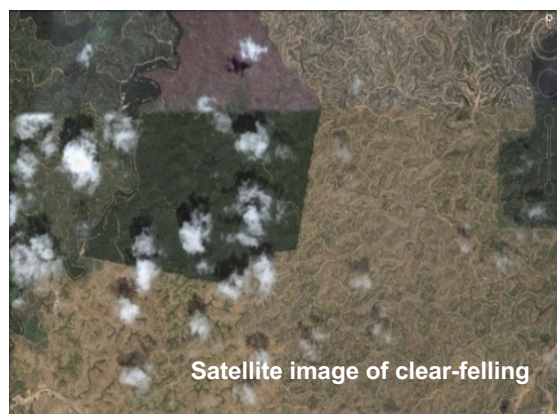
Activity	Potential Impacts
a. Construct roads: <ul style="list-style-type: none"> • Slope cutting • Contouring • Stream crossing • Cross drains • Cut and fills • Waste disposal 	<ul style="list-style-type: none"> • Soil erosion and landslides • Sedimentation of streams • Habitat loss and degradation • Soil compaction • Water pollution • Solid waste • Biomass generation

Activity	Potential Impacts
b. Construct log landings and log yards (matau)	<ul style="list-style-type: none"> • Soil erosion and landslides • Sedimentation of streams • Loss of forest cover and biodiversity • Habitat loss and degradation • Water pollution
c. Establish permanent base camp (kongsi)	<ul style="list-style-type: none"> • Loss of forest cover and biodiversity • Sedimentation • Water pollution (Sewage) • Solid waste generation • Scheduled waste generation • Human-wildlife conflicts
d. Transport supplies and equipment	<ul style="list-style-type: none"> • Air pollution • Noise pollution • Traffic • Safety

Note: The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

5.3.5 Impacts During the Felling Stage

The felling of even a single tree will have impacts on its immediate surroundings – including residual damage to neighbouring trees, and soil erosion when crawler tractors “skid” the logs out to the skid trails (Table 5-3). While selective felling of timber trees in selective harvesting projects can minimise the damage, especially if RIL techniques are used, there will be ecological impacts over the long term. For instance, selective felling (and replanting) focused on economically valuable species alters the natural composition and distribution of forest trees, and consequently the animals associated with the trees.



The presence of workers and contractors living in the timber camp bring about social impacts on the local community. Some workers may hunt wildlife for food or recreation. Pollution problems may arise from timber camps if sewage or waste disposal facilities are not adequate.

Table 5-3 Potential Impacts During Felling (Operations) Stage

Activity.	Potential Impacts
a. Timber felling: <ul style="list-style-type: none"> • Felling • Bucking 	<ul style="list-style-type: none"> • Loss of forest cover and biodiversity • Habitat loss and degradation • Displacement or arboreal species

Activity.	Potential Impacts
<ul style="list-style-type: none"> • Skidding and hauling • Landing • Loading • Waste disposal 	<ul style="list-style-type: none"> • Soil erosion • Sedimentation of streams • Biomass generation
b. Operate base camp	<ul style="list-style-type: none"> • Water pollution (Sewage) • Solid waste • Hunting pressure • Social problems • Human-wildlife conflicts
c. Maintain roads	<ul style="list-style-type: none"> • Sedimentation of streams
d. Transport logs	<ul style="list-style-type: none"> • Traffic • Noise • Safety

Note: The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

5.3.6 Impacts during the Land Clearing Stage

Significant environmental impacts occur during the land clearing stage in the case conversion of forest or development of planted forest. Clear-felling results in the permanent loss of natural forest and biodiversity, and the total displacement of all animals that occupied the site (**Table 5-4**). The remaining forests (within or adjacent to the project site) will also suffer a degree of fragmentation and edge impacts.

Widespread erosion and loss of topsoil will occur, while slope stability is affected when ground vegetation is cleared. Sediment and debris enter the waterways, often totally engulfing the smaller streams where the width of buffers is often too narrow to be effective. On the other hand, fire, which is sometimes used to clear the waste biomass generated from the clearing of hill forest, will release above ground carbon, and cause air pollution.

Table 5-4 Potential Impacts During Land Clearing Stage

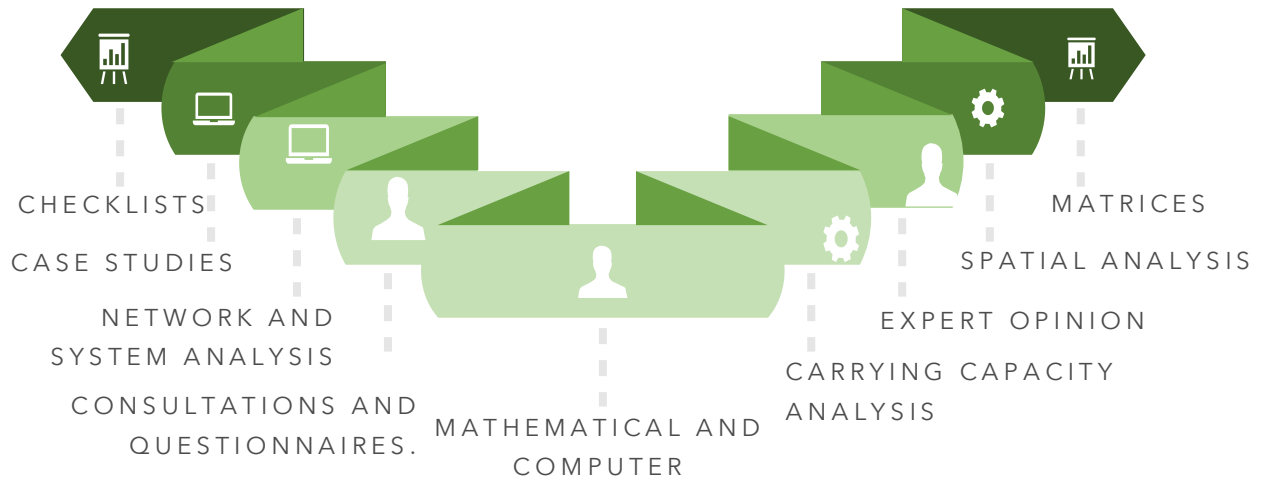
Activity	Potential Impacts
a. Construct roads: <ul style="list-style-type: none"> • Slope cutting • Contouring • Stream crossing • Cross drains • Cut and fill • Waste disposal 	<ul style="list-style-type: none"> • Soil erosion and landslides • Slope stability • Sedimentation of streams • Habitat loss and degradation • Soil compaction • Water pollution • Flooding • Human-wildlife conflicts • Biomass generation

Activity	Potential Impacts
b. Construct log landings and log yards (<i>matau</i>)	<ul style="list-style-type: none"> • Soil erosion and landslides • Sedimentation of streams • Loss of forest cover and biodiversity • Habitat loss and degradation • Water pollution
c. Establish permanent base camp (<i>kongsi</i>)	<ul style="list-style-type: none"> • Loss of forest cover and biodiversity • Sedimentation • Water pollution (Sewage) • Solid waste • Scheduled wastes • Hunting pressure • Social impacts • Health impacts • Human-wildlife conflicts • Traffic
d. Transport supplies and equipment	<ul style="list-style-type: none"> • Air pollution • Noise • Traffic
e. Timber felling	<ul style="list-style-type: none"> • Loss of forest cover and biodiversity • Habitat loss and degradation • Habitat fragmentation • Displacement or wildlife • Human-wildlife conflict • Soil erosion • Sedimentation of streams
f. Transport logs	<ul style="list-style-type: none"> • Traffic • Noise • Safety • Air pollution
g. Clear vegetation	<ul style="list-style-type: none"> • Soil erosion • Sedimentation of streams • Loss of forest cover and biodiversity • Habitat loss and degradation • Water pollution • Flooding • Biomass generation
h. Dispose of waste / debris	<ul style="list-style-type: none"> • Solid waste • Water pollution

Note: The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

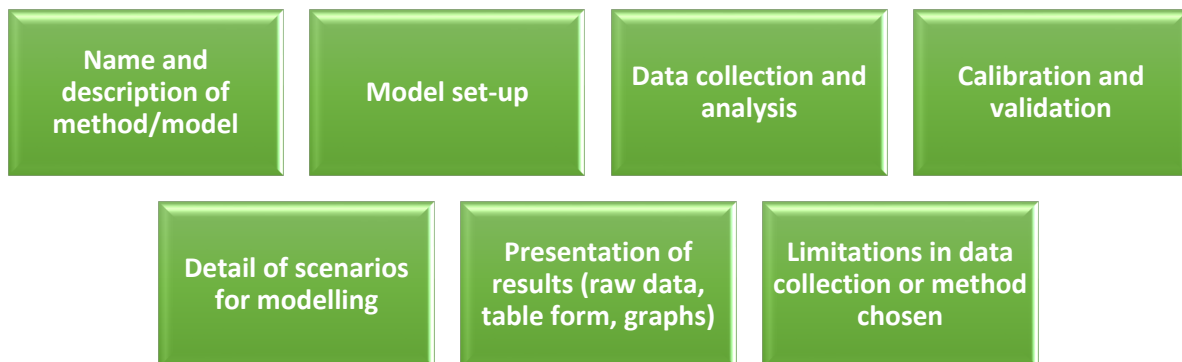
5.4 PREDICTIVE METHODS AND TOOLS

There is a wide range of predictive tools and models for prediction, evaluation and assessment of impacts. Among the methods and tools are:



Simple methodology is preferred, though this depends on the complexity of the impacts. Whichever method is chosen, it must be appropriate to address the problem, taking into consideration the local conditions of the site.

The EIA Report must be scientifically and technically sound, and whenever necessary, quantitative impact prediction on the more significant impacts should be carried out. If computer modelling is carried out, e.g. for water and air quality assessment, flooding etc, the following information is required:



All modelling exercises carried out should capture the impacts under various scenarios, either for short-, mid- to long-term for the worst-case scenario. The modelling studies shall undergo verification, calibration and validation. The outputs of the modelling studies shall be presented in a concise manner and all uncertainties shall be discussed. Technical reports, data analysis and tables and raw data, where necessary, shall be included as appendix in the EIA to support the impact assessment methodology.

Ultimately, the main text for impact assessment in the EIA shall be the predictive results and outputs of studies, which have to be in sufficient technical details to support the assessment. It must also be written in a manner that is easily understood by decision makers and the public.

Whatever methodology used should be stated in the EIA report, and the results of the impact assessment should be presented in a manner that can be understood by the layman, but with sufficient supporting technical details (e.g. technical reports, data analyses and raw data) included in the appendix.

5.4.1 Prediction Of Physio-Chemical Impacts

Some of the tools and methods for assessing physio-chemical impacts are given in **Table 5-5** along with the expected outputs. The Qualified Person should select the most appropriate method(s) to be used for the particular project. While simpler models are often sufficient, more sophisticated models may be required for complex situations.

Modelling exercises should capture the impacts under various scenarios, including short-, mid- to long-term timeframes. The models should undergo verification, calibration and validation, and all uncertainties should be discussed.

Table 5-5 Examples of Prediction Tool and Methods for Physio-Chemical Impacts

Impact	Prediction Method	Output
Soil erosion and sediment yield	<ul style="list-style-type: none"> Revised Universal Soil Loss Equation (RUSLE). Modified Soil Loss Equation (MUSLE). Sediment Delivery Ratio method. Computer models that apply USLE/MUSLE equation. 	<ul style="list-style-type: none"> Soil loss rates and sediment yield. Erosion risk and potential soil loss maps.
Landslide and slope failure	<ul style="list-style-type: none"> Soil investigations. Geological Terrain Mapping (GTM). Risk analysis Site assessment by qualified geotechnical engineer and/or geologist. Engineering design and estimation of Factor of Safety (FOS).. 	<ul style="list-style-type: none"> Identification and mapping of high risk areas to avoid or apply mitigation measures.
Hydrology	<ul style="list-style-type: none"> Hydrological procedures (DID). 	<ul style="list-style-type: none"> Estimation of preconstruction and postconstruction runoff.

Impact	Prediction Method	Output
	<ul style="list-style-type: none"> • Computer models for estimating peak flood, runoff, watershed analysis, flood plain hydraulics, etc. Examples include HEC-HMS, HEC-RAS, FLO- 2D, TUFLOW, EXTRAN and Storm Water Management Model (SWMM). • Hydrological analysis in accordance with Manual Saliran Mesra Alam Edisi-2 (MSMA-2) and approved by DID 	<ul style="list-style-type: none"> • Flood risk map
River Morphology	<ul style="list-style-type: none"> • Prediction of long term changes to the river geometry, dimension and layout. 	<ul style="list-style-type: none"> • Impact of change in river discharge, sediment transport, etc, on river meandering, dimensions, layout and geometry
Water quality	<ul style="list-style-type: none"> • Mathematical models (one, two or three-dimensional) analysis of pollution loads and dispersion in the waterways, such as QUAL2K, MIKE11, etc. • Estimation of BOD loading in the river system. • Simple mass balance models, e.g. Streeter-Phelps Model applied with 1-D or 2-D advective dispersion of plug flow models, e.g. UAL2E. • Operational sewage discharge modelled using OUAL2K or Delft, D or MIKE11. • Dye plume dispersion studies or Advection/Dispersion models for marine water quality. 	<ul style="list-style-type: none"> • Estimation of Total Suspended Solids (TSS) (erosion), Biochemical Oxygen Demand (BOD) and Ammoniacal Nitrogen (AN) (sewage) concentration affecting a stretch of river and downstream areas. • Estimation of pollution load and extent of effect on river quality, river basin and sensitive receptors downstream.
Noise	<ul style="list-style-type: none"> • Mathematical models to assess noise levels for point source or linear sources. • Noise modelling software or Geographic Information System (GIS) acoustic models. • Traffic noise models. 	<ul style="list-style-type: none"> • Quantitative values for noise level at sensitive receptors. • Noise contour map Indicating levels at sensitive areas. • Comparison of computed values to DOE's permissible noise limits.
Biomass	<ul style="list-style-type: none"> • Estimation of the amount of biomass waste generated from site clearing. 	<ul style="list-style-type: none"> • Predicted biomass generation volume

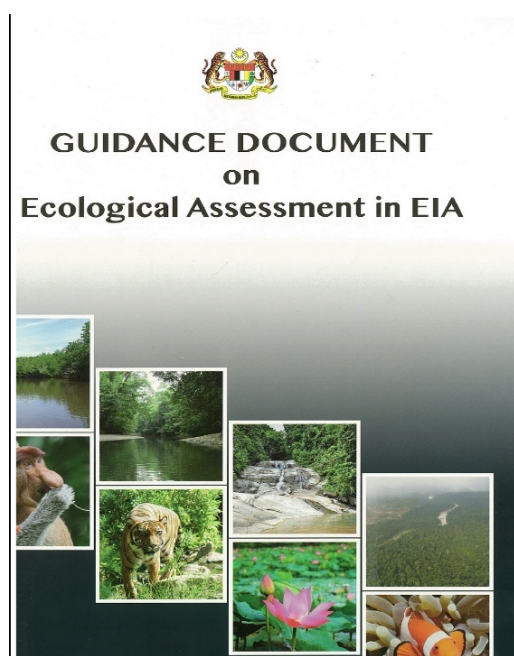
Impact	Prediction Method	Output
	<ul style="list-style-type: none"> • Identification biomass disposal areas 	
Solid Waste	<ul style="list-style-type: none"> • Identification of type and amount solid wastes generation from the project site. • Identification of future spoil disposal areas. 	<ul style="list-style-type: none"> • Predicted solid waste generation.
Scheduled Waste	<ul style="list-style-type: none"> • Identification of potential scheduled wastes generated from the project site. 	<ul style="list-style-type: none"> • Predicted scheduled waste generation
Aesthetics	<ul style="list-style-type: none"> • Visual assess. • Document the scenic and aesthetic value of the area. • 2-D and 3-D Viewshed Analysis. • Economic valuation. 	<ul style="list-style-type: none"> • Before and after scenarios.

Note: The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

5.4.2 Prediction of Ecological Impacts

An analysis of the species lists generated from the surveys will inform if any of the species present are threatened (cross check with IUCN or national Red Lists, where available), endemic (based on scientific literature) or protected by law (for animals, cross check with the relevant schedules in the Wildlife Conservation Act 2010). Refer to the **Guidance Document on Ecological Assessment in EIAs** (DOE, 2012) for impact assessment at species and habitat level including the various prediction and modelling tools available.

Guidance Document on Ecological Assessment in EIA
Publication by DOE Malaysia, 2012



It should be remembered that the ecological assessment should not be focussed merely on developing species lists. but should also identify the habitat elements and ecological processes that support viable populations of each species of interest. For example, particular sites of high biodiversity, structural or spatial elements of the habitat that are necessary for foraging,

breeding, roosting or dispersal, the keystone species, location of mineral salt licks and so forth. This holistic understanding of the ecosystem will provide an insight into how the project will affect the particular species of interest. (**Appendix 6**)

5.4.3 Prediction Of Socio-Economic Impacts

There is range of methods that can be used for socio-economic assessments; however, no specific guidelines are readily available. Socio-economic assessments should be tailored according to the type and size of the affected communities, their level of dependence of forest resources and ecosystem services and the anticipated impacts of the project. In any case, a demographic profile of the community(s) is usually documented, including populations size, age structure and education levels, employment and income, etc.

An economic valuation of the environmental impacts of the project may also need to be undertaken. Consultants and developers are advised to refer to **Guidelines on the Economic Valuation of the Environmental Impacts for EIA Projects** published by DOE in 2008 for details of the assessment methods.

The prediction of wildlife conflict will allow for mitigation measures. Human-elephant conflicts (HEC) may occur if the project area overlaps with elephant migration routes. Economic losses as a result of HEC can be estimated based on existing data from similar sites.

Table 5-6 Examples of Prediction Tool and Methods for Socio-Economic Impacts

Impact	Prediction Method	Output
Socio-economy	<ul style="list-style-type: none"> • Social and economic surveys on affected population. • Perception survey to ascertain acceptance of project. • Social Impact Assessment (SIA). • Cost-benefit assessments 	<ul style="list-style-type: none"> • Socio-economic profiling. • Public opinion. • Stakeholder feedback for EIA including mitigation measures.
Public health	<ul style="list-style-type: none"> • Qualitative/quantitative health risk assessment (HRA) encompassing hazard identification, exposure assessment and risk assessment. 	<ul style="list-style-type: none"> • Potential health impacts to nearby population.
Traffic	<ul style="list-style-type: none"> • Traffic impact assessment including simulation of peak traffic flows under various scenarios and junction analysis, e.t. Signalised and Unsignalised Intersection Design and Research Aid (SIDRA). 	<ul style="list-style-type: none"> • Comparison of traffic scenarios pre- and post-project and need for road improvements.

Note: The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

5.5 CRITERIA AND STANDARDS

The significance of an environmental impact can be gauged by benchmarking the above predictions against relevant standards and criteria, including:



In situations where there are no local standards or limits available, international standards can be adopted based on expert opinion of the Qualified Person. However, the chosen criteria and standards must suit local conditions. Consultation with subject experts and affected local communities is another way to gauge if the impact is within acceptable levels.

Some of the evaluation criteria for various environmental components are listed in **Table 5-7**. The criteria and indicators set out in the MC&I should also be referred to for each component.

5.6 OUTCOMES FROM IMPACT ASSESSMENT

NO IMPACT

This scenario occurs when there are very low to no sensitive receptors in the vicinity of the project to receive the impacts. Examples are communities that live very far away and are only indirectly affected, such as by increases in traffic on the main roads. Another example is when there are terrain constraints such as steep slopes, but the Project Proponent has decided to redesign the layout without affecting these areas

SIGNIFICANT IMPACT

This scenario is based on the predictive results. In the assessment, if the results showed that the project will generate detrimental impacts, then mitigation measures will have to be provided to address the issues. Any residual impacts should also be clearly stated in the EIA

NON-SIGNIFICANT IMPACT

Impacts will inevitably occur in project development, but they may not result in a significant exceedance of the accepted criteria or standards. An example is TSS from erosion and sedimentation. If the TSS emanating from land clearance that abides by standards stipulated for Class II waters of the NWQS, the impact is classified as nonsignificant, with the level of impact abiding by the stipulated criteria and standards

Table 5-7 Standards for Environmental Parameters

Impact	Standards
Erosion and sedimentation	<p><u>Erosion</u></p> <ol style="list-style-type: none"> Guidance Document for Addressing Soil Erosion and Sediment Control Aspects in the EIA Report (DOE) Guidance Document for the Preparation of the Document on LD-P2M2 – Appendix 4 of EGIM 2016 (DOE) Guidelines on LD-P2M2 (DOE) Guidelines for Erosion and Sediment Control in Malaysia (DID) MSMA-2 (DID) <p><u>Sediment basin/silt trap discharge</u></p> <ol style="list-style-type: none"> TSS: 50 mg/L, depending on locality Turbidity: 250 NTU
Water Quality and Pollution Control	<ol style="list-style-type: none"> <u>Ambient water quality</u>: National Water Quality Standards (NWQS) <u>Sewage discharge</u>: Environmental Quality (Sewage) Regulations 2009 <u>Toilets and septic tanks</u>: SPAN approved design and requirements
Flood / Runoff Management	<ol style="list-style-type: none"> MSMA-2 requirements (DID)
Ecology	<ol style="list-style-type: none"> Wildlife Conservation Act 2010 Red list of Mammals for Peninsular Malaysia Version 2.0. (DWNP) Malaysia Plant Red List: Peninsular Malaysian Dipterocarpaceae (FRIM) Guidance Document on Ecological Assessment in EIA (DOE) Red List of threatened species (IUCN) CITES Appendices I, II & III (CITES) Important Bird and Biodiversity Areas (IBAs)(BirdLife International)
Socio-economy	<ol style="list-style-type: none"> FSC guidelines for the implementation of the right to free, prior and informed consent (FSC) Aboriginal Peoples Act 1954, including relevant decisions of the Civil Courts National Heritage Register (National Heritage Department) Preservation of cultural, heritage, historical, and archaeological items and sites of significance SIA requirements in the context of the TCPA 2017
Air Quality	<ol style="list-style-type: none"> Environmental Quality (Clean Air) Regulations 2014 Malaysian Ambient Air Quality Standards (MAAQS)

Impact	Standards
Noise Level and Vibration	<ul style="list-style-type: none"> a. Planning Guidelines for Environmental Noise Limits and Control (DOE). b. Factories and Machinery (Noise Exposure) Regulations 1989.
Land use	<ul style="list-style-type: none"> a. Structure Plans, Local Plans, Special Area Plans. b. ESA Listing under the NPP. c. Local authority requirements.
Traffic	<ul style="list-style-type: none"> a. Acceptable level of service (LOS) for traffic flows. b. Local authority requirement.
Safety and Health	<ul style="list-style-type: none"> a. Occupational Safety and Health Act 1994. b. Factory and Machinery Act 1967. c. Department of Safety and Health (DOSH) requirements. d. International Labour Organisation (ILO) and other guidelines. e. Guidance Document on HIA in EIA (DOE). f. EIA Guidelines for Risk Assessment (DOE).
Solid Waste	<p><u>Scheduled wastes</u></p> <ul style="list-style-type: none"> a. Environmental Quality (Scheduled Wastes) Regulations 2005. <p><u>Other wastes</u></p> <ul style="list-style-type: none"> a. Solid Waste and Public Cleansing Management Act 2007. b. Local authority requirements.

Note: *The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.*



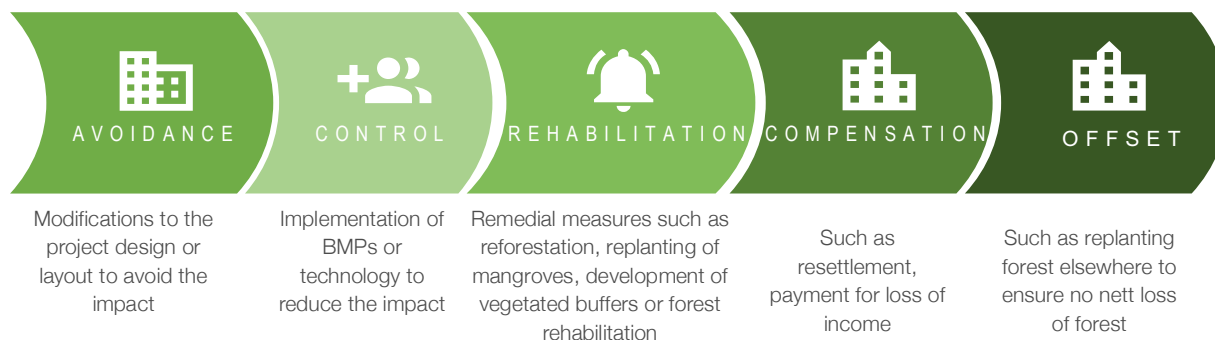
Photo Source: Photo by Mr Dylan Jerri Ong, Mr. Zaharil Dzulkafly

IDENTIFICATION OF MITIGATION MEASURES

CHAPTER 6. IDENTIFICATION OF MITIGATION MEASURES

6.1 ADDRESSING IMPACTS

In general, there are five ways in which an impact can be mitigated:

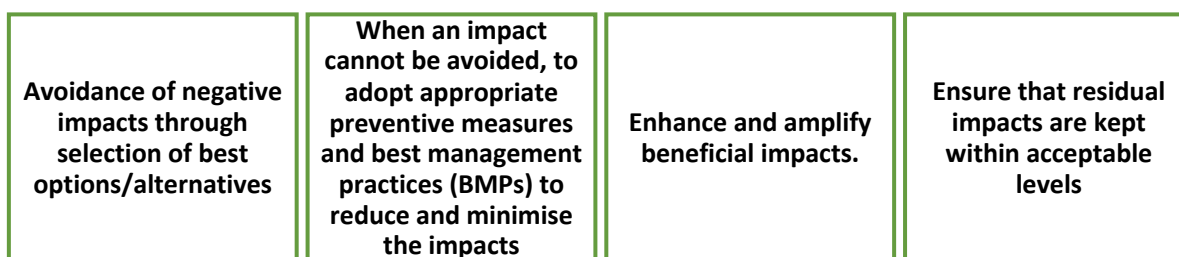


In any case, the Project Proponent should agree and commit to undertake the mitigation measures proposed in the EIA. When cumulative impacts caused by neighbouring developments arise, it may be beneficial to design and coordinate shared mitigation measures amongst the different projects.

6.2 KEY MITIGATION MEASURES

While the most appropriate Pollution Prevention and Mitigating Measures (P2M2) to adopt may vary depending on the nature of the impact and project site, some of the most important P2M2s are outline below. It should be noted that this list is not comprehensive, and other innovative measures should be considered as well.

The implementation of P2M2 is intended to achieve the following:



The Project Proponent and Qualified Person shall recommend alternative measures and/or introduce newer technology whenever these are proven more effective. At the EIA stage, the P2M2 shall be detailed out as best as possible and reported in the EIA Report. The Qualified

Person shall identify and incorporate into the EIA, any additional P2M2 and BMPs required to mitigate significant impacts from the project site.

The key P2M2 that are applicable include Ecological Management, Hydraulics and Hydrodynamics, Erosion and Sediment Management and Water Pollution Control. Other minor mitigation measures that may be required include Air pollution Control, Noise and Vibration Control, Waste Management, Safety and Health, Land Traffic and Visual Aesthetics.

Underpinning principles of P2M2 are to reduce environmental degradation and pollution through management measures best suited to the site conditions & locations to preserve the integrity of the site and to ensure public safety.
Key Approaches:

Extent of P2M2s shall correspond to the degree of significance of impact. Once an impact is identified as significant, P2M2s shall be recommended in the EIA (e.g. as part of the engineering designs for slope reinforcement works, sediment control, etc.). For minor issues, simple management actions will suffice, e.g. water browsing for dust control at site, etc.

Priority shall be given to control at source (e.g. reducing erosion and surface runoff) than to rectify the impacts later on (e.g. maintenance of silt traps and removal of accumulated silt from the drainage system).

Mitigation must be site- and project-specific. The P2M2s need not be complex and costly, but instead should be practical, easy to implement, and effective.

The P2M2 shall include adequate explanations based on the design and function; and supported by diagrams, illustrations, photos and maps. The technical reports and specifications of the P2M2 shall be included as an appendix in the EIA.

The use of new technology is encouraged if it can be proven to be effective in mitigating impacts. The Project Proponent or the Qualified Person is responsible to provide proof and supporting evidence that the proposed technology is tried and tested and capable of addressing the impacts.

P2M2s require regular inspection, maintenance, and rehabilitation. These must be incorporated as part of the environmental management requirements of the project, including the allocation of sufficient budget for such a purpose.

The effectiveness of P2M2s shall be recorded and documented as part of the monitoring and audit programmes (**Chapter 7**).

The Qualified Person shall propose best management practices (BMPs), if deemed necessary.

P2M2 and BMP shall be incorporated early into the overall design of the project and as part of the LD-P2M2 document.

The submission of the EIA and the pledge given by the Project Proponent reflect a commitment to ensure the P2M2s are implemented during all stages of work activities. These efforts shall include, but not limited to, measures, actions, or due diligence in accomplishing the overarching goal of protecting the environment in project implementation.

6.3 MITIGATION MEASURES FOR ECOLOGICAL IMPACTS

Areas within the project site that possess high conservation value such as salt licks, wetlands and riparian zones should be set aside as “**conservation areas**” and exempt from logging or land clearing. To ensure their ecological integrity, it is important that patches of optimum size and shape are set aside, and linked by **wildlife/ecological corridors** to larger forest landscapes.

Riparian zones can be designed to serve as wildlife/ecological corridors, apart from protecting water quality and aquatic habitats. The allocated width of riparian corridors should take into consideration its particular objective(s) and species that it is designed for (See **Box 4**).

Box 4 How wide should riparian corridors be?

Setting aside a network of riparian corridors of sufficient width is an effective mitigation measure, because of the multiple roles that they can serve – as ecological corridors for biodiversity, as buffers to protect water quality and aquatic habitats, as well as to alleviate flooding.

Width is the most important controllable variable determining the effectiveness of riparian buffers in filtering non-point source pollutants. The optimal widths required should be estimated in relation to pollutant loads, topography, climate, hydrology, geology and vegetation cover.

The width required for riparian habitats and corridors is generally much greater than that required for water quality (minimum widths for biodiversity are within the region of 100–400m). While the rule of thumb is simply “the wider the better”, two important aspects to consider are 1) the species that the habitat and/or corridor is designed for, and 2) edge effects.

Contrary to popular belief, the width of riparian corridors should not be based on the width of the river. While the DID Guidelines Guideline for Development Related to Rivers and River Reserves specifies the minimum width of river reserves based on this criteria, the purpose of DID’s river reserves is only to minimise the impact of flooding on property – it is not designed for water quality or biodiversity.

For further details, refer to *Managing Biodiversity in the Riparian Zone*, 2nd Edition (NRE,2010)

Individual trees that play an important role in the ecosystem (such as nesting, food) and those listed as threatened in the IUCN Red List of Malaysian Plant Red List should be left standing, with a sufficient buffer to prevent residual damage.

Phasing of logging / land clearing operations can be designed in such a way that allows wildlife to escape or escape in the direction of suitable habitats, i.e. neighbouring forest. Proper designed logging method is required for minimising impacts on wildlife. Translocation of wildlife to a suitable habitat via a catch and release operation is a more direct option that can be discussed with DWNP and preparation of Wildlife Management Plan will be required. Rescue of rare, endangered or threatened (RTE) plant populations for ex-situ conservation is also an option prior to land clearing.



Logging by helicopter harvesting

A number of important measures should be introduced to prevent poaching. Workers must be made aware of the legal implications for poaching and an informant/reward system may be initiated to encourage reporting of poaching activities. Most importantly, access into the logging concession must be strictly controlled. All gates must be manned, and permanently closed at the end of the concession period.

Offset mechanisms should be considered if the project entails irreversible loss of natural forest due to conversion to other land use. While the most obvious form of offset is to replant trees, the forest loss may also be replaced by reforestation or afforestation a suitable site elsewhere.

6.4 MITIGATION MEASURES FOR PHYSIO-CHEMICAL IMPACTS

When applied to selective logging projects, Reduced Impact Logging (RIL) techniques can help to limit the extent of soil erosion and damage to residual stands.

The amount of skid trails, which are a major source of erosion, should be minimised through optimal planning as well as by using methods such as cable yarding, log fishers, and helicopters, for example. The specifications contained in the **Forest Road Guidelines** (FDPM, 2010) must be adhered to, such as the installation of culverts, side drains and cross drains diversion ditches, sediment basins, silt traps or other facilities.

Land clearing, on the other hand, causes widespread erosion and sedimentation of rivers and streams. To reduce soil erosion, cutting and filling should be minimised and cover crops should be planted on bare surfaces as soon as possible. All operations should cease during the monsoon season. The **Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures** (LD-P2M2) (DOE, 2017) must also be adhered to for all activities that entail land disturbance and erosion. The information to be included is as per the LD-P2M2 Submission Checklist in **Table 6-1** adapted from the EGIM 2016. All submissions must be accompanied by relevant technical drawings and maps.

Other effective and adequate control measures should be considered based on the points /or locations where pollution is anticipated generated and for work activities to be carried out that generates pollutions. Control measures must be installed at all pollution sources, for example proper storage areas for fuel tanks, engine oil and various chemicals, as well as sewage treatment system at timber camps.

Table 6-1 LD-P2M2 Checklist

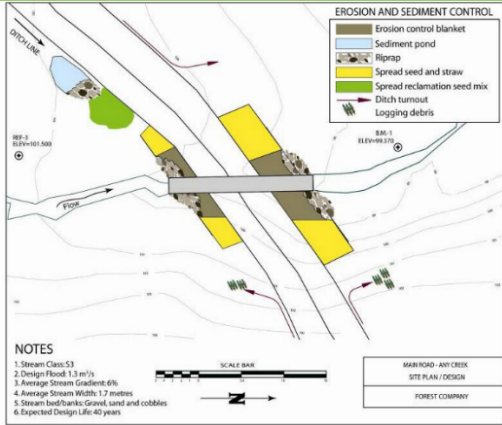
Requirement	Information to be Included
Project Activity And Implementation	<ul style="list-style-type: none"> <input type="checkbox"/> Phasing plan. <input type="checkbox"/> Project implementation schedule. <input type="checkbox"/> Description of construction & forestry activities. <input type="checkbox"/> Construction & operation schedule complete with timeline or charts for P2M2s installations. <input type="checkbox"/> Construction and operation method statements.
Information and Analysis on Project Development	<ul style="list-style-type: none"> <input type="checkbox"/> Selected weather and rainfall data. <input type="checkbox"/> Site runoff velocity and flow rates (pre- and post-development). <input type="checkbox"/> Description of soil and geological characteristics (type, erodibility, hydrologic group, percentage dispersible material, excavation depth, etc.). <input type="checkbox"/> Description of adjacent areas that may be affected by land disturbance & operation activities. <input type="checkbox"/> List of drainage, streams and river onsite as well as receiving streams and rivers. <input type="checkbox"/> List of P2M2s proposed. <input type="checkbox"/> Access roads and project components located outside of project boundary. <input type="checkbox"/> Earthworks cut and fill volume. <input type="checkbox"/> Biomass management. <input type="checkbox"/> Solid waste and domestic waste management. <input type="checkbox"/> Sewage management <input type="checkbox"/> Spill prevention and control plan. <input type="checkbox"/> Hazardous waste management. <input type="checkbox"/> Soil loss prediction (pre, during and post-development) for with and without LD-P2M2 implementation scenarios. <input type="checkbox"/> Calculation of sediment traps/basins and projected runoff flows.
Map of Site Plan with Existing Conditions	<ul style="list-style-type: none"> <input type="checkbox"/> Topographic survey map. <input type="checkbox"/> Geological Terrain Map. <input type="checkbox"/> Erosion risk map. <input type="checkbox"/> Land use map. <input type="checkbox"/> Site development plan map.

Note: All submissions must be accompanied by relevant technical drawings and maps

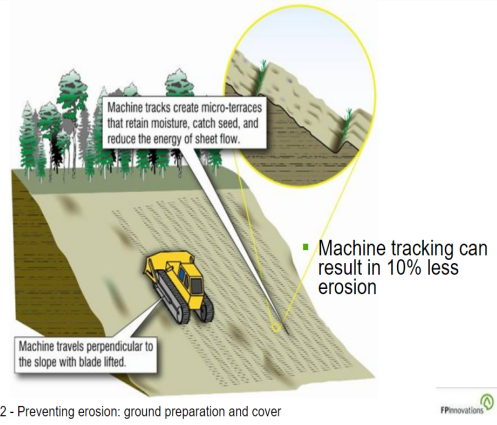
Source: Guidance Document for the Preparation of the Document on LD-P2M2, DOE, 2017.

Examples for erosion and sediment control for forest roads and stream crossings:

Planning: erosion and sediment control

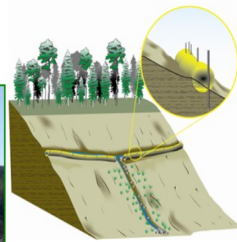


Machine operating techniques



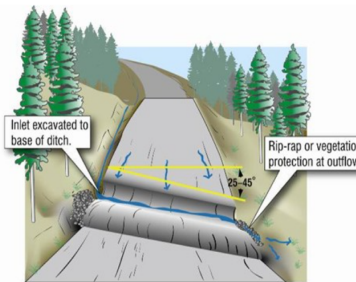
§ 2: Diverting flows & seepage: upland water mgt.

- Upland water can cause severe rills and gullies on exposed slopes.
- Important to identify source areas and incorporate actions in an E&S control plan.



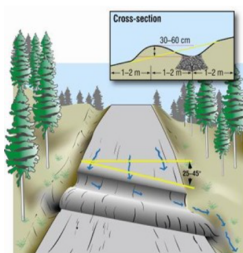
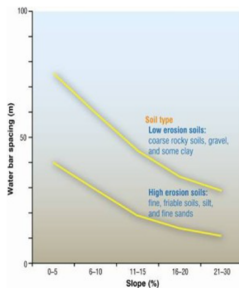
Cross ditch and cross-drain culvert

- Not suitable for main haul roads.
- Spacing correlated to slope, soil type, and terrain.



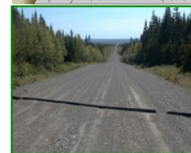
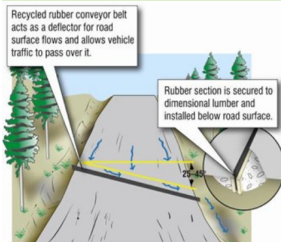
- Locate to allow water to maintain natural flow path.

Waterbars

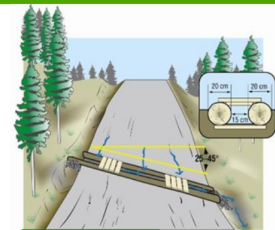


- § 3 - Road surfaces

Deflectors and open-top surface drains



- § 3 - Road surfaces



Source: Erosion And Sediment Control: Handbook Introduction. Clayton Gillies (www.fpinnovations.ca)

6.4.1 Pollution Control Systems

One of the main features of LD-P2M2 is the use of pollution control systems. During construction on slope and hill areas, the concerns are mainly erosion, slope stability, and water pollution. It is judicious to plan and install LD-P2M2s before clearing the land and starting construction.

During the operational phase, top-side development will generate different types of pollutants, mainly from discharges of sullage, sewage, and surface flows. Depending on the scale and volume of such pollutants, a pollution control system plan incorporating appropriate P2M2s is advocated along with specifications of control equipment and technical engineering maintenance works.

The Project Proponent shall engage a Qualified Consultant to prepare the detailed designs of any Pollution Control Systems for the EIA study. The Qualified Consultant must be a professional engineer who holds a current registration certificate issued by the Board of Engineers, and also be a certified Competent Person under Section 49A of the Environmental Quality Act (EQA) 1974.

6.5 MITIGATION MEASURES FOR SOCIO-ECONOMIC IMPACTS

Areas of special importance to local indigenous communities may need to be set aside as conservation areas within the concession. If avoidance is not possible, then comprehensive negotiations to develop an equitable solution based on FPIC (Free, Prior and Informed Consent) principles must be held.

Compensation measures should be developed for impacts that cannot be avoided or reduced. Depending on the impact, such measures may include payments, installation of water treatment systems, provision of employment or alternative sources of income, etc.

As far as possible, the Project Proponent must find ways to ensure that the project will provide some benefits to the local community. This may include for example, maintaining main logging roads that the local community relies on, making it a policy to hire from the local community first, or installing water filters for households (especially if the village water source is compromised by the forestry project).

Care should be taken to minimise nuisance-type impacts of logging operations such as noise, dust and traffic on human settlements located near the project site. This may include wetting roads and vehicle tyres to remove dust, as well as setting strict SOP for operation of vehicles and heavy machinery.



dipterocarp-seed-sprouting
Photo Source: Rainforest Journal (www.rainforestjournal.com)

DEVELOPING OUTLINE OF ENVIRONMENTAL MANAGEMENT PLAN

CHAPTER 7. DEVELOPING OUTLINE OF ENVIRONMENTAL MANAGEMENT PLAN

7.1 INTRODUCTION

The Environmental Management Plan (EMP) is a legal document prepared by the Project Proponent incorporating pollution prevention and mitigation measures (P2M2s) and best management practices (BMPs) stipulated in the Conditions of Approval (COA) by the Department of Environment (DOE).

Key contents of the EMP are formatted as the scope of works in the Bill of Quantities (BQ) for the contractors to bid for project implementation. Other than mitigation measures, the EMP includes the guided self-regulation requirements (GSR), an environmental monitoring plan and an audit programme to assess the effectiveness of the P2M2s implementation.

The EMP is a living document and has to be updated whenever there are major changes to the project design, layout or construction methods that could result in impacts not originally stated in the EMP.

7.2 EMP FRAMEWORK

In the Environmental Impact Assessment (EIA) phase, the project may not have sufficient information of the project work plan to produce a comprehensive EMP. The EMP chapter in the EIA will only be an EMP framework for eventual morphing into a full EMP after the EIA approval stage.

The Project Proponent can submit the detailed EMP concurrently with the EIA Report if there is sufficient information for the EMP. The EMP can later be updated to incorporate the requirements of the COAs.

Standard COAs are:

- (a) Monthly monitoring of the water quality of the receiving water body by an Accredited Laboratory or any other frequency determined by the DOE.
- (b) Monthly monitoring of TSS and turbidity at the inlets and outlets of sediment structures or any other frequency as determined by DOE.
- (c) In situ monitoring of TSS and turbidity after a rain event.
- (d) Monthly or Quarterly monitoring of air, noise, and vibration qualities depending on sensitivity of receptor.
- (e) Planning, construction, and maintenance of LD-P2M2 on site.

-
- (f) P2M2 notification and implementation.
 - (g) Identification for the need of competent people to carry out a specific task on site.
 - (h) Description and implementation details of EMT.
 - (i) Clear documentation on any transfer of ownership or proponent of approved EIA.
 - (j) Allocation and reporting of sufficient resources to carry out project activities on site.
 - (k) Details of the temporary/permanent abandonment/project closure plan for all phases.
 - (l) Implementation of 5S concept in good housekeeping practices.
 - (m) Any other green initiatives undertaken for site development activities
-

The format for the EMP shall be based on the requirements stated within the Environmental Impact Assessment Guideline in Malaysia (EGIM) (DOE, 2016), and shall contain details from the Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) Document and the proposed monitoring and audit programmes.

7.3 SELF-REGULATION (SR)

Environmental Mainstreaming (EM) is a strategic tool that allows for the cultural evolution of embracing the environmental agenda at all levels of the organizational structure of the Project Proponent. With the understanding of EM, all key personnel in an Organization can play a role in safeguarding our environment in an effective manner. As such, the elements as espoused in the EMT provide a Guide in achieving the ultimate Goal of Environmental Excellence in an Organization.

Details on the SR for the project shall be incorporated into the EMP framework as required in the Environmental Mainstreaming Directive issued by DOE. This shall cover the seven environmental mainstreaming tools:

ENVIRONMENTAL POLICY	This refers to the Project Proponent’s Environmental Policy and the conveyance of such policies throughout the organisation.
ENVIRONMENTAL BUDGETING	The Project Proponent has to provide an environmental budget for environmental-related commitments, e.g., personnel, P2M2, monitoring, auditing, training, remedial and rehabilitation works. If budget is not available during the EIA stage, the Project Proponent shall provide a pledge to allocate adequate budget for the project during the post- EIA stage to ensure compliance. The budget requirements shall also form part of the BQ for the contractors at the contractual stage.

ENVIRONMENTAL MONITORING COMMITTEE

The Project Proponent is required to identify and setup an Environmental Regulatory Compliance Monitoring Committee (ERCMC) at the policy level to be headed by the Chief Executive Officer (CEO) or organisation chairman.

At the working level, the Environmental Performance Monitoring Committee (EPMC) is chaired by a senior officer of the organisation.

For projects involving multiple contractual work packages by many contractors, the respective main contractors are required to have their respective Environmental Management Teams (EMTs) comprising at least a minimum number of personnel such as an Environmental Manager (EM) and an Environmental Officer (EO).

The organisation chart along with the roles and responsibilities of all relevant parties in charge of environmental management for the project should be included in the EMP framework.

ENVIRONMENTAL FACILITY

The EMP shall provide the range of environmental facilities in the project, such as wastewater treatment system (WWTS), sewage treatment systems (STS), air pollution control system (APCS), BMPs, P2M2 structures, and associated supporting utilities and facilities that need operational and maintenance support.

ENVIRONMENTAL COMPETENCY

Training requirements are needed to ensure competency for environmental management for all relevant site personnel. The proposed training programme and requirements shall be included in the EMP framework.

ENVIRONMENTAL REPORTING AND COMMUNICATIONS

The EMP framework shall contain a reporting time schedule for various submissions during the post-EIA phase, which shall include:

- Environmental Management Plan.
- Monitoring Reporting.
- Audit Reporting.

The mode of communication between the ERCMC, EPMC, and the respective EMTs must be clearly defined. Lines of communication between the Project Proponent, the EPMC, and the relevant stakeholders must be clearly defined. This is not only limited to project site management, but also in engagements with affected communities and the general public.

(i) Record Keeping

A documented procedure on record keeping for the activities, operations and maintenance of the P2M2 must be established to ensure all aspects of the compliance and

performance of the Organisation in EM is properly and easily referred to. Records must be made available to DOE as the Regulator, whenever requested.

(ii) Data Analysis & Interpretation

The Competent Person has to analyse and interpret the data from the IM, CM and PM in a suitable format for presentation the ERCMC and EPMC for any decision-making purpose. Data from any upset conditions must also be analysed so that records can be kept for continuous improvement purposes.

**ENVIRONMENTAL
TRANSPARENCY**

Company status, environmental policy, compliance, and achievement can be displayed on the company website or billboard located on the project site boundary or the entrance to the company's premises to improve public confidence. An annual environmental sustainability report has to be prepared and submitted to DOE.

7.4 MONITORING AND AUDIT PROGRAMMES

The environmental monitoring and audit programmes are important components of the EMP. Monitoring and audit shall be implemented during the post-EIA stage

7.4.1 Monitoring Category

Environmental monitoring can be categorised into three main categories:

Performance Monitoring (PM)

- Relates to monitoring of the performance treatment systems such as IETS, STS.
- This shall be undertaken by a Competent Person with expertise in the related treatment system.

Compliance Monitoring (CM)

- Relates to the monitoring of P2M2s within the site and their performance. Samplings and measurements are usually taken either of the ambient parameters (water, air and noise) or of the discharges (sewage, sediment basin).
- This shall be carried out by a Qualified Person such as the EO and/or the Qualified Person.

Impact Monitoring (IM)

- Impact monitoring may only be required in cases where there is a possibility that the impacts may still affect receptors outside of the project boundary despite implementation of P2M2s on-site.
- This task must be carried out by a Qualified Person (Environmental Consultant)

7.4.2 Monitoring Methodology

The extent of monitoring shall be determined by the scale of the project and of the predicted impacts. Monitoring covers both within the project site and outside of its boundary where the impacts are perceived to affect sensitive receptors.

Details of the monitoring programme are decided upon by the Qualified Person and Environmental Consultants, and to be approved by DOE before implementation. The monitoring locations, frequencies, parameters to monitor, recommended limits, instrumentation and personnel requirements have to be identified in the EMP.

The monitoring programme shall be tailored for all types of forestry projects involving slope and hill areas as well as other environmentally sensitive areas, based on site conditions and types of development. (refer **Table 7-1** for the Proposed Environmental Monitoring Parameters)

7.4.3 Environmental Audit

Environmental auditing is a post-EIA evaluation process to determine the effectiveness and performance of the mitigation measures put in by the Project Proponent to comply with the COAs. Audit requirements are guided by the Environmental Audit Guidance Manual by DOE. The audit must be undertaken by an independent third party as a DOE registered auditor.

The typical audit process involves:

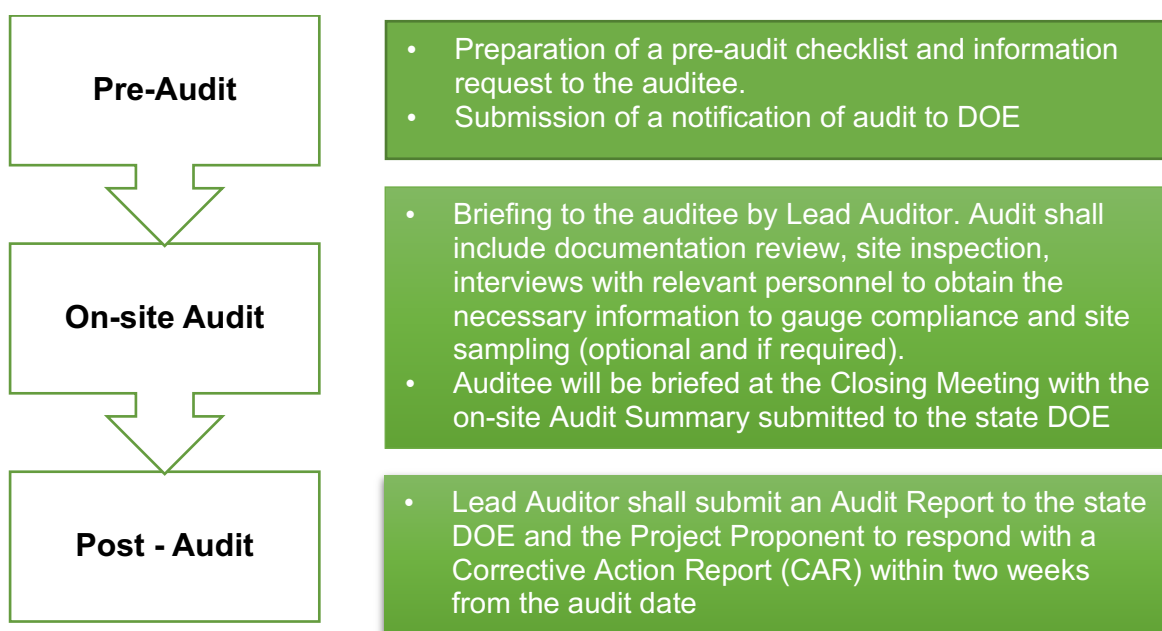


Table 7-1 Proposed Environmental Monitoring Parameters

Aspect	Phase	Methods	Parameters	Frequency
Water Quality	Construction	Grab sampling or other accepted standard methods (upstream and downstream of waterways)	<u>Ambient:</u> Relevant parameters of the National Water Quality Standards (NWQS)	Monthly
		In situ sampling at the final discharge point	Sediment basin/silt trap discharge: TSS and turbidity	After every heavy rain event (12.5 mm measured by the rain gauge)
		Grab sampling before and after silt curtain	Silt curtain: TSS	Weekly throughout active works areas.
	Operational	Sampling at the final discharge outlet of the sewage treatment plant (STP).	<u>Sewage:</u> Environmental Quality (Sewage) Regulations 2009	Monthly
		Grab sampling or other accepted standard methods (upstream and downstream of waterways)	<u>Ambient:</u> Relevant parameters of the National Water Quality Standards (NWQS)	Monthly
		Grab sampling before and after silt curtain	Silt curtain: TSS	Weekly throughout active works areas.
Air Quality	Construction	Measurement using an approved air sampler (boundary and nearest receptors)	<u>Ambient:</u> Relevant parameters of Malaysian Ambient Air Quality Standards (MAAQS)	Quarterly
Noise Level	Construction	Measurement using approved noise meter (boundary and nearest receptors)	<u>Ambient:</u> The Planning Guidelines for Environmental Noise Limits and Control, 2nd Edition, DOE,	Quarterly

Aspect	Phase	Methods	Parameters	Frequency
Vibration	Construction	Measurement by approved vibration measuring meter	2007 and The Planning Guidelines for Vibration Limits and Control in the Environment, 2nd Edition, DOE, 2007	During piling and blasting work
Ecological Monitoring¹	Construction and	Site surveys and inventory	Flora and fauna surveys. .	Half-yearly
	Operational	Site surveys and inventory	Flora and fauna surveys. .	Yearly post-construction

Note:

- (i) *The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the monitoring requirements based on the COA or as required by DOE.*
- (ii) ¹ *If required by the relevant GAs: Dept of Forestry, DWNP, etc., consistent with Forest Management Plan*



8

PREPARING THE EIA REPORT AND REVIEW PROCESS

CHAPTER 8. PREPARING THE EIA REPORT AND REVIEW PROCESS

8.1 INTRODUCTION

This Chapter provides the format and procedures for an Environmental Impact Assessment (EIA) Report to be submitted to the Department of Environment (DOE) for approval, after the completion of all other necessary studies and requirements.

8.2 EIA REPORT

The Environmental Impact Assessment Guideline in Malaysia (EGIM) (DOE, 2016) provides the specifications and format for EIA reporting under Section 4.6 and Appendix 9.

8.2.1 EIA Report Format

The specifications and format for EIA reports are described in Section 4.6 and Appendix 9 of the (EGIM) (DOE, 2016).

The EIA report shall typically include the following contents:

- a) Declaration from the Project Proponent and Qualified Person in the format detailed in Appendix 9 of EGIM (DOE, 2016). The declaration must be printed in the respective company's letterhead and attached to the EIA.

- ❖ The Project Proponent shall provide a pledge that he has understood the studies and recommendations in the EIA and shall carry out all P2M2 recommended in the EIA.
- ❖ The Qualified Person shall provide a pledge that the EIA Study is carried out professionally and that the recommendations for P2M2 to be implemented will be able to mitigate against the identified environmental impacts to an acceptable level to ensure minimal degradation of the environment.

- b) Executive Summary of the EIA Report in Bahasa Malaysia and English.
- c) Brief introduction to the project, Project Proponent (address, key person and contact information), Environmental Firm (address, key person and contact information) and EIA Team Members (name, academic qualifications, areas of study, signature).
- d) Review of the policy, regulatory and legal requirements for the project (refer to **Chapter 2** for details).

- e) Terms of Reference (TOR) for the EIA Study as endorsed by the DOE (refer to **Chapter 3** for details). Endorsement letter from DOE to be attached as an appendix to the EIA report.
- f) Statement of need for the project. Supporting arguments for the project to justify its needs and necessity shall be included as part of the report. Key points to include can include the examples in **Box 5**.

Box 5
Key Points for Statement of Need

Among key supporting arguments for a project can include, but are not limited to the following:

- i. Fulfilment of or adherence to the goals of national and state policies and plans.
- ii. Provision of essential services to the community or stakeholders, e.g. better housing, improved amenities, etc.
- iii. Improving the existing environmental conditions of an area.
- iv. Social and economic benefits to society.
- v. Bringing new green and sustainable technology that will benefit the community and country.

- g) Deliberation on the alternatives and project options.
- h) Detailed description of the project including site information, concept and breakdown of major components, material and manpower requirements, project activities and time schedule (**Table 8-1**)
- i) Description of the baseline conditions (physical, chemical, ecology and socio-economy) within the Zone of Study (ZOS) that may be impacted by the project (see **Chapter 4**).
- j) Assessment of the significant impacts (positive and negative), prediction of the extent and effects on nearby sensitive receptors and proposal of pollution prevention and mitigation measures (P2M2s) to minimise or enhance these impacts and any potential residual impacts (see **Chapters 5 and 6**).
- k) Details of public consultation and engagement as part of EIA requirements.
- l) Environmental Management Plan (EMP) incorporating the Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2), monitoring and audit programme (see **Chapter 7**).
- m) Appendices containing technical studies, supporting documentation, results of analysis, list of references, etc to be included.

Table 8-1 Recommended Project Description in EIA Report

Project Details
<ul style="list-style-type: none"> i. Project title. ii. Name and contact details of the Project Proponent (contact person, address, telephone number, e-mail address). iii. Name of registered EIA Consulting Firm (EIA Team Leader, address, telephone number, e-mail address). iv. Location of project (coordinates, lot no, district, etc.). v. Relevant map showing project location and accessibility.
Location
<ul style="list-style-type: none"> i. General site plan including Zone of Study (ZOS) (5-km radius from project boundary and/or 1-km corridor [0.5 km on either side along the Right of Way (ROW) for linear projects]). ii. Project boundary and layout including boundary coordinates. iii. Description of location in relation to identifiable landmarks (e.g. city centres, main roads, towns, etc.).
Project Component and Design Details
<ul style="list-style-type: none"> i. Project details (land area, buffer requirements, lots and land status). ii. Project concept. iii. Project components. iv. Technology use. v. Examples of similar project type and scale. <p>Note: The above shall be supported with technical drawings, illustration and diagrams.</p>
Project Activities
<ul style="list-style-type: none"> i. Method statement to be provided for major project activities during preconstruction, construction and operational stages. ii. Manpower requirements. iii. Resource requirements (e.g. soil and aggregate sources, spoil disposal area, etc.).
Infrastructure, Utilities and Amenities Requirement
<p>Details of the estimated demand for:</p> <ul style="list-style-type: none"> i. Water supply. ii. Electricity. iii. Sewerage. iv. Telecommunications. v. Transport system. vi. Waste management.
Project Implementation Schedule
<ul style="list-style-type: none"> i. The estimated timeline for various phases of project implementation from planning, to construction and operational phases. ii. Details of each stages of implementation.

Note: The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

n) **Executive Summary**

The Executive Summary provides a concise brief of the findings and recommendations from the EIA. It shall be written in non-technical language, both in Bahasa Malaysia and English, presenting the following information:

Title of the project.
Name and contact details of the Project Proponent.
Name and contact details of EIA Team members.
Location of the project site.
Relevant maps showing the location of the project and sensitive receptors and the extent of ZOS.
Alternatives considered.
A tabulation of significant impacts and proposed P2M2s (format as detailed in EGIM).
Description of the monitoring and audit programme [Performance Monitoring (PM), Compliance Monitoring (CM), and/or Impact Monitoring (IM)].
Conclusion to the Study.

Soft copy of the Executive Summary (PDF format) shall be submitted to DOE along with soft copy of the full EIA report.

o) **Data Deliverables**

The Project Proponent shall make available all relevant data collected during the EIA study (in raw or processed format) along with the EIA report, when requested by DOE. Examples of such data include – sampling results (certificates and raw data), modelling databases, baseline data (surveys, hydrographic data and climate data), metadata files, etc. This data shall also be provided to the relevant government agencies (GAs) upon request.

p) **Conclusion to the EIA Report**

The Qualified Person shall provide a pledge that the EIA Study is carried out professionally and that the recommendations for P2M2 to be implemented will be able to mitigate against the identified environmental impacts to an acceptable level to ensure minimal degradation of the environment.

The Project Proponent shall also provide a pledge that he has understood the studies and recommendations in the EIA and shall carry out all P2M2 recommended in the EIA.

8.3 STAKEHOLDER ENGAGEMENT AND PUBLIC DISPLAY

The stakeholder engagement process shall be ongoing since the project planning stage (see **Section 3.3** for details). In the EIA phase, stakeholder engagement is essential for the Project Proponent to brief the stakeholders about the project and the potential impacts, and to obtain their feedback on the suggested mitigation measures.

For a Second Schedule EIA, there are additional mandatory requirements prior to the approval of the EIA report. These include:

Public Briefing	For EIAs under the Second Schedule, public engagement is mandatory. It can take many forms, but the common one is through a public briefing with the stakeholders within the Zone of Impact (ZOI). In the briefing, the Project Proponent and the EIA Team will present the project brief followed by a questions and answers (Q&A) session. All discussions will be recorded and reported in the EIA.
Public Display and Review of EIA Report	Similarly, after the EIA is submitted, there is a public review period of 30 days, by which the public will officially be requested to submit their responses and comments in writing to the DOE. Notification of the public display is published in two local newspapers (consecutively 3 days).
Display Locations	The EIA will be displayed at selected locations (DOE office, public libraries, and local authority offices) where the public can view the documents easily. The Project Proponent and Qualified Person can hold discussions with DOE to propose suitable locations for display.
Online Display	The EIA report will be uploaded to the DOE website for the duration of the review period.
Additional Engagements	Although it is only mandatory for the Second Schedule EIA for official public engagement, all comments are useful in the EIA study. The Project Proponent is encouraged to carry out stakeholder engagements voluntarily even for the First Schedule EIA.
Documentation	The public participation process shall be properly documented and reported in the EIA. The report shall contain the following: <ul style="list-style-type: none"> • Details of the programme (dates, venue, itinerary). • Attendance list of participants. • Copies of survey forms. • Brief summary of findings from the event, e.g. reports, minutes of meeting, list of questions and responses, photograph of event. • Video or voice recordings (optional and only as reference).

The report shall form part of the appendix in the EIA, and the issues brought up and responses from the Project Proponent, must be clearly stated and discussed in the EIA report.

Box 5 provides some examples of good practices when engaging with the stakeholder.

Box 5
Good Practices in Stakeholder Engagement

- i. **Stakeholder Identification:** Selection of stakeholders should be inclusive, encompassing and without bias. The focus should be those that are directly affected by the project within the zone of impact (ZOI) but may include any other relevant stakeholders.
- ii. **Transparency:** The stakeholder engagement process shall be carried out in a transparent and inclusive manner, with ample opportunities for the relevant stakeholders to obtain information, provide comments and submit feedbacks.
- iii. **Information Disclosure:** Information provided should be adequate and relevant to allow for stakeholders to understand the project and make informed decisions. Sufficient time should be allowed for information assessment and feedback.
- iv. **Communication Tools:** Communication can be in many forms – reports, formal meetings, focal group discussions (FGDs), information sheets, surveys, websites, etc. The method should best be suited to the target audience, with information communicated in simple to understand language and none too technical.
- v. **Notification:** All stakeholders should be informed and notified appropriately of any meetings or discussions to be held and given ample time to make arrangements. All efforts shall be made to ensure representative attendance by the stakeholders.
- vi. **Selection of Venue:** Meeting locations should be in a venue close by, convenient and accessible to the stakeholders. This would ideally be near the project site. For public display of EIA reports, these shall be at locations open and accessible to the public, e.g. public library, police station, local authority office, etc.
- vii. **Documentation:** All engagements shall be properly documented and reported in the EIA. Actions taken to address the issues brought up shall be clearly spelled out and mitigation measures incorporated as part of the project design. It is a good practice to follow up with the stakeholders on actions taken.
- viii. **Accountability and Continuity:** All comments and feedbacks from stakeholders shall be assessed and reviewed objectively. Actions shall be taken by the Project Proponent to address legitimate concerns. Stakeholder management should be throughout the project lifespan. Provision of platforms for stakeholders' engagement post-EIA is a best practice that should be adopted.

8.4 EIA REPORT SUBMISSION AND REVIEW PROCESS

A comparison of the EIA submission and review process for First and Second Schedule EIA is presented in **Table 8-2**.

Table 8-2 Comparison of Submission and Review Process for First and Second Schedule EIA

Components	First-Schedule Activity	Second Schedule Activity
Report Submission	Submission to DOE State Office	Submit to DOE HQ
No. of Reports	Minimum 3 hardcopies + 1 softcopy to State DOE 1 hard copy + 1 soft copy to DOE HQ	Minimum 3 copies + 1 soft copy
No. of corrected EIA (if needed)	3 hard copies + 1 soft copy	3 hardcopies + 1 softcopies
Review Timeline	25 working days (5 weeks)	60 working days (12 weeks)
Public Participation	Required	Required
Public Display	Not required	Required
Web Display	Required Submit a soft copy of the EIA report to the DOE State Office.	Required Submit a soft copy of the EIA report to the DOE State Office.
Advertisement	Not required	Advertise in two major newspapers or main media streams.

Source: Adapted from EGIM, DOE, 2016, and DOE Notice JAS.600-1/1/7Jilid 2(22), 7 December 2020, JAS.100-1/4/1 Jilid 3(22), 3 August 2020, Notis Kepada Jururunding EIA 2/2020, 25 August 2020

The EIA report submission shall be in line with the steps and procedures outlined in the EGIM (DOE, 2016). The EIA Report Quality Self-Assessment Tool (RQSAT) in the EGIM (DOE, 2016) can be used by the Project Proponent and the Qualified Person to assist in conducting self-check of the quality of the EIA prior to submission to the DOE, to avoid rejection.

An EIA Checklist is appended in **Appendix E**, which is required to be filled in by the EIA preparer and included in the EIA report. If the EIA is approved, DOE will issue the Conditions of Approval (COA) to the Project Proponent. If the EIA is rejected, a fresh EIA can be submitted. Details in **Box 6**. This marks the end of the EIA process.

**Box 6:
Outcomes from EIA Review Process**

The outcomes of the EIATRC meetings are:

- i. Approval of the EIA Report, provided that the report meets with the requirements of Section 34A (2C) of the Environmental Quality Act (EQA) 1974.
- ii. Rejection of the EIA Report, where the report does not meet the requirements of Section 34A (2C) of the EQA 1974.



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<http://mandalay.pl/malezja/taman-negara>

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GLOSSARY

Glossary

Biodiversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Bucking	The process of cutting a felled and de-limbed tree into logs.
Ecological corridor	A narrow, linear (or near-linear) piece of habitat that connects two larger patches of habitat that are surrounded by a non-habitat matrix, thereby facilitating movements of animals and dispersal of plants and other organisms.
Ecosystem	A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.
Ecosystem services	The beneficial goods and services provided by healthy ecosystems. Includes provisioning, regulating, supporting and cultural services
Endemic	Native and restricted to a specific geographic area, usually referring to plants or animals.
Ex-situ conservation	The maintenance of species outside their natural habitats in facilities such as arboreta, zoological gardens, seed gene banks.
Forest degradation	Changes within the forest that negatively affect the structure or function of the forest and thereby lower its capacity to supply products and/or services.
Forest Harvesting Plan	An operating plan prescribing the manner and method for the taking of trees from a particular forest, or part thereof to secure the orderly taking, renewal and conservation of trees in accordance with the principle of sustained yield.
Forest Plantation	An area planted with trees or forest vegetation, either from local or exotic species, using the open planting methods that are not less than 50 hectares. Can be located within or outside Permanent Reserved Forest (PRF).
Habitat	The place or type of site where an organism or population naturally occurs.

Invasive species	A species that is not native to a specific location (introduced species), and that has a tendency to spread to a degree believed to cause damage to the environment, human economy or human health
Pre-Felling Inventory	An inventory of trees prior to logging, based on systematic sampling with nested fixed area plots, to determine the minimum cutting limits.
Post-Felling Inventory	An inventory of trees after logging, based on systematic sampling with nested fixed area plots, to determine the appropriate silvicultural treatments.
Reduced Impact Logging (RIL)	The careful planning and control of timber harvesting operations to minimize the environmental impact and waste that result from conventional forms of logging. RIL is implemented through codes of practice and guidelines that include activities such as improved forest management planning, road construction, tree felling, bucking and log yarding.
Silviculture	The art and science of the development and maintaining the forests stand based on the silvics knowledge applications. It is the theoretical and practical exercise of controlling the composition, structural and growth of the forests
Skidding	Terrain transport in which logs are dragged to the landing, rather than suspended in the air or carried on a vehicle.
Stakeholder	Individuals or institutions (public and private) interested and involved in a process or related activities
Sustainable Forest Management	A concept according to which the full range of social, economic and environmental values inherent forests are managed and sustained

BASIC DEFINITION OF FOREST TYPES

The tropical rain forests of Peninsular Malaysia have been broadly classified based on ecology, vegetation and terrain by several pioneer workers like Symington (1943), Wyatt-Smith (1953) and others.

Symington (1943) stated that the *Dipterocarpaceae* is the predominant family of timber trees in the tropical lowland evergreen rainforest of the Malay Peninsula. He classified the Dipterocarps ecologically into the lowland dipterocarp forests (includes all well drained primary forests on the plains, undulating land and foothills up to about 1,000 feet altitude); hill dipterocarp forests (for inland ranges the elevation limits are approximately 1,000 to 2,500 feet but locally along coastal ranges or isolated mountains the forests can develop upon ridges almost at sea level); and the upper dipterocarp forests (altitudinal limits being approximately from 2,500 to 4,000 feet altitude on inland ranges but can be found at lower altitudes). Above the upper dipterocarp forests are the montane oaks (3,500 – 5,000 feet) and the montane ericaceous forests which are generally devoid or above the normal range of dipterocarps. The other forest types occurring are mangrove swamp forests, peat swamp forests, beach forests, riparian fringes and heath forests.

Wyatt-Smith (1963) also included the dipterocarp forests into the lowland evergreen rain forests which are typically of three storeys or layers of trees. Wyatt-Smith (1963) reported that the lowland dipterocarp forests comprise the bulk of the commercially important forests and the upper or emergent storeys are about 100 to 150 feet in height. The hill dipterocarp forest differ from the lowland dipterocarp forests mainly in shift or change to the floristic composition of the dominant species in the upper and middle (main) tree storeys. The upper dipterocarp forests are found in the higher hills (between 2,500 – 4,000 feet in altitude) and the species are generally very different from those in the hill dipterocarp forests. These are the main economic forests besides the peat swamp forests and mangrove swamp forests.

The present generalised or broad classification used by the Forestry Department and others evolved from those of Symington, Wyatt-Smith and other pioneer workers. The Forestry Department in the early seventies classified the forests into two categories for the Land Capability Classification (LCC) i.e. Class IV and Class V. Class V is land possessing little or no forest development potential but suitable for development as protective reserves for conservation, water catchment, recreation, productive forest plantations and others.

Forest types of Peninsular Malaysia can be generalised and grouped into the following categories, namely:

Hill Forest	Hill Forest, also sometimes referred to as Inland Forest or Mixed Dipterocarp Forest (lowland and hill dipterocarps) or Hutan Darat in Bahasa Malaysia is the dominant forest type in Peninsular Malaysia. It is the main source of merchantable timber. The term Dipterocarp Forest is commonly used to denote this category because it forms the main tropical forest tree type and 90 percent of the commercial timber produced is from the trees of the Dipterocarpaceae family.
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Examples of timber trees species commonly found in such forest are *Shorea leprosola* (meranti tembaga), *Dryobalanops aromatica* (kapur), *Anisoptera* (mersawa), and *Dyera constulata* (jelutong).

Peat Swamp Forest

Peat Swamp Forest or Hutan Paya Gambut which includes peat and mixed freshwater swamps is found occurring in low lying coastal plains with a high water table and reaching inland along the lower reaches of major river systems. The main timber producing families of the Lowland Dipterocarp Forests are represented but the number of species of each is small.

Example of timber tree species found commonly in such forest are *Gonystylus bancanus* (ramin), *Shorea albida* (alan), and *Dactyloctenium aegyptium* (jangkang).

Mangrove Swamp Forest

Mangrove Swamp Forest also known as Mangrove Forest or Hutan Paya Laut in Bahasa Malaysia are littoral plant formations in the tidal and estuarine sheltered coastlines extending inland from mudflats and where saline waters begin. They derive their form and nurture from both terrestrial and marine influences. The vegetation is simple in structure, 20-80 feet in height, depending on the community, with a comparatively even and unbroken canopy, very poor- under storey layer which is even frequently absent and poor in species.

The extent and limits of these forests change due to accretion on the seaward side by the deposition of mud and subsequent growth by pioneer species and a reduction on the seaward side by erosion caused by various factors and on the landward side from a change of vegetation type caused by the raising and improved drainage of the land surface for agriculture etc. and as a consequence reduced inundation by seawater.

Examples of species are *Rhizophora* (bakau), *Bruguiera*, and *Sonnerita*.

Plantation Forest

Plantation Forest or Ladang Hutan in Bahasa Malaysia is man made plantation of certain species of trees capable of yielding high volume of wood per unit area in a shorter period of time for commercial purposes. Examples are *Pinus* spp, *Araucaria* spp., *Acacia mangium* and *Tectona grandis* (teak).

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APPENDICES

Appendix 1: Generalised Pathway for Planning Sustainable Harvesting Projects

STAGE	ACTION	BY WHOM
Project Identification	Reconnaissance Survey	Project Proponent (PP)
	Consultation with DOE / Forest Dept. (FD)	PP
Pre-Feasibility & Feasibility	Identification of site(s) areas	Project Proponent
	Screening for site selection	PP & EIA Consultant
	Scoping of EIA	PP, EIA Consultant & DOE
	Preparation of TOR & Approval by DOE	PP, EIA Consultant & DOE
	Harvesting / Operations Plan	Project Consultant appointed by PP
	Selection of site / area	PP
	EIA Study	EIA Consultant
	Submission of EIA to DOE for approval	PP
	Application to Approval Authority for project approval (State Forest Dept.)	PP
	DOE & State Forest Dept. sends EIA and harvesting plan submission, respectively, to various public sector agencies for comments	DOE (for EIA)
	Comments compiled, and recommendations made.	DOE & FD
	Decision on EIA	DOE
	PP informed of EIA approval / conditions	DOE
	Key EIA Issues (if necessary)	EIA Consultant
	Recommendation made to Approval Authority	FD
	Decision of project	Approval Authority
PP informed of project approval	Approval Authority	
Implementation	Detailed layout plan and trees marked for harvesting including direction of felling	PP
	Type of harvesting machines / vehicles	PP
	Harvesting camp and landings for timber	PP
	Construction of roads, drainage, bridge	PP
	Operations and Safety Measures	PP
	Environmentally Monitoring Auditing (EM&A) / Reporting	PP/DOE/Consultant
	Post-Harvesting	Decommissioning and removal of all machines, vehicles, logs, waste and debris
Ongoing EM&A (as necessary)		PP/DOE/Consultant

Appendix 2: Generalised Pathway for Planning Land Conversion Projects

STAGE	ACTION	BY WHOM
Project Identification	<input type="checkbox"/> Reconnaissance Survey	Project Proponent (PP)
	<input type="checkbox"/> Consultation with DOE / Forest Dept. (FD) / Land Office (LO)	PP
Pre-Feasibility & Feasibility	<input type="checkbox"/> Identification of site(s) areas	Project Proponent
	<input type="checkbox"/> Screening for site selection	PP & EIA Consultant
	<input type="checkbox"/> Scoping of EIA	PP, EIA Consultant & DOE
	<input type="checkbox"/> Land Conversion Plan(s)	Project Consultant appointed by PP
	<input type="checkbox"/> Selection of site / area	PP
	<input type="checkbox"/> EIA Study	EIA Consultant
	<input type="checkbox"/> Submission of EIA to DOE for approval	PP
	<input type="checkbox"/> Application to Approval Authority for project approval (State Forest Dept.)	PP
	<input type="checkbox"/> DOE, FD / Land Office sends EIA and harvesting plan submission, respectively, to various public sector agencies for comments.	DOE (for EIA) LO(for land conversion)/FD
	<input type="checkbox"/> Comments compiled, and recommendations made.	DOE & LO
	<input type="checkbox"/> Decision on EIA	DOE
	<input type="checkbox"/> PP informed of EIA approval / conditions	DOE
	<input type="checkbox"/> Key EIA Issues (if necessary)	EIA Consultant
	<input type="checkbox"/> Recommendation made to Approval Authority	FD
	<input type="checkbox"/> Decision of project	Approval Authority
<input type="checkbox"/> PP informed of project approval	Approval Authority	
Detailed design / planning	<input type="checkbox"/> Detailed layout plan / engineering design	PP
	<input type="checkbox"/> Submission to LO, FD and various agencies (e.g. JKR, JPS, DOE, Fisheries, Agriculture, etc.) for approval.	PP
	<input type="checkbox"/> Approval of detailed layout by referred agencies	Individual agencies referred to
Implementation	<input type="checkbox"/> Land clearing, land preparation / construction	PP
	<input type="checkbox"/> Operation	PP
	<input type="checkbox"/> Environmentally Monitoring and Auditing (EM&A) / Reporting	PP/DOE/Consultant
Post-Harvesting	<input type="checkbox"/> Decommissioning	PP
	<input type="checkbox"/> Ongoing EM&A (as necessary)	PP/DOE/Consultant
	<input type="checkbox"/> Post-closure Landuse Plan	PP

Appendix 3: Impact Assessment Matrix For Forest Harvesting

KEY

1. Potential significant impact, design solution identified.
2. Adverse impact, but insufficient information.
3. Residual & significant adverse impact.
4. Significant environmental enhancement.
5. Potentially significant cumulative impact.

		PROJECT ACTIVITIES																								
		Inventory			Road Construction				Felling Operation					Post-Felling												
		Enumeration	Access roads, tracks	Camp site	Rentis cutting	Slope cutting	Contouring	Stream crossing	Cross drain	Cut and Fill	Waste disposal	Felling	Bucking	Skidding	Landing	Log transport/hauling	Solid waste disposal	Chemical disposal	Base camps	Pos-F inventory	Silviculture	Enroachment	Reforestation			
ENVIRONMENTAL COMPONENTS	SOIL	Surface Erosion																								
		Landslip																								
		Slope stability																								
		Soil compaction																								
	Soil fertility																									
	HYDROLOGY	Water yield																								
		Dry season flow																								
		Stormflow/Flood response																								
	WATER QUALITY	Sediment load																								
		Turbidity																								
		Physical quality																								
		Chemical quality																								
	DRAINAGE	Biological quality																								
		Channel morphology																								
	GROUNDWATER	Sedimentation																								
		Drainage pattern																								
		Water Table Recharge																								
	ATMOSPHERE	Groundwater Quality																								
		Aquifer Characteristics																								
		Existing Uses																								
		Local climate																								
	LANDUSE	Regional Climate																								
		Air pollution (dust, smoke, etc.)																								
	SPECIES AND POPULATION	Adjacent Land Uses																								
		Downstream Land Uses																								
		Vegetation																								
Birds																										
Mammals																										
Reptiles/Amphibians																										
HABITATS	Invertebrates																									
	Fish																									
	Other aquatic life																									
	Primary forest																									
	High altitude forest																									
SILVICULTURE	Rare or residual forest																									
	Seedbank collection																									
	Aquatic Habitat																									
HEALTH AND SAFETY	Sustainability																									
	Regeneration potential																									
SOCIAL AND ECONOMICAL	Restocking																									
	Domestic water supply																									
	Physical safety																									
AESTHETIC AND CULTURAL	Human settlement																									
	Cultivation areas																									
	Employment																									
	Wilderness																									
	Visual quality																									
	Cultural, historic, burial site																									

Appendix 5: List of Invasive Species

No	Type	Common Name	Scientific Name/ Causal Organism
1	PLANT	Alligator Weed	<i>Alternanthera philoxeroides</i>
2	PLANT	Barnyard Grass	<i>Echinochloa crus-galli</i>
3	INSECT	Beet Armyworm	<i>Spodoptera Exigua</i>
4	PLANT	Bitter Vine	<i>Mikania Micrantha</i>
5	BACTERIA	Blood Disease of Banana (BDB)	<i>Blood disease bacterium (Ralstonia solanacearum species complex Phylotype IV)</i>
6	FUNGUS	Bud Rot Disease of Oil Palm	<i>Phytophthora palmivora</i>
7	VIROID	Cadang Cadang Disease	<i>Coconut Cadang-cadang Viroid (CCCVd)</i>
8	FUNGUS	Ceratocystis Wilt Disease	<i>Ceratocystis fimbriata (syn: C. manginecans) and C. acaciivora</i>
9	FUNGUS	Citrus Greening Disease	<i>Candidatus Liberobacter Asiaticum</i>
10	FUNGUS	Cocoa Pod Borer	<i>Conopormopha Cramerella</i>
11	VIRUS	Cocoa Swollen Shoot Virus	<i>Cocoa Swollen Shoot Virus (CSSV)</i>
12	FUNGUS	Diamondback Moth	<i>Plutella Xylostella</i>
13	FUNGUS	Frosty Pod Rot of Cocoa	<i>Moniliophthora roreri</i>
14	INSECT	Golden Apple Snail & Black Apple Snail	<i>Pomacea Canaliculata & Pomacea Insularus</i>
15	PLANT	Ithgrass	<i>Rottoboellia Cochinchinensis</i>
16	PLANT	Kariba Weed	<i>Salvinia Molesta</i>
17	INSECT	Khapra Beetle	<i>Trogoderma granarium</i>
18	PLANT	Leaf Miners	<i>Chromatomyia Horticola and Liriomyza Huidobrensis</i>
19	BACTERIA	Lethal Yellowing Disease of Coconut	<i>Candidatus Phytoplasma palmae (16SrIV)</i>
20	BACTERIA	Moko Disease	<i>Ralstonia solanacearum species complex Phylotype II</i>
21	BACTERIA	Papaya Dieback	<i>Erwinia papayae, E. mallotivora</i>
22	VIRUS	Papaya Ringspot Virus	<i>Papaya ringspot virus (PRSV-P)</i>
23	PLANT	Parthenium Weed	<i>Parthenium Hysterophorus</i>
24	INSECT	Red Palm Weevil (RPW)	<i>Rhynchophorus ferrugineus</i>

No	Type	Common Name	Scientific Name/ Causal Organism
25	NEMATODE	Red Ring Disease of Palm	<i>Bursaphelenchus cocophilus</i> (≡ <i>Rhadinaphelenchus cocophilus</i>)
26	PLANT	Siam Weed	<i>Chromolaena Odorata</i>
27	FUNGUS	South American Leaf Blight	<i>Microcyclus ulei</i> (≡ <i>Pseudocercospora ulei</i>)
28	INSECT	South American Palm Weevil	<i>Rhynchophorus palmarum</i>
29	PROTOZOA	Sudden Wilt Disease of Oil Palm	<i>Phytophthora staheli</i>
30	FUNGUS	Vascular Wilt Disease of Oil Palm	<i>Fusarium oxysporum f. sp elaeidis</i>
31	VIRUS	Virus Disease of Honeybees	-
32	PLANT	Water Hyacinth	<i>Echhornnia Crassipes</i>
33	INSECT	West Indian Cane Weevil/ Silky Cane Weevil	<i>Metamasius hemipterus</i>
34	PLANT	Elephant Thorn	<i>Mimosa Pigra</i>
35	PLANT	Yellow Acacia	<i>Acacia Auriculaeformis</i>
36	PLANT	Broad-leaved Acacia	<i>Acacia Mangium</i>
37	PLANT	Lantana	<i>Lantana Camara</i>

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List of Invasive Species in Malaysia

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
1	Acacia confusa	formosa acacia (English) formosa koa (English) ianangi (English) small Philippine acacia (English)	Philippines; China; Taiwan	Indonesia; Malaysia	For ornamental purposes (local): Spread through ornamental plantings; Forestry (local): Spread through forestry.
2	Acanthaster planci	coral-eating starfish coral-feeding starfish crown-of-thorns-starfish giant thorny starfish	Mauritius; West coast of America	Thailand; Philippines; Malaysia; Indonesia	
3	Acanthophora spicifera	red alga (English) spiny alga (English-Hawaii) spiny seaweed (English)	Florida; Caribbean	Indonesia; Myanmar; Malaysia; Philippines; Singapore; Viet Nam	
4	Achatina fulica	giant African land snail giant African snail (English)	East Africa	Indonesia; Malaysia; Philippines; Singapore; Thailand; Viet Nam	Introduction pathways to new locations for agricultural, horticultural, and other commercial purposes by unintentional transport of snails and eggs in shipping containers (Thiengo et al. 2007). Unintentional transport in aircrafts, on military vehicles, in sea freight, in pet and aquarium trade, on floating vegetation/debris (Thiengo and Cowie, pers. obs., in Thiengo et al. 2006). Dispersal for ornamental purposes or ignorant possession: Snails may be inadvertently transported with personal belongings, for landscape/fauna "improvement". Achatina fulica has often been deliberately introduced as a human food resource, and in some cases as an animal food resource (Thiengo et al. 2007). Escapes and purposeful releases for the live food trade have contributed to the establishment of A. fulica in new areas of Asia (Raut & Barker 2002). Further, translocation happens in nursery trade.

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
					Other: Targeting risk industries such as nurseries, farmers markets, vehicle depots is important to prevent long distance spread of the snail. Smuggling: <i>Achatina fulica</i> may be smuggled for use as food, medicine or ornamental use. Transportation of habitat material (local): Movement of plants, soil, garden rubbish, building materials, vehicles and equipment should be inspected to contain the snail in a localized area
5	<i>Aedes aegypti</i>	yellow fever mosquito	Africa	Indonesia; Cambodia; Lao PDR; Myanmar; Malaysia; Philippines; Singapore; Thailand; Viet Nam	
6	<i>Ageratum conyzoides</i>	Billy goat weed (English) blue Ageratum (English) blue flowered groundsel (English) blue top (English) white weed (English)	Central America and the Caribbean	Viet Nam; Thailand; Singapore; Philippines; Malaysia; Cambodia; Indonesia; Brunei Darussalam	
7	<i>Albizia lebbek</i>	Indian siris	India; Australia; Cambodia; Indonesia; Lao PDR; Myanmar; Philippines; Thailand	Malaysia; Viet Nam	Strong winds are the main agent of seed dispersal, when intact pods can be carried for considerable distances (Lowry et al., 1994). Some seed passes through the intestinal tract of cattle but not that of smaller ruminants, which also aids dissemination (Lowry et al. 1998).
8	<i>Angiopteris evecta</i>	giant fern (English) king's fern (English) mule's foot (English) mule's-foot fern (English) oriental vessel fern (English)	Polynesia; Melanesia; Micronesia; Australia; New Guinea	Malaysia; Thailand	
9	<i>Anoplolepis gracilipes</i>	crazy ant (English); long-legged ant (English); yellow crazy ant (English)	Africa; Cambodia; Myanmar; Philippines; Singapore; Thailand;	Brunei Darussalam; Indonesia; Malaysia	Long distance transportation: in produce or habitat material in packing material, timber, soil, goods, packaging and pallets in aircrafts, road vehicles,

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
			Viet Nam		military machineries, boats and sea cargo. Deliberate introduction for biological control of plant pests on coconut, coffee and cacao plantations. Local dispersal methods: Anoplolepis gracilipes has been known to successfully colonize a variety of agricultural systems, including cinnamon, citrus and coffee crops and coconut plantations (Haines and Haines 1978, Van Der Goot 1916, in Holway et al. 2002; O'Dowd et al. 1999). Additional spreading mechanisms through translocation in packaging material, timber, produce, soil and plants per boat. Natural dispersal by colonization though it rarely or never disperse via winged female reproductive forms but instead relies on colony "budding" for colony dispersal. The rate of spread is lower than that of colonies able to disperse via flight. Species that reproduce and disperse solely by budding, depend to a greater extent on human-mediated dispersal instead of natural dispersal for the colonization of distant locations. However, <i>A. gracilipes</i> spreads about 37 to 402 meters per year in the Seychelles, which is relatively high (Holway et al. 2002). On Christmas Island, an infestation of yellow crazy ants expanded 1100m in one year, according to one survey. This represents greater than a ten-fold increase in area and an average spread of about three meters per day (O'Dowd et al. 1999)
10	<i>Aphis spiraeicola</i>	Spirea aphid	North America; Lao PDR; Philippines; Singapore; Thailand; Viet Nam	Brunei Darussalam; Indonesia; Malaysia	<i>A. spiraeicola</i> is mainly spread via the flight of winged forms. These can be carried considerable distances in weather systems before colonizing new host plants. Aphids can also be carried on fruits and ornamental plants to new areas, where they may establish on host crops
11	<i>Aristichthys nobilis</i>	bighead carp	China	Brunei Darussalam; Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar;	Aquaculture; Escape from confinement/ garden escape

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
				Philippines; Singapore; Thailand; Viet Nam	
12	Artemia	brine shrimp	China; India; Iran; Iraq; Israel; Japan; Kazakhstan; Korea, Republic of; Kuwait; Mongolia; Pakistan; Saudi Arabia; Sri Lanka; Syria; Taiwan; Turkey; Turkmenistan; United Arab Emirates; Uzbekistan; Africa; North America; Central America and Caribbean; South America; Europe; Australia	Indonesia; Malaysia; Myanmar; Philippines; Thailand; Viet Nam	Aquaculture
13	Asclepias curassavica	bloodflower	Central America and Caribbean; South America	Malaysia; Philippines; Singapore; Thailand	A. curassavica is dependent on seeds for dispersal, and seeds are easily germinated. Natural dispersal at the local scale is by wind, and seeds are each topped with a fluffy white coma to assist in wind dispersal. Due to the long-term and widespread naturalization of A. curassavica, little information regarding anthropogenic-mediated dispersal is available. Considering the popularity of A. curassavica as an ornamental plant, it is likely that national and international movement and dispersal is due to predominantly intentional introductions for horticultural purposes and use as a garden plant. However, it is also possible that accidental introductions have occurred, and GRIN (USDA-ARS, 2013) lists A. curassavica as a potential seed contaminant
14	Axonopus fissifolius	common carpetgrass	Argentina; Mexico; Caribbean	Indonesia; Malaysia; Myanmar; Philippines; Singapore	Natural Dispersal: Natural dispersal is achieved mainly by wind and water movement, especially flood irrigation (Henskens, 1997); Vector Transmission: Seeds are readily dispersed by cattle

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No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
					and sheep, whether externally, or after having been ingested. Survival of seeds after ingestion is higher for <i>A. fissifolius</i> than for many other pasture species (Jones et al., 1991; Gardener et al., 1993); Accidental Introduction: Accidental introduction could occur as a result of the contamination of seed lots of other pasture grasses, or in hay, on farm vehicles etc.; Deliberate introduction continues to be a significant risk as it is widely used as a turf or pasture grass and readily available from many sources
15	<i>Bidens pilosa</i>	black fellows (English) black jack (English) broom stick (English) broom stuff (English)	Antigua and Barbuda; Argentina; Australia; Barbados; Belize; Bolivia; Brazil; Chile; Coasta Rica; Columbia; Cuba; Dominica; Dominican Republic; Ecuador; El Salvador; French Guiana; Guadeloupe; Guatemala; Guyana; Haiti; Honduras; Jamaica; Martinique; Mexico	Thailand; Viet Nam; Malaysia; Philippines; Indonesia; Cambodia	
16	<i>Brontispa longissima</i>	coconut hispid beetle coconut hispine beetle coconut leaf beetle coconut leaf hispine beetle palm leaf beetle	Indonesia; Papua New Guinea	Cambodia; Lao PDR; Myanmar; Malaysia; Philippines; Singapore; Thailand; Viet Nam	
17	<i>Buddleja davidii</i>	butterfly bush	China	Malaysia	Natural Dispersal (Non-Biotic): The release of <i>B. davidii</i> seeds takes place in early spring (northern hemisphere) or late autumn (southern hemisphere), during dry periods when capsules open (Miller, 1984). Miller (1984) reported that 95% of the seeds fall outside of a 10 metre radius, whereas Ream

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					<p>(2006) determined dispersal distances of up to 14 metres depending on structure of the habitat. The maximum dispersal distance by wind has not been determined. <i>B. davidii</i> seeds are also reported to be water-dispersed, especially along sea coasts, flood plains and riparian corridors (Miller, 1984; Webb et al., 1988; Brown, 1990), where they can be washed downstream and establish new populations (ISSG, 2009); Accidental Introduction: Automobiles and trains disperse <i>B. davidii</i> seeds physically (Blacker, 2000; von der Lippe and Kowarik, 2007); Intentional Introduction: <i>B. davidii</i> was introduced to Europe and North America as an ornamental and since that time, various breeding programmes have continued to develop <i>B. davidii</i> hybrids and cultivars. Gardens are a leading source of spreading, naturalized <i>B. davidii</i> populations (Ream, 2006). Currently, <i>B. davidii</i> is widely cultivated and an extremely popular garden plant of economic value to the horticultural industry (Turnbull, 2004; Wilson et al., 2004a). Due to its popularity, the horticultural trade has been recognized as one of the main dispersal pathways for this and other plant invasions (Dehnen-Schmutz et al., 2007). Nevertheless, production nurseries continue to contribute to the spread of <i>B. davidii</i> by serving as satellites that subsequently compound the number of seeds that are dispersed beyond gardens (Ream, 2006).</p>
18	<i>Cabomba caroliniana</i>	Carolina fanwort Carolina water-shield Fanwort fish-grass Washington-grass Washington-plant	Brazil; Paraguay; Uruguay; Argentina	Malaysia	

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No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
19	<i>Carassius auratus</i>	goldfish	Central Asia; China; Japan	Viet Nam; Thailand; Singapore; Philippines; Malaysia; Indonesia	
20	<i>Cardamine flexuosa</i>	wavy bittercress (English) wavy-leaved bittercress (English) wood bittercress (English) woodland bittercress (English)	Europe	Viet Nam; Thailand; Philippines; Malaysia; Indonesia; Lao PDR; Myanmar	
21	<i>Cecropia peltata</i>	pop-a-gun (English), snakewood tree (English) trumpet tree (English), trumpet wood (English)	Belize; Colombia; Costa Rica; Guatemala; Guyana; Honduras; Jamaica; Mexico; Panama; Nicaragua; Suriname; Trinidad and Tobago; Venezuela	Malaysia	It was introduced for ornamental purposes. Long-distance dispersal is also done by bats and birds eating large quantities of its succulent fruits and are the main seed disperser. In some locations fruits are consumed during the day, mainly by monkeys, and at night by bats and arboreal mammals (Bingelli, 1999)
22	<i>Chamaecrista nictitans</i>	sensitive partridge pea	USA	Indonesia; Malaysia; Singapore	Natural Dispersal (Non-Biotic): Seeds are likely to be dispersed through force and gravity when seed pods open (PIER, 2013); they are not adapted for wind or water dispersal; Vector Transmission: Seeds are not adapted for attachment, and fruits are not eaten by animals (PIER, 2013); Accidental Introduction: There is potential for <i>C. nictitans</i> to be introduced as a contaminant of soil, debris, or garden waste (Space et al., 2004); Intentional Introduction: <i>C. nictitans</i> could be introduced to new areas as a soil-stabilising plant, and for cut-and-carry forage (Hacker et al., 2001). It has also been shown to enhance pest management in longan (<i>Dimocarpus longan</i>) orchards, by maintaining natural enemies of pest species (Zhan et al., 2005), and might possibly be introduced for that reason. It is known to have been planted experimentally in China for these purposes.

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
23	<i>Cherax quadricarinatus</i>	redclaw crayfish	Australia; Papua New Guinea	Indonesia; Malaysia; Philippines; Singapore; Thailand	Aquaculture; Fisheries; Hunting/angling/sport/racing; Live food/feed trade; Pet/aquarium trade; Research
24	<i>Chromolaena odorata</i>	bitter bush (English) chromolaena (English); jack in the bush (English) Siam weed (English) triffid weed (English)	Tropical America	Indonesia; Cambodia; Lao PDR; Myanmar; Malaysia; Philippines; Singapore; Thailand; Viet Nam	
25	<i>Clerodendrum chinense</i>	Chinese glory bower	China; Vietnam	Indonesia; Malaysia; Singapore; Thailand	<i>C. chinense</i> is primarily dispersed by root suckers. These root suckers can grow rapidly and when they find suitable environmental conditions they develop and establish new trees. Seeds and fruits are rarely produced (Liogier, 1995); Medicinal use: Use in traditional Chinese medicine; Ornamental purposes: Common in gardens
26	<i>Clidemia hirta</i>	soap bush (English)	Central America; South America	Singapore; Malaysia; Indonesia	
27	<i>Columba livia</i>	feral pigeon (English) feral rock pigeon (English) pigeon (English) rock pigeon (English)	Europe; Western Asia; Northern Africa; Viet Nam; Lao PDR; Myanmar	Brunei Darussalam; Indonesia; Cambodia; Malaysia; Singapore; Thailand	
28	<i>Commelina benghalensis</i>	Benghal dayflower (English-United States) bias-bias (Pampangan) blue commelina (English-United States) dayflower (English-United States) hairy wandering-Jew (English-Australia)	Asia and the Pacific; Djibouti; Ethiopia; Somalia; Kenya; Tanzania; Uganda; Cameroon; Congo; Rwanda; Benin; Cote D'Ivoire; Gambia; Ghana; Guinea; Nigeria	Viet Nam; Malaysia	
29	<i>Conyza sumatrensis</i>	tall fleabane	South America	Indonesia; Malaysia; Philippines	Natural Dispersal (Non-Biotic): <i>C. sumatrensis</i> is principally a wind-dispersed species; it has light seed accompanied by a pappus which aids flight; Vector Transmission: No information is available on the

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					possibility of spread by animals, but if it occurs, it is likely to be of only minor significance in comparison to wind dispersal; Agricultural Practices: Mowing along roadsides, especially during seed production, is also likely to increase spread. Also, late tillage or other practices at such inappropriate times will also facilitate seed dispersal; Accidental Introduction: Seed of several Conyza species now widely present as weeds outside of their native ranges were probably introduced to most of their introduced ranges accidentally as contaminants in cotton, cereals or forage grains/seed. Also a weed in nurseries, Conyza spp. may be spread as seed present in the soil in pots or other planting containers that accompany nursery stock, either as ornamentals or for establishing forest plantations (see the datasheets on C. bonariensis and C. canadensis). The spread of Conyza spp., along with numerous other weeds in central European forests, was thought to have been assisted by seeds in tree containers, and thus, presence in soil must be considered as a potential pathway
30	Corvus splendens	Indian crow (Asia) Indian house-crow (English)	India; Nepal; Bhutan; Pakistan; Afghanistan; Iran; Bangladesh; Thailand	Singapore; Malaysia; Indonesia	
31	Crassocephalum crepidioides	redflower ragleaf	Africa	Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	
32	Crassostrea gigas	Pacific oyster	Japan	Malaysia; Philippines	
33	Ctenopharyngodon idella	gardd carp (English) grass carp (English)	China; Russian Federation	Brunei Darussalam; Cambodia; Indonesia; Lao	

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				PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	
34	<i>Cuscuta campestris</i>	field dodder	North America; Caribbean	Indonesia; Malaysia; Philippines	<i>C. campestris</i> commonly occurs as a contaminant of crop seed, especially lucerne, red clover and niger seed (<i>Guizotia abyssinica</i>) which have similarly sized seeds. As seeds do not shatter from the capsules, they are harvested with the crop and are then difficult to separate. Contamination of crop seed with any <i>Cuscuta</i> species can result in preclusion from importation into countries with quarantine regulations. Holm et al. (1997) indicate that 25 countries have declared <i>Cuscuta</i> spp. as noxious, and that the movement of <i>Cuscuta</i> -infested material is prohibited in every single state of the USA; Agriculture; Aid; Cut flower trade; Flooding/ other natural disaster; Forage; Horticulture; Nursery trade; Research
35	<i>Cynodon dactylon</i>	Australian couch (English), Bahama grass (English), balama grass (English) common bermuda grass, couch grass (English), devil grass, devil's grass (English)	Europe	Cambodia; Indonesia; Malaysia; Philippines; Singapore; Thailand; Viet Nam	
36	<i>Cyperus rotundus</i>	purple nutsedge	Eurasia	Cambodia; Indonesia; Malaysia; Philippines; Singapore; Thailand; Viet Nam	
37	<i>Cyprinus carpio</i>	common carp	Europe	Brunei Darussalam; Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	It has been introduced as food source, for angling and ornamental purposes.

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38	<i>Dactyloctenium aegyptium</i>	crowfoot grass	Belize; Costa Rica; El Salvador; Guatemala; Honduras; Nicaragua; Argentina; Bolivia; Brazil; Guyana; Paraguay; Peru; Suriname; Uruguay; Venezuela	Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	Natural dispersal: This grass is a small-seeded annual. Dispersal is likely to be in water run-off and by seed-eating insects, birds and mammals; Agricultural practices: Tillage for land preparation spreads seed of <i>D. aegyptium</i> locally in an infested field. Seed may also be carried in soil on tractors and implements from site to site.
39	<i>Delonix regia</i>	flamboyant	Madagascar	Brunei Darussalam; Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Vietnam	Natural Dispersal (Non-Biotic): Pods can be spread by floodwaters (PIER, 2009); Vector Transmission (Biotic): Mice and small rodents in a forest in Mexico were important agents for removing the fruits and seeds of plants including <i>D. regia</i> . Mice appear to selectively remove and hoard fruits and seeds according to their energy and nutritional content and the presence of secondary metabolites, and from high-density food patches and preferred habitats (Briones-Salas et al., 2006); Intentional Introduction: The exceptionally showy red and golden-yellow flowers make this an immediately popular ornamental tree species, one of many from Madagascar, and as such it was very widely introduced.
40	<i>Dichrostachys cinerea</i>	sickle bush	Afghanistan; China; Iraq; Israel; Kuwait; Oman; Pakistan; Qatar; Saudi Arabia; Sri Lanka; United Arab Emirates; Algeria; Cameroon; Djibouti; Eritrea; Ethiopia; Ghana; Kenya; Libya; Madagascar; Malawi; Nigeria;	Brunei Darussalam; Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Thailand; Viet Nam	Natural Dispersal (Non-Biotic): Pods can be spread by floodwaters (PIER, 2009); Vector Transmission (Biotic): Mice and small rodents in a forest in Mexico were important agents for removing the fruits and seeds of plants including <i>D. regia</i> . Mice appear to selectively remove and hoard fruits and seeds according to their energy and nutritional content and the presence of secondary metabolites, and from high-density food patches and preferred habitats (Briones-Salas et al., 2006); Intentional Introduction:

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			Réunion; Somalia; South Africa; Sudan; Swaziland; Tanzania; Togo; Tunisia; Uganda; Western Sahara; Zambia; Brazil; Papua New Guinea		The exceptionally showy red and golden-yellow flowers make this an immediately popular ornamental tree species, one of many from Madagascar, and as such it was very widely introduced
41	<i>Digitaria sanguinalis</i>	large crabgrass	Europe	Brunei Darussalam; Indonesia; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	Plant Trade
42	<i>Eichhornia crassipes</i>	water hyacinth (English)	Brazil	Brunei Darussalam; Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	<p>Eichhornia crassipes was introduced for ornamental purposes as due to its attractive purple flower it is a favourite amongst ornamental pond and botanical garden enthusiasts. As a result humans have spread it widely and due to its fast growth rate it now flourishes in all continents but Europe (Lindsey and Hirt 1999, in Williams Undated). In the 1950s and 1960s, water hyacinth was distributed widely into almost all provinces in China for animal food. After artificial transplanting and mass rearing and breeding, water hyacinth was distributed to further areas in the 1970s (Jianqing et al. 2001). Most spread can be attributed to deliberate planting of water hyacinth in ponds or dams as an ornamental, or use in aquariums. Unwanted plant material is discarded into creeks, rivers and dams is a major mode of dispersal (Burton 2005). It further is transported in road vehicles over long distances and its seeds are translocated by machinery (Burton 2005). Local dispersal takes place by water hyacinth contaminating boating and waterway equipment (Burton 2005) or by seeds sticking to hikers' clothes and boots, off-road vehicles, water flow, mud and</p>

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					birds (Burton 2005). Stolons, solitary plants and drifting mats are readily distributed by water currents, winds and boat traffic. High water flows and floods can move infestations to new locations (Burton 2005)
43	<i>Eucalyptus camaldulensis</i>	red gum	Australia	Brunei Darussalam; Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	No specific information was available for <i>E. camaldulensis</i> , but the small seed size would be consistent with the wind dispersal of several other invasive Eucalypt species e.g. <i>E. cladocalyx</i> , <i>E. grandis</i> , <i>E. lehmanii</i> (Dean et al., 1986). Long distance dispersal is common as this species is among the most widely introduced forestry species with a vast global distribution.
44	<i>Frankliniella occidentalis</i>	western flower thrips	North America	Malaysia	Natural dispersal: e.g. non-biotic factors: Adults can be carried long distances on the wind and thrips breeding outdoors on wild plants can be carried on the wind and then drawn in through the vents of glasshouses. It is possible that adults are carried between countries in this way, although glasshouse outbreaks in new countries are typically linked with the arrival of horticultural plant material from other countries; Movement in trade: <i>F. occidentalis</i> is hard to detect on plant material and is easily missed in plant quarantine. However, during the 1980s it was detected on a wide range of plant material from many countries at ports of entry to the Netherlands (Vierbergen, 1995). Sampling of plant material imported into Switzerland in 1990-1991 showed that 20% of cuttings and 12% of plants were infested with <i>F. occidentalis</i> (Frey, 1993).
45	<i>Gambusia affinis</i>	Mosquito fish (English)western mosquitofish (English)	USA; Mexico	Indonesia; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	

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46	<i>Gliricidia sepium</i>	mother of cocoa	Mexico; Central America; South America	Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	<i>G. sepium</i> pods open explosively, and can catapult seed up to 40 m from standing trees (Simons, 1996a), and wind and water flow also influences the direction in which seeds are dispersed (WAC, 2005). Long distance dispersal is by man, who has planted this species widely in agroforestry, particularly as a shade tree, and widescale repeated introduction to exotic ranges has led to a pantropical distribution.
47	<i>Gracilaria salicornia</i>	red alga (English)	NIL	Indonesia; Malaysia; Philippines; Singapore; Thailand; Viet Nam	
48	<i>Grevillea robusta</i>	silky oak	Australia	Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Thailand; Viet Nam	The seeds of <i>G. robusta</i> are dispersed by wind (Smith, 1998). <i>G. robusta</i> has gained widespread popularity in warm temperate, subtropical and tropical highland regions of many countries, originally as a shade tree for tea and coffee and now as an agroforestry tree for small farms (Harwood, 1989) and intentional introduction is the principal means of long-distance dispersal.
49	<i>Haematoxylum campechianum</i>	logwood	Mexico; Guatemala; Belize; Central America	Malaysia; Philippines; Singapore	<i>H. campechianum</i> can be propagated by seed and vegetatively by cuttings. Each fruit (legume) produces 2-3 seeds that can be dispersed by wind, water, and by human activities (Gurib-Fakim, 2005). Under natural conditions, this species does not propagate vegetatively and then cuttings have to be planted (Seegeler, 1992; Gurib-Fakim, 2005); Escape from confinement/ garden escape; Intentional release; Medicinal use; Timber trade
50	<i>Hypophthalmichthys molitrix</i>	silver carp (English)	China; Russia	Indonesia; Lao PDR; Malaysia; Philippines; Singapore; Thailand; Viet Nam	
51	<i>Icerya purchasi</i>	cottony cushion scale	Australia	Malaysia; Singapore; Thailand; Viet Nam	Natural Dispersal (Non-Biotic Factors): The dispersal stage of the giant mealybugs is the first-

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					<p>instar crawler stage (G Watson, [address available from CABI], personal communication, 2004); these are often dispersed passively in the wind, and have been recorded being taken by the wind to an altitude of 6 metres and a distance of 3.5 kilometres (Hill, 1980); Vector Transmission: The crawlers may also be carried passively by animals and people that come into contact with the host plant; Agricultural Practices: Harvesting infested plant material, e.g. fruit, aids dispersal by scattering the crawlers into the air, where the wind may carry them away. Prunings of infested plants, and the clothing, tools and vehicles of agricultural workers, can become contaminated with the crawlers and so aid in their dispersal</p>
52	Imperata cylindrica	alang-alang blady grass (English); carrizo cogon grass (English)	Australia; China; Japan; Philippines; East Africa	Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar	<p>Introduction pathways to new locations for agriculture purposes (forage) and nursery trade. Vegetative reproduction from rhizome segments is a significant factor in human spread of the species because these are often found in dirt moved as fill (Ayeni and Duke 1985, Willard 1988, Shilling et al. 1997, in Van Loan Meeker and Minno 2002). Further, transportation in road vehicles and sea freight (container/bulk). Local dispersal is either natural which is effective in a way that rhizomes are highly resistant towards disturbance and fire. Local distribution for longer distances is also due to windborne seed dispersal as the plumed seeds are capable of traveling long distances in the wind, with an average flight path of 15 to 100 m. Transport of rhizomes and seeds on road vehicles and machinery/equipment contaminated with soil): The transport of rhizomes and seeds on equipment or in contaminated soil are considered important modes of spread.</p>

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53	Indigofera suffruticosa	Anil indigo	USA; Argentina; Caribbean; Central America	Cambodia; Indonesia; Malaysia; Philippines; Singapore; Thailand; Viet Nam	Natural Dispersal (Non-Biotic): <i>I. suffruticosa</i> has no specialized dispersal mechanism. The seeds are not even shed from the pods at maturity so the plant may depend on wind or water for dispersal; Vector Transmission (Biotic): No certain agents have been identified but the hard seeds may presumably survive passage through livestock or wild animals; Accidental Introduction: Accidental introduction of the species is possible by introduction of contaminated forage crop seeds; Intentional Introduction: Deliberate introduction is much less likely than in the past, as it is no longer widely used as a source of dye, but it is still a possible pathway if new medicinal uses are confirmed.
54	Jatropha curcas	jatropha	Tropical America; Caribbean	Cambodia; Indonesia; Malaysia; Myanmar; Philippines; Thailand; Viet Nam	<i>J. curcas</i> has been deliberately introduced into many areas as a crop plant and this has been the principle means of long-distance dispersal. Locally, vehicles and machinery aid the spread of <i>Jatropha</i> through the movement of capsules and seed, vegetative parts of the plant, and soil containing seeds. Livestock also assist in the spread through the movement of seed and aid in establishment by the selective grazing of other more palatable but competitive species (Pitt, 1999). Naturally, capsules split open when ripe to eject seeds some distance, though gravity may be more important on sloped sites. Seeds are also dispersed by water and some spread occurs from the tuberous roots which sucker; Agriculture; Disturbance; Erosion control/ dune stabilization; Escape from confinement/ garden escape; Flooding/ other natural disaster; Forestry; Hedges/ windbreaks; Industrial purposes; Internet sales
55	Kappaphycus spp.	red alga	Philippines	Indonesia; Malaysia; Viet Nam	

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56	<i>Lantana camara</i>	ach man (Cambodia)lantana lantana wildtype largeleaf lantana (USA)	Mexico; Florida; Trinidad; Jamaica; Brazil	Indonesia; Cambodia; Malaysia; Philippines; Thailand	Introduction pathways to new locations are for ornamental purposes and nursery trade. Local dispersal methods are by consumption and excretion as flowers and the seeds are dispersed by birds (Swarbrick et al. 1998, in Day et al. 2003). Further, specimens escape from gardens and garden waste.
57	<i>Leucaena leucocephala</i>	jumbie bean (English); lead tree (English) leucaena (English)	Mexico; Central America	Brunei Darussalam; Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	
58	<i>Limnocharis flava</i>	sawah-flower rush (English) sawah-lettuce (English) velvetleaf (English) yellow bur-head (English)	Mexico; Nicaragua; Costa Rica; Panama; Cuba; Haiti; Dominican Republic; Windward Islands; Colombia; Venezuela; Ecuador; West Indies; Peru; Brazil	Indonesia; Malaysia; Myanmar; Thailand; Viet Nam	Introduction pathways to new locations unintentional within agricultural trade or intentional the seed via agricultural imports. Its use and cultivation as a food source may result in intentional spread of the plant into new countries, same is true for ornamental purposes. It was introduced and cultivated as a a food source for humans. Intentional introduction occurred by taken to botanical garden/zoo. Agricultural purposes lead to local dispersal as seeds may be transported into uninfected areas when cereals are transported from a contaminated field. Seeds may be dispersed also by animals, hikers' clothes and boots: man and his impediments. Natural dispersal by vegetatively (clonally) reproduction, fruiting and short distance transportation of seeds in water currents.
59	<i>Lithobates catesbeianus</i>	bullfrog (English)	Canada; North America; Mexico	Indonesia; Malaysia; Singapore; Philippines; Thailand	
60	<i>Litopenaeus vannamei</i>	whiteleg shrimp	Panama	Cambodia; Indonesia; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	Aquaculture: Imported into non-native countries in the Americas. Asian importers sourced from stocks from Hawaii; Breeding/ propagation: Stocks from native countries used to establish domesticated strains; Food: Frozen and processed exports sent

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
					worldwide; Research: Research institutes have moved this species worldwide; Smuggling: Has occurred, especially in Asian countries which still ban its culture; Stocking: Post-larvae and juveniles have been moved worldwide for stocking ponds
61	<i>Macfadyena unguis-cati</i>	cat-claw creeper (English), catclaw-trumpet (English), catclawvine (English), cat's claw climber (English), cat's claw creeper (English), cat's claw vine (English), cat's-claw (English), claw vine (English), funnel-creeper (English)	Mexico; Belize; Costa Rica; El Salvador; Guatemala; Honduras; Nicaragua; Panama; Argentina; Bolivia; Brazil; Chile; Colombia; Ecuador; French Guiana; Guyana; Paraguay	Indonesia; Malaysia	
62	<i>Macrosiphum euphorbiae</i>	potato aphid	North America	Malaysia	Natural dispersal is the main means of spread for <i>M. euphorbiae</i> in field crops. A spring migration takes host-alternating populations from the primary host (<i>Rosa</i> spp.) to a wide range of secondary hosts, including potato, tomato and lettuce. Aphid populations can survive year-round in warm climates and in greenhouses, infesting crops late in the season. Aphids can potentially be dispersed on foliage, stems or fruits (especially with leaves attached) in trade.
63	<i>Megathyrsus maximus</i>	Guinea grass	Africa	Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	Natural dispersal: <i>M. maximus</i> spreads mainly by seed and only slowly by vegetative means (Holm et al., 1977). It can be established either by seed or vegetatively from cuttings of roots or rhizomes (Lazarides, 1980). In commercial pastures, it is sometimes propagated by crown divisions (Holm et al., 1977); Agricultural practices: <i>M. maximus</i> has become widely naturalized in the tropics and warm temperate regions following introductions for use as a pasture species. Local movement can occur in contaminated soil on agricultural equipment.

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64	Melaleuca quinquenervia	paperbark tree	Australia	Malaysia; Philippines; Singapore; Thailand; Viet Nam	M. quinquenervia seeds are dispersed locally by wind and water. Large numbers of seeds are stored on the tree in the fruiting capsules and are released when fire or other disturbance occurs (PIER, 2007). Long-distance movement has been via international introductions throughout the tropics mainly as an ornamental, but also for windbreaks or for other agroforestry purposes; Agriculture; Disturbance; Erosion control/ dune stabilization; Flooding/ other natural disaster; Forestry; Landscape improvement/ landscaping industry; Nursery trade; Ornamental purposes; Research
65	Micropterus salmoides	bass	USA	Philippines; Malaysia	
66	Mikania micrantha	mile-a-minute	Central America; South America	Indonesia; Malaysia; Philippines; Thailand	Natural Dispersal (Non-Biotic): Dispersal of M. micrantha is mainly by wind, but water dispersal is possible; Vector Transmission: Highly likely that it is dispersal by animals; Accidental Introduction: Being wind-dispersed, the seeds may be carried on any article that is transported through an area where the weed grows. Vehicles and equipment moving through areas infested with M. micrantha are likely carriers that should be cleaned before travelling long distances to avoid spread of the weed.
67	Mimosa pudica	sensitive grass (English) sensitive plant (English) shameplant (English) sleeping grass (English)	Belize; Brazil; Colombia; Costa Rica; Ecuador; El Salvador; Guatemala; Honduras; Mexico; Nicaragua; Panama; Peru	Brunei Darussalam; Cambodia; Indonesia; Malaysia; Philippines; Singapore; Thailand; Viet Nam	Introduction to new locations by seed pods floating and being spread in water (Smith, 2002; in PIER, 2005). Local dispersal on animals: Pods can be spread by attaching to fur (Smith, 2002; in PIER, 2005), on clothings and footwear (Smith 2002; in PIER, 2005), by mud on road vehicles (Smith, 2002; in PIER, 2005), in water currents as seed pods float and are spread by water (Smith, 2002; in PIER, 2005).
68	Mycale grandis	orange keyhole sponge (English-US-Hawaii) orange sponge	Asia; Australasia-Pacific Region	Malaysia	

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69	<i>Oncorhynchus mykiss</i>	rainbow trout	Alaska; USA; Mexico	Indonesia; Malaysia; Thailand	
70	<i>Oreochromis</i> spp.	boulti, freshwater snapper, mojara, ngege, pla nil, St. Peters fish, tilapia	Africa; Middle East	Cambodia; Indonesia; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	Most of the species were intentionally introduced as food sources, for commercial fisheries and aquaculture as well as for commercial aquaristic reasons
71	<i>Oxalis corniculata</i>	wood sorrel yellow oxalis yellow wood sorrel	origin obscure	Cambodia; Indonesia; Malaysia; Philippines; Thailand; Viet Nam	
72	<i>Paratrechina longicornis</i>	crazy ant, hairy ant, higenaga-ameiro-ari, long-horned ant, slender crazy ant	Africa; Asia	Brunei Darussalam; Indonesia; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	
73	<i>Paspalum vaginatum</i>	biscuit grass (English) jointgrass (English-USA) knot grass (English) knottweed (English) salt grass (English), saltwater couch (English), saltwater paspalum (English), seashore crowngrass (English-USA), seashore grass (English), seashore paspalum (English)	North America; Caribbean	Indonesia; Malaysia; Philippines; Viet Nam	
74	<i>Pennisetum pedicellatum</i>	deenanath grass	India; Benin; Burkina Faso; Cameroon; Cape Verde; Côte d'Ivoire; Eritrea; Ethiopia; Gambia; Ghana; Guinea; Kenya; Mali; Mauritania; Niger; Nigeria; Senegal;	Indonesia; Malaysia; Philippines; Thailand	The factors associated with <i>P. pedicellatum</i> potential are prolific seedling, and windborne seed dispersal, a highly competitive and smothering growth habit, and poor values as dry standing feed. The collection of <i>P. pedicellatum</i> as a cut and carry fodder to livestock also contributes to the movement of the weed.

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
			Sudan; Tanzania; Togo; Zambia		
75	<i>Physalis angulata</i>	cutleaf groundcherry	Bermuda; Mexico; USA; Antigua and Barbuda; Bahamas; Barbados; British Virgin Islands; Cuba; Dominican Republic; El Salvador; Grenada; Guadeloupe; Guatemala; Haiti; Honduras; Jamaica; Martinique; Nicaragua; Panama; Puerto Rico; Saint Kitts and Nevis; Saint Vincent and the Grenadines; Trinidad and Tobago; United States Virgin Islands; Brazil; Colombia; Ecuador; Peru; Venezuela	Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Thailand; Viet Nam	Natural Dispersal and Vector Transmission (Biotic): Natural dispersal of <i>P. angulata</i> by water is likely (Travlos et al., 2010). There is presumed to be dispersal by birds and mammals eating the fruit, but no documentation exists (Travlos, personal observations); Accidental Introduction: The seeds of <i>P. angulata</i> can be carried short distances on people's clothing or footwear (Travlos et al., 2010).
76	<i>Piper aduncum</i>	bamboo piper (English) spiked pepper (English)	West Indies; Tropical America	Indonesia; Malaysia; Philippines	
77	<i>Pistia stratiotes</i>	tropical duckweed (English) water lettuce (English)	Cambodia; Indonesia; Malaysia; Philippines; Thailand; Viet Nam	Cambodia; Indonesia; Malaysia; Philippines; Thailand; Viet Nam	introduction pathways to new locations by floating vegetation and debris: <i>P. stratiotes</i> is a free floating plant that is capable of forming dense mats on the surfaces of lakes, ponds, rivers and other bodies of water (Rivers, 2002). Internet sales and postal services for aquarium trade: According to Ramey (2001), <i>P. Stratiotes</i> continues to be sold through aquarium supply dealers and through the internet. <i>P. stratiotes</i> can be spread by ship and boat hull fouling. On a local scale <i>P. Stratiotes</i> can spread from broken-off pieces or whole plants being moved on boats or fishing equipment from an infested to a

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
					clean body of water (Rivers, 2002). It can also spread from garden escape and garden waste or water currents and floods.
78	<i>Pithecellobium dulce</i>	Manila tamarind	Mexico; USA; Belize; Costa Rica; El Salvador; Guatemala; Honduras; Nicaragua; Panama; Brazil; Colombia; Peru; Venezuela	Brunei Darussalam; Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	Seeds are dispersed by birds attracted by the red pods, and sweet fleshy white, pale-pink, or occasionally red arils which persist after the pods open. Local birds, such as the False Mynah bird in Hawaii (Degener, 1930), have adapted to disperse seeds of <i>P. dulce</i> in many areas where it is introduced aiding its spread and naturalization. This species has been widely introduced to countries outside its American tropical native range for use as an ornamental, shade and street tree, which has been the principal means of long-distance dispersal.
79	<i>Poecilia reticulata</i>	guppy (English) rainbow fish (English)	Brazil; Guyana; Venezuela; Caribbean	Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	
80	<i>Pomacea canaliculata</i>	apple snail (English) channeled apple snail (English) golden apple snail (English) golden kuhol (English-Philippines) miracle snail (English-Philippines)	Argentina	Cambodia; Indonesia; Lao PDR; Malaysia; Philippines; Singapore; Thailand; Viet Nam	Introduction pathways to new locations in live food trade: Imported legally and illegally for development of aquaculture projects for human food. Nursery trade: Possibly introduced as eggs or small juveniles attached to aquatic plants. Pet/aquarium trade: Developed as a domestic aquarium snail and sold in pet stores. Smuggling: Illegally introduced, usually for development as a human food resource. Local dispersal pathways occur in aquaculture: Deliberately moved in order to establish new aquaculture facilities. Probably accidentally dispersed as eggs or more likely small juveniles on agricultural products. Deliberately introduced to uncontained wetland systems in the hope of harvesting the snails for food. Escape from confinement: Escape (or even release) from aquaculture facilities is probably the major dispersal

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
					mechanism. Water currents: Probably one of the main means of dispersal within a watershed.
81	<i>Psidium guajava</i>	guava; biyabas (Brunei Darussalam)	Mexico; Central America; Peru	Brunei Darussalam; Cambodia; Indonesia; Lao PDR; Malaysia; Philippines; Singapore; Viet Nam	
82	<i>Pterygoplichthys</i> spp.	catfish (English) janitor fish (English) radiated ptero (English) sailfin catfish (English) suckermouth armored catfish (English)	South America	Indonesia; Malaysia; Philippines; Singapore; Thailand; Viet Nam	It was intentionally introduced for minor commercial fisheries and commercial aquaristics as well as for live food trade. Accidental release happens from commercial farms, pet holding or aquaculture, intentional release from farmers.
83	<i>Pycnonotus jocosus</i>	red-whiskered bulbul); Crested Bulbul (English)	India; Andaman Is.; Nepal; Bhutan; Bangladesh; Myanmar; Thailand; Viet Nam; Northern Malaya; Lao PDR; Cambodia; China	Indonesia; Malaysia; Singapore	Long distance transportation as domesticated animal. Sea freight (container/bulk) and fishing boats from native countries in which single individuals or nests were transported. Local dispersal in most parts of the Pacific is usually blamed on the release, either intentional or accidental, of caged birds. (Meyer 1997, Williams 1983, in Vander Velde, 2002)
84	<i>Quadrastichus erythrinae</i>	Erythrina gall wasp (EGW)	Africa	Malaysia; Philippines; Singapore; Thailand; Viet Nam	
85	<i>Rana catesbeiana</i>	American bullfrog	Canada; USA	Indonesia; Lao PDR; Malaysia; Philippines; Singapore; Thailand; Viet Nam	Bullfrog tadpoles will spread throughout the water bodies in which they have hatched, though they tend to seek out the warmest water. From here they can enter the inflow and outflow waterways that feed and drain lakes and ponds and therefore have a limited ability to migrate. However, because bullfrog larvae (tadpoles) are gill-breathing and entirely aquatic this life stage is unable to move out of the water on its own. Near the end of each active season a new generation of bullfrog juveniles, recently transformed from tadpoles, aggregate around lake and pond margins waiting for warm, rainy nights. While the ground surface is wet and under the cover of

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
					darkness hundreds to thousands of these juveniles can be seen migrating en masse overland and away from the home lake. Through this risky collective impulse at least some of them will find their way to adjacent lakes and ponds to pioneer new populations. As this activity goes on throughout the late summer and autumn, juveniles seemingly run the risk of being trapped by early frosts; Natural dispersal (non-biotic): Deluge floods that create sudden or seasonal spillways to interlink otherwise disconnected lakes and ponds could facilitate the dispersal of bullfrog tadpoles and eggs; Accidental introduction: Accidental introductions have occurred where bullfrogs that were meant to be confined as pets or as farm stock have escaped captivity; Intentional introduction: Bullfrogs are commonly transported by people.
86	Raoiella indica	coconut mite coconut red mite frond crimson mite leaflet false spider mite red date mite, red palm mite, scarlet mite	India	Malaysia; Philippines; Thailand	
87	Rattus exulans	Maori rat (English) Pacific rat (English) Polynesian rat (English)tikus Polynesia (Indonesia)	Southeast Asia	Indonesia; Malaysia; Myanmar; Philippines	
88	Rubus rosifolius	forest bramble (English) Mauritius raspberry (English) native bramble (English-Australia) native raspberry (English-Australia)	Asia, Australia, China, Taiwan	Indonesia; Malaysia	It was introduced for ornamental purposes as in some countries it is grown for its flowers (NCCPG, 2001). Local dispersal takes place by seed consumption and excretion by birds and rodents that eat the fruit (PIER, 2002).

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
		roseleaf raspberry (English) thimbleberry (English)			
89	Salvinia molesta	aquarium watermoss (English-United States) giant salvinia (English) kariba weed (English) koi kandy, salvinia (English) water fern (English) water spangles (English)	Brazil; Argentina	Indonesia; Malaysia; Philippines; Singapore; Thailand	
90	Samanea saman	rain tree	Costa Rica; El Salvador; Guatemala; Honduras; Nicaragua; Panama; Venezuela	Brunei Darussalam; Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	In the native range, <i>S. saman</i> seeds are dispersed by rodents, tapirs, peccaries, cattle and horses, which eat the pods. Whenever livestock are around fruits never accumulate beneath the tree. This species has been widely planted in agroforestry systems as a shade tree leading to its intentional international distribution and it has been so widely cultivated that the precise native range is now uncertain
91	Sansevieria trifasciata	mother-in-law's tongue	Central African Republic; Congo; Congo Democratic Republic; Equatorial Guinea; Gabon; Nigeria	Malaysia; Myanmar; Singapore	<i>S. trifasciata</i> can be dispersed by seeds, leaf cuttings and rhizomes. Seeds are mainly dispersed by birds and other animals that eat the brightly coloured fruits. Leaf segments and rhizomes can be dispersed in garden waste (ISSG, 2012). The species has the potential to spread vegetatively from areas where it is cultivated. Several cultivars of <i>S. trifasciata</i> are also sold in the nursery and landscape trade.
92	Scaevola sericea	beach naupaka half-flower Hawaiian beach cabbage Hawaiian half-flower Hawaiian seagrape huahekili (Hawaii) sea lettuce	East Africa; Australia; Pacific Islands	Indonesia; Malaysia; Philippines; Thailand	

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
93	<i>Senna occidentalis</i>	coffee senna	Belize; Cayman Islands; Costa Rica; Dominican Republic; El Salvador; Guatemala; Nicaragua; Panama; Argentina; Bolivia; Brazil; Ecuador; French Guiana; Guyana; Peru; Suriname; Venezuela	Cambodia; Indonesia; Lao PDR; Malaysia; Philippines; Thailand; Viet Nam	Natural Dispersal (Non-Biotic): The seeds of <i>S. occidentalis</i> have no specific dispersal mechanism and are spread mainly in water flow over the soil surface, especially flood waters (Parsons and Cuthbertson, 1992); Agricultural Practices: Seeds of <i>S. occidentalis</i> can be spread in mud sticking to animal hooves, footwear, farm machinery and other vehicles (Parsons and Cuthbertson, 1992); Accidental Introduction: A small number of seeds of <i>S. occidentalis</i> may be spread as contaminants in agricultural produce such as hay and grain (Parsons and Cuthbertson, 1992).
94	<i>Sida acuta</i>	sida	Mexico; USA; Central America and Caribbean; South America	Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	Seeds of <i>S. acuta</i> are easily spread by a variety of means including machinery, equipment, people, animals, seed or hay contamination and water (Pettit and Froend, 2001; Smith, 2002). Movement of <i>S. acuta</i> seed on tourist vehicles was documented for a national park in northern Australia (Lonsdale and Lane, 1994). Spread of <i>S. acuta</i> is commonly by seed, transported on vehicles or as contaminants in hay or seed (Smith, 2002). Seeds could also be transported directly by livestock either through clinging via sharp awns on the seeds or attaching to the hide of animals (Lonsdale et al., 1995).
95	<i>Solenopsis geminata</i>	fire ant (English) ginger ant (English) tropical fire ant (English)	USA; South America	Indonesia; Malaysia; Myanmar; Philippines; Viet Nam	
96	<i>Spathodea campanulata</i>	African tulip tree	Angola; Benin; Burundi; Cameroon; Central African Republic; Congo; Congo Democratic Republic; Côte d'Ivoire; Equatorial	Indonesia; Malaysia; Singapore; Thailand	<i>S. campanulata</i> is wind-dispersed, the light winged seeds being able to travel long distances if uninterrupted. This means that local spread can be rapid. However, long-distance introduction has been entirely intentional, as an ornamental tree, and once

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
			Guinea; Ghana; Guinea; Kenya; Liberia; Nigeria; Rwanda; Sierra Leone; Sudan; Tanzania; Togo; Uganda; Zambia		in a country it will have been planted widely for its aesthetic value.
97	<i>Striga asiatica</i>	Asiatic witchweed buri common mealie witchweed isona weed, Matabele flower, mealie poison, mealie witchweed, red witchweed, scarlet lobelia, striga, witchweed, yaa mae mot	Cambodia; Indonesia; Malaysia; Philippines; Singapore	Australasia-Pacific Region; North America	
98	<i>Tapinoma melanocephalum</i>	black-headed ant ghost ant hormiga bottegaria house infesting ant, tiny yellow house ant, tramp ant Organism type: insect	It has not been established if this species is of African or Oriental origin (Nickerson et al. 2003).	Cambodia; Indonesia; Malaysia; Myanmar; Philippines; Singapore; Thailand; Viet Nam	
99	<i>Technomyrmex albipes</i>	white-footed ant (English) white-footed house ant (English)	Indo-Pacific Area	Malaysia; Philippines	
100	<i>Trachemys scripta</i>	slider (English)	USA; Mexico	Cambodia; Indonesia; Malaysia; Philippines; Singapore; Thailand; Viet Nam	
101	<i>Trogoderma granarium</i>	khapra beetle (English)	West Africa	Indonesia; Malaysia; Myanmar	

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
102	<i>Tubastraea coccinea</i>	colonial-cup coral (English) orange-cup coral (English) orange-tube coral (English)	Indo-Pacific	Indonesia; Malaysia; Myanmar; Singapore; Thailand; Viet Nam	
103	<i>Typha latifolia</i>	broadleaf cattail broad-leaf cattail cattail cattail (common), common cattail, Cooper's reed, cumbungi (Australia)	Alaska; USA; Algeria; Morocco; Ethiopia; Kenya; Tanzania; Uganda and Nigeria; Afghanistan; Iran; Israel; Jordan; Lebanon; Syria; Turkey; Armenia; Azerbaijan; Georgia; Russian Federation - Ciscaucas	Indonesia; Malaysia; Philippines	
104	<i>Urochloa maxima</i>	buffalograss (English) green panic (English) Guinea grass (English)	Africa	Indonesia; Malaysia; Philippines; Thailand; Viet Nam	
105	<i>Xyleborus volvulus</i>	NIL	North America; Central America and Caribbean; South America	Indonesia; Malaysia; Myanmar; Philippines; Thailand	It is believed that <i>X. volvulus</i> is native to the Americas (Wood, 1982). It probably arrived in Africa hundreds of years ago, and is now well-established in many parts of the Afrotropical region, although less common than <i>X. perforans</i> (Schedl, 1963). In Asia and the Pacific, <i>X. volvulus</i> was probably accidentally introduced through commerce. It is not clear whether the species is established in Australia, although it has been intercepted there (Schedl, 1964). No specimens have been seen in extensive collections of Scolytidae from Queensland (RABeaver, Chiangmai University, Thailand, unpublished data). Although established on the main islands of Japan (apart from Hokkaido), <i>X. volvulus</i> has often been intercepted at Japanese ports from timber imported from countries from Indonesia to the Solomon Islands (Schedl, 1966; Ohno et al., 1987,

No	Species	Common Names	Native Range	Known Introduced Range In the Asean	Pathway of Introduction
					1988, 1989; Ohno, 1990). It has also been intercepted in certain European countries and New Zealand, but has not established there, probably because it is unable to survive winter conditions.
106	Xylosandrus compactus	ambrosia beetle (English) black twig borer (English)	Asia	Indonesia; Malaysia; Viet Nam	

APPENDIX 6 CONSIDERATION POINTS FOR UNDERTAKING ECOLOGY ASSESSMENT

Habitats are complex and variable between the highland areas (Hill Forest) and those within the lowlands (Peat Swamp Forest or Mangrove Swamp Forest). Significant differences in existing floral and faunal composition must be known for the assessment of impacts as pre-requisite for harvesting or land conversion for development especially of undisturbed virgin forests. It is important to document all floral (especially endemic, unique, rare, endangered and medicinal plants) and faunal species (especially invertebrates) in order to derive an acceptable and appropriate assessment methodology.

In order to derive the impacts towards habitats alteration due to felling and land conversion, it is important to appreciate the entire ecosystem and understand how one species may rely on another for some form of life support. The flora and fauna must be evaluated in terms of species diversity, inter-linkages in the food chain, and any specific habitat requirements.

The Qualified Person must be aware of the harvesting plan and its operation whereby it should fit into the silvicultural concept to provide conditions for successful regeneration for future harvesting. This would allow for predicting possible negative impacts of habitat disruption and reduction of biological diversity and evaluate them accordingly early in the process.

Methodology for Assessment of Flora

- Examination of topographic maps, forest type or resource maps, aerial photographs and possibly remote sensing imageries.
- Identification of the habitat (e.g. for Hill Forest the major habitats include ridge tops, hillslopes and riparian vegetation) for range of plant species in the area.
- Pre-felling inventory from the Forestry Department would provide additional data on the expected composition of the tree species.
- A reconnaissance survey would help to confirm the identification made from such secondary sources
- Quantitative plant assessment follows habitat identification to determine the plant species, their distribution, role and relative importance, structure of the plant community and populations of species. Sample plots or quarters representative of the habitat is selected for a representative study. (for example: 100 m x 20 m transect laid out in each of Hill Forest namely ridge top, hills slope, valley bottom and riparian fringe would suffice. A 1 to 2% sampling would be sufficient to assess the common plant species in the area).
- Note and document each forest habitat, the altitudinal range, forest structure, status of natural regeneration and relative abundance of non-woody plants such as herbaceous flora, climbers, palms, bamboos and ferns.
- Survey of adjacent areas that have been logged previously to gauge anticipating possible adverse impacts of logging in an area. The nature of the vegetational growth including the litter layers will provide a reasonably accurate assessment of environmental impacts in the project area under study.

Reference can be made to the various publications for the technique in sampling flora and identification of plant species including rare and endemic species. Care to note protected

species and tree species that are food supply or nesting grounds, where felling of these should be avoided.

Methodology for Assessment of Fauna

- A reconnaissance survey to establish the habitat and probable range of fauna expected in the area. Findings can be verified with local inhabitants (e.g. Orang Asli) within or adjacent to the project area.
 - Direct sighting (for example: sighting of birds, reptiles, amphibians and mammals) or indirectly through animal signs (for example: tracks, noise and calls, burrows, den, nests, markings on soil or vegetation, bones or carcass, droppings and others).
 - Animal trappings (involves the capture and release of animals), such as pit falls (for ground animals like reptiles, amphibians, small mammals, rodents and others), mist nets (for birds and bats), cage traps for small mammals, light traps (for nocturnal animals), baited activated camera system, and others.
- Records from DWNP may provide a generalised and latest status of the distribution pattern in the area. Information can be sourced from local inhabitants (e.g. Orang Asli) within or adjacent to the project area.

Faunal assessment includes the identification of the common species, rare or endangered species, species of conservational significance, migratory species, species sensitive to impacts and the relationship between the species and the habitat. For practical reasons, the more easily studied and assessable fauna can be used as indicators of the overall fauna diversity, especially due to impacts of logging or land development to the habitat system. For land development purposes it will be useful to undertake detailed fauna population studies to assist DWNP in relocation of some of the important species. The Qualified Person should propose appropriate methodology for the fauna assessment.

An analysis of the project from the inventory to the felling stage will indicate how much of the forest habitat will be changed permanently or be in transient. This will allow for the impact on each listed species to be predicted, of which should include the overall impact of the project on the species as a whole. The Qualified Person should formulate a mechanism by which these impacts can be quantified for each species at the project level and the species range. The analysis should include other ongoing developments within the habitat range of each species affected by the project.

It is important that the impacts on all vertebrate species in the area should be investigated, especially if they are listed as **conservation species – endangered or threatened species, species protected by national legislations / international agreements, and endemic species**. When the elimination has been done then the Qualified Persons should go into details of the significant species. If important species of special significance occur and the habitat is needed for survival then the negative impacts can be modified by redesigning or altering the plan to meet the needs.

(i) Endangered or Threatened Species

Endangered species are those in danger of extinction and whose survival is unlikely if the casual factors continued to operate. Threatened species are those that are likely to be endangered if the present rate of growth diminishes. In general, most endangered species are listed in internationally recognised lists such as the Red Data Book

published by the International Union for the Conservation of Nature (IUCN), 1996. Examples of endangered species are Sumatran rhinoceros, Proboscis monkey and Malayan False Gharial (crocodile in peat swamp areas). However, some species may be endangered or threatened in a more local context and the status could be obtained from the Wildlife Department.

It is recommended that if there is a sizeable number of endangered or threatened species in an area, then the habitat of these species should not be disturbed, and a buffer zone be established from areas of development or logging. The impacts are to be considered as very significant with little likelihood for effective mitigation of the potential impacts to these species. Translocation can be carried if there are a few species. Attention should be focused on the habitat needs of the endangered species especially mammals. These needs should include their use of salt licks, the provision of escape routes and corridors to adjacent habitat system. These needs should also be evaluated with respect to the full habitat range of the herds and individuals within the area up to the full watershed if necessary.

(ii) **Protected Species**

These are species protected under the law, either within the Protection of the Wildlife Act 1972 in Peninsular Malaysia or the relevant state legislations such as the Wildlife Protection Ordinances of Sabah and Sarawak. For example in Sarawak, 51 species of wildlife are under protected status. Sabah has classified 206 animals as protected species under the Wildlife Conservation Enactment 1997. However, the provisions of the Wildlife Act need to be referred to with caution and an understanding of the true conservational status of many of the species listed in its schedule should be re-examined. Virtually the entire bird fauna of Peninsular Malaysia is listed as 'Totally Protected' including many species that are common, widespread and increasing in numbers. Sometimes or seasonally the DWNP issues permits to hunters to shoot certain birds and mammals under this category. Therefore, a Qualified Person needs to apply the provisions of the law within certain amount of awareness of the true conservation status of each species. It is suggested that areas containing protected species may be developed if the occurrence of species is not limited to the project area in question. The impacts may be considered as acceptable.

(iii) **Endemic Species**

Endemic species are those that occur in very limited habitat ranges. This can occur within a country, several countries or even to a limited patch of habitat within a single area. Local examples of endemic species are the Proboscis Monkey (found in mangrove and peat swamp forests) and the Orang Utan found in the lowland forests of Sarawak and Sabah. If the endemic species is only found in the project area and nowhere else in the country, then the impact can be considered as major and no development is recommended in the area. If the species is also found elsewhere, consideration should be given to their occurrence, conservation status and population growth. If they fall within the threatened list, no development is recommended; otherwise some development may be accepted.

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