EIA FOR THE PROPOSED ENCROACHER BUSH BIOMASS POWER PROJECT IN NAMIBIA

Environmental Management Plan for Harvesting & Associated Activities and Transportation of Biomass, Tsumeb , Namibia

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	
ADT	Average Daily Traffic
BACI	Before-After-Control-Impact
dB	Decibels
EAPAN	Environmental Assessment Professionals Association of Namibia
ECC	Environmental Clearance Certificate
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EM	Environmental Manager
EMA	Environmental Management Act
EMP	Environmental Management Plan
FMU	Forest Management Unit
FSC®	Forest Stewardship Counsel
ha	Hectare
H&TCs	Harvesting and Transport Contractors
MAWF	Ministry of Agriculture, Water and Forestry
MET	Ministry of Environment and Tourism
MPs	Management Plans
MWe	Megawatts electricity
NamPower	Namibia Power Corporation (Pty) Ltd
PM	Project Manager
SEA	Strategic Environmental Assessment
SHEQ	Safety, Health, Environmental and Quality
SHEW	Safety, Health, Environmental and Wellness
TE	This is defined in terms of 'Tree Equivalents', where one TE is a woody plant 1.5 metres high (i.e. a 3 metre tree is 2 TEs, and a 0.75 metre woody bush is 0.5 TEs)
TEs/ha	Tree Equivalents per hectare

1. INTRODUCTION

This Environmental Management Plan (EMP) documents a series of individual management plans (MPs) which are designed to meet legal requirements, align to Forest Stewardship Counsel (FSC®) Standards, and avoid, minimise or manage the impacts associated with the implementation of the proposed Encroacher Bush Biomass Power Project (Biomass Power Project). This EMP specifically relates the following components of the Project:

- Harvesting, processing and transportation of the encroacher bush as a fuel source to the proposed Otjikoto Biomass Power Station.

An Environmental Impact Assessment (EIA) Report has been produced by SLR Environmental Consulting (Namibia) (Pty) Ltd (SLR) to assess the potential environmental issues associated with the Namibia Power Corporation (Pty) Ltd (NamPower) Biomass Power Project.

The management plans recommended by the individual specialists form part of the assessment process and have been compiled into this EMP (refer to section 7).

The EMP gives the commitments, which form the 'environmental contract' between NamPower and the Ministry of Environment and Tourism (MET).

A separate EMP was developed for the following components of the Project:

- 40 MWe Otjikoto Biomass Power Station at the Otjikoto site, near Tsumeb.
- Transmission substation and connection to the national grid via an overhead power line of maximum 132 kV.

1.1 KEEPING THE EMP CURRENT

It is the intention that this EMP shall be seen as a living document that will be amended, in consultation with the Directorate of Forestry and the Department of Environmental Affairs, during the harvesting and associated activities relating to the Biomass Power Project, as the activities might change or new ones be introduced. Due to the nature of the commitments in this EMP an adaptive management approach needs to be followed (see section 12), certain commitments may therefore have to be amended.

1.2 SITE-SPECIFIC HARVESTING PLANS

Due to; the significant scale of the harvesting area that was assessed as part of the EIA process, the uncertainties around the exact harvesting locations, uncertainties with regards to exact harvesting methods per area, etc., a requirement from the EIA is that Site-Specific Harvesting Plans will need to be developed for each harvesting site

The Site-Specific Harvesting Plans will be specifically aimed to provide further guidance on various issues specifically relating to biodiversity, archaeology, monitoring, buffer zones around sensitive land users, etc., in the specific area to be harvested, and will need to take cognisance of the results of the EIA Report for the Biomass Power Project and this EMP.

The aim of the Site-Specific Harvesting Plans will not be to repeat the requirements from this EMP, but rather to provide further, site-specific, input to strengthen and support the relevant Action Plans (section 7) and monitoring requirements (section 8).

Further authorisation from MET will not have to be sought for each of the Site-Specific Harvesting Plans, however these Plans will need to be developed in consultation with the various stakeholders and approved by the NamPower Safety, Health, Environmental and Wellness (SHEW) Manager.

More details regarding the content and other requirements of the Site-Specific Harvesting Plans are provided in section 11.

1.3 DETAILS OF THE PERSON WHO PREPARED THE EMP

SLR, the independent firm of consultants who compiled the Biomass Power Project EIA Report has also compiled this EMP, with input from the various Environmental Specialists (as presented in the EIA Report).

Werner Petrick, the EIA project manager has more than twenty years of relevant experience in managing EIAs, compiling and implementing EMPs, and Environmental Management Systems. Werner is certified as lead environmental practitioner and reviewer under the Environmental Assessment Professionals Association of Namibia (EAPAN).

Immanuel Katali, the project assistant, holds an Honours degree in Geography and Environmental Studies and Sociology and has more than 3 years of experience in the environmental management discipline. Immanuel is certified as an ordinary member under the Environmental Assessment Professionals Association of Namibia (EAPAN).

Chris Herbert is a Chartered Town Planner with over twenty (20) years of experience in both planning and EIA development. Chris has worked on a wide range of waste, energy, and minerals proposals. Recent biomass experience in the UK includes being the lead EIA professional on a 177,000 tpa waste wood biomass CHP plant for a German company MVV.

Marc Scourfield has over 20 year's industrial experience and is a Principal Process engineer in the Process Engineering & Process Safety Group. Marc has extensive operational and process engineering experience in Energy from waste & Biomass plants, waste treatment technologies and EHS experience in the oil and gas and waste management industries.

2. SCOPE OF THE EMP

The components of the EMP are included in Table 2-1 below.

TABLE 2-1: CONTENT OF THE EMP

EIA Regulation requirement	EMP Reference
Details of the persons who prepared the EMP and the expertise of those persons to prepare an environmental management plan.	Section 1.2
Environmental legislation relevant to this project.	Section 3
Project overview	Section 4
A description of the aspects and impacts of the harvesting and transportation activities that are covered by the EMP.	Section 5
Overall objectives.	Section 6
Information on any proposed management or mitigation measures to address the environmental impacts that have been identified in a report contemplated by these regulations, including environmental impacts or objectives in respect of – i. Planning and design ii. Construction activities iii. Operation or undertaking of the activity iv. Rehabilitation of the environment v. Closure, where relevant	Section 7
An identification of the persons to be responsible for the implementation of the mitigation measures.	Sections 7 & 8
Proposed mechanisms for monitoring compliance with the EMP and reporting on it.	Section 9
Training requirements.	Section 10
Requirements for Site-Specific Harvesting plans.	Section 11
A description of the adoptive management approach recommended for this EMP.	Section 12
Biomass harvesting guidelines.	Section 13
Aftercare	Section 14
Recommendations for further research.	Section 15

3. ENVIRONMENTAL LEGISLATION

This section outlines Namibian legislation and international criteria and standards which are relevant to the proposed harvesting and associated activities.

Relevant legislation and standards currently in force in Namibia include:

- Environmental Management Act (Act 7 of 2007) and Regulations promulgated in terms of the Environmental Management, Act 7 of 2007;
- The Forest Act (Act 12 of 2001) and Regulations (2015);
- The Soil Conservation Act (Act 76 of 1969) & the Soil Conservation Amendment Act (Act 38 of 1971);
- The Water Act, No. 54 of 1956 and Water Resources Management Act, No.11 of 2013;
- The Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act 36 of 1947);
- National Heritage Act 27 of 2004;
- Labour Act 11 of 2007;
- Nature Conservation Ordinance of 1975;
- Atmospheric Pollution Prevention Ordinance 11 of 1976;
- Draft Pollution Control and Waste Management Bill of 1999;
- Public Health Act 36 of 1919;
- Road Traffic and Transport Act, 22 of 1999;
- Forestry and Environmental Authorisations Process for Bush Harvesting Projects (MAWF, 2017); and
- Harvesting of Encroacher Bush: Compendium of harvesting technologies for encroacher bush in Namibia (MAWF, 2015).

The development of the proposed project may be reliant on finance through loans from a lending institution. There may therefore be a requirement for the proposed project to be undertaken in such a manner that it complies with the European Investment Standards, World Bank Group Equator Principles, and International Finance Corporation (IFC) Performance Standards.

The EIA process assessed the impacts of the proposed project in terms of the relevant Namibian environmental legislative requirements. Furthermore, the EIA process followed is considered to be sufficiently robust to conform to the Equator Principles and IFC Performance Standards relating to EIA aspects.

Relevant international criteria and standards were considered as part of this EIA process. These include, amongst others, International Finance Corporation's (IFC's) Performance Standards, Equator Principles and World Bank standards.

By aligning the proposed project to FSC® standards it will require compliance to the ten Principles and Criteria of FSC®, International Labour Organisation (ILO) requirements and associated conventions, however due to the fact that no product is being marketed on the international market the actual cost certification would not be recoverable and therefore would make certification unfeasible. However, by aligning and implementing the FSC® standards this will allow for industry best practice which is the goal of the proposed project and funding organisations. The associated conventions are listed below:

- Convention 29: Forced Labour Convention, 1930;
- Convention 87: Freedom of association and protection of the right to organize conventions, 1948;
- Convention 97: Migration for employment (revised) convention, 1949;
- Convention 98: Right to organize and collective bargaining convention, 1949;
- Convention 100: Equal remuneration convention, 1951;
- Convention 105: Abolition of forced labour convention, 1957;
- Convention 111: Discrimination (occupation and employment) convention, 1958;
- Convention 131: Minimum Wage fixing convention, 1970;
- Convention 138: Minimum age convention, 1973;

- Convention 141: Rural workers organizations convention, 1975;
- Convention 142: Human Resources Development Convention, 1975;
- Convention 143: Migrant Workers (Supplementary Provisions) Convention, 1975;
- Convention 155: Occupational Safety and Health Convention, 1981;
- Convention 169: Indigenous and Tribal Peoples Convention, 1989;
- Convention 182: Worst Forms of Child Labour Convention, 1999; and
- ILO Code of Practice on Safety and Health in Forestry Work. Recommendation 135 Minimum Wage Fixing Recommendation, 1970.

For more details on the relevant Acts, Policies and Standards, refer to Section 2 in the EIA Report and legal summaries in Appendices 5 to 13 of the EIA Report.

3.1 ENVIRONMENTAL PERMITS AND APPROVALS

Before the operations can commence, NamPower will need to acquire a number of permits and certificates. The list of possible environmental authorisations required are outlined in Table 3-1 below.

TABLE 3-1: LIST OF ENVIRONMENTAL PERMITS/APPROVALS

Aspect	Legislation	Permits/Certificates/Authorizations	Regulator
EIA	Environmental Management Act (Act 7 of 2007)	Environmental Clearance Certificate for the proposed bush harvesting activities (refer to section 2.1.2.1 of the EIA Report for relevant listed activities).	Ministry of Environment and Tourism
Disturbance of archaeological objects.	National Heritage Act, 2004	Requirement to obtain consent in terms of section 55 before altering or developing any land in which an archaeological object or palaeontological site or a meteorite is believed to be located. This is only relevant in the event of a chance find and the harvesting activities cannot avoid the disturbance of such objects.	National Heritage Council of Namibia
Harvesting activities	The Forest Act (Act 12 of 2001)	Forestry harvesting permit, marketing permit and transport permit	Ministry of Agriculture, Water and Forestry (MAWF) (Directorate of Forestry)
Protected species	The Forest Act (Act 12 of 2001)	No protected species may be removed unless special permission is granted. This could be relevant the possible harvesting of Mopane trees in certain areas.	MET

Aspect	Legislation	Permits/Certificates/Authorizations	Regulator
Chemicals used during aftercare	The Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act 36 of 1947)	All chemical products, including weed killers used in Namibia are obliged to be registered with the Registrar of this Act. The Act makes it possible to prohibit the use or import of any remedy that could be an environmental risk. Registration of agricultural chemicals in MAWF is presently dysfunctional, and there is little record of what types and volumes of chemicals are being imported into and used in Namibia. (SEA, 2016). Apply for a Bush Control Licence (Form 7) at the Forestry Office. Align to the FSC® List of 'highly hazardous' pesticides FSC-STD-30-001-a EN.	MAWF

4. PROJECT DESCRIPTION

This section provides a summarised description of the proposed harvesting and associated activities and the transportation of the biomass to the proposed Otjikoto Biomass Power Station. A detailed project description is included in section 4 of the EIA Report.

4.1 PROJECT OVERVIEW

The proposed Biomass Power Project will consist of the following components:

- Construction and operation of a 40 MWe Biomass Power Station at the Otjikoto site;
- Harvesting and processing activities of the encroacher bush to suitable fuel specification, including all temporary storage. The annual fuel requirements i.e. wood chips, on a dry basis, for a 40 MWe biomass plant would be:
  - 175,000 at approximately 60% capacity factor
  - 200,200 at approximately 70% capacity factor
  - 245,000 at approximately 85% capacity factor
- Logistics, transportation and stock piling of the of the wood chips; and
- Transmission substation and connection to the national grid via an overhead power line of maximum 66 kV.

With reference to section 1, this EMP relates to harvesting, processing and transportation of the encroacher bush as fuel source to the proposed Otjikoto Biomass Power Station.

A separate EMP was developed for the Otjikoto Biomass Power Station and the transmission substation and connection to the national grid via an overhead power line.

4.2 PROJECT LOCATION

The location for the proposed Otjikoto Biomass Power Station site is approximately 7 km northwest of Tsumeb, in the Oshikoto Region. Refer to Figure 4-1 for the harvesting area, which covers an area of roughly 3.1 million ha surrounding the proposed Otjikoto Biomass Power Station site that is owned by NamPower, excluding no-go areas and other constraints in the harvesting area. These constraints and no-go areas were highlighted during the Scoping Phase of the EIA, as indicted in Figure 4-1, and includes the following:

- National Parks (i.e. Etosha and Waterberg National Park);
- Slopes exceeding 12.5% gradient; and
- Sensitive bioclimatic endemism.

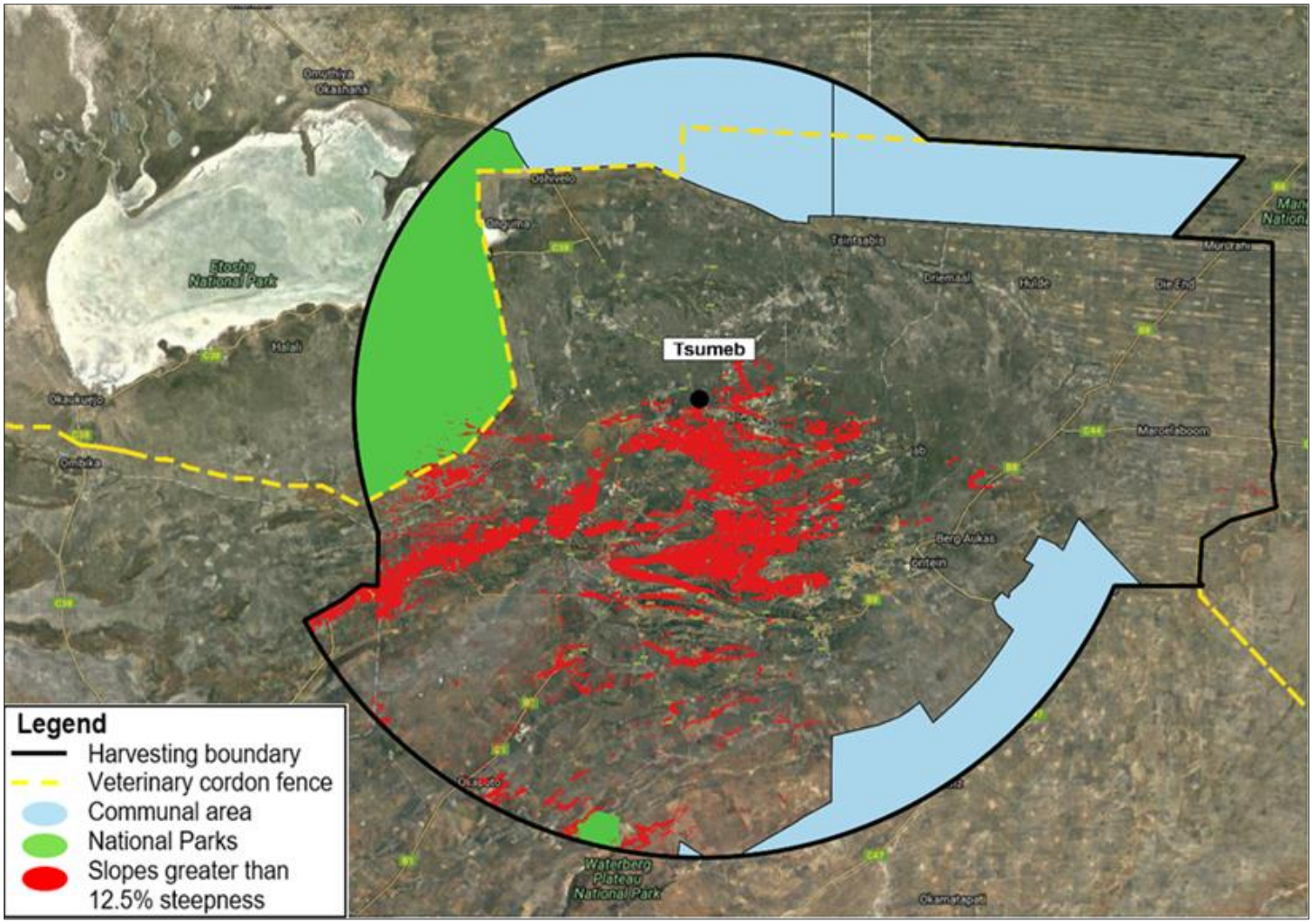

FIGURE 4-1: LOCALITY MAP FOR THE PROPOSED OTJIKOTO BIOMASS POWER STATION IN RELATION TO THE HARVESTING AREA

4.3 HARVESTING AND PROCESSING OF BIOMASS

The harvesting will be undertaken in suitable areas around the proposed Otjikoto Biomass Power Station site. The specific harvesting areas will be determined by the harvesters, where strict adherence to the requirements included in the various Management Pans (Section 7) will be imposed.

There are six main operations relating to the harvesting and processing component, described in the sections below:

- Felling;
- Stacking;
- Feeding;
- Chipping/Grinding;
- Shuttling; and
- Transferring (i.e. transportation of the biomass to the plant).

4.3.1 Felling

The proposed 40 MWe biomass plant will require 245,000 tonnes of wood chips per annum (on a dry basis) at approximately 85% design capacity factor i.e. base load operations. Harvesting has to happen at a higher rate due to the fact that the wood harvested will be wet and first needs to dry, therefore losing weight. Also, assuming harvesting take place only 9 months of the year due to rain events and other unforeseen circumstances, the assumption is that the harvesting rate will have to be around 750 tonnes per day. At an average yield of 12.65 t/ha, this would thin approximately 20,000 hectares of land per annum, equivalent to approximately 3 commercial farms per annum, depending on the methodology, scale and intensity of harvesting. The harvestable area around the proposed Biomass Power Station is approximately 3.1 million ha, excluding slopes & protected areas. Approximately 12.8% of the harvestable area will be harvested over the 25 years.

Different felling equipment can be used to harvest bushes. The equipment varies, depending on the size of the bushes to be harvested and on the level of mechanisation of the harvesting operation. For bushes and small-scale harvesting; labour intensive felling methods are typically used. For larger harvesting operations; larger, fully mechanised methods are used. Both methods are, however, being considered by NamPower. From a biodiversity impacts perspective, intensive, non-selective mechanised harvesting should be minimised where possible. Whichever method is used, it is subject to compliance with; this EMP, general guidelines provided by the Strategic Environmental Assessment (SEA) of Large-Scale Bush Thinning and Value-Addition Activities in Namibia (SAIEA, 2016), and the Forestry and Environmental Authorisations Process for Bush Harvesting Projects (Pallett & Tarr, 2017). Based on the impacts of harvesting techniques different aftercare and levels of aftercare will be applicable.

Bush will be thinned, not cleared, during the felling activities. Practical guidelines for thinning intensities, as provided in the above mentioned “Forestry and Environmental Authorizations Process for Bush Harvesting Projects”, will be followed.

Also, the enormous potential woody resource compared to the supply requirements for the proposed Biomass Power Station means that re-harvesting i.e. bush farming, is not required. From a biodiversity impact perspective,

it has been identified that intentional bush farming may not be included as an objective by any landowners or harvesting contractor (refer to section 4.3.8 for further information).

4.3.2 Stacking

The expected moisture content of the delivered biomass woodchips as fuel to the biomass power station will vary between 45% moisture content in the rainy season to a minimum of approximately 5% in the dry winter months. Thus, the biomass power station has to be designed to handle a fuel source with high moisture variation in its boiler.

However, stacking will be undertaken in the dry months to facilitate further processing i.e. grinding/chipping. Felled bushes will be stacked in windrows or piles to allow for the air and sun to dry the biomass. The Namibian climate is ideal for this drying process to be conducted naturally. However, some bush species chip easier when wet. Dry and harder wood species are often easier crushed or grinded by means of an impact action. The specific requirements of the boiler can be met with additional drying on site and/or blending of woodchips with different moisture content.

4.3.3 Feeding

The harvested bushes will be fed into the chipper/grinder manually or mechanically. A three-wheel logger is often used for this purpose. The proposed Otjikoto Biomass Power Station is likely to use wood chips.

A mechanical feeder grabs the trees from the stacked windrows with a hydraulically operated buncher or grab and feeds the bush into the grinder.

4.3.4 Chipping/Grinding

The fuel specification for the proposed Biomass Otjikoto Biomass Power Station depends on the final specification agreed between the technology suppliers and the capability of the harvesters but will be in wood chip format.

The bushes will be fed through a grinder, or chipper for some softer and wet woods, to produce wood chips. The chipping/grinding operation will have a built-in screen which will regulate the size of the chips. The wood will need to be chipped to specific size requirements.

4.3.5 Shuttling

Wood chips will be gathered in a shuttling trailer near the point of harvesting, at the point where the grinding/chipping takes place, and transported to the collection or transferring point.

4.3.6 Transferring

The wood chips will be stored at a central collection point prior to being loaded onto road trailers for road transport to the delivery point at the power station.

4.3.7 Harvesting workforce

For the assessment, it is assumed that multiple harvesting teams will be operating at any one time. The biomass harvesting will take place over 40 weeks per year. Please note that this may differ to the actual conditions during operations, nonetheless the impacts and mitigation measures prescribed in the EIA Report and this EMP will remain relevant.

4.3.8 Aftercare

Bush encroacher species, especially *Dichrostachys cinerea,* which is to be considered a dominant species in the harvesting area are extremely prone to regeneration, especially when the topsoil is disturbed. Therefore, if the landowners have made an informed decision to improve rangelands, they will need to adopt a suitable aftercare programme to maintain the rangelands for livestock production and to realize other biodiversity improvements.

One of the benefits of the proposed Biomass Power Project is the restoration of degraded savanna through bush thinning practices. This will create the opportunity to restore ecological structure, function and composition in a way that will simultaneously improve agricultural rangeland productivity, which is a secondary objective of the project (refer to section 1.3). It is not the goal of the project to sustainably harvest wood for energy production, also known as 'bush farming'. The post-harvesting management of the de-bushed rangeland is the most important aspect to get right in the quest to restore rangeland ecological integrity and productivity. All the hard work of bush clearing could come undone if sound rangeland management principles are not applied.

The Biodiversity Specialists confirmed through their studies that herbaceous biomass increases after woody plant harvesting, but that aftercare is required to sustain a high herbaceous production over longer timeframes.

Aftercare should be conducted according to the guidelines provided in section 14, Appendix B, and the Site Specific Harvesting Plans (section 11).

4.4 TRANSPORTATION OF BIOMASS TO THE OTJIKOTO BIOMASS POWER STATION

The biomass fuel supply strategy consists of two main biomass suppliers i) long term fuel suppliers and ii) ad hoc fuel suppliers. Long term fuel suppliers will provide the bulk of the fuel with 30 ton payload trucks and large annual volumes that will be allocated to these suppliers. The long term suppliers will have performance obligations towards NamPower There will be at least 4 long term fuel suppliers, each assigned at least 30,000 tonnes per annum that can be ramped up to 60,000 tonnes. Smaller suppliers, termed ad hoc suppliers, will also be afforded the opportunity to supply biomass to the plant. Ad hoc suppliers' truck size will be limited to a minimum 8 ton payload. In total the ad hoc fuel suppliers will be allocated a maximum of 30,000 tonnes per annum.

The conservative number of biomass trips adopted for the Transport Impact Assessment (TIA) are 47 return trips per day, resulting in 47 trips in and 47 trips out or an equivalent of 94 additional trips to the average daily traffic (ADT). This may however change and is dependent on the final fuel delivery strategy that will be adopted by the Otjikoto Biomass Power Station and the figures in this report are indicative only.

5. ENVIRONMENTAL ASPECT (ISSUES) AND POTENTIAL IMPACTS

Understanding the biophysical and human environment in which the harvesting and transportation of biomass to the proposed Biomass Otjikoto Biomass Power Station will be conducted is the first step to understanding the environmental impacts. The next step is to identify the environmental aspects that give rise to the impacts. All of these aspects have the potential to cause impacts on the environment, or third parties in different ways. Successful management will be gauged by how well NamPower and their relevant contractors avoid, minimise or mitigate all of the impacts associated with each environmental aspect.

The proposed Biomass Power Project will enable the promotion of recovery of savanna rangeland productivity through the beneficial ecosystem level effects of bush clearing, i.e. thinning. Although the ultimate impact of restoring harvested areas will be positive, with proper post harvesting maintenance, negative impacts could take place during the harvesting process, where mitigation measures fail or are not followed. Savanna ecosystems are very complex (SEA, 2016) and therefore difficult to fully understand, and difficult to predict responses to disturbances and management interventions.

The EIA process for the proposed Biomass Power Project included studies of the current environment associated with the harvesting area, surrounding the Otjikoto Biomass Power Station (see Figure 4-1). Environmental aspects and potential environmental impacts associated with the activities were identified. The full suite of harvesting and associated activities, including the transportation of the biomass, are described in the EIA Report for the Biomass Power Project in Namibia and summarized in section 4 of this EMP.

Potential environmental impacts were identified by SLR in consultation with IAPs, regulatory authorities, specialist consultants (see Team of Specialists in section 1.4.1 of the EIA Report) and NamPower. The impacts were assessed under the issue headings in Chapter 7 of the EIA Report. Impacts were considered in a cumulative manner, where possible, such that the impacts of the proposed Biomass Power Project were assessed in the context of the baseline conditions described in section 6 of the EIA Report.

Table 5-1 provides; a summary of the environmental aspects associated with harvesting and associated activities, including the transportation of the biomass, how they could impact the biophysical and human environments respectively' and their assessment ratings in the unmitigated and mitigated scenarios.

TABLE 5-1: DESCRIPTION OF ENVIRONMENTAL ASPECTS AND IMPACTS ASSOCIATED WITH PROPOSED HARVESTING, ASSOCIATED ACTIVITIES, AND TRANSPORTATION OF BIOMASS

Environmental component	Environmental and Socio-Economic Aspects		Potential Impacts	Assessment Significance Rating	
	Harvesting and associated activities	Transport of Biomass to the Otjikoto Biomass Power Station		Unmitigated	Mitigated
Traffic	• Moving equipment and workers to the specific harvesting area.	• Transport of the wood chips to the Otjikoto Biomass Power Station.	**Impact on road capacity and road condition – TR 1/10**	**M**	**L**
			Impact on road capacity and road condition – Gravel Roads: • **DR 3007** • **Other gravel Roads**	**M** **L**	**L** **L**
			Impact at the TR 1/10 and DR 3007 intersection	**M**	**L**
Soils	• Soil compaction through vehicle movement and machinery used for harvesting activities. • Oil and fuel spills from equipment and vehicles used. • Removal of protective shrubs and trees causing erosion. • Reduction in nutrient transfer from deep soil layers though seasonal leaf fall in the harvesting area. • Improved soil carbon cycle and soil structure. • Use of arboricide during aftercare.	• Soil compaction through increased vehicular movements associated with the transport of the wood chips to the Otjikoto Biomass Power Station. • Oil and fuel spills from vehicles used.	**Soil compaction potentially affecting plants and animals above the soil surface, as well as soil macro-fauna and microorganisms below the soil surface**	**M**	**L**
			Wind and water erosion in the harvesting area	**M**	**L**
			Reduction in nutrient transfer from deep soil layers though seasonal leaf fall in the harvesting area	**M**	**M**
			Improved soil carbon cycle and soil structure	**M+**	**-**
			Soil contamination through fuel and oil spills in the harvesting area and arboricides after-effects	**M**	**L-M**
Biodiversity	• Improvement of rangeland productivity. • Improvement of biodiversity and ecological integrity of savannas. • Harvesting operations (using heavy machinery and labourers) causing	• Transportation of the biomass causing physical destruction of organisms and habitats and / or the general disturbance to biodiversity.	**Failure to achieve savanna ecological restoration goals in the harvesting area**	**H**	**H+**
			Large scale loss of protected woody species, including fruit-bearing species important for humans and other fauna, as well as rare, iconic timber species	**H**	**M**

Environmental component	Environmental and Socio-Economic Aspects		Potential Impacts	Assessment Significance Rating	
	Harvesting and associated activities	Transport of Biomass to the Otjikoto Biomass Power Station		Unmitigated	Mitigated
	physical destruction of organisms and habitats and / or the general disturbance to biodiversity.		**due to indiscriminate and excessive take-off**		
			Loss of and disturbance of animals in harvesting area	**M-H**	**L-M**
Surface Water	• Increased salinization through bush harvesting, impacting surface water quality. • Surface water contamination as a result of hydrocarbon spills from harvesting machinery and trucks. • Non-environmentally friendly arboricides impacting surface water quality. • Ash from the Power Station taken back to the harvested farms.	• Surface water contamination as a result of hydrocarbon spills from trucks during transportation of biomass.	**Bush harvesting activities causing increased salinization, causing surface water quality impacts**	**H**	**L**
			Non-environmentally friendly arboricides used after bush harvesting i.e. aftercare impacting on surface water quality	**H**	**L**
			Contamination of surface water from hydrocarbon spillages and undetected leakages from harvesting equipment and trucks transporting biomass	**M**	**L**
			Contamination of surface water from ash from the Power Station taken back to the harvested farms	**M**	**L**
Groundwater	• Positive impacts of bush harvesting activities on the groundwater levels. • Groundwater contamination as a result of hydrocarbon spills from harvesting machinery and trucks transporting biomass. • Impact of bush harvesting on groundwater and soil through salinization. • Impact of seeping of arboricides into the underlying aquifer. • Ash from the Power Station taken back to the harvested farms.	• Groundwater contamination as a result of hydrocarbon spills from trucks during transportation of biomass.	**Impact of bush harvesting on the groundwater levels**	**M+**	**-**
			Impact of bush harvesting on groundwater and soil through salinization	**M**	**L**
			Non-environmentally friendly arboricides used after bush harvesting i.e. aftercare, impacting on groundwater quality	**M**	**L**
			Contamination of groundwater from hydrocarbon spillages and undetected leakages from harvesting equipment and trucks transporting biomass	**M**	**L**

Environmental component	Environmental and Socio-Economic Aspects		Potential Impacts	Assessment Significance Rating	
	Harvesting and associated activities	Transport of Biomass to the Otjikoto Biomass Power Station		Unmitigated	Mitigated
			Impact on groundwater from ash from the Power Station taken back to the harvested farms	**M**	**L**
Air Quality	• Dust from bush harvesting activities causing impacts to third parties' health and causing nuisance. • Gaseous and particulate emissions from vehicle tailpipes	• Dust from transportation on gravel roads causing impacts to third parties' health and causing nuisance. • Gaseous and particulate emissions from vehicle tailpipes	**Air pollution in the harvesting areas**	**M**	**L-M**
Noise	• Vehicle movement and machinery used for bush thinning activities, including: felling, stacking, feeding, chipping and shuttling.	• Increased vehicular movements associated with the transport of the wood chips to the Otjikoto Biomass Power Station.	**Noise pollution in the harvesting areas**	**L**	**L**
Archaeology	• Vehicle movement and machinery used for bush thinning activities.	• Increased vehicular movements associated with the transport of the wood chips to the Otjikoto Biomass Power Station.	**Damage to archaeological resources**	**H**	**L**
Visual	• Moving equipment and workers to the specific harvesting area. • Bush thinning activities.	• Increased vehicular movements associated with the transport of the wood chips to the Otjikoto Biomass Power Station.	**Visual impact to third parties**	**L**	**L**
Socio-economic	• Harvesting contracts i.e. business opportunities. • Harvesting Contractors i.e. workers, working on farms near residences. • Other biomass users in the area. • Land productivity improvements.	• Transport of biomass using contractors.	**Job creation and skills development**	**H+**	**-**
			Creating business opportunities	**H+**	**-**
			Impact on existing wood biomass users	**H**	**M**
			Bush-thinning on land productivity i.e. improvement of rangeland productivity	**M-H+**	**H+**
			Impact on safety, security and health in the farming community	**H**	**M**

Environmental component	Environmental and Socio-Economic Aspects		Potential Impacts	Assessment Significance Rating	
	Harvesting and associated activities	Transport of Biomass to the Otjikoto Biomass Power Station		Unmitigated	Mitigated
			Community resilience to population in-migration	H	M
			Upholding human rights and interests of vulnerable people	M+	M+

6. OVERALL ENVIRONMENTAL OBJECTIVES

The following overall environmental objectives have been set for the proposed Biomass Power Project:

- Comply with national legislation and standards for the protection of the environment;
- Comply with corporate sustainable development policies and objectives.
- Conservation of protected species of trees;
- Promote the management of the savannah ecosystems towards sustainable grazing.
- Protection of habitats required by birds and animals.
- To protect soils and groundwater resources through the implementation of measures for spill prevention and clean-up;
- Prevent soil erosion;
- Promote optimum balance between grass and trees.
- Protect cultural heritage.
- Ensure the legal and appropriate management and disposal of general and hazardous waste, through the implementation of a strategy for the minimisation, recycling, management, temporary storage, and removal of wastes;
- Minimise the potential for dust emissions through the implementation of dust control measures where required;
- Minimise the potential for noise and light disturbance in surrounding areas;
- Avoid potential impacts on the safety of third parties through appropriate site access control;
- Develop, implement and manage monitoring systems to ensure good environmental performance in respect of the following: ground and surface water, air quality, noise, biodiversity, and soil;
- Prevent pollution and clean up if incidents occur;
- Support and encourage environmental awareness and responsibility amongst all employees and service providers;
- Promote and provide appropriate environmental training for all employees and service providers;
- Keep surrounding communities informed of activities through appropriate, constructive communication.

NamPower has a Safety, Health, Environmental and Quality (SHEQ) Management System in place. The commitments in this EMP will need to be incorporated into the SHEQ Management System, where relevant, when it is implemented for the Biomass Power Project. A copy of the NamPower SHEQ Policy Statement is attached as Appendix 3 of the EIA Report.

7. MANAGEMENT PLANS FOR THE HARVESTING AND ASSOCIATED ACTIVITIES AND TRANSPORTATION OF BIOMASS

Two key documents that guide bush harvesting are the SEA commissioned by the GiZ project on bush thinning (SAIEA, 2016) and the National Rangeland Management Strategy and Policy of the MAWF[1]. With reference to section 1, the ten Principles and Criteria of FSC will also guide the implementation of the proposed harvesting and associated activities.

The various Management Plans (MPs) presented in the sections below, that were developed as an outcome of the EIA process for the proposed Biomass Power Project, need to be read in conjunction with the above mentioned documents and FSC principles and criteria.

The Management Plans, listed in the table below, are applicable to all the relevant harvesting and associated activities and transportation of biomass.

TABLE 7-1: VARIOUS MANAGEMENT PLANS

Number	Various Management Plans
7.1	Encroacher Bush Biomass Power Project General MP
7.2	Biodiversity MP
7.3	Soil MP
7.4	Groundwater MP
7.5	Surface water MP
7.6	Archaeology MP
7.7	Noise MP
7.8	Traffic MP
7.9	Air Quality MP
7.10	Third Party Health Risk MP
7.11	Visual MP
7.12	Socio-Economic MP
7.13	Climate Change and adaption and management measures

[1] http://www.nrmps.org/

7.1 Biomass Power Project

General MP

7.1 GENERAL MANAGEMENT PLAN

7.1.1 Objectives

- To define roles and responsibilities for the implementation of the EMP.
- To ensure that channels of communication are maintained over the life of the Biomass Power Project with surrounding landowners and other relevant stakeholders, specifically relating to the harvesting and associated activities.
- To ensure that public complaints are recorded and addressed.
- To ensure that all persons working on the project i.e. harvesting sites and transportation to the Otjikoto Biomass Power Station, are aware of the objectives of the EMP as well as the consequences of their individual actions.
- Avoid/minimise environmental impact from spills.
- To ensure effective management of wastes generated during the biomass harvesting and associated activities.
- Implementation of the required management measures and compliance with the EMP.
- To minimise the opportunities for crime and the occurrence of social ills.
- To recognise impacts on environmental resources in the area.
- Minimise the risk for environmental emergencies occurring and implement controls to deal with situations, shall they occur.
- Ensure appropriate response to an emergency and prevent the recurrence of incidents.

7.1.2 Action Plan

TABLE 7-2: GENERAL MP

7.1	Issue	Item	Management, Mitigation and Monitoring Actions	Implementation Programme	
				Responsible Entity	Implementation and Frequency
Relevant to all Project Phases					
7.1.1	**Roles and Responsibilities for the implementation of the EMP**	**7.1.1.1**	Ultimate accountability relating to the compliance with the EMP commitments rests with NamPower.	NamPower	On approval of EMP, ongoing
		7.1.1.2	Overall responsibility for the implementation of the EMP commitments rests with various harvesting and transport contractors (H&TCs), through contractual obligations with NamPower.	H&TCs	Ongoing
		7.1.1.3	The various landowners / lessees are responsible for the implementation, monitoring and auditing of compliance with the EMP relevant to their specific activities.	H&TCs	Ongoing
		7.1.1.4	NamPower will nominate a capable and suitably qualified Safety, Health & Environmental (SHE) Officer for the project to oversee the implementation of the EMP by the contractors. This person will be dedicated to the Biomass Power Project.	NamPower	On approval of EMP, ongoing
		7.1.1.5	The NamPower SHE Officer will ensure regular compliance checks throughout the project.	NamPower	On approval of EMP, ongoing
		7.1.1.6	NamPower will ensure that all contractors and sub-contractors are aware of and familiar with site operations, the key environmental issues and consequences of non-compliance to the EMP.	NamPower	Throughout the project
		7.1.1.7	Adherence to the ECC, permit conditions, the EMP and NamPower policies will be included as a contractual requirement.	NamPower	Throughout the project
		7.1.1.8	All contractors will be provided with a copy of the EMP and relevant Emergency Response Plan.	NamPower	Throughout the project
		7.1.1.9	Each contractor will provide NamPower with a signed letter indicating their acknowledgement of the conditions of the ECC, relevant permit conditions, the EMP, and relevant policies.	Various contractors	Throughout the project

		7.1.1.10	Contractors are responsible for compliance with the EMP for all aspects of their work package. The harvesting contractors will develop Site-Specific Harvesting Plans (see section 11).	Various contractors	Throughout the project
		7.1.1.11	Incidences or non-compliance will be reported to the dedicated NamPower representative and the Steering Committee (see below).	Various contractors	Throughout the project
		7.1.1.12	The harvesting contractors shall each appoint a Safety, Health & Environmental (SHE) Officer to ensure regular compliance checks during their harvesting activities. Records are to be kept.	Various contractors	Throughout the project
		7.1.1.13	To clearly define ecological/restoration goals, standards, best practises and specify further roles and responsibilities, also relating to the aftercare, at the start of the project. Tit is recommended that this includes a consultative process. The consultative process could, for example, entail a workshop coordinated by NamPower and attended by key stakeholders, which include representatives from, amongst others: Directorate of Wildlife and National Parks, Director of Forestry, and other key stakeholder in the agricultural sector.	NamPower	On approval of EMP, ongoing
		7.1.1.14	A Steering Committee shall be established before harvesting commences. The Steering Committee will meet at least quarterly at the beginning of the activities and thereafter at least bi-annually. The objectives of the Steering Committee will be to: (a) oversee the adaptive management approach (see section 12) and further implementation of the EMP at the regional level, to serve as a platform for information sharing, to guide and evaluate monitoring data, and to make decisions about management that will maintain the project's trajectory to promoting the relevant restoration goals; (b) Obtain further input on the above mentioned activities and objectives from key stakeholders and relevant specialists, as and when required.	NamPower	On approval of EMP, ongoing
7.1.2	**Ongoing stakeholder and community outreach,**	**7.1.2.1**	**Specific to the site being harvested (7.1.2.1 - 7.1.2.4)** Develop a detailed Stakeholder and Community Engagement Plan, taking the various commitments in this EMP into consideration.	NamPower	Prior to activities commencing

	education and general communication	**7.1.2.2**	Consult with landowners and provide feedback regarding activities on a basis specified in the site access contract.	Harvesting contractors	As per the site access contract
		7.1.2.3	Provide contact details of a designated NamPower person, who will handle complaints from landowners, harvesters or general public relating to the harvesting activities.	Harvesting contractors	Prior to activities commencing
		7.1.2.4	The harvester to provide the landowners with a list of all people working at the relevant harvesting area.	Harvesting contractors	Prior to activities commencing
		7.1.2.5	NamPower to consult critical stakeholders such as local farmers, to assist with the monitoring of social impacts and the effectiveness of the mitigation measures put in place.	Harvesting contractors	Prior to activities commencing
		7.1.2.6	**General to the wider project area (7.1.2.6 - 7.1.2.10)** Maintain and update the Biomass Power Project stakeholder register.	NamPower	On approval of EMP, ongoing
		7.1.2.7	Ensure that relevant stakeholder groups are included in the stakeholder register, including nearby residents and the Tsumeb Municipality.	NamPower	On approval of EMP, ongoing
		7.1.2.8	NamPower will communicate at least annually with the identified stakeholder groups.	NamPower	On approval of EMP, ongoing
		7.1.2.9	Devise and implement a stakeholder communication and engagement strategy.	NamPower	Throughout the duration of the project
		7.1.2.10	Keep stakeholders informed about the Biomass Power Project activities. Use appropriate communication channels to consult with, and disseminate information to, the identified stakeholder groups and to monitor social impacts and the effectiveness of the mitigation measures put in place. Identify a spokesperson for the San people to ensure effective communication and input from them, where relevant.	NamPower	Throughout the duration of the project

		7.1.2.11	Communication channels could include the following: public meetings or open days, newsletters for both employees and the public, national and local newspapers, television, radio and the internet, and annual sustainable development report.	NamPower	Throughout the duration of the project
		7.1.2.12	Develop and maintain a complaints register for stakeholders and publicise the channels through which issues can be submitted to the harvesting contractors.	NamPower/ harvesting contractors	Throughout the duration of the project
		7.1.2.13	Develop and maintain a complaints register for employees and contractors working at the harvesting areas and inform them of the channels through which issues can be submitted to management to address	NamPower & contractors	Prior to activities commencing
		7.1.2.14	The complaints register will record the following: date when complaint was received; name of person to whom the complaint was reported; nature of the complaint reported; the way in which the complaint was addressed; and the date when it was addressed. Complaints will include grievances and concerns.	NamPower/ harvesting contractors	Throughout the duration of the project
		7.1.2.15	Any complaints received regarding the harvesting activities will be brought to the attention of the relevant harvesting contractor and NamPower within one working day.	NamPower/ harvesting contractors	Throughout the duration of the project
		7.1.2.16	NamPower and the relevant harvesting contractor will assess the merits of every complaint and initiate an investigation when required. Complaints will be investigated and remedied where possible. A response will be provided to the complainant.	NamPower/ harvesting contractors	As required, within 2 weeks, where possible
		7.1.2.17	The complaints register will be kept up to date for inspection.	NamPower/ harvesting contractors	Ongoing
7.1.3	**SHE Awareness and training**	**7.1.3.1**	Safety, health and environmental (SHE) induction training will be provided to all persons undertaking work at the harvesting areas.	NamPower / harvesting contractors	Prior to activities commencing
		7.1.3.2	This will ensure that all persons working at the project are: (a) aware of the environmental sensitivities of the project site; (b) informed of the risks of the project and the causes thereof; (c) aware of the objectives of the EMP;	NamPower	Prior to activities commencing

			(d) aware of the Biomass Harvesting Guidelines; and (e) the consequences of their individual actions.		
		7.1.3.3	Refer to section 10 for further training requirements.		
7.1.4	**Site Access Contracts / Fuel Supply Agreements**	**7.1.4.1**	Site access contracts between the relevant parties shall be drawn up and signed, to include the following as a minimum: (a) Defining contracting term period; (b) Commitment to the Site Specific Harvesting Plan and management plan; (c) Access agreements for auditing and monitoring; (d) Transport speed limits; (e) Commitment to compliance with the EMP; (f) Willingness to agree to aftercare, as per Site Specific Harvesting Plan.	Landowners /lessees and NamPower	Prior to activities commencing
		7.1.4.2	Honour agreements set out in the site-access contracts.	Landowners /lessees and NamPower	Prior to activities commencing
		7.1.4.3	Share induction training material with the landowners during the agreement process.	Harvesting Contractors	Prior to activities commencing
7.1.5	**Safety and security**	**7.1.5.1**	Note that a separate Occupational Health and Safety (OHS) Plan shall be developed for the harvesting and associated activities and that this does not form part of this EMP. The harvesting contractors will adhere to; all the relevant Namibian legislation and the requirements of its financing partners in terms of workers' rights and employment conditions, health and safety, the rights of indigenous peoples and other vulnerable groups and community relations. Implement a formal health and safety management system. Ensure that fuel suppliers adhere to the OHS precautions for bush harvesting for a range of potential impacts including HIV/AIDS infection, snake bites, scorpion stings, body injuries from thorns, machinery, fire and traffic accidents as detailed in government guidelines for bush thinning.	Harvesting contractors	Throughout the duration of the activities
		7.1.5.2	Agreements between the harvesting contractors and the landowners will include safety requirements.	NamPower/ harvesting contractors	Throughout the duration of the activities

		7.1.5.3	Temporary warning signs will be in place at appropriate intervals, in appropriate languages with danger pictures to warn people of the safety risks of entering the harvesting area.	NamPower/ harvesting contractors	Throughout the duration of the activities
		7.1.5.4	Information will be provided to the landowners to educate them about the dangers associated with the harvesting activities and machinery used.	NamPower/ harvesting contractors	Throughout the duration of the activities
		7.1.5.5	The site will be operated as alcohol-free and drug-free. The harvesting contractor shall take the necessary measures to ensure compliance.	NamPower/ harvesting contractors	Throughout the duration of the activities
		7.1.5.6	Only companies that comply with all legal health and safety requirements will be used for the supply and transport of biomass to the plant.	NamPower/ harvesting contractors	Throughout the duration of the activities
		7.1.5.7	Develop and implement a Harvesting Emergency Response Plan.	NamPower/ harvesting contractors	Throughout the duration of the activities
		7.1.5.8	Harvesting contractors shall give consideration to indigenous people, if present on the land, giving local communities preference for employment and adhering to national labour legislation (refer to the Socio-Economic MP for further details).	Harvesting contractors	Throughout the duration of the activities
		7.1.5.9	Harvesting contractors to have a comprehensive HIV, AIDS and TB workplace policy and wellness programme which will detail HIV prevention measures in the workplace and enable easy access to AIDS treatment, care and support for employees.	Harvesting contractors	Throughout the duration of the activities
		7.1.5.10	Critical stakeholders, such as local farmers, will assist with the monitoring of social impacts and the effectiveness of the mitigation measures put in place.	Harvesting contractors	Throughout the duration of the activities
		7.1.5.11	Possession of a firearm, snare or other weapon or a trap shall be prohibited; such items shall be confiscated if detected, and the offender issued with a warning, or prosecution, as appropriate.	Harvesting contractors	Throughout the duration of the activities
		7.1.5.12	All staff operating in the harvesting area will be provided with identification and proof that they are working on the project.	Harvesting contractors	Throughout the duration of the activities

		7.1.5.13	To avoid starting a fire, smoking will only be allowed in dedicated smoking areas with a sand filled drum or similar container for disposal of cigarette butts or otherwise, as agreed by the landowners.	Harvesting contractors	Throughout the duration of the activities
		7.1.5.14	No open fires for cooking will be permitted unless otherwise agreed with the landowner. Furthermore, fire extinguishers will be available at each site.	Harvesting contractors	Throughout the duration of the activities
		7.1.5.15	**Emergency Situations (7.1.5.16 - 7.1.5.17)** If people (or animals) do get injured as a result of the harvesting and associated activities, the Harvesting Emergency Response Plan will be followed.	Harvesting contractors	Prior to activities commencing. Throughout the duration of the activities
		7.1.5.16	A transparent Public Consultation and Disclosure Plan will be developed, which will be regularly reviewed, to ensure stakeholders' concerns and grievances are addressed promptly.	NamPower/ harvesting contractors	Prior to activities commencing. Throughout the duration of the activities
7.1.6	**Spill Prevention and Management**	**7.1.6.1**	Ensure that all potentially polluting substances and materials such as hydrocarbons, hazardous chemicals, dirty water, and wastes, are handled in a manner so that they do not pollute the environment. This will be implemented through one or more procedure, work instruction, and /or method statement covering the following: (a) pollution prevention through basic infrastructure design and through the education and training of workers; (b) the required steps to enable pollution incidents to be contained and remediated in a timely manner. Options include in situ treatment, bioremediation, or disposal of contaminated soils as hazardous waste.	Harvesting contractors	Throughout the duration of the activities
		7.1.6.2	Regular maintenance of machinery and servicing of vehicles to prevent breakdowns and the need to repair machinery on-site.	Harvesting contractors	Throughout the duration of the activities
		7.1.6.3	All diesel / petrol tanks, including trailers, shall be contained or stored in lined and bunded areas.	Harvesting contractors	Throughout the duration of the activities

		7.1.6.4	Drip trays shall be kept under all diesel and petrol bowsers whilst in operation and during the refuelling of equipment.	Harvesting contractors	Throughout the duration of the activities
		7.1.6.5	All machinery and equipment shall be properly maintained to prevent oil and fuel spills.	Harvesting contractors	Throughout the duration of the activities
		7.1.6.6	Ensure that the fuel transport companies have a system in place to deal with hydrocarbon spills and the subsequent clean-up thereof.	Harvesting contractors	Throughout the duration of the activities
		7.1.6.7	Designate refuelling areas for harvesting equipment. Re-fuelling procedures are to be developed.	Harvesting contractors	Throughout the duration of the activities
		7.1.6.8	Hydrocarbon spills will be regarded as an environmental incident and reported through the incident reporting system.	Harvesting contractors	Throughout the duration of the activities
		7.1.6.9	Proper oil spill cleaning kits shall be available at harvesting areas. All spills of hydrocarbons, oil, grease, diesel, petrol, etc. will be cleaned with the use of suitable absorbent materials.	Harvesting contractors	At a spill. Continues
		7.1.6.10	Major spillage incidents will be handled in accordance with the Harvesting Emergency Response Plan.	Harvesting contractors	At a spill. Continues
		7.1.6.11	Ensure appropriate inspections are conducted to ensure the early detection of spills.	Harvesting contractors	At a spill. Continues
7.1.7	**Waste Management**	**7.1.7.1**	**Waste management hierarchy (7.1.7.1 - 7.1.7.2)** The following waste management hierarchy will be implemented: (a) Waste minimisation; (b) Re-use, recycle and recover waste; (c) Treat waste if possible; and (d) Disposal in suitably permitted and managed landfills.	NamPower/ harvesting contractors	Throughout the duration of the activities
		7.1.7.2	The Harvesting Contractors will assess each waste type to see whether there are alternative uses for the material.	NamPower/ harvesting contractors	Throughout the duration of the activities

		7.1.7.3	**Waste Management procedure (7.1.7.3 - 7.1.7.4)** The harvesting contractors will each develop and implement a waste management procedure that will cover the storage, handling and transportation of waste to and from the site.	Harvesting contractors	Prior to start of activities
		7.1.7.4	Written evidence of safe disposal of all waste types will be kept.	Harvesting contractors	Prior to start of activities
		7.1.7.5	**Waste collection in work areas (7.1.7.5 - 7.1.7.8)** Adequate skips or rubbish bins will be provided in relevant work areas.	Harvesting contractors	Throughout the duration of the activities
		7.1.7.6	Waste will be separated as far as practically possible.	Harvesting contractors	Throughout the duration of the activities
		7.1.7.7	Littering will be prohibited.	Harvesting contractors	Throughout the duration of the activities
		7.1.7.8	Mixing of non-hazardous and hazardous wastes will be prohibited.	Harvesting contractors	Throughout the duration of the activities
		7.1.7.9	**Waste transport** Waste will be transported to the appropriate disposal facilities.	Harvesting contractors	Throughout the duration of the activities
		7.1.7.10	**Waste Disposal (7.1.7.10 - 7.1.7.12)** No waste shall be burnt or buried at the harvesting areas.	Harvesting contractors	Throughout the duration of the activities
		7.1.7.11	Domestic waste will be disposed of at a licensed or municipal landfill site.	Harvesting contractors	Throughout the duration of the activities
		7.1.7.12	Hazardous waste will be disposed of at the licensed hazardous landfill in Walvis Bay or Windhoek.	Harvesting contractors	Throughout the duration of the activities
		7.1.7.13	**Sewage (7.1.7.13 - 7.1.7.16)**	Harvesting contractors	Throughout the duration of the activities

			Provide appropriate mobile chemical toilet facilities. Surrounding bushes shall not be used as alternative ablution sites.		
		7.1.7.14	Ensure that mobile toilets are working properly and are cleaned at least weekly, so they do not pollute the surrounding environment or create hygiene problems.	Harvesting contractors	Throughout the duration of the activities
		7.1.7.15	The contractor shall ensure regular servicing of mobile toilets.	Harvesting contractors	Throughout the duration of the activities
		7.1.7.16	All sewerage from the chemical toilets and tanks will be pumped out by a contractor when required and disposed of at a licenced facility.	Harvesting contractors	Throughout the duration of the activities
7.1.8	**EMP Compliance**	**7.1.8.1**	A copy of the ECC and EMP will be kept by the harvesting contractors.	Harvesting contractors	Throughout the duration of the activities
		7.1.8.2	Contractors will implement any procedures and written instructions in terms of the EMP issued to them by NamPower.	Harvesting contractors	Throughout the duration of the activities
		7.1.8.3	Contractors will not deviate from the EMP.	Harvesting contractors	Throughout the duration of the activities
		7.1.8.4	The harvesting contractors' environmental representatives and NamPower's SHE Officer will monitor and audit the activities to ensure compliance with this EMP.	Harvesting contractors / NamPower	Quarterly audits (weekly inspections)
		7.1.8.5	A register of all environmental incidents will be maintained. The designated NamPower official is to be notified of all environmental incidents.	Harvesting contractors / NamPower	At an incident
		7.1.8.6	Records relating to the compliance and non-compliance with the conditions of the ECC and EMP will be kept in good order. Such records will be available for inspection at the site office and must be made available to the MET within seven (7) working days of the date of the written request by MET for such records.	Harvesting contractors / NamPower	Throughout the duration of the project
7.1.9	**Environmental Emergencies**	**7.1.9.1**	Risk assessments will be undertaken for all facilities and activities. The risk assessments must be documented and kept on record.	Harvesting contractors	Prior to activity

		7.1.9.2	The harvesting contractors will provide employees with a copy of the appropriate Harvesting Emergency Response Plan.	Harvesting contractors	Prior to activity
		7.1.9.3	Harvesting Emergency Response Plans will be developed for potential high risks and high risk activities. The Emergency Response Plans will follow the template provided in Appendix A of this EMP.	Harvesting contractors	In the case of an incident.
		7.1.9.4	In the case of an emergency the appropriate response in terms of the Harvesting Emergency Response Plan will be initiated.	Harvesting contractors	In the case of an incident.
7.1.10	**Reporting**	**7.1.10.1**	Report regularly as required to the relevant authorities in terms of authorisations issued by the relevant departments or ministries.	Harvesting contractors / NamPower	Throughout the duration of the project
		7.1.10.2	In the event of an emergency, an incident report will be submitted to the relevant authorities and NamPower.	Harvesting contractors	In the case of an incident
		7.1.10.3	In the event of an incident or accident, NamPower must be notified as soon as reasonably possible.	Harvesting contractors	In the case of an incident
		7.1.10.4	Environmental Performance Reports will be submitted by the harvesting contractors to NamPower. Annual Environmental Performance Reports will be submitted to the MET by NamPower.	Harvesting contractors / NamPower	Bi-annual
		7.1.10.5	Hydrocarbon spills of 200 litres or more must be reported to the relevant Ministries i.e. MET, MAWF, and DWA.	Harvesting contractors / NamPower	At an incident

7.2 Biodiversity MP

7.2 BIODIVERSITY MANAGEMENT PLAN

7.2.1 Objectives

- To ensure savanna ecological restoration goals in the harvesting area are achieved.
- To avoid large scale loss of protected woody species during the harvesting activities.
- To establish and enforce no go areas for harvesting and buffer zones around National Parks.

7.2.2 Action Plan

TABLE 7-3: BIODIVERSITY MP

7.2	Issue	Item	Management, Mitigation and Monitoring Actions	Implementation Programme	
				Responsible Entity	Implementation and Frequency
Relevant to Harvesting and Associated Activities					
7.2.1	**Failure to achieve savanna ecological restoration goals in the harvesting area**	**7.2.1.1**	Mitigating this potential impact involves the definition and implementation of measures to reduce the risk of failing to achieve savanna restoration. Specific recommendations about the structure or function of the measures are not provided due to the complexity of the task however, the critical characteristics are provided below: a) A clear authority and governance structure has to be established, with some form of central supervision and accountability. Ideally this should be vested in NamPower itself, but there are a number of other possible options including the formation of an industry body. b) NamPower could unlock all the potential of this project by appointing an Environmental Manager who can play various roles to ensure that the overall risk of failure is reduced, including auditing, regular training, monitoring and being a champion for responsible management. This is only a recommendation due to the rapid development of the biomass and charcoal sectors and expected impacts of possible changes in European import requirements.	NamPower/ landowners / Steering Committee, in consultation with key stakeholders	Throughout the duration of the activities

			c) The overall management shall be based on an adaptive management approach, including explicit ecological goals and scientific standards. Adaptive management entails a continuous assessment of the condition of savanna structure against the promoted ecological goals and a decision-making process where management actions are adapted to reflect the current and expected future conditions in such a way as to maintain progress towards the defined goals (see section 12 for more details). d) Alignment with FSC standards, although actual certification is not required. By aligning and implementing the FSC standards this will allow for industries best practices to be complied with. Implementing FSC standards will require displaying long term commitment by harvesters that supply the project with biomass, which may be the required model to achieve central supervision and accountability. e) Clear contractual clauses in both the harvesting and fuel supply agreements will be in place to ensure commitment to the project, and environmental, objectives. f) Regular training of harvesters and landowners on the ecological principles that underlie savanna dynamics (see Biodiversity Report and the Biodiversity Baseline Section in the EIA Report), the important species and ecological features, specific cutting and aftercare guidelines.		
		7.2.1.2	**Site-Specific Harvesting Plans** Develop Site-Specific Harvesting Plans (see section 11 for more details).	Harvesting contractors	Throughout the duration of the activities
		7.2.1.3	Monitor the adherence of harvesters to the site-specific EMPs, as prescribed by the FSC® standard (see Section 9 for more details).	Harvesting contractors	Throughout the duration of the activities
		7.2.1.4	Promote spatial heterogeneity in harvesting intensity e.g. for every 10 ha harvested, according to TE-rainfall guidelines, at least one area is left untouched of approximately 30 m to 50 m diameter.	Harvesting contractors	Throughout the duration of the activities
		7.2.1.5	Monitor site-level and regional changes in savanna structure relevant to agreed ecological goals (see more on the Monitoring Requirement in section 9).	Harvesting contractors	Throughout the duration of the activities

		7.2.1.6	Develop and implement a site-based harvesting audit process (see section 10 for more details).	NamPower/ harvesting contractors	As part of the planning stage for the project. Throughout the duration of the project
7.2.2	**Large scale loss of protected woody species, including fruit-bearing species important for humans and other fauna, as well as rare, iconic and timber species due to indiscriminate and excessive take-off**	**7.2.2.1**	Avoid harvesting of the no-go areas.	Harvesting contractors	Throughout the duration of the activities
		7.2.2.2	Develop Site-Specific Harvesting Plans for harvesters and landowners (see more details in section 11).	Harvesting contractors	Throughout the duration of the activities
		7.2.2.3	Before and after harvest inventories of the population densities of valuable species.	Harvesting contractors	Throughout the duration of the activities
		7.2.2.4	Harvesters should be encouraged to follow biomass harvesting guidelines (see section 13). It is important not to over clear: tree equivalents/ha that should remain after thinning should follow the recommended rainfall-TE guidelines per dominant encroacher species.	Harvesting contractors	Throughout the duration of the activities
		7.2.2.5	Only use harvesting methods and/or machinery that are able to selectively harvest encroacher bush while avoiding damage to desirable species.	Harvesting contractors	Throughout the duration of the activities
		7.2.2.6	Regular training events where all harvesting contractors, landowners, bush cutters and machine operators are informed about which woody plants to target, which ones to avoid, and how to calculate TEs/ha.	Harvesting contractors	Throughout the duration of the activities
		7.2.2.7	Intentional bush farming[2] shall not be conducted as part of this project.	Harvesting contractors	Throughout the duration of the activities

[2] "Bush farming" means: Re-harvesting regrowth within the project's lifespan from areas where aftercare was not applied. Aftercare must be implemented after harvesting. Intentional bush farming will therefore not be encouraged. However, "special cases / harvested areas" could be evaluated, if reasonable aftercare measures were implemented.

		7.2.2.8	Supervision to prevent cutting of non-target plants.	Harvesting contractors	Throughout the duration of the activities
		7.2.2.9	Frequent inspections of harvested biomass and harvesting operations by the Directorate of Forestry officials and/or appointed environmental officials (see section 9).	Directorate of Forestry, and MET	To be devised by Officials
		7.2.2.10	Long-term monitoring of population trends and health of valuable species to also include the post-harvest management efficiency (refer to section 9).	Harvesting contractors	Throughout the duration of the activities
7.2.3	**Loss of and disturbance of animals in harvesting area**	**7.2.3.1**	Enforce a buffer zone around Etosha and Waterberg National Parks, this should be enforced by the Directorate of Wildlife and National Parks.	Harvesting contractors	Throughout the duration of the activities
		7.2.3.2	Avoid harvesting in the no-go areas or from the buffer zone along the National Parks.	Harvesting contractors	Throughout the duration of the activities
		7.2.3.3	Give preference to harvesting methods that allow smaller animals to move away i.e. slow moving machinery or manual methods.	Harvesting contractors	Throughout the duration of the activities
		7.2.3.4	Harvesters to be instructed to assign clear responsibilities and control over field personnel at all time.	Harvesting contractors	Throughout the duration of the activities
		7.2.3.5	Anti-poaching measures shall be strictly enforced, and this shall be emphasised during induction to harvesters. Offenders shall be prosecuted.	Harvesting contractors	Throughout the duration of the activities
		7.2.3.7	All staff shall be informed in writing about the consequences of breaking these rules, and it must be clear that the rules are understood (SAIEA 2016, Pallett & Tarr 2017).	Harvesting contractors	Throughout the duration of the activities
		7.2.3.8	Ongoing awareness shall be promoted about the value of biodiversity and the negative impacts of poaching, especially to breeding birds.	Harvesting contractors	Throughout the duration of the activities
		7.2.3.9	Regulations and strict adherence to speed and traffic rules.	Harvesting contractors	Throughout the duration of the activities

		7.2.3.10	Ensure swift law enforcement in poaching cases by reporting immediately to the police and to community anti-poaching organisations.	Harvesting contractors	Throughout the duration of the activities
		7.2.3.11	Restrict harvesting activities at night. Transport at night shall be limited.	Harvesting contractors	Throughout the duration of the activities
7.2.4	**Aftercare**	**7.2.4.1**	Refer to section 14 and Appendix B for details regarding aftercare and responsibilities.	Harvesting contractors	Throughout the duration of the activities
		7.2.4.2	Verify that measures have been taken to implement aftercare through visual inspections.	NamPower	After harvesting at a specific area
		7.2.4.3	Landowners should be encouraged to provide grazing animals with mineral lick supplements when grazing harvested areas to counter the nutrient loss from biomass removal.	Harvesting contractors	Throughout the duration of the activities
		7.2.4.4	Harvesters and landowners should be encouraged to use stem/foliar applied chemicals instead of soil applied arboricides and shall comply with FSC pesticides standards.	Harvesting contractors	Throughout the duration of the activities
		7.2.4.5	Landowners should be encouraged to use integrated post harvesting approach by including fire and browsers to lessen arboricide use	Harvesting contractors	Throughout the duration of the activities
		7.2.4.6	Use of fire for rangeland management purposes is regulated, and approval must be obtained from the relevant authorities.	Harvesting contractors	Throughout the duration of the activities
		7.2.4.7	Site specific aftercare actions to be include in the “Site-specific harvesting Plan” (refer to section 11).	Harvesting contractors	Throughout the duration of the activities
7.2.5	**Modification/ restoration of bird habitats in biomass harvesting areas following bush thinning operations.**	**7.2.5.1**	Refer to sections 7.2.1 to 7.2.4.	Harvesting contractors, in liaison with the landowners	After harvesting activities on a specific area has been completed.

7.2.6	**Disturbance of birds in biomass harvesting areas, especially of breeding birds.**	**7.2.6.1**	Before biomass harvesting starts, the proposed area shall be inspected for any signs of bird nesting activity especially for protected bird species, in particular priority birds. Birds that are in the process of nesting or raising chicks shall not be disturbed.	Harvesting contractors	Before harvesting starts
		7.2.6.2	Active nests of large raptors, including White-Backed Vultures, shall be avoided by any harvesting activities by a distance of at least 100 m, and preferably more, and those of Lappet-Faced Vultures by 500 m. If such nests are found, the clump of vegetation around them shall also not be harvested. Active nests of cavity dwellers e.g. Rüppell's Parrot, Carpr's Tit and Hornbills shall also be avoided, by at least 100 m.	Harvesting contractors	Before harvesting starts
		7.2.6.3	Training shall be provided for dedicated staff tasked to identify bird nests, including those of cavity dwellers.	Harvesting contractors	Throughout the duration of the activities
		7.2.6.4	Ongoing awareness shall be promoted about the value of biodiversity and the negative impacts of disturbance, especially to breeding birds.	Harvesting contractors	Throughout the duration of the activities
7.2.7	**Destruction/ modification of bird habitats in biomass harvesting areas during biomass harvesting and transportation operations.**	**7.2.7.1**	Harvesting shall be done sustainably and with the least amount of environmental harm. The destruction or degradation of the environment, including sensitive habitats such as drainage lines or ephemeral rivers, shall be avoided. The unnecessary destruction or over harvesting of large trees shall be avoided.	Harvesting contractors	Throughout the duration of the activities
		7.2.7.2	No living tree, bush or shrub may be cut, destroyed or removed within 100 m of a river, stream or watercourse. Bush is naturally denser along the margins of rivers. The trees are usually taller in these areas, providing important habitat for birds and other animals, and this vegetation shall not be cleared.	Harvesting contractors	Throughout the duration of the activities
		7.2.7.3	All trees taller than 4 m, or greater than 18 cm diameter at the base, must be retained. Large dead trees shall also not be cut, as they provide cavities for nesting, and perches for larger birds. The only exception is if the vegetation consists entirely of encroachers that are all over 4 m; in that case, a prescribed formula for desired density after thinning shall be followed.	Harvesting contractors	Throughout the duration of the activities

		7.2.7.4	Bush harvesting shall aim for selective bush thinning, rather than indiscriminate bush clearing, and aim to create a heterogeneous mosaic of avian habitats. The veld that remains shall have a variety of tree and bush species and may include some of the encroacher species of different size classes, and spaced so that there are some open patches and some dense patches, to provide a variety of habitats for birds and other animals. Bush thinning shall take place gradually, in phases.	Harvesting contractors	Throughout the duration of the activities
Relevant to Transportation of Biomass					
7.2.8	**Road mortalities of birds during biomass transportation operations.**	**7.2.8.1**	Traffic rules, especially speed limits, shall be enforced strictly.	Transport contractors	Throughout the duration of the activities
		7.2.8.2	Vehicles shall travel with headlights on at all times, whether using tar or gravel roads.	Transport contractors	Throughout the duration of the activities
		7.2.8.3	Ongoing awareness shall be promoted about the value of biodiversity and the negative impacts of road mortalities, especially to breeding birds.	Transport contractors	Throughout the duration of the activities

7.2.3 Notes

- SEA Guidelines - Savanna ecosystems are by definition very complex and therefore difficult to fully understand and predict responses to disturbances and management interventions. Risks can be decreased to a manageable level by increasing knowledge and adhering to the standards, guidelines and rules (see harvesting Guidelines in section 13). If risks are managed in this way, the outcomes will be, on balance, positive for biodiversity regardless.

7.3 SOIL MP

7.3 SOIL MANAGEMENT PLAN

7.3.1 Objectives

- To avoid or minimise the compaction of soil in the harvesting area as far as practically possible.
- To avoid or minimise the erosion impact of soil in the harvesting area as far as practically possible.

7.3.2 Action Plan

TABLE 7-4: SOIL MP

7.3	Issue	Item	Management, Mitigation and Monitoring Actions	Implementation Programme	
				Responsible Entity	Implementation and Frequency
Relevant to Harvesting, Associated Activities and Transport of Biomass					
7.3.1	**Soil compaction potentially affecting plants and animals above the soil surface, as well as soil macro-fauna and microorganisms below the soil surface**	**7.3.1.1**	Whenever possible, avoid harvesting with machinery during wet or very moist soil conditions to avoid undue soil compaction. With respect to the sandy soils these conditions can be expected to last for two or three days after 25 mm or more rain in a single event and with respect to the sandy clay loam soils, for four to five days.	Harvesting contractors	Throughout the duration of the activities
		7.3.1.2	Avoid no-go areas.	Harvesting contractors	Throughout the duration of the activities
		7.3.1.3	Harvesters to be instructed to use appropriate harvesting techniques and experienced operators (refer to section 13, which specifically refers to the SEA of Large-Scale Bush Thinning and Value-Addition Activities in Namibia (SAIEA, 2016) and the Forestry and Environmental Authorisations Process for Bush Harvesting Projects (Pallett & Tarr, 2017).	Harvesting contractors	Throughout the duration of the activities
7.3.2	**Wind and water erosion in the harvesting area**	**7.3.2.1**	Restrict off road vehicular movement as far as possible to marked routes in order to curb damage to the grass cover.	Harvesting and transport contractors	Throughout the duration of the activities

		7.3.2.2	Harvesting activities to take place only on land with a slope of less than 12.5 degrees.	Harvesting and transport contractors	Throughout the duration of the activities
7.3.3	**Disturbance of soil, loss of soil fertility, soil contamination through fuel and oil spills in the harvesting area, and arboricide after effects**	**7.3.3.1**	Refer to Spill Prevention and Management in the General MP.	Harvesting and transport contractors	Throughout the duration of the activities
		7.3.3.2	Refer to Aftercare in the Biodiversity MP.	Harvesting contractors	Throughout the duration of the activities
		7.3.3.3	Harvesters should be encouraged to avoid very sensitive zones and no-go areas.	Harvesting contractors	Throughout the duration of the activities
		7.3.3.4	Harvesters should be encouraged to follow biomass harvesting guidelines (see section 13. It is important not to over clear). (See Biodiversity MP).	Harvesting contractors	Throughout the duration of the activities
		7.3.3.5	Harvesters and landowners should be encouraged to use manual aftercare e.g. small-scale operations. When using chemical controls stem/foliar applied arboricides should be promoted, instead of soil applied arboricides. Ensure that the chemicals used, and the waste management of chemicals comply with FSC pesticide standards.	Harvesting contractors	Throughout the duration of the activities
		7.3.3.6	When using manual aftercare, plants should be uprooted to prevent regrowth. Manual aftercare is not recommended for controlling *Dichostachys cinerea*, which readily coppices from damaged roots.	Harvesting contractors	Throughout the duration of the activities
		7.3.3.7	Give preference to harvesting methods and machinery that minimally disturb soils, e.g. no blades disturbing soil and no shunting of harvested material over the soil surface. Aftercare using heavy machinery should be discouraged.	Harvesting contractors	Throughout the duration of the activities
		7.3.3.8	When arboricides are used for aftercare, landowners should be encouraged to use an integrated post harvesting approach to lessen arboricide use.	Harvesting contractors	Throughout the duration of the activities

7.3.4	**Impact of ash from the Power Station taken back to the harvested farms**	**7.3.4.1**	Ash to be dispersed and used as fertilizer at the harvested farms or used for alternative applications or disposed of at an approved municipal landfill, in line with their approved EMP (refer to the Biomass Power Station EMP). However, further soil analysis will need to be done on the farms to determine the benefits of using the ash as a fertiliser. This is also dependent on agreements with the landowners.	Landowner / harvesting contractors	Throughout the duration of the activities
		7.3.4.2	Monitor the effect of the ash in relation to the aftercare programme (refer to section 9).	Landowner / harvesting contractors	Throughout the duration of the activities

7.3.1 Further Recommendations

- The sandy soils are the least resilient with respect to overland movement and stability on denudation and shall not constitute priority areas for biomass harvesting, using mechanised techniques.
- The other soils are relatively resilient with respect to overland movement, although somewhat susceptible to compaction, and shall be regarded as being suitable and adaptable to the purposes of the project.
- Soil disturbance and compaction due to overland movement shall be minimised and at all times. The measures put forward above shall be considered as far as possible.
- If tracks are visibly and significantly sunken below the soil surface after the harvesting of a land portion is completed it will mean that the soil has been compacted. In such cases, the following must be considered:
    - In sand: no action, as the tracks will probably not turn into water erosion rills.
    - In loamy soils: consider ripping up the tracts to a depth of about 25 cm where rockiness allows and consider sowing in natural grass seed.

7.4 Groundwater MP

7.4 GROUNDWATER MANAGEMENT PLAN

7.4.1 Objectives

- To enhance the positive impacts of bush harvesting activities on the groundwater levels.
- To prevent impact on groundwater and soil through salinization.
- To prevent impacts on groundwater though seeping of non-environmentally friendly arboricides.

7.4.2 Action Plan

TABLE 7-5: GROUNDWATER MP

7.4	Issue	Item	Management, Mitigation and Monitoring Actions	Implementation Programme	
				Responsible Entity	Implementation and Frequency
Relevant to Harvesting and Associated Activities					
7.4.1	**Impact of bush harvesting on the groundwater levels**	**7.4.1.1**	See Further Recommendations below.	NamPower	Throughout the duration of the activities
7.4.2	**Impact of bush harvesting on Groundwater and Soil through Salinization**	**7.4.2.1**	Bush thinning as opposed to bush clearing shall be practiced (refer to the Biodiversity MP).	Harvesting contractors	Throughout the duration of the activities
		7.4.2.2	No harvesting in rivers and drainage lines and within a buffer of 100m away from the water source.	Harvesting contractors	Throughout the duration of the activities

7.4.3	**Non environmentally friendly arboricides used after bush harvesting i.e. aftercare, impacting on groundwater quality**	**7.4.3.1**	Refer to the Biodiversity MP for the use of Arboricides.	Harvesting contractors	As per management and mitigation action
		7.4.3.2	Refer to Aftercare in the Biodiversity MP.	Harvesting contractors	
		7.4.3.3	Do not use arboricides in sensitive areas with shallow water levels of 0-20m bgl. If this cannot be avoided, the use of Arboricides with short half-lives, shall be promoted as potential aftercare application, specifically in groundwater sensitive areas.	Harvesting contractors	Throughout the duration of the activities
7.4.4	**Impact on groundwater from ash from the Power Station taken back to the harvested farms**	**7.4.4.1**	Ash to be dispersed and used as fertilizer and not stockpiled for longer periods.	Harvesting contractors	Throughout the duration of the activities
		7.4.4.2	Preferably fly ash and bottom ash composite be deposited due to the less harmful metal and salt content compared to fly ash and bottom ash alone.	NamPower / harvesting contractors	Throughout the duration of the activities

7.4.1 Further Recommendations

- The systematic monitoring of groundwater levels using existing boreholes in the harvesting area, is recommended in order to quantify the proposed enhanced groundwater recharge and therefore the positive impact.
- Soil isotope studies and other recharge assessment studies such as the Chloride Method should be carried out in areas prior to de-bushing and after de-bushing, which will give a direct result of the change in recharge.
- In sensitive areas, no large scale agricultural irrigation projects shall be implemented in harvested areas.

7.5 SURFACE WATER MP

7.5 SURFACE WATER MANAGEMENT PLAN

7.5.1 Objectives

- To prevent overharvesting in specifically sensitive areas, and the associated potential increased salinization and surface water quality impacts.
- To prevent impacts on surface water quality as a result of the use of arboricides.

7.5.2 Action Plan

TABLE 7-6: SURFACE WATER MP

7.5	Issue	Item	Management, Mitigation and Monitoring Actions	Implementation Programme	
				Responsible Entity	Implementation and Frequency
Relevant to Harvesting & associated activities					
7.5.1	**Bush harvesting activities causing increased salinization, causing surface water quality impacts**	**7.5.1.1**	Bush thinning as opposed to bush clearing shall be practiced, specifically in the groundwater sensitive areas.	Harvesting contractors	Throughout the duration of the activities
7.5.2	**Non environmentally friendly arboricides used after bush harvesting (i.e. after care), impacting on surface water quality**	**7.5.2.1**	Refer to Groundwater MP (section 7.4.2).	Harvesting contractors	Throughout the duration of the activities
		7.5.2.2	Harvest 100 m away from main drainage lines and open surface water sources.	Harvesting contractors	Throughout the duration of the activities
		7.5.2.3	Use water insoluble Arboricides.	Harvesting contractors	Throughout the duration of the activities
		7.5.2.4	Refer to Aftercare in the Biodiversity MP and section 14.		

7.5.3	**Contamination of surface water from hydrocarbon spillages and undetected leakages from harvesting equipment and trucks transporting biomass**	**7.5.3.1**	Refer to "Spill Prevention and management" in the General MP.	Harvesting and transport contractors	Throughout the duration of the activities
7.5.4	**Impact on surface water from ash from the Power Station taken back to the harvested farms**	**7.5.4.1**	Refer to the Soil MP.	Harvesting and transport contractors	Throughout the duration of the activities
		7.5.4.2	Ash not to be stockpiled for long periods, preferably prior to the start of the rainy season.	Harvesting and transport contractors	Throughout the duration of the activities
		7.5.4.3	Spread ash over larger areas.	Harvesting and transport contractors	Throughout the duration of the activities
		7.5.4.4	Not to be disposed of in riverbeds and drainage lines	Harvesting and transport contractors	Throughout the duration of the activities
		7.5.4.5	Preferably fly ash and bottom ash composite be deposited due to the less harmful metal and salt content compared to fly ash and bottom ash alone.	Harvesting and transport contractors	Throughout the duration of the activities

7.6 ARCHAEOLOGY MP

7.6 ARCHAEOLOGY MANAGEMENT PLAN

7.6.1 Objectives

- To prevent the unacceptable loss of archaeological resources.
- To maximise the knowledge base of potential archaeological and cultural heritage sites following the bush harvesting regime through discovery, recording and, mitigation.

7.6.2 Action Plan

TABLE 7-7: ARCHAEOLOGY MP

7.6	Issue	Item	Management, Mitigation and Monitoring Actions	Implementation Programme	
				Responsible Entity	Implementation and Frequency
Relevant to Harvesting and Associated Activities and Transport of Biomass					
7.6.1	**Damage to archaeological resources**	**7.6.1.1**	Prior to manual and semi mechanised bush-harvesting activities: • As part of the Site Specific Harvesting Plan (see Section 11) include specific known archaeological remains and areas of potential sensitivity, in liaison with the landowners. • Harvesters will either avoid these areas or employ vigilance within them, to prevent damage occurring to historic features • A chance find procedure will be followed (see below).	Harvesting contractors	Before Harvesting activities
		7.6.1.2	Prior to mechanised bush-harvesting, review of the Archaeological Specialist Study of the EIA would enable a measure of predictive modelling for each specific area and preparation of a tool-box talk on the types of site that might be encountered, the protocol for reporting finds, and the need for engaging a professional archaeologist.	Harvesting contractors	Before Harvesting activities

		7.6.1.3	All harvesting contractors and workers shall be made aware that under the National Heritage Act any items protected under the definition of heritage, defined as any site that is over 50 years old, found in the course of development shall be reported to the National Heritage Council.	Harvesting contractors	Throughout the duration of the activities
		7.6.1.4	The area where machinery or vehicles will move, during the harvesting activities, will be limited to the minimum required.	Harvesting contractors	Throughout the duration of the activities
		7.6.1.5	NamPower and their harvesting contractors will ensure that all archaeology and cultural heritage procedures, as required by the National Heritage Act 27 of 2004 are complied with.	Harvesting contractors	Throughout the duration of the activities
7.6.2	**Chance find procedure**	**7.6.2.1**	If there are any chance finds of archaeological sites or artefacts during the harvesting activities, the harvesting contractors will implement the following procedure: • Inform the NamPower SHE Officer immediately who will inspect and inform a Specialist Archaeologist if necessary. • If a likely archaeological site is discovered, work activities in that area shall be halted. • An archaeologist will need to be commissioned so that they can work closely with the harvesting teams in order to identify and record any newly discovered sites. These sites will be afforded immediate protection as appropriate. • The archaeologist will conduct an assessment of its importance, preservation, or management if so recommended. • The area will be demarcated until the assessment is completed. The key component will therefore be to ensure that the site remains undisturbed until a specialist archaeologists or cultural heritage professional has assessed the site, assessed the potential damage, advised on the necessary management steps, and advised on the requirements for authority consultation and permitting.	Harvesting contractors	In the event of a chance find

7.7 NOISE MP

7.7 NOISE MANAGEMENT PLAN

7.7.1 Objectives

- To prevent an unacceptable increase in disturbing noise and limit nuisance noise at sensitive receptors as far as practically possible.

7.7.2 Action Plan

TABLE 7-8: NOISE MP

7.7	Issue	Item	Management, Mitigation and Monitoring Actions	Implementation Programme	
				Responsible Entity	Implementation and Frequency
Relevant to Harvesting and Associated Activities and Transport of Biomass					
7.7.1	**Noise Pollution**	**7.7.1.1**	Noise levels, due to harvesting activities, must be designed and sited within the harvesting area to comply with the IFC and World Bank guideline of 55dB LAeq for daytime at noise sensitive receptors.	Harvesting contractors	Throughout the duration of the activities
7.7.2	**Buffer zone**	**7.7.2.1**	This would be achieved based on a combined sound power level of 113dB(A) from all harvesting related plant and activities, at a distance of 200m from the closest receptor. This is, however, also dependent on the landowner's requirements, should there be a request for harvesting closer to a relevant homestead.	Harvesting contractors	Throughout the duration of the activities

7.8 Traffic MP

7.8 TRAFFIC MANAGEMENT PLAN

7.8.1 Objectives

- To minimise the impact on road transport infrastructure.
- To minimise the condition/deterioration of the DR 3007.
- To minimise the impact at the TR 1/10 and DR 3007 intersection.
- To avoid traffic related accidents.

7.8.2 Action Plan

TABLE 7-9: TRAFFIC MP

7.8	Issue	Item	Management, Mitigation and Monitoring Actions	Implementation Programme	
				Responsible Entity	Implementation and Frequency
Relevant to the Transport of the Biomass					
7.8.1	**Impact on road capacity and road condition/ deterioration – TR 1/10**	**7.8.1.1**	Refer to the Otjikoto Biomass Power Station and Powerline EMP.	NamPower and transport contractors	Before transportation of the biomass starts
		7.8.1.2	Promote basic road safety behaviour for all transport contractors through training and awareness. Typical issues include: (a) keeping to safe speed limits, but as a minimum all specified road speeds will be adhered to; (b) ensuring that drivers all have valid licenses; (c) making sure that all vehicles are roadworthy; (d) zero tolerance for drinking and driving and; (e) limited driving at night. (f) drive with lights on.	NamPower and transport contractors	Before transportation of the biomass starts

7.8.2	**Impact on road capacity and road condition/ deterioration – (including the DR 3007)**	**7.8.2.1**	The increase of traffic on the gravel roads does not merit an upgrade to bitumen standards. Depending of the exact increase of traffic on these roads, the ongoing maintenance by the Namibian Roads Authority (NRA) on specific roads might have to occur more frequently. The NRA has effective blading contracts and roads are bladed at the required frequency.	NamPower, in liaison with the Namibian Roads Authority	Throughout the duration of the activities
		7.8.2.2	NamPower to engage with the NRA prior to the project implementation and on an ongoing basis after the implementation to ensure that the blading and other maintenance activities are carried out as and when required.	NamPower, in liaison with the Namibian Roads Authority	Before transportation of the biomass starts
7.8.3	**Impact at the TR 1/10 and DR 3007 intersection**	**7.8.3.1**	Refer to the Otjikoto Biomass Power Station and Powerline EMP.		
7.8.4	**Community safety**	**7.8.4.1**	Promote basic road safety behaviour for all transport contractors through awareness. All persons transporting biomass are expected to conform to the harvesting site traffic rules (to be included in the Site Access Contracts / Agreements – See General MP).See section 7.8.1.2.	NamPower and transport contractors	Before transportation of the biomass starts
7.8.5	**Emergency situations**	**7.8.5.1**	In the event of an incident or accident on a national or public road, NamPower should be notified in addition to relevant authorities. The national regulations will apply to any road accident on national or public roads.	Harvesting and transport contractors	Throughout the duration of the activities

7.9 Air Quality MP

7.9 AIR QUALITY MANAGEMENT PLAN

7.9.1 Objectives

The main objective of the proposed air quality management measures for the project is to ensure that operations result in ambient air concentrations that are within the relevant ambient air quality limits at nearby AQSRs. Although the impact assessment for the proposed Otjikoto Biomass Power Station showed low impacts, it is advisable to adopt good practice control measures on-site to avoid dust generating problems.

7.9.2 Action Plan

TABLE 7-10: AIR QUALITY MP

7.9	Issue	Item	Management, Mitigation and Monitoring Actions	Implementation Programme	
				Responsible Entity	Implementation and Frequency
Relevant to the Harvesting and Associated Transport of the Biomass					
7.9.1	**Air Pollution**	**7.9.1.1**	It is recommended that sensitive areas within harvest zones are identified via field inspection prior to the commencement of felling operations and that setback distances are determined between harvest zones and sensitive populations, taking into account the topography and prevailing wind directions. Harvest intensity shall be reduced close to sensitive land uses, apply bush thinning (see Biodiversity MP), and vegetation buffers shall be retained between harvesting activities and sensitive receptors to reduce the potential of windblown dust from open areas (as per access agreements).	Harvesting contractors	Before harvesting starts
		7.9.1.2	Water sprays can be used on unpaved roads, or placing wood chips, to suppress fugitive dust due to vehicle entrainment near sensitive air quality receptors, as and where required.	Harvesting contractors	Throughout the duration of the activities
		7.9.1.3	Vehicle speeds will be limited to 40 km/h on farms roads, specifically near sensitive receptors, to limit dust.	Harvesting contractors	Throughout the duration of the activities

7.9.2	**Buffer zone**	**7.9.2.1**	Evaluation distances provide an envelope around an activity, or multiple activities, within which environmental risks need to be assessed against current knowledge, technologies, and practices.	Harvesting contractors, in liaison with the landowner	Throughout the duration of the activities
		7.9.2.2	The following may be considered sensitive land uses: (a) Caravan parks; (b) Childcare centres; (c) Community centres; (d) Consulting room; (e) Educational institutions; (f) Hospital; (g) Hotels and motels; (h) Nursing homes and retirement villages; (i) Parklands, recreation areas and reserves; (j) Residential dwellings and associated private outdoor recreational areas; (k) Tourism accommodation; and (m) Residential zones.	Harvesting contractors, in liaison with the landowner	Throughout the duration of the activities
		7.9.2.3	The recommended evaluation distance for biomass harvesting and sensitive land uses is 200 m.	Harvesting contractors, in liaison with the landowner	Throughout the duration of the activities
		7.9.2.4	The profiles created in the Air Quality Specialist Report (Appendix 5 of the EIA Report) may also be used to determine setback distances between harvesting areas and residential areas. The biggest setback distance indicated for wood chipping activities was for NO_2, which is 200 m for flat terrain, and 130 m for hilly terrain. Vegetation buffers shall be retained in areas that fall within these respective setback distances to reduce the potential for windblown dust.	Harvesting contractors, in liaison with the landowner	Throughout the duration of the activities

7.9.3 Further recommendations

Refer to the Air Quality Specialist Report (Appendix 5 of the EIA Report) for further Guidelines for biomass harvesting practices.

7.10 THIRD PARTY HEALTH MP

7.10 THIRD PARTY HEALTH MANAGEMENT PLAN

7.10.1 Objectives

- To avoid health risk to third parties

7.10.2 Action Plan

TABLE 7-11: THIRD PARTY HEALTH RISK MP

7.1	Issue	Item	Management, Mitigation and Monitoring Actions	Implementation Programme	
				Responsible Entity	Implementation and Frequency
Relevant to Harvesting and Associated Activities and Transport of Biomass					
7.10.1	**Health Risk**	**7.10.1.1**	It is recommended that sensitive areas within harvest zones be identified via field inspection prior to commencement of felling operations and that setback distances are to be determined between harvest zones and sensitive populations, taking into account the topography and prevailing wind directions.	Harvesting contractors	Before harvesting starts
		7.10.1.2	Harvest intensity shall be reduced close to sensitive land uses, harvesting blocks shall be kept small i.e. done in patches, with vegetation kept in between, and vegetation buffers shall be retained between harvesting activities and sensitive receptors to reduce the potential of windblown dust from open areas.	Harvesting contractors	Before harvesting starts

7.11 VISUAL MP

7.11 VISUAL MANAGEMENT PLAN

7.11.1 Objectives

- To avoid / minimize negative visual impacts.

7.11.2 Action Plan

TABLE 7-12: VISUAL MP

7.11	Issue	Item	Management, Mitigation and Monitoring Actions	Implementation Programme	
				Responsible Entity	Implementation and Frequency
Relevant to Harvesting and Associated Activities and Transport of Biomass					
7.11.1	**Visual Impacts**	**7.11.1.1**	Harvesting operations shall prevent and minimize negative visual impacts through consultation with local communities and landowners about the extent and timing of activities. The operational procedures shall take into consideration the proximity to public viewpoints, primarily tourist and residential, when scheduling and allocating bush areas to be thinned.	Harvesting contractors	Before harvesting starts
		7.11.1.2	Good housekeeping rules must also apply i.e. no undue damage is done to vegetation that will not be harvested.	Harvesting contractors	Throughout the duration of the activities
7.11.2	**Buffer zone**	**7.11.2.1**	A buffer zone, no go harvesting zones established unless otherwise mutually agreed to with the landowner, shall be recognised around sensitive tourist and or residential sites. Given this buffer and the general density of the existing bush, most ground level views to the operation will be screened or at least partially screened.	Harvesting contractors	Throughout the duration of the activities
		7.11.2.2	This buffer zone shall be agreed with the landowner (see General MP). With reference to the Noise and Air Quality MPs, a buffer zone of 200 m is required. However, depending on	Harvesting contractors	Throughout the duration of the activities

			the landowners' requirements, this buffer zone could be extended up to 500 m to avoid potential visual impacts.		

7.12 SOCIO-ECONOMIC MP

7.12 SOCIO-ECONOMIC MANAGEMENT PLAN

7.12.1 Objectives

- To maximise job creation and skills development during construction, operations, and through the supply chain.
- NamPower shall encourage a range of mechanised harvesters to operate to maximise sustainable business development in the region, whilst ensuring a steady fuel supply.
- To encourage charcoal and / or woodchip harvesters fill the market demand for both woodchips and charcoal.
- To maximise land productivity after bush-thinning.

7.12.2 Action Plan

TABLE 7-13: SOCIO-ECONOMIC MP

7.12	Issue	Item	Management, Mitigation and Monitoring Actions	Implementation Programme	
				Responsible Entity	Implementation and Frequency
Relevant to Harvesting and Associated Activities and Transport of Biomass					
7.12.1	**Job Creation and Skills development**	**7.12.1.1**	Ensure that strategies and programmes are in place prior to harvesting that, where possible, maximises the use of the local labour force during operations.	NamPower / harvesting contractors	Throughout the duration of the activities
		7.12.1.2	Encourage recruitment and training of women and support female employees to perform well in the workplace.	NamPower / harvesting contractors	Throughout the duration of the activities
		7.12.1.3	Promote continuous learning programmes to diversify and upgrade skills of employees and ensure that the skills gained on the job are documented and accredited wherever possible.	NamPower / harvesting contractors	Throughout the duration of the activities
7.12.2	**Impact on existing wood biomass users**	**7.12.2.1**	It is advised that NamPower proactively engages with harvesters and processors once harvesting begins to ensure that new or expanded charcoal and / or woodchip harvesters can meet the demand for both woodchips and charcoal.	NamPower	Planning phase

			FSC standards would allow anyone who complies, to be able to be considered for a fuel supply agreement.		
		7.12.2.2	It is advised that NamPower Implement measures, where possible, to ensure that sufficient numbers of woodchip producers have access to the appropriate finances to ensure that the required quantity of woodchips are delivered to the power station i.e. that there are bankable agreements in place to assist in gaining financing.	NamPower	Planning phase
7.12.3	**Bush-thinning on land productivity i.e. improvement of rangeland productivity**	**7.12.3.1**	Refer to Biodiversity MP with regards to undertaking bush-thinning activities.	NamPower / harvesting contractors	Throughout the duration of the activities
		7.12.3.2	NamPower should include contractual clauses in the Fuel Supply and Harvesting Agreement to ensure that aftercare is conducted from the proceeds of the biomass sales.	NamPower	Throughout the duration of the activities
		7.12.3.3	Refer to aftercare requirements in the Biodiversity MP and sections 12 and 14.	Landowner	Post harvesting
		7.12.3.4	Sound rangeland management principles should be applied such as; appropriate stocking rates for forage availability and resting for at least a significant part of the growing season.	Landowner	Post harvesting
		7.12.3.5	If desirable perennial grass species are lost or at a very low density there should be reseeding with indigenous, desirable grass species.	Landowner	Post harvesting
7.12.4	**Community resilience to population in-migration**	**7.12.4.1**	See Otjikoto Biomass Power Station and Powerline EMP with regards to in-migration.	NamPower	Throughout the duration of the activities
7.12.5	**Upholding Human Rights and Interests of vulnerable people and Labour**	**7.12.5.1**	The organisation responsible for selecting bush harvesting sites should be encouraged to consult with San traditional authorities and San living on bush encroached resettlement farms. The aim is to prioritise their farms for bush-thinning and, where possible, to prioritise San people for jobs opportunities.	NamPower / harvesting contractors	Planning phase
		7.12.5.2	The proposed project and its harvesting contractors must ensure that wages are paid to the individual and not to a spouse.	Harvesting contractors	Throughout the duration of the activities
		7.12.5.3	NamPower should review its policies and procedures to ensure it complies with international standards regarding human rights, with particular emphasis on ways it can protect and uphold the rights of San people and women.	NamPower	Planning phase

			Strategies will need to be based on "Free, Prior, and Informed Consent[3]" (FPIC) and engagement, and not assume that existing laws or practices in Namibia recognize or respect Indigenous Peoples or their rights.		
		7.12.5.4	The bush harvesting operators supplying the biomass Power Station should ensure they are aligned with the guidelines detailed in Principle 2 of the Forest Stewardship Standard of Namibia. For example, by aligning with the FSC Standard for Namibia, Criteria 2.1 and 2.2, the bush harvesting organisations will be aligned with the ILO standards regarding the use of child labour, forced or compulsory labour, debt bondage, discrimination in employment and occupation, freedom of association, gender equality, wage gender equity, maternity and paternity leave and sexual harassment. On some issues, the ILO standards give more detail than Namibia's Labour Act. FSC Criterion 2.3 details aspects of health and safety practices to protect workers from occupational safety and health hazards which meet or exceed the recommendations of the ILO Code of Practice on Safety and Health in Forestry Work and the relevant sections of EIB Standard 9. Annexures C and D of the FSC Standard details specific health and safety measures for bush harvesters and minimum housing requirements, respectively. FSC Criterion 2.4 – 2.6 details job-specific training and mechanisms of engagement to resolve grievances and disputes.	Harvesting contractors	Throughout the duration of the activities
		7.12.5.5	In the (unlikely) event that individuals need to be relocated as a result of the planned activities, develop a framework to ensure the resettlement would be implemented in accordance with the project standards and the promoter, with full involvement in the decision-making process of all relevant stakeholders, and in particular the affected people; adopting adequate steps to minimise and mitigate its adverse impacts from an early stage.	NamPower and Harvesting contractors	Throughout the duration of the activities

[3] A condition whereby a person or community can be said to have given consent to an action prior to its commencement, based upon a clear appreciation and understanding of the facts, implications and future consequences of that action, and the possession of all relevant facts at the time when consent is given. Free, prior and informed consent includes the right to grant, modify, withhold or withdraw approval (FSC, 2019).

Further recommendations:

- NamPower to interact with financing stakeholders from any early stage to ensure the availability of capital for the timely start-up and up-scaling of biomass harvesters.
- Encourage semi-mechanized woodchip harvesters to supply biomass as far as possible.
- NamPower should facilitate ad hoc fuel suppliers to harvest areas close to the power plant as they do not have the economies of scale of the long term harvesting contractors.
- Harvesting contractors should preferably source wood from potentially more productive land to the North-East and South of Tsumeb as these areas have greater livestock carrying capacity than to the West/North West.

7.13 CLIMATE CHANGE

7.13 CLIMATE CHANGE ADAPTION AND MANAGEMENT MEASURES

7.13.1 Project adaptation and mitigation measures

Climate change management includes both mitigation and adaptation. The main aim of mitigation is to stabilise or reduce Greenhouse Gas (GHG) concentrations as a result of anthropogenic activities. This is achievable by reducing emissions and enhancing sinks through human intervention.

One way to keep GHG emissions to a minimum would be to ensure there is minimal fuel use; this can be achieved by ensuring the vehicles and equipment are maintained through an effective inspection and maintenance program.

A measure of reducing the project's impact is to limit the removal of vegetation around the Power Station and to ensure that that as much as possible indigenous revegetation occurs surrounding the Power Station area.

8. PARTIES RESPONSIBLE FOR EMP IMPLEMENTATION AND RELEVANT AGREEMENTS

This section describes the overarching responsibilities in terms of implementing the various commitments in this EMP through a contract chain which may include fuel supply agreements and harvesting agreements. This section aims to capture the guiding principles of the various agreements and gives an overview of the allocations of responsibilities. The specific roles and responsibilities of each EMP commitment has been defined in the "General MP" (section 7.1.1) and the other MPs.

8.1 NAMPOWER

Ultimate accountability relating to the compliance with the EMP commitments rests with NamPower. NamPower intends to procure the required quantities of Biomass woodchips as fuel from contracted fuel suppliers.

NamPower will develop fuel supply agreements for managing deliveries and payment for the fuel delivered to the power station in line with the EMP.

NamPower further aims to develop a harvesting agreement to ensure that the site specific harvesting of encroacher bush and the associated aftercare requirements are adhered to, as stated in the EMP.

NamPower will appoint a SHE Officer for the Biomass Project to oversee and monitor adherence to the EMP by fuel suppliers. The SHE officer will be responsible for conducting site audits and inspections in accordance with the site specific harvesting plans. The SHE Officer will also be responsible for gathering the necessary information to implement the adaptive management approach as described in section 12 of this EMP.

8.2 HARVESTING CONTRACTORS

Harvesting contractors also referred to as fuel suppliers are divided in the following categories:

- **Long term fuel suppliers** – these fuel suppliers will provide the bulk of the fuel to the Power Station and essentially secure the minimum fuel quantities required to operate the Otjikoto Biomass Power Station at the minimum required levels. They will incur significant financial cost to ramp up and invest into the necessary harvesting equipment and must comply with this EMP.
- **Ad hoc fuel suppliers** - these fuel suppliers are expected to be entities or individuals who may be involved in smaller scale de-bushing with varying frequency and limited harvesting equipment. The objective of the ad hoc fuel suppliers is to allow greater participation and facilitate the upscaling of the local biomass fuel supply industry. The ad hoc fuel suppliers will have to comply with an abridged version of this EMP.

In either of these scenarios the entity contracting with NamPower may be an individual or a company that obtains the right to harvest on a landowners property or it could be the landowner who hires an individual or company to harvest on their behalf. The remainder of this section

focuses on the former scenario where the landowner makes his farm land available to a fuel supplier.

The Fuel Supply Agreement will have a contracting term long enough to facilitate the financing of equipment through commercial financing institutes. This would typically be a period of between 5 to 7 years.

Compliance to the EMP and in particular the aftercare commitments will be enforced through the harvesting agreement. It is the fuel suppliers' duty to develop a site specific harvesting plan and map in conjunction with the landowner and in accordance with the EMP (see section 11). The site specific harvesting plan will be used by NamPower for auditing and inspection purposes.

The harvesting agreements and fuel supply agreements will ensure that there are consequences for non-compliance to the EMP which may include financial penalties or ultimately cancellation of the fuel supply contract.

The fuel supplier will be responsible for arranging all permits necessary for fulfilling their obligations as set out in the EMP.

8.3 LANDOWNERS

Landowners will be required to display their long term commitment to the project through the execution of a harvesting agreement with a fuel supplier. This will enable monitoring and compliance auditing by the NamPower representative. Most importantly the long term commitment will ensure a sustainable fuel supply within the proximity of the project site over the lifetime of the power station, while ensuring sustainable and improved rangeland management in the area.

The key roles and responsibility of the landowner includes but is not limited to the following:

- Select the specific farm area that shall be harvested;
- Select the specific farm area where the fuel suppliers staff may camp and set up ablutions;
- Identify areas of potential archaeological significance in accordance with the EMP;
- Identify no go and sensitive areas on the farm in accordance with the EMP; and
- Implement the aftercare of the harvested farmland in accordance with the approved site specific harvesting plan.

9. MONITORING AND AUDITING

9.1 AUDITING COMPLIANCE OF THE EMP

The commitments contained in this EMP will be NamPower's contractual agreement with the Namibian authorities for sound environmental management, once an environmental clearance certificate has been obtained. All employees, harvesting contractors, and transport contractors will be expected to comply with the commitments contained in this EMP.

9.1.1 Audits and inspections

The NamPower SHE Officer will conduct internal management audits against the commitments in the EMP. These audits will be conducted on a quarterly basis. The audit findings will be documented for both record keeping purposes and to inform continual improvement.

In addition, an independent professional will conduct an EMP performance assessment at least once a year for the Bi-Annual Report. The compliance of the harvesting activities with the provisions of the EMP, and the adequacy of the EMP relative to the on-site activities, will be assessed in this report. To ensure compliance and that high standards are maintained. The compliance auditing shall be conducted by a suitably qualified person with a strong ecological background and preferably with FSC experience.

The harvesting contractors' SHE Officers will conduct weekly inspections during operations.

9.1.2 Submission of information

Monitoring reports will be provided to the relevant authorities as per permits and authorisations issued by the relevant departments and ministries.

Bi-annual Environmental Performance Reports will be submitted to the MET and Directorate of Forestry.

9.1.3 MET and Directorate of Forestry

MET and Directorate of Forestry Officials should, as a minimum, conduct annual inspections of harvested biomass and harvesting operations. These inspections should refer to the Bi-annual Environmental Performance Reports, this EMP, site specific harvesting plans (see Section 11), and harvesting permit conditions (see section 3.1).

In this regard, NamPower will ensure collaboration with the relevant Directorate of Forestry Officials, providing capacity building, regarding the proposed Biomass Power Project and the various EMP requirements, where required.

9.2 MONITORING

The management plans in Section 7 have covered various aspects of the proposed monitoring. This section both augments those requirements and provides further detail where relevant.

9.2.1 Biodiversity monitoring

A monitoring framework per harvesting site is suggested in Table 9-1. This will need to be adapted according to the demands by industry, regulating institutions e.g. MET, DoF, NamPower, and critical issues that may arise in future. It is proposed that the monitoring programme is split in two components.

The first monitoring framework deals with the operations before, during, and immediately after harvesting processes and states. This component also monitors the initial aftercare process and its success. These monitoring actions are required for all harvesting areas. This monitoring could be concluded within a year after harvesting but will depend on the aftercare methods applied e.g. stump treatment with arboricides has a quicker response than foliar treatment where some regrowth is required before treatment. It is suggested that the responsibilities of monitoring operational activities is shared by the respective harvesters and NamPower, who may choose to source this out to a qualified third party (Table 9-1).

The second monitoring framework at selected sites is suggested in Table 9-2. This monitoring component looks at longer timeframes, starting with a baseline before harvesting and repeated annually thereafter. This monitoring is more quantitative in nature using accepted ecological monitoring methods and sampling designs but is restricted to a selection of sites situated in different harvesting areas. The purpose of this monitoring is to inform the adaptive management process, evaluate savanna restoration and biodiversity trajectories and, potentially, feed into the ECC renewal applications. Site selection should therefore aim to both foster learning for management adaptation, as well as to provide robust information on biodiversity and ecological trends relevant to restoration over time. A powerful monitoring design would be to monitor paired control treatment sites, where the control represents the non-harvested situation but with comparable environmental traits i.e. similar soils, vegetation species composition and biomass, previous land use, which is then compared to the harvested site. It is proposed that the responsibility of carrying out the biodiversity monitoring is facilitated by NamPower, who may choose to source this out to an independent and qualified third party (Table 9-1).

Furthermore, the long term monitoring should include monitoring trials of ash from the Biomass Power Station taken back to farms after harvesting of certain areas.

The Directorate of Forestry should be involved in all monitoring activities.

TABLE 9-1: A SUGGESTED OPERATIONAL MONITORING FRAMEWORK PER HARVESTING SITE

Type of Monitoring	Indicator	Type of Data	When	Responsibility
Process monitoring	Size of targeted harvesting area	Ha shown on maps	Before harvest	Harvester
	Estimated biomass to harvest	Tons dry mass	Before harvest	Harvester
	Area actually harvested	Ha shown on maps	After harvest	Harvester/NamPower
	Biomass actually removed	Tons dry mass	After harvest	Harvester/NamPower
	Fixed point photos	N/A	Before and repeated after harvest	Harvester
Compliance monitoring	Protected plant species impacted	Yes/No, details of species involved	During harvest/after harvest	NamPower
	Poaching/illegal harvesting incidents	Yes/No, details	During harvest	NamPower
	Signs of pollution	Yes/No, details	During harvest/after harvest	NamPower
	Harvesting on slopes	Yes/No, details	During harvest/after harvest	NamPower
	Harvesting on contours	Yes/No, details	During harvest/after harvest	NamPower
	Disturbances to soil	Yes/No, details	During harvest/after harvest	NamPower
	Post harvesting tree equivalents	Tree equivalents per ha	After harvest	NamPower

Initial aftercare	Aftercare methods used	Description	During harvest/After harvest depending on method	Harvester
	Aftercare implementation	Visual inspection / observation	During aftercare	NamPower
	Chemicals and quantities applied	l/ha per arboricide type	After aftercare	Harvester
	Regrowth rates	No. of targeted woody plants controlled per m^2	Applicable time after harvesting when aftercare success can be assessed	NamPower

TABLE 9-2: A SUGGESTED LONG TERM MONITORING FRAMEWORK IN SELECTED SITES

Type of monitoring	Indicator	Type of data or units	When	Responsibility
Long-term monitoring in selected sites				
	Rainfall (closest practical)	mm per month	Annually	NamPower
	Events such as fire, frost, insect outbreaks	Description	Annually	NamPower
	Post-harvest land-use including animal stocking rates, grazing/browsing management	Description	Annually	NamPower
	Aftercare effort by landowner	Description	Annually	NamPower

	Fixed point photos	N/A	Annually in May/June	NamPower
	Herbaceous biomass in May/June	kg Dry Matter/ha	Annually in May/June	NamPower
	Herbaceous species composition	% cover per species	Annually in May/June	NamPower
	Woody structure (marked transects)	Woody plant density per species per height class	Annually in May/June	NamPower
	Bare ground	% of land not covered by vegetation or plant litter	Annually in May/June	NamPower
	Severity of soil erosion patterns such as sheet, pedestal, rill, gully, wind deflation/deposits	Estimates on subjective scale	Annually in May/June	NamPower
	Soil carbon %	% soil carbon in top and sub soil layers	Annually	NamPower
	Soil compaction	Compaction of the soil	Annually	NamPower
	Invertebrate species richness and diversity indices (diversity, evenness, similarity)	% trapping success per species	Annually in May/June	NamPower
	Small mammal species richness and diversity indices	% trapping success per species	Annually in May/June	NamPower
	Bird species richness, diversity and similarity indices	Bird recordings per site	Annually in May/June	NamPower
	Large mammal species richness and diversity indices	Dung/track density per species	Annually in May/June	NamPower

9.2.2 Air Quality monitoring

Dust bucket i.e. fallout dust, monitoring to be undertaken as follows:

- Identify sensitive receptors, e.g. farmhouse, near proposed harvesting activities or frequently used gravel roads for transporting biomass.
- Conduct monitoring for 1 month prior to the activities to be conducted in close proximity i.e. 1 km, to the receptor.
- Conduct additional monitoring during the harvesting and associated activities being undertaken near the receptors i.e. activities being conducted within 1 km from the receptor.
- Three dust buckets[1] to be placed, taking the dominant wind-direction into consideration:
    - one bucket at a receptor to the northwest of the activities
    - one bucket at a receptor to the west-south west of the activities.
    - one bucket where the activities are being undertaken. Where the most dust, visually, is being generated. This bucket can be moved with the activities, as required.
- Assess whether additional mitigation measures are required.

The above mentioned monitoring shall only be undertaken for the first 2 harvesting campaigns, which will be in close proximity to sensitive receptors. Thereafter, the monitoring shall be conducted as and when required in the event of complaints received from third parties.

Note:

[1] – This is dependent on the number of receptors near the harvesting activities.

9.2.3 Noise monitoring

Undertake a once off noise monitoring campaign for the initial harvesting and associated activities to verify the noise levels and mitigation measures provided in this EMP; thereafter as and when required, in the event of complaints received. This shall be undertaken for a worst case harvesting operation where all the machinery are in use. Baseline noise measurements, for the specific location, shall however be taken prior to the activities starting.

Noise monitoring will be undertaken by a suitably qualified and experienced person, using a Type 1 or Type 2 sound level meter conforming to all appropriate IEC standards, which will be field-calibrated before and after each monitoring period. The sound level meters will be positioned such that the microphone is located 1.2 to 1.5 m above the ground level in free-field conditions i.e. at least 3.5 m from the nearest vertical reflecting surface.

A note of the prevailing weather conditions will be made at the time of monitoring. Noise levels will be measured during favourable weather conditions i.e. wind speeds less than 5 m/s and avoiding periods of rainfall, to minimise interference to the measurements. An effective microphone windshield will be used.

10.TRAINING REQUIREMENTS

Training is key to the success of the positive outcome of the harvesting activities. Training of all people involved in the Biomass Power Project's harvesting and associated activities, is important to ensure they understand the environmental related objective of the project i.e. to improve rangelands where the encroacher bush will be harvested.

10.1 INDUCTION TRAINING

Environmental induction training will be provided by the various Harvesting Contractors' SHE Officers in liaison with NamPower's SHE Officer, to all persons undertaking work on the Biomass Power Project, including the Transport Contractors. This this will be provided as formal once off training, to all harvesting contractors, including all harvesters and workers coming onto the harvesting areas. Refreshment training may be provided during any contract year, depending on the results of the audits.

This will ensure that all persons working at the project are:

- Aware of the overall management approach and target to restore the savanna ecology and improve the rangeland productivity.
- Aware of the environmental sensitivities of the project;
- Informed of the risks of the project and the causes and effects thereof;
- Aware of the objectives of the EMP and the relevant management and mitigation requirements.; and
- Aware of the consequences of their individual actions.

Each of the Management Plans in this EMP must be referred summarised in the training material to be developed. Also, the Generic EMP for Bush Thinning Project, contained in the SEA (see section 12), and FSC Standards must be referred summarised and key points highlighted.

Landowners shall also be made aware of the above mentioned and the same induction material shared with them as part of the Access Agreements.

10.2 ACTIVITY SPECIFIC TRAINING

Training to all of the people involved in bush harvesting shall be done as a starter course for all new participants and as an annual refresher. This will include the following:

- Which trees to target and which to avoid i.e. protected species,
- Bush thinning requirements; and
- Which areas are sensitive and no-go areas in a specific harvesting area with reference to the Site-specific Harvesting Plan (see section 10).

It would be advisable to consult an expert botanist in the compiling the course material, specifically relating to the specific trees to avoid.

11.SITE-SPECIFIC HARVESTING PLANS

With reference to section 1.2, due to the significant scale of the harvesting area that was assessed as part of the EIA process, as well as the uncertainties around the exact harvesting locations, exact harvesting methods per

area, etc. a requirement from this EIA is that Site-Specific Harvesting Plans are developed for each harvesting area.

11.1 RECOGNIZE THE COMMITMENTS IN THE HARVESTING AND ASSOCIATED ACTIVITIES EMP

Recognize and commit to complying with the commitments in this Harvesting and Associated Activities EMP and the Generic EMP for Bush Thinning Projects in the SEA (see section 12).

11.2 BIODIVERSITY MANAGEMENT

Develop a site-specific harvesting map that shall delineate sensitivity zones based on the overarching sensitivity map (see EIA Report and Biodiversity Specialist Report, AWR, 2018) and on the description of the sensitivity zones (see section 6.7 of the EIA Report) and on the list of important or protected species in Appendix 1 and 2 of the Biodiversity Impact Assessment Report (Appendix 6.1 of the EIA Report)):

- See the map in Figure 6-38 in the EIA Report for a regional scale indication of the location of sensitivity zones. This is a first level filter to indicate the relative sensitivity of a specific harvesting area. For each harvesting area, a detailed, site specific map shall be drafted by the landowner or harvester, focusing firstly on the presence and spatial organisation of important ecological processes e.g. drainage lines, and habitat features e.g. large old trees for nesting, and secondly on the location and density of important tree species.
- These site-level sensitivity zones shall indicate where harvesting shall be either avoided i.e. no go zones, or carefully applied following harvesting rules as defined in Appendix 6.1. Ensure adherence to rules in this regard.
- Adherence to the harvesting guidelines as described in the National Harvesting Guidelines (SAIEA 2017), the best-practice principles defined in Section 13 and Appendix B below, and FSC standards as interpreted per Forestry Management Unit.
- Develop site specific aftercare actions aligned with the above mentioned guidelines and principles.

At risk species: Several plant species across all growth forms fall in the category of rare, threatened, endangered, protected, or iconic plant species. These are summarised in Appendix 1 and 2 of the Biodiversity Specialist Report (Appendix 6.1 of the EIA Report).

- The first aspect is the formally protected species, for which a risk assessment has led to legal protection which dictates steps that have to be taken to prevent negative impacts. These steps are set out in the relevant Acts and Regulations.
- There are however many others that are known to be rare or threatened for various reasons e.g. over-harvesting in other parts of their range, that shall be managed to prevent the loss of individuals.
- Some other species are only encountered in intact, climax savannas and are thus indicators of a healthy ecosystem. Such an area will not be encroached on and shall therefore not be included in the harvesting plans.

Whatever other steps have been identified, in terms of the current project the management of all of these at risk species, and all mitigation options, depend on the drafting of a site-level sensitivity map that shall include no go zones that delineate their presence, in addition to delineating functionally important features such as drainage lines.

11.3 ARCHAEOLOGY MANAGEMENT

Develop site specific archaeological sensitivity map, as follows:

- Manual and semi mechanised bush-harvesting activities:
    - Include specific known archaeological remains and areas of potential sensitivity, in liaison with the landowners.
- Mechanised bush-harvesting activities:
    - Include specific known archaeological remains and areas of potential sensitivity, in liaison with the landowners and a professional archaeologist. Refer to the Archeologic Specialist Study of the EIA to assist with additional predictive modelling of the specific harvesting area, where required by the archaeologist.

11.4 BUFFER ZONE AROUND SENSITIVE LAND USE – IN LIAISON WITH THE LANDOWNER

Identify sensitive areas within harvesting area and establish setback distances i.e. buffer zones. (Refer to Noise, Air Quality, and Visual MPs).

Any settlements on a farm also have to be taken into consideration.

11.5 HARVESTING EMERGENCY RESPONSE PLAN

Develop and implement a Harvesting Emergency Response Plan to address the following as a minimum:
- Safety and security of third party and actions to be undertaken in the event of an incident;
- Major spillages of hydrocarbons i.e. more than 200 litres;
- Road accidents;
- Other environmental emergencies e.g. killing of animals, fires, etc.

Refer to Appendix A for an Emergency Response Plan template.

12.ADAPTIVE MANAGEMENT

The large-scale extraction of woody biomass from Namibian savannas is a recent development and consequently information on its effect on biodiversity and ecological processes is limited. The removal of woody biomass will not automatically achieve ecological restoration goals because it is critical how the harvesting and aftercare are undertaken. Bush harvesting differs from most other development projects in the sense that it has two implicit but potentially opposing objectives: it wants to achieve an ecological restoration outcome, and it must be economically successful. It is not impossible to achieve both these goals, but it requires commitment from all participants and a particular focus on the governance structure. Below, we summarise best practice implementation of harvesting projects. However, while necessary, a set of guidelines based on broad ecological principles and experience will not be sufficient. Given that an important goal of this project is aiming to achieve restoration outcomes across a large region while harvesting will be in the hands of many participants with diverging agendas, it is essential and critical to create an appropriate governance framework. In this regard it is particularly important to define responsibilities and accountability for overall project objectives.

For these reasons, and as a first step, we recommend an adaptive management approach. Adaptive management entails that management decisions are based upon the best available knowledge at the time, but with effort to improve on this through dedicated research and analysis of monitoring data. The documentation should include the following:

- A description of the system and its dynamics;
- Definition of specific, measurable, achievable, relevant and time bound (SMART) objectives;
- Definition of ecological management actions; and

- Definition of a robust monitoring programme to serve as the basis of management decisions and to improve the knowledge base.

The system, including specific knowledge gaps, is described in the EIA Report and Biodiversity Specialist Report (AWR, 2018). A consultative process with the project proponent, funders and other relevant stakeholders and specialists is recommended to define the SMART objectives, including explicit desired ecological outcomes to aim for. The specifics of management actions and a monitoring programme; the indicators to use, the implementation framework, the handling of data, and management decision-making, are in turn dependent on the definition of goals. The latter three aspects are outside the scope of the current report but are a critical requirement for successful achievement of environmental obligations.

It is therefore recommended that a consultative process be undertaken, with a key goal being to define the project level ecological goals and the governance structure with specific obligations and accountability. The consultative process could entail a workshop with the key stakeholders, including representatives from, amongst others; Directorate of Wildlife and National Parks, Directorate of Forestry, GIZ, harvesters, N-BIG, and representative from the agricultural sector.

13. BIOMASS HARVESTING GUIDELINES

An important recent development has been the publication of the Authorisations Process for Bush Harvesting Projects of the Ministry of Agriculture, Water and Forestry (Pallett & Tarr 2017). This publication is the result of a full strategic environmental assessment process (SAIEA, 2016) and is based on sound ecological principles,

With reference to the various Management Plans in section 7, that were developed as an outcome of the EIA process for the proposed Biomass Power Project, they must be read in conjunction with the commitments in the SEA, as these are an integral part of this EMP. The content of the SEA will not be repeated in this EMP.

The Biodiversity specialist team elaborated on some aspects that the SEA deals with only in principle. The guiding principles defined in the SEA are generic and based on broad principles and extensive practice. Since the current project is area specific, spatially explicit biodiversity sensitivity could be defined. These sensitivity zones have implications for environmental management, which are described in more details in section 8 of the Biodiversity Specialist Report (AWR, 2018). Similarly, for plants data on the location of species of concern (endemic and legally protected) exists on a national scale and their overlap with the harvesting area has implications for management. The main implication is that each harvesting project shall define its own sensitivity zones before harvesting commences. Further best practice and guiding principles for harvesting with ecological restoration objectives are presented in section 17 of the Vertebrate and Vegetation Baseline Study, Integration of all Biodiversity Components and Biodiversity Impact Assessment (Appendix 6.1 of the EIA Report).

14. AFTER HARVEST: PREVENTING WOODY REGROWTH TO ACHIEVE GRASS-LAYER PRODUCTIVITY

In harvested areas the rapid regrowth of harvested woody plants and the establishment of woody seedlings is to be expected, which will need to be controlled in order to maintain the thinned, stable state and associated ecosystem benefits. The majority of savanna woody species are able to regrow from the collar region of the plant after removal of stems. In addition, the absence of tree-on-tree competition often results in a wave of woody reproduction through seedling establishment and root suckers. An effective aftercare programme is therefore

deemed essential to keep woody plant densities in harvested areas in check. This is especially true for the higher rainfall parts of the study area.

How the harvesting is conducted, and the harvesting area is managed after harvesting will impact on the effort required to maintain an open woody state. Important natural allies in preventing a resurgence of undesirable woody plants include harvesting in such a way that a good stand of large trees and bushes are retained to help suppress the growth of young woody plants, as well as suppressing the establishment of recruits close to large trees and bushes. Selective thinning where large trees and bushes are retained, evenly spread over the harvested area, is therefore seen as a crucial component of the harvesting operation. Second, the competitiveness of the herbaceous layer should be encouraged through an effective grazing management system aiming to increase the vigour and competitiveness of perennial grasses. Managing for a competitive herbaceous layer may take several seasons and will depend on the level of degradation e.g. perennial grass cover loss, as well as current climatic conditions. Even in the best of cases will these actions not be enough to maintain an open savanna state indefinitely but will result in both fewer woody recruits to be dealt with and will reduce the growth rate of surviving plants in the aftercare programme. Third, the season when harvesting is conducted appears to affect the subsequent growth and mortality rate of cut woody plants.

All three factors mentioned above may slow down the re-infestation rate of the harvested areas but does not negate the necessity of controlling coppice growth and reproducing woody plants years after the initial harvest event.

Aftercare in the current context deals mainly with the re-sprouting of harvested plants, existing saplings of encroacher species not harvested, and emerging woody recruits. It is important that aftercare is not seen as a once off operation. These undesirable woody plants can be controlled in several ways, which include mechanical, chemical, and biological approaches or a combination of these.

In mechanical bush control, plants are either physically removed or damaged to such an extent that these plants eventually die. Seedlings and saplings can be removed manually. Physically removing larger coppiced plants is labour intensive as many encroacher species have to be removed to a depth of at least 20cm below ground. Slashing the aboveground parts is usually ineffective, except when done repeatedly in a single season i.e. 4 times/annum, and perhaps also in the case of seedlings, which are more vulnerable to physical damage. The use of heavy machinery in aftercare operations is not recommended due to the high soil disturbance and soil compaction expected. One exception may be where the young new growth is cut or mulched and used as roughage in animal feeds. In this case it should be kept in mind that the removal of the plants, especially the foliage, will drain the ecosystem of nutrients in the long run, browsing animals, on the other hand, recycle nutrients through dung and urine.

Various chemical herbicides have been developed to kill shrubs and trees (arboricides) and are registered in Namibia for the purpose of controlling encroacher species. Arboricides, however, differ with regards to the mode of application, safety of use, and potential environmental impacts. Essentially three application modes can be distinguished. First, soil applied arboricides where the chemical is applied to the soil surface within the root range of target plants. These arboricides dissolve in rainwater and are transported to the roots of plants as it infiltrates the soil. The use of soil applied arboricides is generally not recommended in aftercare programmes due to their non-selective nature, arboricides may affect proximate desirable plants, and the risk of leaching from the target

area to affect desirable plants. Soil applied arboricides are also not suitable for treating harvested bushes and the long-term residual effects of soil applied arboricides has not been well studied in a Namibian context.

Second, stem applied arboricides are applied to the freshly cut surface of harvested plants as soon as possible after harvesting i.e. within hours. Failure of applying the arboricide according to the specified time can result in poor control of woody plants. Stem applications have the advantage that it is selective, as only the treated plants are controlled. A disadvantage of stem applications is that a percentage of harvested plants would probably die naturally after being harvested therefore, some arboricide will be unintentionally 'wasted'. Cunningham and Detering (2017) in a Namibian study showed that on average about half of *Senegalia mellifera, Vachellia reficiens* and *Terminalia pruniodes* did not coppice after being cut close to the ground (stem diameter 75-118mm). *Dichrostachys cinerea*, however, coppiced prodigiously, especially on soils with a high clay content (Cunningham & Detering 2017).

Third, the foliage of target plants can be sprayed with a registered arboricide. Foliar control is effective where stem treatment is not feasible, e.g. where stems are broken off rather than cut or sheared. To effectively control coppiced plants, the regrowth should be allowed to grow out after harvesting e.g. 2-10 months; knee to hip height and the foliage should be green and mostly mature to ensure good arboricide action. Foliar applied arboricides have the advantage that they are also selective and that saplings and seedlings can be effectively controlled. Unselective spraying using for example tractor boom sprayers will negate the selective advantage and a substantial amount of arboricide may reach the soil surface, therefore this should be discouraged. A disadvantage of foliar control is that it is susceptible to drift in windy conditions, thereby potentially harming desirable plants. Spraying should only take place during suitable weather conditions.

A list of arboricides suitable for controlling regrowth of Namibian encroacher species are provided in Van Oudshoorn (2015). However, new developments are underway and new arboricides may replace or complement the existing registered chemicals in future. The FSC also developed a list of 'highly hazardous' pesticides to be considered in this project.

Other approaches to aftercare include the use of periodic fire and/or browsers such as goats. Nevertheless, fire needs thorough planning, preparations and fire-fighting equipment, approval from neighbours and carries the risk that it may spread. Also, to be effective, the fire interval in the harvesting area will probably be every 3-4 years, depending on the rainfall and fuel accumulation. Fire generally kills only seedlings and larger saplings and coppiced plants are only top killed and therefore can be coppiced again. To minimize damage to desirable larger shrubs and trees, fires for aftercare purposes should be managed to be of intermediate intensity. This can be achieved by burning only during the cool time of the day, when fuel loads are < 1500 kg DM/ha and when the wind is calm. It is always best to burn as far as possible with the wind, some back fires are necessary to contain the fire on the downwind side of the burned area. Burning where *Dichrostachys cinerea* are present should be avoided, because scarification of hard-scaled seeds of species such as *D. cinerea* by fire can facilitate mass germination of dormant seeds. It is possible that fire may have the same effect on other encroacher species with long lived seeds. The effect of fire can be drastically enhanced if combined with foliar spraying of re-sprouting plants, regrowth must be at least knee high, and seedlings, as well as in combination with intensive browsing, e.g. with goats and/or browsing game.

Using goats to control post fire bush may suppress benign woody species more than spinescent encroacher species such as Vachellia/Senegalia (*Acacia)* species and *Dichrostachys cinerea*. A sufficiently high browsing stocking rate is also required to keep re-sprouting bush under control.

The benefit of incorporating browsers in the aftercare programme is that it is a source of additional income for the landowner, but this will require considerable management inputs. Browsing game will also benefit from the available vegetation, but it is more difficult to control stocking rates and their impact on the woody component, therefore should not be relied on as the primary aftercare method.

It is important that the area harvested does not exceed the ability of landowners, or responsible third parties, to undertake effective aftercare. Aftercare should be conducted according to the guidelines provided in this section, Appendix B and the Site Specific Harvesting Plans (Section 11). The first control to be deployed in the first year after harvesting are stem or foliar arboricides. After three years, the situation can be assessed and an appropriate schedule for further aftercare actions planned, as per the adaptive management approach required by this EMP (see section 12).

Above average rainfall years may result in mass germination and establishment of encroacher species. A contingency plan should be in place to handle such a situation, should it occur.

Aftercare methods differ with regards to the potential impact on the environment, which may be positive or negative. In Appendix B of this EMP these impacts are summarised and suitable recommendations provided from an environmental impact perspective.

Encroacher species have different traits that affect the effort required to control regrowth and recruitment. Especially harvested areas where *Dichrostachys cinerea* (sickle bush) was dominant may be difficult to control and should be properly planned for in advance. This species is widely distributed in Namibia and at least 19% of the quarter-degree grid squares, in which it has been recorded as common to abundant in the Tree Atlas project occur within the harvesting area. Traits that make *D. cinerea* control challenging include the ability to rapidly regrow from disturbed roots and stems, the persistent and long-lived seed bank, and effective dispersal of seeds by animals. *D. cinerea* also tends to be more resistant to soil applied arboricides than other encroacher species, requiring a higher dose to control.

Fortunately, *D. cinerea* is sensitive to current stem and foliar applied arboricides. (Refer to the Biodiversity Specialist Report for more detail and relevant references).

14.1 AFTERCARE RESPONSIBILITIES

It is recommended that the post-harvest aftercare should be the responsibility of the landowner, who signs an agreement with regards to these long term commitments, compliance, and supply of biomass to achieve rangeland restoration. Aftercare shall be implemented as per the farm's (defined as a Forestry Management Unit by FSC) specific management plan and guidance supplied by the Site Specific Harvesting Plan (see section 11). If not complied with, the contract for the supply of biomass will be suspended or cancelled. (Refer to section 8.3).

15.REFERENCES

FSC, 2019. The FSC National Forest Stewardship Standard for the Republic of Namibia.

Pallett, J., & Tarr, P. 2017. SAIEA (The Southern African Institute for Environmental Assessment). 2017. Forestry and Environmental Authorisations Process for Bush Harvesting Projects. Guidelines for complying with regulations governing bush thinning and value addition projects. Ministry of Agriculture, Water and Ministry of Environment and Tourism.

SAIEA (The Southern African Institute for Environmental Assessment). 2016. Strategic Environmental Assessment of large-scale bush thinning and value-addition activities in Namibia: Final report. Unpublished report for the MAWF/GIZ Support to De-bushing Project.

APPENDIX A: EMERGENCY RESPONSE PLAN TEMPLATE

APPENDIX B: POTENTIAL POSITIVE AND NEGATIVE ENVIRONMENTAL IMPACTS OF AFTERCARE WITH RECOMMENDATIONS

The colours in the first column indicate recommended (green), less desirable (yellow) and not recommended (red) aftercare methods from an environmental perspective.

Aftercare method	Appropriate harvesting method	Potential for successful control of target plants	Potential positive impacts	Potential negative impacts	Mitigation measures	Management considerations
Treatment of cut stump surfaces with registered arboricide.	Mechanical or manual stem cutting or sawing that leaves a clear cut surface of harvested bushes.	Good control of treated plants possible but newly established seedlings, re-sprouts e.g. root suckers following harvesting not controlled.	Highly selective with least impact on non-target plants. Minimal soil contamination. Minimum soil disturbance. Minimal disturbance of animals and birds because following directly after harvesting operations. Effective for *Dichrostachys cinerea* control.	Concern about current arboricide health issues for applicators[4]. Chemical spills resulting in non-target plant impacts.	Proper protective clothing and thorough training of labourers. Training and proper equipment.	Excellent supervision necessary. Have to be applied within hours of harvesting to be effective.
Foliar spot treatment of resprouting/emerging woody plants between 2-8 months after	Any method.	Good.	Highly selective. Newly established problem seedlings after harvesting are also controlled.	Concern about current arboricide health issues for applicators.	Proper protective clothing and thorough training of labourers required.	To be effective the plants to be controlled need to have a fully expanded, green foliage cover, e.g.

[4]The active ingredient Picloram is on FSC's current Restricted Pesticide List as a suspected carcinogen (Cat. 2)(GHS) and endocrine disruptor (Cat. 2) (GHS). In Namibia known FSC certified producers such as the Cheetah Conservation Fund are using this arboricide because of the lack of alternative registered arboricides currently available.

Aftercare method	Appropriate harvesting method	Potential for successful control of target plants	Potential positive impacts	Potential negative impacts	Mitigation measures	Management considerations
harvesting with a registered arboricide e.g. arboricides with active ingredients such as Picloram.			Minimal soil contamination, although more than stem treatment. Minimum soil disturbance.	Drift in windy conditions may cause non-target plant impacts.	Only spraying under low wind conditions	height between knee and hip height. Must not be stressed e.g. drought.
Soil applied arboricides	Any method.	Poor in dense situations. Improves in low density situations.	Minimal soil disturbance.	Long term residual effects of arboricide. May contaminate ground water resources. Non-target plants may be affected. Species such as *Dichrostachys cinerea* require higher doses to be effective.	Only apply where low densities of target plants occur and are evenly distributed. Training and field supervision important to minimize arboricide amounts used.	Soil type affects the dosage required.
Manual uprooting of regrowth, saplings and seedlings (simply cutting/sawing of plants not effective)	Any method	Medium. labour intensive and inefficient for controlling larger shrubs where underground parts need to be removed. Appropriate for small harvested areas .	No chemicals used. Highly selective. Little soil disturbance. Manually intensive creating jobs.	Labour intensive therefore increased risk of poaching, illegal collection of protected organisms, etc. Not effective against species such as *Dichrostachys cinerea* that readily sprout from exposed roots.	Close supervision, training and strict rule enforcement.	Not appropriate for large harvested areas due to slow control rate.

Aftercare method	Appropriate harvesting method	Potential for successful control of target plants	Potential positive impacts	Potential negative impacts	Mitigation measures	Management considerations
Heavy mechanised machinery such as rollers, bulldozers, chains, etc.	Any method, but cut stumps may be a problem.	Regrowth will only be suppressed temporary and will require re-application according to growth rate of plant e.g. every 3-5 years.	High quality browse is kept within reach of browsers.	Soil disturbance and compaction is cumulative. Killing of slow moving animals and ground nesting birds. Disturbance of wildlife through noise and dust pollution. Not selective at small-scale due to limited manoeuvrability. Continued competition of suppressed bushes with herbaceous layer. Small scale pollution by leaking oil, fuels, grease, etc. Greenhouse gas emissions. Loss of life and injuries from accidents.	Proper training of operators. Close supervision in the field. Appropriate stakeholder engagement. Inspect aftercare areas and remove and flag sensitive animals and plants before operations. Slow down operation to allow slow-moving organisms to move out the way.	Can only be applied on flat areas without rocks.
Fire	Can be used with any harvesting method.	Depends on fuel load, atmospheric conditions at the time of the burn, and whether burning is with or against the wind	Considered a natural method of controlling woody plants i.e. no chemicals or machinery used. High quality browse is kept within reach of browsers. Can be effective in combination with other	Fire may escape intended area and destroy grazing and property. May kill or injure animals. A drought year after the fire may result in rangeland degradation. Seeds of species with long-lived seed banks such as	Good preparations and adequate fire fighting equipment and management of the actual fire and aftermath	Only effective where a large enough fuel load accumulates Right climatic conditions and fuel loads should be chosen to prevent too hot fires that damage the canopies of large trees or too cold fires that fail to control regrowth

Aftercare method	Appropriate harvesting method	Potential for successful control of target plants	Potential positive impacts	Potential negative impacts	Mitigation measures	Management considerations
			methods such as selective foliar spraying.	*Dichrostachys cinerea* can be stimulated to germinate. Only seedlings are effectively killed. Saplings and larger plants re-sprout, therefore fire needs to be repeated e.g. every 3-5 years Emissions of smoke and greenhouse gasses		Good rangeland management practises such as adequate resting essential after fire Requires adequate firefighting equipment and regulations must be followed.
Browsers such as goats. Game are considered too difficult to control to be effective as an aftercare method.	Any method	Poor. At best browsers can be expected to slow down regrowth rates. May be effective against seedlings. A combination of fire and browsers potentially more effective.	Considered a biological method. Generates an additional income.	Browsers have feeding preferences and especially thorny encroacher species may be avoided while desirable broadleaved species are preferred. May negatively impact on palatable grass species, goats are mixed feeders and also consume herbaceous plants.		Goats demands intense management and to sustain high stocking densities herding or fencing is required, which can be expensive. Adequate preparations in terms of predator control, kraaling at night, and animal health are required.

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