Environmental Scoping Assessment Report for Groundwater Abstraction Permit Renewal: Lucerne Irrigation Activities on Portion 2 (Marlo) of Farm Klein Nabas 137, Hardap Region

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Proponent: Jonkheer Boerdery (Pty) Ltd

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Title: Environmental Scoping Assessment Report for the Groundwater Abstraction Permit Renewal: Lucerne Irrigation Activities on Portion 2 (Marlo) of Farm Klein Nabas 137 near Stamptriet, Hardap Region

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Date: 05 April 2019
EXECUTIVE SUMMARY

Jonkheer Boerdery (Pty) Ltd (hereinafter referred to as The Proponent) proposes to apply for a renewal of their water abstraction permit from the Ministry of Water, Agriculture and Forestry (MAWF). The permit is aimed at abstracting 273,000 cubic metres per year (273,000 m$^3$/year) of water from the Stampriet Aquifer to irrigate 19.3 Hectares (ha) of Lucerne (Medicago Sativa) on three fields on Portion 2 (Marlo) of Klein Nabas 137. Portion 2 of Farm Klein Nabas 137 is located in Mariental District, in the Hardap Region and about 30 km southeast of Stampriet along the C15 road to Gochas.

The Lucerne will be grown on the three farm fields yearly, for a period of eleven (11) months from May to June, until harvesting and or grazing. After the planting and growth period, the Lucerne will then be harvested, packaged and sold to customers (farmers). Some of the Lucerne will be used to feed the Proponent's livestock on the Farm.

A sprinkler irrigation method will be used on the fields as required of Lucerne to water the total area. The water to be used will be acquired from the aquifer (accessed by two boreholes) into a reservoir and pumped from here to the sprinklers. The two boreholes and the reservoir to be used for irrigation are located within proximity of the irrigation fields on the Farm.

Need and Desirability of the Project

Commercial farming is a challenging business especially in a dry country such as Namibia. The current weather changes have not been easy either hence adding to sustainability constraints. In order to farm healthy and profitable livestock, The Proponent identified the need to restart growing Lucerne on Portion 2 (Marlo) of Farm Klein Nabas No. 137.

The irrigation activities will not only results in the production of animal fodder leading to successful farming and income generation, but also the creation of employment opportunities to the locals. These will both contribute to the socio-economic development in the area, and possibly to the country at large.

Project Description
The proposed project site is located on Portion 2 of Farm Klein Nabas 137 about 30 km southeast of Stampriet along the C15 road to Gochas. The Farm is bordered by Fricourt, Boomplaas and Bernafay farms. The area is mostly commercial farms with activities such as irrigation and livestock farming.

The proposed project has the overall objective of resuming the irrigation activities that had stopped in 2014. The primary aim is to produce the animal fodder known as Lucerne that will be sold to commercial farmers in the surrounding area and possibly other farmers outside the Stampriet area.

**Background on Lucerne Irrigation**

According to Pioneer Brand Products (undated), Lucerne is renowned for its drought tolerance, but at the same time is very responsive to water. In general terms Lucerne requires 65-80 mm of water to produce one tonne of dry matter. In areas where summer rainfall is low, Lucerne will benefit from one or two irrigations between cuts. Around 90% of the water extracted from the soil comes from the top metre due to the high root concentration in this zone. When under moisture stress Lucerne diverts its nutrients from the top to the crown and roots. Plant stress can occur when available soil moisture falls below 50%.

Following germination the young Lucerne plant puts most of its emphasis into the production of a root system. In mature crops, a general darkening in crop colour, tendency to wilt, cessation of growth and drying and cracking of the surface soil all indicate that it is time to irrigate. Excessive watering, especially on poorly drained soils and where it causes localised ponding can increase root damage. Recently cut and well-grown plants are the most susceptible.

**Construction Phase**

Minimal construction work will be carried out. This will include revamping existing infrastructure on the farm such workers rooms, ablution facilities, equipment storage rooms, setting up new pumps, etc. Manual labour will mostly be used, employing 5 people to set up the related project facilities.

**Operational and Maintenance Phase**

It is within this phase that the irrigation and associated activities will be undertaken and maintenance of the irrigation fields and equipment done by the Proponent.
The Lucerne will be planted on the three fields yearly, for a period of ten to eleven months (June to May) until harvesting and or grazing. After this planting and growth period, the Lucerne will then be harvested, packaged and sold to customers (farmers). Some of the Lucerne will be used to feed the Proponent's livestock on the Farm.

**Proposed Irrigation Method**

The project site is divided into three portions (fields) totalling 19.3ha. A sprinkler irrigation method will be used on the fields as required of Lucerne to water the total area. The water to be used will be acquired from the aquifer (accessed by 2 boreholes) into a reservoir and pumped from here to the sprinklers. The two boreholes and the reservoir to be used for irrigation are located within proximity of the irrigation fields on the Farm.

The operation works will further entail the following activities:

- Pumping water from the two boreholes into the dam;
- Frequent measuring and recording of water levels to monitor water levels and for management purposes;
- Monitoring of water storage reservoir to ensure safety and water leakages.

**Decommissioning Phase**

It is not anticipated that the project activities will be decommissioned given the constant need to produce enough animal feed for farmers. However, should it come to light later that irrigation activities need to be stopped, different infrastructure related to the project will need to be decommissioned and groundwater abstraction ceased. This will also mean that further irrigation permit renewals will not be considered.

**Services Infrastructure**

**Site Access, Power and Water Supply:** Power supply (at 2MVA) for pumping water to the sprinklers will be supplied from NamPower power line per month. Tractors and trucks will be used for some irrigation works and transporting Lucerne to customers, respectively. The tractors and trucks will both be operated on diesel. There are already two diesel tanks on site and these will be used to store the diesel.
Water required for the operations will be abstracted from two existing boreholes with a yield of about 25m³/h. These two boreholes are deemed sufficient to cater for the project; therefore, no additional boreholes will be drilled.

The site is accessible by the existing gravel (C15) that connects the southern farms to Stampriet. This road passes by the Farm (site) to Gochas.

**Project Alternatives Considered**

The following alternatives have been considered for the project. The preferred alternatives are summarized as follows:

- **No-go vs. continuation of the proposed project (irrigation):** Should the proposed project not be allowed to go ahead, the farmers will continue to struggle with feeding their livestock. Added to this, income for the farmer (Proponent) and employment will not be generated and created, respectively, leading to poor socio-economic development in the area.

- **Irrigation method:** The sprinkler method was used on the Farm in the previous years. The fact that sprinkler irrigation method has been practiced on the Farm with cultivating Lucerne, this can be deemed viable that the Proponent continues with this method when resuming the irrigation. For these reasons, the sprinkler irrigation is the preferred method for the proposed project.

- **Project location:** The location is strategically chosen as it is the area previously used for the same activity, using the same existing boreholes. The location is also chosen because the existing irrigation fields are well within proximity of the water supplying boreholes and there are already sprinklers installed in all the three fields. The location is environmentally friendly because there will be no need to clear new land, drill new boreholes nor install completely new infrastructure and equipment to cater for the irrigation activities.

- **Water source:** The project area has no reliable surface water bodies, as the nearest known rivers are all ephemeral and are currently dry and usually for most, if not all year. The only reliable source of water supply in the area is groundwater which is obtained either via springs or boreholes. This water is then stored in reservoirs on some farms and in tanks for some farmers, depending on the intended water use. The project site is supplied with water from boreholes and these will be used for the irrigation activities. Therefore, the groundwater source is the only way to sustain the irrigation on the Farm compared to surface water that is already not there.
**Potential impacts Identified**

The following impacts stemming from the proposed project have been identified:

**Positive impacts**

- income generation
- Employment Creation
- Provision of animal feed / fodder

**Negative impacts**

- Water quantity (over-abstraction) and quality (pollution)
- Health and safety
- waste generation
- Loss of income, employment and animal fodder production (during upon cessation of irrigation).

**Public Consultation**

Public Participation forms an important component of the Environmental Assessment process. It is defined by the Environmental Management Act (2007), as a ‘process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters’. Communication with stakeholders about this proposed development was facilitated through the following means:

- Key stakeholders were identified as the Stampriet village council, Mariental Rural constituency office, various Ministries (including Environment and Tourism and Ministry of Agriculture, Water and Forestry). Their contact details were added to a stakeholders list.
- A Background Information Document (BID) was compiled. It contained brief information of the project. The BID was forwarded to all relevant authorities and registered interested and affected parties (I&APs).
Notices were placed in the press (on 4 and 11 February 2019) in the Market Watch of the three daily Newspapers being Republikein, Namibian Sun and Allgemeiner Zeitung, briefly explaining the development and its locality, inviting the public to register as stakeholders.

A public participation meeting was arranged and held on 18th February at Aoub Lodge, Gochas. Five people from the area attended the meeting. The meeting minutes were taken and an attendance register was circulated for the attendees to register their names. Issues raised during the meeting were also recorded and incorporated into the minutes.

Public Feedback on the Draft Environmental Scoping Report

The draft environmental report together with its appendices was circulated to all registered interested and affected parties (IAPs) for review and comments. The review period started on the 25th of March to the 4th of April 2019, i.e. nine days. Some of the IAPs acknowledged receipt of the draft report. However, no comments were received during this period.

Recommendations and Conclusions

The objective of the study was to identify potential environmental impacts stemming from the proposed groundwater abstraction from the Stampriet artesian aquifer for the application of an Environmental Clearance Certificate. The study is also aimed at enforcing for the application of the renewal of groundwater abstraction and use permit from the Ministry of Agriculture, Water and Forestry.

The proposed project is a good development that will enable the Proponent to supply animal fodder for his livestock and also to the surrounding farmers in the area. The other positive impact associated with the project is the creation of employment to five people from the area. The identified potential risks associated with the proposed project were assessed and mitigation measures made thereof. All of the impacts assessed were found to have moderate significance. The effective implementation of mitigation measures and recommendations provided in this scoping assessment report and management action plans provided in the draft EMP, can be deemed sufficient to avoid and reduce (where impact avoidance is not possible) the environmental impacts to acceptable levels (low significance). For the impact significance to remain low, monitoring has to be effectively done for the site. In order to manage groundwater abstraction from the aquifer, it will be crucial for the Proponent to implement monitoring on site as per recommendations made in the Groundwater Report.
It is for this reason that Green Team Consultants believe that these measures are sufficient and thus recommends that the Proponent be issued with the ECC as well the water abstraction and use permit. It is also recommended that the Proponent work closely with a Geohydrologist to advice on matters pertaining to groundwater. This will help them to fully implement the management actions plans for the proposed project, especially monitoring and groundwater use reporting. This will also enable early identification of excessive impact on groundwater at any stage of the project and accordingly advice on the implementation of appropriate mitigation measures.
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1 INTRODUCTION

Irrigation is mostly practised in arid to semi-arid zones, here referred to as dry lands, but is also known from humid areas. Dry lands are poor in precipitation and suffer tremendous climate variability from year to year, thus increasing the vulnerability of cultivated ecosystems.

There are two main ways that farmers and ranchers use agricultural water to cultivate crops: rain-fed farming and irrigation. Rain-fed farming is the natural application of water to the soil through direct rainfall. Relying on rainfall is less likely to result in contamination of food products but is open to water shortages when rainfall is reduced. On the other hand, artificial applications of water increase the risk of contamination.

Irrigation is the artificial application of water to the soil through various systems of tubes, pumps, and sprays. Irrigation is usually used in areas where rainfall is irregular or dry times or drought is expected. There are many types of irrigation systems, in which water is supplied to the entire field uniformly. Irrigation water can come from groundwater, through springs or wells, surface water, through rivers, lakes, or reservoirs, or even other sources, such as treated wastewater or desalinated water. As a result, it is critical that farmers protect their agricultural water source to minimize the potential for contamination. As with any groundwater removal, users of irrigation water need to be careful in not pumping groundwater out of an aquifer faster than it is being recharged (Centres for Disease Control and Prevention, Undated).

1.1 Project Background

Due to the current effects of climate change in Namibia farmers are struggling to sustain their animals with enough food and water. Jonkheer Boerdery (Pty) Ltd identified the need to improve current farming status by re-applying for their groundwater abstraction permit in order to irrigate Lucerne for their livestock and to sell to surrounding farmers. It is for this reason that Jonkheer Boerdery (Pty) Ltd (hereinafter referred to as The Proponent) proposes to apply for a renewal of their water abstraction / extraction permit from the Ministry of Water, Agriculture and Forestry (MAWF). The permit is aimed at abstracting 273 cubic metres per year (273 000 m$^3$/year) of water from the Stampriet Aquifer to irrigate 19.3 Hectares (ha) of Lucerne (*Medicago Sativa*) on three fields on Portion 2 (Marlo) of Klein Nabas 137. Portion 2 of Farm Klein Nabas 137 is located in Mariental District, in the Hardap Region and about 30 km southeast of Stampriet along the C15 road to Gochas. The approximate locality map of the Farm is shown in *Figure 1-1* and *Figure 1-2* below.
Figure 1-1: Location of Marlo Portion 2 of Farm Klein Nabas 137 near Stampriet, Hardap Region
Figure 1-2: Portion of the Farm intended for irrigation activities
The Portion 2 of Farm Klein Nabas was previously used for the same purpose (irrigation) up until 2012 when the permit also expired. The Proponent intends to re-apply for the water abstraction of 273 000 m$^3$/year. However, groundwater abstraction, if not managed properly may lead to over-abstraction, which may have adverse negative impacts on the environment. Furthermore, both surface and groundwater abstraction for commercial purposes in Namibia is subjected to environmental assessments, whereby certain activities and development cannot be undertaken without an environmental clearance certificate (ECC).

Subsequently, the Proponent is required to apply for the ECC from the Department of Environmental Affairs at the Ministry (MET) after conducting the required environmental assessment process and submitting the environmental assessment report and management plan to the competent authority, respectively.

1.2 Scope of work

The objective of this study is to assess the impacts of water abstraction of up to 273 000 m$^3$/year from the Stampriet Aquifer and apply for an Environmental Clearance Certificate to attach to the water extraction renewal permit application.

This scoping study was carried out in accordance with the Environmental Management Act (EMA) (7 of 2007) and it’s EIA Regulations (GG No. 4878 GN No. 30).

In order to meet the objectives of the study, the assessment report has been compiled and includes the following chapters:

- Chapter 1: Introduction, covering the need and desirability of the proposed development
- Chapter 2: Description of the project and its related activities and services;
- Chapter 3: Alternatives considered for the project;
- Chapter 4: Legal framework governing the proposed project;
- Chapter 5: Environmental Baseline of the project area;
- Chapter 6: Public consultation process followed to engage the interested and affected members of the public;
- Chapter 7: Impact identification and assessment. The mitigation measures on how to minimize and/or avoid the potential impacts will also be presented under this chapter.
Chapter 8: The recommendations and conclusions reached will be presented under this chapter.

Chapter 9: References List. The list of all data sources consulted for the assessment and report compilation.

1.3 Need and Desirability of the Project

Commercial farming is a challenging business especially in a dry country such as Namibia. The current weather changes have not been easy hence adding to sustainability constraints. In order to farm healthy and profitable livestock, The Propponent identified the need to restart growing Lucerne on Portion 2 (Marlo) of Farm Klein Nabas No. 137.

The irrigation activities will not only results in the production of animal fodder leading to successful farming and income generation, but also the creation of employment opportunities to the locals. These will both contribute to the socio-economic development in the area, and possibly to the country at large.

1.4 Appointment of the Environmental Assessment Practitioner (EAP)

In accordance with the Environmental Management Act (2007) of Namibia (and its regulations of 2012), an Environmental Clearance Certificate is required for activities listed under:

- **Section 8.1:** Abstraction of ground or surface water for industrial or commercial purposes.
- **Section 8.2:** The abstraction of groundwater at a volume exceeding the threshold authorised in terms of a law relating to water resources.
- **Section 8.7:** Irrigation schemes for agriculture excluding domestic irrigation.

Consequently, to satisfy the requirements of the Act (No 7 of 2007) and its Regulations (2012), Jonkheer Boerdery (Pty) Ltd appointed Green Team consultants cc as an independent environmental consultant to conduct an Environmental Assessment (EA) and submit the required documents as part of an application for an ECC to the Environmental Commissioner. The findings of the EA process are incorporated in this report and together with the Environmental Management Plan (EMP), will be submitted as part of an application for an ECC to the relevant competent authorities for evaluation and recommendation and consideration for an ECC at the Department of Environmental Affairs.
Ms. Linda Uulenga (Environmental Assessment Practitioner) conducted this EA process. Ms. Uulenga was assisted by Ms. Fredrika Shagama, a qualified and experienced Hydrogeologist and experienced and registered environmental assessment practitioner. Ms. Shagama was the environmental report reviewer and authored the groundwater specialist report attached as Appendix G. The CV's of the project team are attached under Appendix A.
2 PROJECT DESCRIPTION

The proposed project site is located on Portion 2 of Farm Klein Nabas 137 about 30 km southeast of Stampriet along the C15 road to Gochas. The Farm is bordered by Fricourt, Boomplaas and Bernafay farms. The area is mostly commercial farms with activities such as irrigation and livestock farming. The fields to be used for irrigation are shown in Google Earth Map below (Figure 2-1).

![Google Earth Map showing marked irrigation fields](image)

**Figure 2-1:** The three marked irrigation fields on Portion 2 of Farm Klein Nabas 137

The proposed project has the overall objective of resuming the irrigation activities that had stopped in 2014. The primary aim is to produce the animal fodder known as Lucerne that will be used to feed the farmer’/Proponent's livestock. The Lucerne will also be sold to commercial farmers in the surrounding area and possibly other farmers outside the Stampriet area.
2.1.1 **Background on Lucerne Irrigation**

According to Pioneer Brand Products (undated), Lucerne is renowned for its drought tolerance, but at the same time is very responsive to water. In general terms Lucerne requires 65-80 mm of water to produce one tonne of drymatter. In areas where summer rainfall is low, Lucerne will benefit from one or two irrigations between cuts. Around 90% of the water extracted from the soil comes from the top metre due to the high root concentration in this zone. When under moisture stress lucerne diverts its nutrients from the top to the crown and roots. Plant stress can occur when available soil moisture falls below 50%.

Following germination the young lucerne plant puts most of its emphasis into the production of a root system. In mature crops, a general darkening in crop colour, tendency to wilt, cessation of growth and drying and cracking of the surface soil all indicate that it is time to irrigate. Excessive watering, especially on poorly drained soils and where it causes localised ponding can increase root damage. Recently cut and well-grown plants are the most susceptible.

The anticipated project phases are presented below.

2.2 **Construction Phase**

Minimal construction work will be carried out. This will include revamping existing infrastructure on the farm such as workers rooms, ablution facilities, equipment storage rooms, setting up new pumps, etc. Manual labour will mostly be used, employing 5 people to set up the related project facilities.

2.3 **Operational and Maintenance Phase**

It is within this phase that the irrigation and associated activities will be undertaken and maintenance of the irrigation fields and equipment done by the Proponent.

The Lucerne will be planted on the three fields yearly, for a period of ten (10) to eleven (11) months (June to May) until harvesting and / or grazing. After this planting and growth period, the Lucerne will then be harvested, packaged and sold to customers (farmers). Some of the Lucerne will be used to feed the Proponent's livestock on the Farm.
2.3.1  Proposed Irrigation Method

The project site is divided into three portions (fields) totalling 19.3ha. A sprinkler irrigation method will be used on the fields as required of Lucerne to water the total area. The water to be used will be acquired from the aquifer (accessed by 2 boreholes) into a reservoir and pumped from here to the sprinklers (Figure 2-4). The two boreholes and the reservoir to be used for irrigation are located within proximity of the irrigation fields on the Farm - see Figure 2-2 and Figure 2-3 below.

Figure 2-2:  Water boreholes to be used for the irrigation on the Farm

Figure 2-3:  Water Reservoir on the Farm, located on the western side of the Farm
The operation works will further entail the following activities:

- Pumping water from the two boreholes into the dam;
- Frequent measuring and recording of water levels to monitor water levels and for management purposes;
- Monitoring of water storage reservoir to ensure safety and water leakages.

Figure 2-4: Sprinklers (encircled) on one of the irrigation fields (view to the north)

2.4 Decommissioning Phase

It is not anticipated that the project activities will be decommissioned given the constant need to produce enough animal feed for farmers. However, should it come to light later that irrigation activities need to be stopped, different infrastructure related to the project will need to be decommissioned and groundwater abstraction ceased. This will also mean that further irrigation permit renewals will not be considered.
2.5 Services Infrastructure

2.5.1 Site Access, Power and Water Supply

Power supply (at 2MVA) for pumping water to the sprinklers will be supplied from NamPower power line per month. Tractors and trucks will be used for cultivation works and transporting Lucerne to customers, respectively. The tractors and trucks will both be operated on diesel. There are already two diesel tanks on site and these will be used to store the diesel.

Water required for the operations will be abstracted from two existing boreholes with a yield of about 25m³/h. These two boreholes are deemed sufficient to cater for the project; therefore, no additional boreholes will be drilled.

The site is accessible by the existing gravel (C15) that connects the southern farms to Stampriet (Figure 2-5, Figure 2-6). This road passes by the Farm (site) to Gochas - Figure 2-7.

![Image](image-url)  

Figure 2-5: Beginning of C15 at the intersection with C20 (to Aranos) from Stampriet
Figure 2-6: C15 (gravel road) passing by Portion 2 of Farm Klein Nabas 137

Figure 2-7: Turn off from the C15 to the site (Portion 2 of Farm Klein Nabas)
3 ALTERNATIVES AND THE NO-GO OPTION

Alternatives are defined as: “different means of meeting the general purpose and requirements of the activity” (Environmental Management Act (2007) of Namibia (and its regulations (2012))). The alternatives considered for the proposed water abstraction are discussed in the following subchapters.

3.1 The No-Go Alternative

The “No-go” alternative is the option of not proceeding with the activity, which typically implies a continuation of the status quo. In this case, this would mean, not abstracting water to cultivate Lucerne. Should the proposed project not be allowed to go ahead, the farmers will continue to struggle with feeding their livestock. Added to this, income for the farmer and employment will not be generated and created, respectively, leading to poor socio-economic development in the area.

In considering the proposed activity, the no-go option is not a preferred option.

3.2 Irrigation Method

Testing of the various methods (systems) under the prevailing local conditions provides the best basis for a sound choice of irrigation method (Brouwer, et al (2001). There commonly used irrigation methods are surface, sprinkler or drip, basin, furrow or border. The suitability of these methods depends mainly on the following factors:

- **Natural conditions**: These include; soil type, slope, climate and water availability.
- **Type of crop**: Surface irrigation can be used for all types of crops. Sprinkler and drip irrigation, because of their high capital investment per hectare, are mostly used for high value cash crops, such as vegetables and fruit trees. They are seldom used for the lower value staple crops. Drip irrigation is suited to irrigating individual plants or trees or row crops such as vegetables and sugarcane. It is not suitable for close growing crops (e.g. rice).
- **Type of technology**: The type of technology affects the choice of irrigation method. In general, drip and sprinkler irrigation are technically more complicated methods. The purchase of equipment requires high capital investment per hectare. To maintain the equipment a high level of 'know-how' has to be available. Also, a regular supply of fuel and spare parts must be maintained which, together with the purchase of equipment. Surface irrigation systems - in particular small-scale schemes usually require less sophisticated equipment for both construction and maintenance (unless pumps are used).
• **Previous experience with irrigation**: The choice of an irrigation method also depends on the irrigation tradition within the region or country. Introducing a previously unknown method may lead to unexpected complications.

• **Required labour inputs**: Surface irrigation often requires a much higher labour input - for construction, operation and maintenance - than sprinkler or drip irrigation. Surface irrigation requires accurate land levelling, regular maintenance and a high level of farmers' organization to operate the system. Sprinkler and drip irrigation require little land levelling; system operation and maintenance are less labour-intensive.

• **Costs and benefits**: Before choosing an irrigation method, an estimate must be made of the costs and benefits of the available options. On the cost side not only the construction and installation, but also the operation and maintenance (per hectare) should be taken into account. These costs should then be compared with the expected benefits (yields).

The different irrigation methods are listed and briefly described below according to Centre for Disease Control and Prevention (undated) and Brouwer, *et al* (2001):

• **Surface**: Water is distributed over and across land by gravity, no mechanical pump involved.

• **Centre pivot irrigation**: Water is distributed by a system of sprinklers that move on wheeled towers in a circular pattern. This system is common in flat areas of the United States.

• **Sprinkler**: Sprinkler irrigation is similar to natural rainfall. Water is pumped through a pipe system and then sprayed onto the crops through rotating sprinkler heads.

• **Drip**: With drip irrigation, water is conveyed under pressure through a pipe system to the fields, where it drips slowly onto the soil through emitters or drippers which are located close to the plants. Only the immediate root zone of each plant is wetted. Therefore this can be a very efficient method of irrigation (Figure 6). Drip irrigation is sometimes called trickle irrigation.

• **Lateral move irrigation**: Water is distributed through a series of pipes, each with a wheel and a set of sprinklers, which are rotated either by hand or with a purpose built mechanism. The sprinklers move a certain distance across the field and then need to have the water hose reconnected for the next distance. This system tends to be less expensive but requires more labor than others.

• **Sub-irrigation**: Water is distributed across land by raising the water table, through a system of pumping stations, canals, gates, and ditches. This type of irrigation is most effective in areas with high water tables.
- **Manual irrigation:** Water is distributed across land through manual labor and watering cans. This system is very labor intensive.

The sprinkler method was used on the Farm in the previous years. There are obviously some disadvantages associated with all irrigation methods, which includes sprinkler. However, the fact that sprinkler irrigation method has been practiced on the Farm with cultivating Lucerne, this can be deemed viable that the Proponent continues with this method when resuming the irrigation. For these reasons, the sprinkler irrigation is the preferred method for the proposed project.

### 3.3 Project Location

The location is strategically chosen as it is the area previously used for the same activity, using the same existing boreholes. The location is also chosen because the existing irrigation fields are well within proximity of the water supplying boreholes and there are already sprinklers installed in all the three fields. The location is environmentally friendly because there will be no need to clear new land, drill new boreholes nor install completely new infrastructure and equipment to cater for the irrigation activities.

For these reasons, the proposed irrigation activities are viably located as previously operated.

### 3.4 Water Source

The water source that could be used for the proposed irrigation can either be surface or groundwater. However, the project area has no reliable surface water bodies, as the nearest known rivers are all ephemeral and are currently dry and usually for most, if not all year. The only reliable source of water supply in the area is groundwater which is obtained either via springs or boreholes. This water is then stored in reservoirs on some farms and in tanks for some farmers, depending on the intended water use.

The Farm (project site) is supplied with water from boreholes and these will be used for the irrigation activities. Therefore, the groundwater source is the only way to sustain the irrigation on the Farm compared to surface water that is already not there.

### 3.5 Conclusion on Weighed Alternatives

The following alternatives have been considered for the project. The preferred alternatives are summarized as follows:
• **No-go vs. continuation of the proposed project (irrigation):** Should the proposed project not be allowed to go ahead, the farmers will continue to struggle with feeding their livestock. Added to this, income for the farmer (Proponent) and employment will not be generated and created, respectively, leading to poor socio-economic development in the area.

• **Irrigation method:** The sprinkler method was used on the Farm in the previous years. For these reasons, the sprinkler irrigation is the preferred method for the proposed project.

• **Project location:** The location is strategically chosen as it is the area previously used for the same activity, using the same existing boreholes. The location is environmentally friendly because there will be no need to clear new land, drill new boreholes nor install completely new infrastructure and equipment to cater for the irrigation activities.

• **Water source:** The project area has no reliable surface water bodies, as the nearest known rivers are all ephemeral. The only reliable source of water supply in the area is groundwater which is obtained either via springs or boreholes. Therefore, the groundwater source is the only way to sustain the irrigation on the Farm compared to surface water that is already not there.

The proposed irrigation and groundwater abstraction activities are governed by certain legislation. The listed of legal requirements that will need to be complied with for this project are presented under chapter 4.
4 LEGISLATION, POLICIES AND GUIDELINES

A review of applicable and relevant Namibian legislation, policies and guidelines to the proposed development are given in this chapter. This review serves to inform Jonkheer Boerdery, Interested and Affected Parties and the decision makers at the DEA of the requirements and expectations, as laid out in terms of these instruments, to be fulfilled in order to abstract groundwater for commercial purposes.

4.1 The Environmental Management Act (No. 7 of 2007)

This scoping assessment was carried out according to the Environmental Management Act (EMA) and its Environmental Impact Assessment (EIA) Regulations (GG No. 4878 GN No. 30). The EMA has stipulated requirements to complete the required documentation in order to obtain an Environmental Clearance Certificate (ECC) for permission to undertake certain listed activities.

The Act aims at promoting sustainable management of the environment and use of natural resources. The Environmental Management Act is broad; it regulates land use development through environmental clearance certification and/or Environmental Impact Assessments. The Act provides for the clearance certification for surface or groundwater abstractions for industrial or commercial purposes in order to protect water resources. It further stipulates requirements to complete the required documentation in order to obtain an Environmental Clearance Certificate (ECC) for permission to undertake this activity. The following Sections of the EIA Regulations that are relevant to this project are:

- "8.1 Abstraction of ground or surface water for industrial or commercial purposes"
- "8.2 The abstraction of groundwater at a volume exceeding the threshold authorised in terms of a law relating to water resources."
- "8.7 Irrigation schemes for agriculture excluding domestic irrigation".

The lists of other relevant and applicable legislations are presented below.

4.2 Additional Relevant Regulations and Standards

The legislations that have been identified and conducted during the EA process are presented in Table 4-1.
Table 4-1: Applicable and relevant Namibian and relevant International legislations, policies and guidelines conducted during the EA process

<table>
<thead>
<tr>
<th>Legislation/Policy/Guideline</th>
<th>Relevant Provisions</th>
<th>Implications for this project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Management Act EMA (No 7 of 2007)</td>
<td>Requires that projects with significant environmental impacts are subject to an environmental assessment process (Section 27). Details principles which are to guide all EAs.</td>
<td>The EMA and its regulations should inform and guide this EA process.</td>
</tr>
<tr>
<td>Environmental Impact Assessment (EIA) Regulations GN 28-30 (GG 4878)</td>
<td>Details requirements for public consultation within a given environmental assessment process (GN 30 S21). Details the requirements for what should be included in a Scoping Report (GN 30 S8) and an Assessment Report (GN 30 S15).</td>
<td></td>
</tr>
<tr>
<td>Water Act No. 54 of 1956</td>
<td>To consolidate and amend the laws relating to the control, conservation and use of water for domestic, agricultural, urban and industrial purposes; to make provision for the control, in certain respects, of the use of sea water for certain purposes; for the control of certain activities on or in water in certain areas; for the control of activities which may alter the natural occurrence of certain types of atmospheric precipitation; for the control, in certain respects, of the establishment or the extension of townships in certain areas; and for incidental matters.</td>
<td>This Act (Government Gazette 5367) has been passed by Parliament, but it has not yet been brought into force. The Regulations have been passed in December 2016 but have not yet been promulgated. Therefore, the Regulations of the 1956 Water Act still apply. The 2013 Water Act restricts water abstraction activities (for commercial purposes) without an authorised licence. The protection (both quality and quantity/abstraction) of water resources should be a priority.</td>
</tr>
<tr>
<td>Water Resource Management Act (No 11 of 2013)</td>
<td>Details on who and how water may be used. Section 45 describes &quot;a person must not abstract/irrigate and use water from a water resource unless the person holds a license issued by the Minister that authorises the abstraction and use of water from that water source.</td>
<td></td>
</tr>
<tr>
<td>Fertilizers Farm Feeds and Agricultural Remedies Act No.</td>
<td>To provide for the appointment of a Registrar of Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies; for the registration of fertilizers, farm feeds,</td>
<td>Jonkheer Boerdery should ensure that they obtain relevant permits or licenses from the Directorate of Agricultural</td>
</tr>
<tr>
<td>Legislation/Policy/Guideline</td>
<td>Relevant Provisions</td>
<td>Implications for this project</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>36 of 1947 and its 2007 Regulations</td>
<td>agricultural remedies and stock remedies; to regulate or prohibit the importation, sale, acquisition, disposal or use of fertilizers, farm feeds, agricultural remedies and stock remedies; to provide for the designation of technical advisers and analysts; and to provide for matters incidental thereto.</td>
<td>Extensions and Engineering Services of the Ministry of Agriculture, Water and Forestry (MWAF).</td>
</tr>
<tr>
<td>Public and Environmental Health Act No. 1 of 2015</td>
<td>To provide a framework for a structured uniform public and environmental health system in Namibia; and to provide for incidental matters.</td>
<td>The Proponent should ensure adherence to this Act and its Regulations.</td>
</tr>
<tr>
<td>Soil Conservation Act No. 76 of 1969</td>
<td>The Act makes provision for the prevention and control of soil erosion and the protection, improvement and conservation of soil, vegetation and water supply sources and resources, through directives declared by the Minister.</td>
<td>Duty of care must be applied for soil conservation.</td>
</tr>
<tr>
<td>The Regional Councils Act (No. 22 of 1992)</td>
<td>These Acts set out the conditions under which Councils must be elected and administer each delineated region. From a land use and project planning point of view, their duties include; “undertaking the planning of the development of the region/ local authority for which it has been established with a view to physical, social and economic characteristics, urbanisation patterns, natural resources, economic development potential, infrastructure, land utilisation pattern and sensitivity of the natural environment.”</td>
<td>The relevant Regional Councils are considered to be IAPs and must be consulted during the Environmental Assessment (EA) process. The Hardap Regional Council is regional authority for the area; therefore they should be consulted for this project.</td>
</tr>
<tr>
<td>Labour Act (No 6 of 1992)</td>
<td>Ministry of Labour (MOL) is aimed at ensuring harmonious labour relations through promoting social justice, occupational health and safety and enhanced labour market services for the benefit of all Namibians. This ministry insures effective implementation of the Labour Act no. 6 of 1992.</td>
<td>The Proponent should ensure that the activities do not compromise the safety and welfare of workers.</td>
</tr>
</tbody>
</table>

The project will be undertaken in specific environmental conditions. The environmental baseline for the project area is presented under the following chapter.
5 BASELINE ENVIRONMENT

The proposed project will be undertaken in a specific biophysical and social environment. The baseline conditions of these environmental features are described in the following subchapters.

5.1 Biophysical Environment

5.1.1 Climate
Stampriet is situated in a semi-arid environment, with a climate classification designated as having a hot desert climate with moderate rains during summer. The climate of Namibia is a subtropical country. However, due to the influence of the ocean currents, topography and air circulation, most of the country experience semi arid to arid conditions. Rainy season starts from October to April with most rainfall occurring from December onwards. The average maximum temperature is 30°C and minimum of 2°C within the study area. The annual potential evaporation ranges between 3 200 mm - 3 800 mm and daily evaporation rate within the study area is 9.7 mm in December and 4.7 mm in July (Peck, 2009).

The average rainfall for the study area is 150 mm - 300 mm per annum. There is a decrease of rainfall when moving from north to south. Systematic episodic rainfall takes place in ±20 year cycles. These heavy rainfall events can produce the annual rainfall within a few days, resulting in flooding in many areas. The highest rainfall event documented was 774mm in 1977-78 in Owingi located along the Black Nossob River. This heavy rainfall event is believed to be the main source of recharge to the "confined" Auob and Nossob aquifers.

5.1.2 Topography
The Stampriet area is bounded by the Weissrand, a surface plateau that rises 80m above the Fish River plain. Dune fields commence west of the Auob and stretches eastwards to the Nossob River. The north has gradual comparatively monotonous sand or calcrete plains (Christelis and Struckmeier, 2001).

According Peck (2009), the topography of the Stampriet area is relatively flat with an elevation of 1500 m – 950 m from the northwest and southeast. The north western part of the Stampriet Artesian Basin (SAB) has an elevation of 1 350 m above mean sea level and is reported to drop 500 m to 850 m in the southeast.

5.1.3 Soil and Geology
In the Stampriet area there are fertile eutric leptosols (caused by erosion) and fluvisols (flood deposits) with a low base saturation. Irrigation is common on these soils (Alker, 2009).
The irrigation project area (Marlo Portion 2) is mostly covered by light brown and grey loamy sand soils and at some areas of the Farm gravel and calcrete. The typical soils found on the Farm are shown in Figure 5-1 below.

**Figure 5-1: Soils overlying the Farm**

Geologically, the Dwyka Group, Nama Group and Damara Sequence form the basement rocks in the study area. It serves as an impermeable barrier for the confined Auob and Nossob aquifers. The Kalahari beds host the overlying unconfined aquifer known as the Kalahari Aquifer. The typical rock units found on the hilly outcrops found on the southeast and southwest of the Farm irrigation workshop are light grey to light brown, well bedded, fine to medium-grained sandstone; sand grains well rounded and well sorted; accessory biotite; isolated clay pellets. The common rock units found on site are shown on Figure 5-2.

**Figure 5-2: Common rock units found on the Farm**
5.1.4 Hydrology and Hydrogeology

Given the climatic and other geographic features, there are no permanent rivers in the Stampriet Transboundary Aquifer System (STAS) area. Apart from the ephemeral Auob and Nossob Rivers that provide some water during the rainy season, there are surface waterpans scattered over the area that collect and store water for livestock watering during rainy season; these reserves can last a few months after the rains (Haasbroek, 2018).

The Marlo Portion 2 of Farm Klein Nabas 137 falls under the Stampriet Artesian groundwater basin. This Stampriet area was declared a Subterranean Water Control Area, as defined by law in the Artesian Water Control Ordinance of 1955. Groundwater in the Stampriet Artesian Basin (SAB) occurs in the Nossob and Auob sandstones of the Ecca Group (lower Karoo Sequence), which are divided by shale layers and overlain by Rietmond shale and sandstone. Younger Kalkrand Basalt occurs in the north-west and Kalahari Sequence deposits. Predominantly calcrete and dune sand, cover virtually the entire surface of the Stampriet Artesian Basin (Christelis and Struckmeier, 2001).

The basin comprises of three aquifers, namely; The Kalahari, Auob aquifer and Nossob aquifers.

5.1.5 Stampriet Artesian Basin (SAB)

The name "Stampriet Artesian Basin" refers to a transboundary groundwater system that has been identified and investigated, where it encompasses the Nossob and Auob sandstones of the Ecca subgroup in the Karoo and Kalahari Sequences. SAB covers a large arid region stretching from Central Namibia into Western Botswana and South Africa's Northern Cape Province (International Groundwater Resources Assessment Centre, 2019). It contains two confined sandstone aquifers and the overlying unconfined Kalahari aquifer units. In Namibia it covers an area of about 71 000 square kilometers. The detailed description of the Hydrogeology in the area is presented under Appendix G - Desktop Groundwater Assessment (Specialist) Report.

5.1.6 Fauna and Flora

There are almost 1 200 000 head of small stock and 160 000 large stock in the STAS area. While 90% of small livestock is in Namibia, large stock (mainly cattle) is more equally distributed in the STAS area as Botswana accounts for approximately 35% of total large stock. Small stock in the STAS area mainly consists of sheep (≈80%) and goats (≈15%). Other small livestock consist of horses, pigs, donkeys, ostriches and poultry. Dependency on sheep farming in Namibia is considered due to low rainfall and grazing capacity of the study area.
In terms of flora, the project (calcrete/sandy surface) area is covered by shrubs and in some cases thick bushes. Grass cover is sparse. The alien Prosopis species (native to America) also forms part of vegetation across the three countries. Farmers were encouraged in the past to plant these tree species in large numbers to provide shade, fuel wood and livestock fodder. The arid local climatic conditions and saline and/or alkaline soils provided suitable condition for the survival of these contrary to others species that could not survive. Prosopis trees are found in abundance along the Auob and Nossob Rivers, causing bush encroachment in some parts of the basin (UNESCO's International Hydrological programme, 2016).

The typical vegetation found on the Farm includes camel thorn shrubs, palm, pine and orange trees - Figure 5-3.
Figure 5-3: Common vegetation found on the Farm and in the surrounding area

5.2 Social Environment

5.2.1 Background

Stampriet Village is the nearest urban centre to the farm, located about 30km northeast of the project area in the Mariental Rural Constituency. Stampriet is located 64km north-east of Mariental. The population of Stampriet recorded in 2011 was 1 947 (1 019 women and 928 men). The economy is dependent on trading in Mariental, the regional capital. The activities surrounding the area are composed of commercial farms with a number of tourism activities due to scenic views in the area.

5.2.2 Economy

According to UNESCO's International Hydrological Programme (2016), the predominant groundwater use for economic purposes in the STAS area is concentrated on livestock and agricultural production. Major economic activities are concentrated in a relatively small number (80) of commercial farms undertaking a system of mixed livestock (mainly sheep, but also cattle and other animals) and irrigated crop production in Namibia. Other commercial and communal farms mainly rely on livestock farming in grazing areas in Namibia and Botswana. There are some aquaculture activities (e.g. growing tilapia in open pond systems tilapia) in Leonardville (Namibia), but its contribution to the economy is relatively negligible as the sector is in its early stages and production is still low.

The Project site is on Portion 2 (Marlo) of Farm Klein Nabas 137, a commercial farm used for agriculture and livestock farming. The farm is under the ownership of Jonkheer Boerdery.
5.3 Identified Potential Impacts

The following potential impacts have been identified and are summarized in Table 5-1. The assessments of the negative impacts are presented in the Impact Assessment Chapter.

Table 5-1: Summary of the Identified Potential Impacts

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description of Project Activity</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive impacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment Creation</td>
<td>Local community will be employed to better their livelihood</td>
<td>Socio-economic impact through employment creation</td>
</tr>
<tr>
<td>Income</td>
<td>Income will be generated from selling the Lucerne</td>
<td>Income generation</td>
</tr>
<tr>
<td>Animal feed</td>
<td>Through the project, animal fodder will be produced and made available</td>
<td>Production of Animal feed / fodder</td>
</tr>
<tr>
<td>Negative impacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water quality and quantity</td>
<td>Over-abstraction, poor design and construction of wells and/or boreholes</td>
<td>Water pollution and over-abstraction</td>
</tr>
<tr>
<td>Health and Safety</td>
<td>Workers may be exposed to heavy machinery. Improper handling of materials and equipment may cause injuries</td>
<td>Health and safety risks</td>
</tr>
<tr>
<td>Waste</td>
<td>Development of such nature usually generates wastes which leads to environmental pollution, if not properly handled.</td>
<td>Environmental pollution</td>
</tr>
</tbody>
</table>

The public consultation process followed for this environmental assessment is presented under the following chapter (6).
6 PUBLIC CONSULTATION

Public Participation forms an important component of the Environmental Assessment process. It is defined by the Environmental Management Act (2007), as a ‘process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters’. Communication with stakeholders about this proposed development was facilitated through the following means:

- Key stakeholders were identified as the Stampriet village council, Mariental Rural constituency office, various Ministries (including Environment and Tourism and Ministry of Agriculture, Water and Forestry). The stakeholders’ list is attached as Appendix C of this report.

- A Background Information Document (BID) (in Appendix D) was compiled. It contained brief information of the project. The BID was forwarded to all relevant authorities and registered interested and affected parties (I&APs).

- Notices were placed in the press (on 4 and 11 February 2019) in the Market Watch of three daily Newspapers being Republikein, Namibian Sun and Allgemeiner Zeitung, briefly explaining the development and its locality, inviting the public to register as stakeholders. The proof of newspaper adverts are shown in Appendix E.

- A public participation meeting was arranged and held on 18th February at Aoub Lodge, Gochas. Five people from the area attended the meeting - Figure 6-1. The meeting minutes were taken and an attendance register was circulated for the attendees to register their names. Issues raised during the meeting were also recorded and incorporated into the minutes - Appendix F.

Figure 6-1: Public meeting at Auob Lodge on the 18th of February 2019
6.1 Public Feedback on the Draft Environmental Scoping Report

The draft environmental report together with its appendices was circulated to all registered interested and affected parties (IAPs) for review and comments. The review period started on the 25th of March to the 4th of April 2019, i.e. nine days. Some of the IAPs acknowledged receipt of the draft report. However, no comments were received during this period.

The assessment of identified potential impacts for this project and mitigation measures are given under chapter 7.
7 IMPACT ASSESSMENT AND MITIGATION MEASURES

This section describes the affected environment and the potential impacts on the biophysical and socio-economic environments, which may occur due to the proposed project and activities. These include potential impacts, which may arise during the operation of the proposed development as well as the potential construction related impacts. These impacts on the biophysical and socio-economic environment were assessed and relevant mitigation measures have been proposed to reduce and/or avoid negative impacts and enhance positive impacts. This assessment is aimed at assessing the potential negative impacts only:

- Impacts on water over-abstraction (quantity) and pollution (quality);
- Health and safety; and
- Environmental pollution (waste).

7.1 Impact Assessment Methodology

The identified impacts were assessed in terms of probability (likelihood of occurring), scale/extent (spatial scale), magnitude (severity) and duration (temporal scale). To enable a scientific approach to the determination of the environmental significance, a numerical value is linked to each rating scale. This methodology ensures uniformity and that potential impacts can be addressed in a standard manner so that a wide range of impacts are comparable.

It is assumed that an assessment of the significance of a potential impact is a good indicator of the risk associated with such an impact. The following process will be applied to each potential impact:

- Provision of a brief explanation of the impact;
- Assessment of the pre- and post-mitigation significance of the impact; and
- Description of recommended mitigation measures.

The recommended mitigation measures prescribed for each of the potential impacts contribute towards the attainment of environmentally sustainable operational conditions of the project for various features of the biophysical and social environment. The following criteria were applied in this impact assessment:

7.1.1 Extent (spatial scale)

Extent is an indication of the physical and spatial scale of the impact. Table 7-1 shows rating of impact in terms of extent of spatial scale.
Table 7-1: Extent or spatial impact rating

<table>
<thead>
<tr>
<th>Low (1)</th>
<th>Low/Medium (2)</th>
<th>Medium (3)</th>
<th>Medium/High (4)</th>
<th>High (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact is localised within the site boundary: Site only</td>
<td>Impact is beyond the site boundary: Local</td>
<td>Impacts felt within adjacent biophysical and social environments: Regional</td>
<td>Impact widespread far beyond site boundary: Regional</td>
<td>Impact extend National or over international boundaries</td>
</tr>
</tbody>
</table>

7.1.2 Duration

Duration refers to the timeframe over which the impact is expected to occur, measured in relation to the lifetime of the project. **Table 7-2** shows the rating of impact in terms of duration.

Table 7-2: Duration impact rating

<table>
<thead>
<tr>
<th>Low (1)</th>
<th>Low/Medium (2)</th>
<th>Medium (3)</th>
<th>Medium/High (4)</th>
<th>High (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate mitigating measures, immediate progress</td>
<td>Impact is quickly reversible, short term impacts (0-5 years)</td>
<td>Reversible over time; medium term (5-15 years)</td>
<td>Impact is long-term</td>
<td>Long term; beyond closure; permanent; irreplaceable or irretrievable commitment of resources</td>
</tr>
</tbody>
</table>

7.1.3 Intensity, Magnitude / severity

Intensity refers to the degree or magnitude to which the impact alters the functioning of an element of the environment. The magnitude of alteration can either be positive or negative. These were also taken into consideration during the assessment of severity. **Table 7-3** shows the rating of impact in terms of intensity, magnitude or severity.
Table 7-3: Intensity, magnitude or severity impact rating

<table>
<thead>
<tr>
<th>Type of criteria</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H- (10)</td>
</tr>
<tr>
<td>Qualitative</td>
<td>Very high deterioration, high quantity of deaths, injury of illness / total loss of habitat, total alteration of ecological processes, extinction of rare species</td>
</tr>
</tbody>
</table>

7.1.4 Probability of occurrence

Probability describes the likelihood of the impacts actually occurring. This determination is based on previous experience with similar projects and/or based on professional judgment. See Table 7-4 for impact rating in terms of probability of occurrence.

Table 7-4: Probability of occurrence impact rating

<table>
<thead>
<tr>
<th>Low (1)</th>
<th>Medium/Low (2)</th>
<th>Medium (3)</th>
<th>Medium/High (4)</th>
<th>High (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improbable; low likelihood; seldom. No known risk or vulnerability to natural or induced hazards.</td>
<td>Likely to occur from time to time. Low risk or vulnerability to natural or induced hazards.</td>
<td>Possible, distinct possibility, frequent. Low to medium risk or vulnerability to natural or induced hazards.</td>
<td>Probable if mitigating measures are not implemented. Medium risk of vulnerability to natural or induced hazards.</td>
<td>Definite (regardless of preventative measures), highly likely, continuous. High risk or vulnerability to natural or induced hazards.</td>
</tr>
</tbody>
</table>
7.1.5 Significance

Impact significance is determined through a synthesis of the above impact characteristics. The significance of the impact “without mitigation” is the main determinant of the nature and degree of mitigation required. As stated in the introduction to this chapter, for this assessment, the significance of the impact without prescribed mitigation actions was measured.

Once the above factors have been ranked for each potential impact, the impact significance of each is assessed using the following formula:

\[ SP = (\text{magnitude} + \text{duration} + \text{scale}) \times \text{probability} \]

The maximum value per potential impact is 100 significance points (SP). Potential impacts were rated as high, moderate or low significance, based on the following significance rating scale - Table 7-5 below.

Table 7-5: Significance rating scale

<table>
<thead>
<tr>
<th>SIGNIFICANCE</th>
<th>ENVIRONMENTAL SIGNIFICANCE POINTS</th>
<th>COLOUR CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>High (positive)</td>
<td>&gt;60</td>
<td>H</td>
</tr>
<tr>
<td>Medium (positive)</td>
<td>30 to 60</td>
<td>M</td>
</tr>
<tr>
<td>Low (positive)</td>
<td>&lt;30</td>
<td>L</td>
</tr>
<tr>
<td>Neutral</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>Low (negative)</td>
<td>&gt;-30</td>
<td>L</td>
</tr>
<tr>
<td>Medium (negative)</td>
<td>-30 to -60</td>
<td>M</td>
</tr>
<tr>
<td>High (negative)</td>
<td>&gt;-60</td>
<td>H</td>
</tr>
</tbody>
</table>

For an impact with a significance rating of high, mitigation measures are recommended to reduce the impact to a low or medium significance rating, provided that the impact with a medium significance rating can be sufficiently controlled with the recommended mitigation measures. To maintain a low or medium significance rating, monitoring is recommended for a period of time to enable the confirmation of the significance of the impact as low or medium and under control.

7.2 Assessment of Impacts

The assessment of the potential negative impacts and their mitigation measures are presented under the following subchapters. Some mitigation measures will be provided under the relevant (assessed) component and the full management action plans will be provided under the draft Environmental Management Plan (Appendix B) and in the Specialist Groundwater Report (for water management and protection) - Appendix G.
7.2.1 Impact on Groundwater Quantity (Over-abstraction)

One of the main potential impacts of the project on groundwater is over-abstraction. The Stampriet artesian aquifer is found in a water controlled area. The abstraction yield in the project area, including the site is estimated to be at 25 m$^3$/hour, which is an excellent yield. However, this does not mean that management measures should be ignored. Over-pumping / abstraction of water for irrigation, would lead to excessive lowering of the water levels in the aquifer, which will potentially affect people and the environment. The lowering of the groundwater levels would pose a risk to neighbouring properties to Portion 2 of Farm Klein Nabas 137 and the environment at large.

Groundwater within the project area is mostly in the confined Auob aquifers (sandstones and shale) that are overlain by Kalahari aquifers of unconsolidated to semi-consolidated sediments (sand, calcrete and gravel). These Kalahari aquifers are considered porous and hold water in intergranular pore spaces. Due to the high permeability of these aquifers, water can enter the groundwater system fairly easily and rapidly. The nature of these sediments (unconfined aquifers) would cause rapid drawdown in boreholes during excessive pumping and spreading over a large area. However, this impact is minimal because the Farm's groundwater is mainly hosted in the sandstones of the Auob rock units, therefore, rapid drawdown is unlikely. The impact is briefly assessed in the Table below and the full assessment of this impact is presented under Chapter of the Specialist Groundwater Report (Appendix G). The potential impact on the groundwater resources in the area is considered moderate.

Table 7-6: Assessment of irrigation activities on groundwater quantity

<table>
<thead>
<tr>
<th></th>
<th>Extent</th>
<th>Duration</th>
<th>Intensity</th>
<th>Probability</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-mitigation</td>
<td>M/H - 4</td>
<td>M - 3</td>
<td>M - 6</td>
<td>M/H - 4</td>
<td>M - 52</td>
</tr>
<tr>
<td>Post-mitigation</td>
<td>L/M - 2</td>
<td>L/M - 2</td>
<td>L/M - 4</td>
<td>L/M - 2</td>
<td>L - 16</td>
</tr>
</tbody>
</table>

Mitigation measures of minimizing the impact on groundwater quantity (over-abstraction)

- The Proponent should apply for and obtain a groundwater abstraction and use permit from the Department of Water Affairs (Ministry of Agriculture, Water and Forestry). This permit should be obtained prior to the commencement of the irrigation activities or any irrigation related water abstractions.
- The annual volume allocated to the permit should be adhered to and if necessary, the Proponent should aim to only abstract water when needed.
- Groundwater quality monitoring (sampling) is recommended to be undertaken on a quarterly basis and a groundwater database developed as soon monitoring starts. Based on Pacific Consultants International and Sanyu Consultants (2002) statement on flow direction, groundwater into each aquifer flows from northwest to southeast. Therefore, the borehole on the far northwestern side (upstream) of the Farm irrigation areas should be used as a monitoring borehole. An additional borehole will need to be drilled southeast (downstream) within 500 m of the irrigation sites so that it also forms part of the monitoring network.

- The Proponent should use water wisely, by re-using some of the wastewater (Environmentally Water Standard acceptable only) for some activities on site.

- The design of a sufficient groundwater monitoring plan is essential for the management of the groundwater resource.

- Water monitoring program should be put in place, so as to obtain relevant data for management to make informed decisions.

- Inspection of leakages must be made on a monthly basis to prevent water losses from the reservoir.

- The water reservoir should be covered in order to minimize water losses through evaporation. Thus, minimizing the need to abstract more water from the aquifer to replenish reservoir loses.

### 7.2.2 Impact on Groundwater Quality (Pollution)

In terms of pollution (quality), improper handling of site potential pollutants such as hydrocarbons (fuel), fertilisers, herbicides and pesticides, waste and eventual wastewater from the operational activities may be washed into nearby surface water bodies and/or infiltrate into the ground and pollute local water resources. Without any mitigation, the impact is rated as of medium significance. In order to change the significance from the pre-mitigation significance to low rating, the mitigation measures given under the impact assessment table below should be implemented.

#### Table 7-7: Assessment of irrigation activities on groundwater quality

<table>
<thead>
<tr>
<th>Mitigation Status</th>
<th>Extent</th>
<th>Duration</th>
<th>Intensity</th>
<th>Probability</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre mitigation</td>
<td>M - 3</td>
<td>M - 3</td>
<td>M/H - 8</td>
<td>M - 3</td>
<td>M – 42</td>
</tr>
<tr>
<td>Post mitigation</td>
<td>L/M - 2</td>
<td>M - 3</td>
<td>L/M - 4</td>
<td>L/M -2</td>
<td>L - 18</td>
</tr>
</tbody>
</table>

#### Mitigation measures of minimizing the impact on groundwater quality (pollution)

- Irrigation systems should be designed and managed for zero or minimum deep percolation during the growing seasons to keep fertilizer and pesticides in the root zone as long as possible.
Nitrate contamination of groundwater should be minimized by carefully controlling the timing and amount of nitrogen fertilizer applications according to crop needs, using slow-release fertilizers and other Best Management Practices (BMPs). This is done to keep nitrate in the root zones as long as possible where it can be taken up by the plant roots or denitrified.

Groundwater pollution awareness for irrigation workers should be implemented.

Irrigation waste landfill site should be lined, so that soluble substances from the wastes do not leach into groundwater when it rains.

All run off materials such as hydrocarbons, waste water and other potential pollutants associated with the project should be contained on site in designated containers and disposed of in accordance of the nearby municipal waste discharge standards, so that they do not reach groundwater systems.

Septic tank (if any) on site should be maintained regularly in order to ensure that waste is not leaching into the ground and eventually groundwater.

Spill control preventative measures should be put in place to manage soil contamination, thus minimizing the contamination from reaching to groundwater.

7.2.3 Health and Safety

When handling machinery and equipment during the operations, workers may be exposed to health and safety risks, such as injuries. The impact can be rated as medium significant if no mitigation measures are implemented, but upon implementation, the impact will be of low significance. The impact is assessed in the Table below.

### Table 7-8: Assessment of irrigation activities on Health and Safety

<table>
<thead>
<tr>
<th>Mitigation Status</th>
<th>Extent</th>
<th>Duration</th>
<th>Intensity</th>
<th>Probability</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre mitigation</td>
<td>M - 3</td>
<td>L/M - 2</td>
<td>M - 6</td>
<td>M/H - 4</td>
<td>M - 44</td>
</tr>
<tr>
<td>Post mitigation</td>
<td>L/M - 2</td>
<td>L/M - 2</td>
<td>L/M - 4</td>
<td>L/M - 2</td>
<td>L - 16</td>
</tr>
</tbody>
</table>

**Mitigation measures of minimizing the impact health and safety**

- The site should be equipped with security control gate, once in operation. This is to limit / restrict access to authorised personnel only.
- As part of their induction, the workers should be provided with an awareness training of the risks of mishandling equipment and materials on site.
- When working on site, employees should be properly equipped with personal protective equipment relevant to the type of work they are doing on site.
- No employee should be allowed to drink alcohol prior to and during working hours as this may lead to mishandling of equipment which may lead to injuries and other health and safety risks.
Employees should not be allowed on site if under the influence of alcohol.

### 7.2.4 Waste Management

Developments of such nature usually generate wastes of all kinds. These are caused, but not to; improper handling, storage and disposal of wastes and this may lead to environmental degradation / pollution. Waste generation is an ongoing activity for any development, and this can be rated as medium significant if no mitigation measures are implemented. However, upon implementation of waste management measures, the impact will be of low significance. The impact assessment is presented in the Table below.

#### Table 7-9: Assessment of irrigation activities on the environment (waste)

<table>
<thead>
<tr>
<th>Mitigation Status</th>
<th>Extent</th>
<th>Duration</th>
<th>Intensity</th>
<th>Probability</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre mitigation</td>
<td>M - 3</td>
<td>L/M - 2</td>
<td>M - 6</td>
<td>M/H - 4</td>
<td>M – 44</td>
</tr>
<tr>
<td>Post mitigation</td>
<td>L/M - 2</td>
<td>L/M - 2</td>
<td>L/M - 4</td>
<td>L/M - 2</td>
<td>L - 16</td>
</tr>
</tbody>
</table>

**Mitigation measures of minimizing the impact on the environment**

- Workers should be sensitized to dispose of waste in a responsible manner and not to litter.
- All domestic and general operations waste produced on a daily basis should be contained until such time that it will be transported to designated waste sites.
- Hazardous waste should be properly handled, stored and disposed of to the nearest authorized waste sites.
- No waste may be buried or burned on site or anywhere else throughout the project lifecycle.
- The sites should be equipped with separate waste bins for hazardous and general waste / domestic.
- A penalty system for irresponsible disposal of waste on site and anywhere in the area should be implemented.
8 RECOMMENDATIONS AND CONCLUSIONS

The objective of the study was to identify potential environmental impacts stemming from the proposed groundwater abstraction from the Stampriet artesian aquifer for the application of an Environmental Clearance Certificate. The study is also aimed at enforcing for the application of the renewal of groundwater abstraction and use permit from the Ministry of Agriculture, Water and Forestry.

The proposed project is a good development that will enable the Proponent to supply animal fodder for his livestock and also to the surrounding farmers in the area. The other positive impact associated with the project is the creation of employment to five people from the area. The identified potential risks associated with the proposed project were assessed and mitigation measures made thereof. All of the impacts assessed were found to have moderate significance. The effective implementation of mitigation measures and recommendations provided in this scoping assessment report and management action plans provided in the draft EMP, can be deemed sufficient to avoid and reduce (where impact avoidance is not possible) the environmental impacts to acceptable levels (low significance). For the impact' significance to remain low, monitoring has to be effectively done on the site. In order to manage groundwater abstraction from the aquifer, it will be crucial for the Proponent to implement monitoring on site as per recommendations made in the Groundwater Report.

It is for this reason that Green Team Consultants believe that these measures are sufficient and thus recommends that the Proponent be issued with the ECC as well the water abstraction and use permit. It is also recommended that the Proponent work closely with a Geohydrologist to advice on matters pertaining to groundwater. This will help them to fully implement the management actions plans for the proposed project, especially monitoring and groundwater use reporting. This will also enable early identification of excessive impact on groundwater at any stage of the project and accordingly advice on the implementation of appropriate mitigation measures.
9 REFERENCES


National Radiation Protection Authority. (Unknown date). *Atomic Energy Board of Namibia: Directive Issued Under Section 33 (3) of the Atomic Energy & Radiation Protection Act*
(No 5 of 2005) *Relating to the Regulation of Sources of Non-Ionizing Radiation.*
Windhoek: National Radiation Protection Authority.

APPENDIX A: CV’S OF LINDA UULENGA AND FREDRIKA SHAGAMA
APPENDIX B: DRAFT ENVIRONMENTAL MANAGEMENT PLAN (EMP)
APPENDIX C: LIST OF INTERESTED AND AFFECTED PARTIES
APPENDIX D: BACKGROUND INFORMATION DOCUMENT (BID)
APPENDIX E: NEWSPAPER ADVERTS
APPENDIX F: PUBLIC MEETING MINUTES AND ATTENDANCE REGISTER
APPENDIX G: DESKTOP GROUNDWATER IMPACT ASSESSMENT (SPECIALIST REPORT)