

**IMPLEMENTATION OF AND COMPLIANCE WITH THE ENVIRONMENTAL
MANAGEMENT PLAN FOR THE OPERATION OF A BIOGAS PLANT BY
MARIENTAL BIOENERGY (PTY) LTD AT THE !AIMAB SUPERFARM,
MARIENTAL, HARDAP REGION, NAMIBIA**



05 February 2023

Prepared by:



Prepared for:

Mariental BioEnergy (Pty) Ltd

CONTACT DETAILS

Mariental BioEnergy (Pty) Ltd

Mr Gunter Ling
Managing Director
Mariental BioEnergy (Pty) Ltd
P.O. Box 16
Windhoek
Namibia
Tel: +264 61 2075111 Ext 5313
Fax: +264 61 234 021
E-mail: Gunther.Ling@ol.na



Dr Lima Maartens
LM Environmental Consulting
P.O. Box 1284
Windhoek
Namibia
Tel: +264 61 255750
Fax: +264 88 619004
E-mail: lima@iway.na

Declaration: LM Environmental Consulting is an independent consulting firm with no interest in the project which is the subject matter hereof other than to fulfil the contract between the client and the consultant for delivery of specialised services as stipulated in the terms of reference.

Limitation of liability: LM Environmental Consulting accept no responsibility or liability in respect of losses, damages or costs suffered or incurred, directly or indirectly, under or in connection with this report to the extent that such losses, damages, and costs are due to information provided to LM Environmental Consulting for purposes of this report that is subsequently found to be inaccurate, misleading or incomplete, or due to the acts or omissions of any person other than ourselves. LM Environmental Consulting shall not be liable for any direct, incidental, special or consequential damages for loss of profit, revenue, data or use incurred by the Client or any third party, whether in contract or delict, regardless whether the Client or the other party has been advised of the possibility of such damages.

Copyright Warning: Unless otherwise noted, the copyright in all text and other matter (including the manner of presentation) is the exclusive property of LM Environmental Consulting and/or Dr Maartens. It is an offence to reproduce and/or use, without written consent, any substance, matter, technical procedure and/or technique or part thereof contained in this document.

TABLE OF CONTENTS

1	Introduction.....	5
1.1	Background	5
1.2	Terms of Reference	7
1.3	Environmental Assessment Practitioner	7
2	Biogas Plant.....	8
2.1	Location.....	8
2.2	Process	9
2.3	Challenges	13
3	Environmental Management Plan: Implementation and Compliance	14
3.1	Introduction.....	14
3.2	Compliance: Environmental Management Plan.....	14
4	Conclusions and Recommendations	21
5	References	22

LIST OF TABLES

Table 1: Compliance with the Proposed Mitigation Measures for the Biogas Plant at !Aimab Superfarm, Mariental, Hardap Region, Namibia (<i>after EnviroSolutions, 2014</i>).	15
---	----

LIST OF FIGURES

Figure 1: Map showing the location of the !Aimab Superfarm close to Mariental in the Hardap Region, Namibia (<i>Source: Miss Maike Prickett, GIS Specialist, 29 October 2021</i>).	5
Figure 2: Map showing the location of the !Aimab Superfarm on the Remainder of Portion R607 and the O&L Properties, around 6 kilometres north of Mariental (<i>Source: Miss Maike Prickett, GIS Specialist, 29 October 2021</i>).	6
Figure 3: Map showing the infrastructure layout at the !Aimab Superfarm (<i>Source: Miss Maike Prickett, GIS Specialist, 29 October 2021</i>).	8
Figure 4: Manure transport system (<i>Source: Namibia Dairies (Pty) Ltd and Cape Advanced Engineering (Pty) Ltd, 2019</i>).	9
Figure 5: The bio-digester: from design to site (<i>Source: Namibia Dairies (Pty) Ltd and Cape Advanced Engineering (Pty) Ltd, 2019</i>).	10
Figure 6: The bio-digester: filling and covering process (<i>Source: Namibia Dairies (Pty) Ltd and Cape Advanced Engineering (Pty) Ltd, 2019</i>).	10
Figure 7: Picture showing the solid separator or screw press (<i>Source: Miss Gloudi de Beer, August 2022</i>).	11
Figure 8: Plant layout (<i>Source: Namibia Dairies (Pty) Ltd and Cape Advanced Engineering (Pty) Ltd, 2019</i>).	12

ABBREVIATIONS / ACRONYMS / SYMBOLS / UNITS

The following is a list of the abbreviations, acronyms, symbols, and units used in this Report:

°C	degrees Celsius
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EAPAN	Environmental Assessment Professionals of Namibia
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GHG	Greenhouse Gas
ha	hectare
IEMA	Institute of Environmental Management and Assessment
km	kilometre
m ³	cubic metre
MAWF	Ministry of Agriculture, Water and Forestry
MAWLR	Ministry of Agriculture, Water, and Land Reform
MET	Ministry of Environment and Tourism
MEFT	Ministry of Environment, Forestry and Tourism
MFMR	Ministry of Fisheries and Marine Resources
NCE	Namibia Chamber of Environment
O&L	Ohlthaver & List Group
SA	South Africa
UK	United Kingdom
UNAM	University of Namibia
WWTP	Wastewater Treatment Plant

1 Introduction

1.1 Background

Please note: in 2008, the Applicant for the Application of an Environmental Clearance Certificate (ECC) for the proposed !Aimab Superfarm was **Namibia Dairies (Pty) Ltd**; in 2014, the Applicant for the Application of an ECC for the Biogas Plant (at !Aimab Superfarm) was Namibia Dairies (Pty) Ltd and **Mariental BioEnergy (Pty) Ltd**. Due to changes in Ownership / Directorship, a separate Application for an ECC for the !Aimab Superfarm was submitted in 2021; this Report deals with the Application for an ECC for the Biogas Plant only. The detailed sequence of events are as follows:

In 2008, an Environmental Impact Assessment (EIA) and Management Plan (EMP) was prepared for the proposed !Aimab Superfarm, situated on the Remainder of Portion R607, around six (6) kilometres (km) north of Mariental, in the Hardap Region, Namibia (see Figure 1). An ECC was issued by the Office of the Permanent Secretary, Ministry of Environment and Tourism (MET) (now Ministry of Environment, Forestry and Tourism (MEFT)) to Namibia Dairies (Pty) Ltd on 05 August 2008.

Namibia Dairies (Pty) Ltd was established in 1997, following the merger between Rietfontein Dairies and Bonmilk. Properties include: i) the Dairy Processing Facility in Avis, Windhoek; ii) the main distribution centre located in Prosperita, Windhoek (secondary distribution centres are located in Swakopmund, Otjiwarongo and Oshakati); and iii) the !Aimab Superfarm near Mariental that was opened in 2009 (Ohlthaver & List Group, 2020; De Beer, 2021; <https://www.namibiadairies.com>).

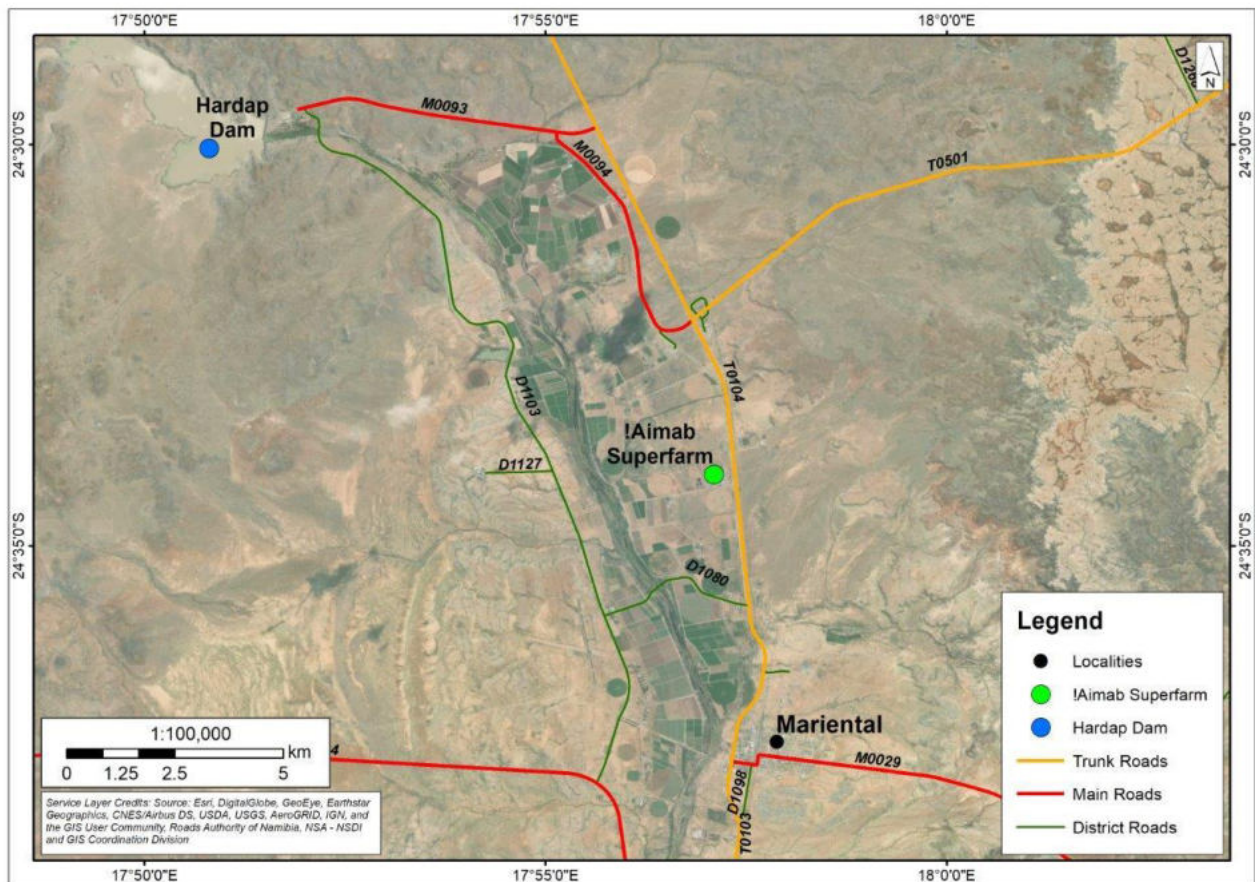


Figure 1: Map showing the location of the !Aimab Superfarm close to Mariental in the Hardap Region, Namibia (Source: Miss Maïke Prickett, GIS Specialist, 29 October 2021).

The total (!Aimab Superfarm) area is 398.73 hectares (ha) in size; the area taken up by the Superfarm infrastructure amounts to approximately 47.5 ha. The WUM Properties (Pty) Ltd T/A Ohlthaver & List Group (O&L) Properties can be found the north, west and south of the !Aimab Superfarm (see Figure 2).

Namibia Dairies (Pty) Ltd is leasing the Government Property Remainder of Portion R607 in the Registration Division "R" in the Hardap Region through the Ministry of Agriculture, Water and Forestry (MAWF) (now the Ministry of Agriculture, Water and Land Reform (MAWLR)). The Lease Agreement is valid for a period of 99 years, commencing 01 October 2009.

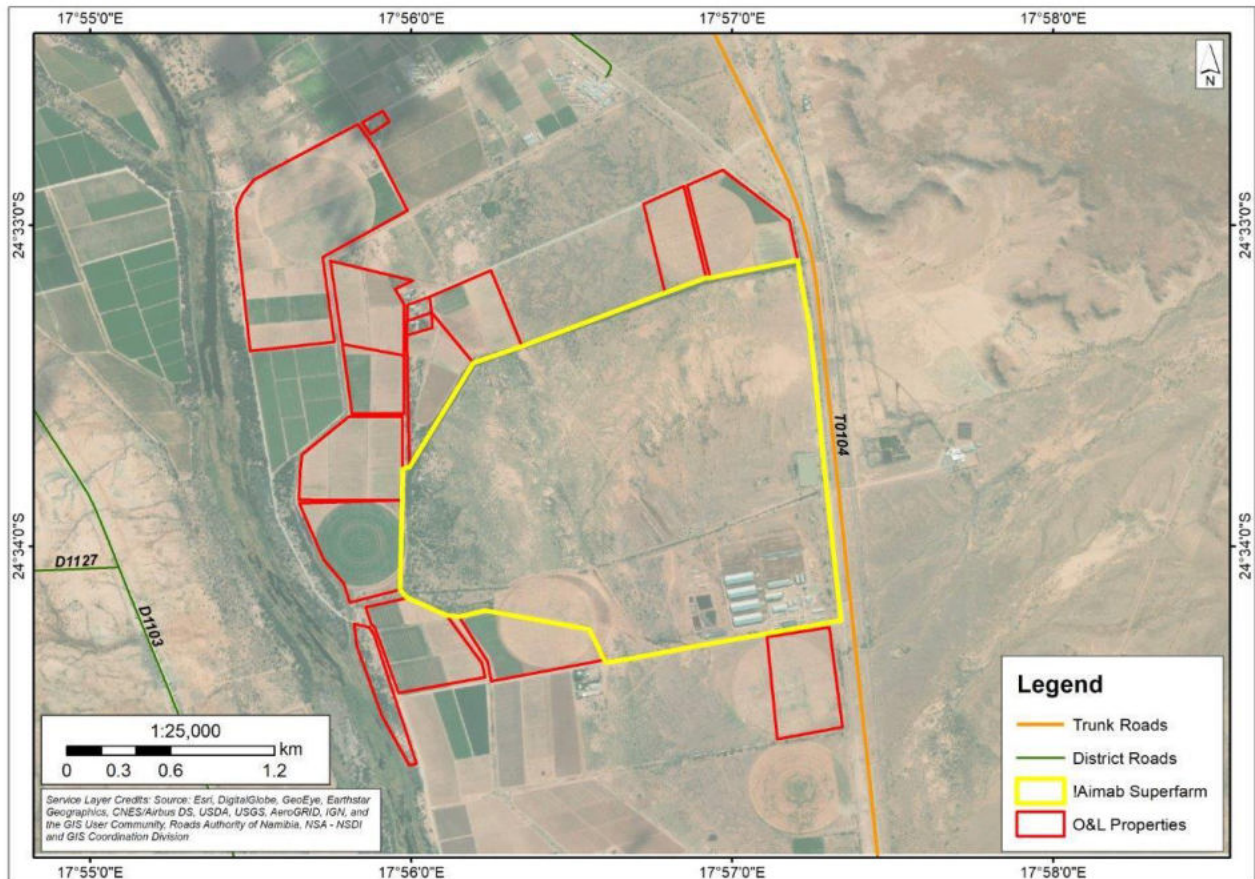


Figure 2: Map showing the location of the !Aimab Superfarm on the Remainder of Portion R607 and the O&L Properties, around 6 kilometres north of Mariental (Source: Miss Maïke Prickett, GIS Specialist, 29 October 2021).

After 2008, Namibia Dairies (Pty) Ltd improved the management of their waste; a biogas plant was put up (investment of 30+ million N\$) and Mariental BioEnergy (Pty) Ltd was formed to operate the waste (cow manure and sanitary wastewater; Mrs Leonie Prinsloo, Managing Director, Namibia Dairies (Pty) Ltd, pers. comm.) to energy (electricity, liquid bio-fertiliser, and sterile bedding) plant. At the time, it was also anticipated to convert the waste into thermal heat (for cooling), but the latter did not realise (Mr Gunter Ling, Managing Director, Mariental BioEnergy (Pty) Ltd, pers. comm.).

In June 2014, EnviroSolutions Safety & Environmental Consultants prepared an *Amended Environmental Impact Assessment June 2014 for the !Aimab Milk Farm Near Mariental for Namibia Dairies (Pty) Ltd and Mariental Bioenergy (Pty) Ltd* and an application for the amendment of the ECC was submitted to the MET (now MEFT) on 03 July 2014.

The MAWF (now MAWLR) issued a letter in support of the Biogas Plant at !Aimab Superfarm on 17 July 2014.

The Office of the Environmental Commissioner, MET (now MEFT), issued an ECC on **06 August 2014**. The ECC since expired and no bi-annual reports have been submitted by the Company.

LM Environmental Consulting was appointed by Namibia Dairies (Pty) Ltd on 04 October 2021 to prepare an Environmental Management Plan (EMP) for the !Aimab Superfarm at Mariental, Hardap region, Namibia (*Mariental BioEnergy's Biogas Plant at the !Aimab Superfarm and the waste disposal site (see Figure 3), as well as the WUM Properties (Pty) Ltd T/A O&L Properties' Hardap Green Scheme*) activities were not included in the Scope of Work).

The *Environmental Management Plan for the !Aimab Superfarm, Mariental, Hardap Region, Namibia* (Maartens, 2021) was submitted to the Executive Director, MAWLR, and the Environmental Commissioner, MEFT, on 29 November 2021. ECC-01987 was issued by the Office of the Environmental Commissioner to Namibia Dairies (Pty) Ltd on 20 February 2022.

1.2 Terms of Reference

LM Environmental Consulting was appointed by Mariental BioEnergy (Pty) Ltd for the renewal of the (expired) ECC on 07 September 2022.

1.3 Environmental Assessment Practitioner

The author of this Report is Dr Lima Maartens who has more than 30 years' experience in natural resource management (*she gained her doctorate (Ph.D.) in Fisheries Science from Rhodes University, South Africa (SA) while working for the Namibian Ministry of Fisheries and Marine Resources (MFMR) in 2000*), lecturing (*University of Namibia (UNAM)*), environmental science and management (*De Beers Marine Namibia and the Canadian Forsys Metals Corp*), and consulting. Dr Maartens is registered as a Lead Practitioner and Reviewer with the Environmental Assessment Professionals of Namibia (EAPAN) (she served on the Executive Committee during 2016/17), an Associate Member and Environmental Auditor with the Institute of Environmental Management and Assessment (IEMA) in the United Kingdom (UK), an Full Member of the Namibia Chamber of Environment (NCE), and a Member of the Namibia Scientific Society. LM Environmental Consulting was established by Dr Maartens in October 2009.

2 Biogas Plant

2.1 Location

The location of the Biogas Plant, including the bio-digester, fertiliser dams, and old evaporation ponds at !Aimab Superfarm is shown in Figure 3.

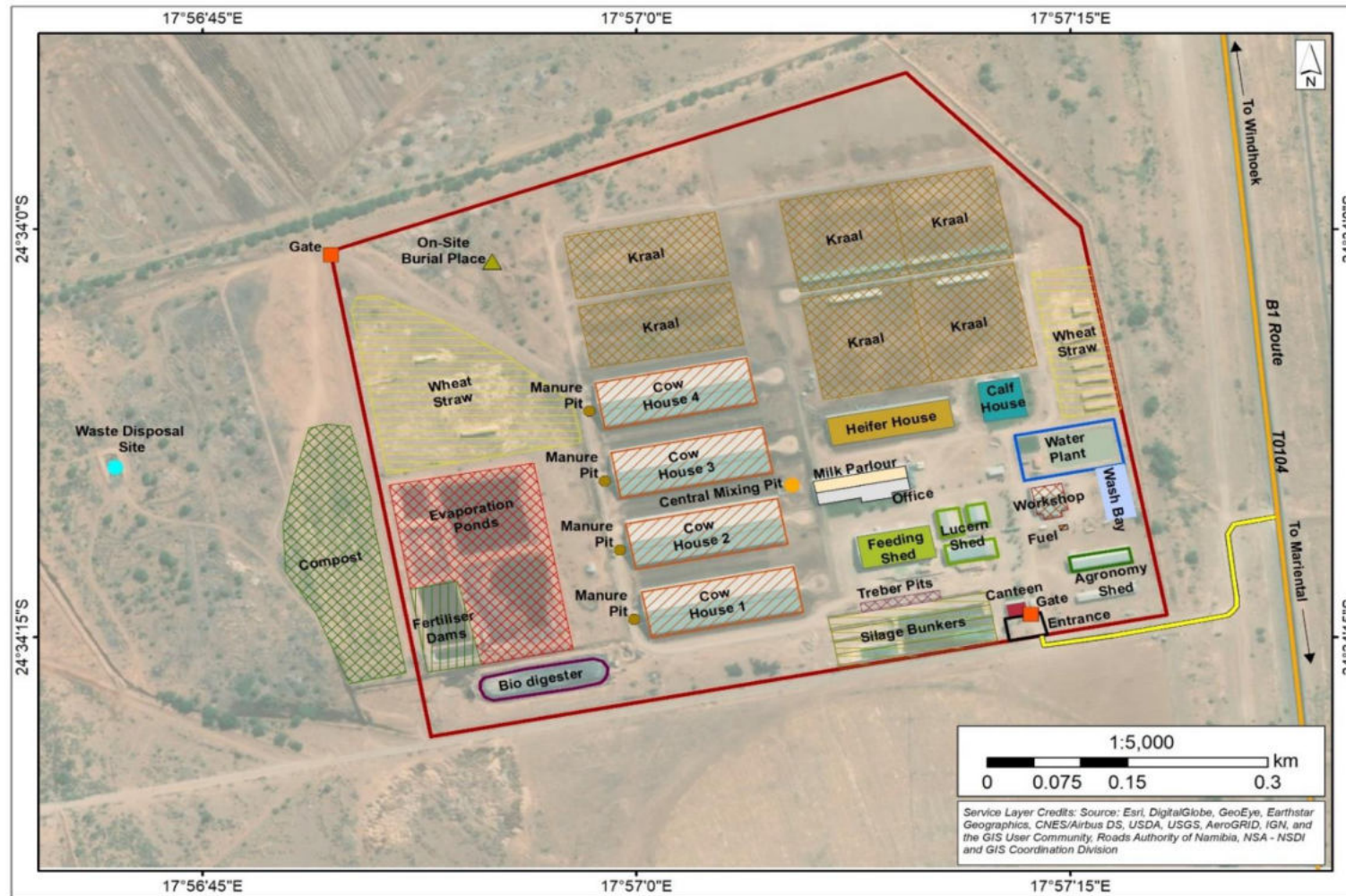


Figure 3: Map showing the infrastructure layout at the !Aimab Superfarm (Source: Miss Maike Prickett, GIS Specialist, 29 October 2021).

2.2 Process

The process can be described as follows (*after EnviroSolutions, 2014, unless otherwise stated*):

All the wastewater from the !Aimab Superfarm (including all sanitary wastewater and the wastewater from the milk parlour), is collected in a “central mixing pit” (see Figure 3) (or “wash water pit”; see Figure 8) and from there it is pumped to one of the eight manure pits (see Maartens, 2021).

The Department of Water Affairs (DWA), MAWLR, issued a Wastewater and Effluent Disposal Exemption Permit (permit number 778) in terms of Sections 21 and 22 of the Water Act 54 of 1956, as amended by the Water Act 22 of 1985 on 17 September 2021. The Aim of the Permit is ... *in order that domestic and industrial wastewater be treated at !Aimab Superfarm Wastewater Treatment Plant and the final effluent be re-used as liquid fertilizer for irrigation purposes of the Superfarm lands.* Note that the “Wastewater Treatment Plant (WWTP)” (as per permit number 778) is in fact a Bio-digester (referred to as a Biogas Plant; see Maartens, 2021).

Also, the manure (around 100 tonnes per day) from the four (4) cow houses (see Figure 3) are scraped from the lanes (two lanes per house; see Figure 4) by means of a tractor and it is then delivered to eight (8) manure (collection) pits.

When a manure crust has formed overnight, it is broken using wash water slurry from additional crust breaking nozzles

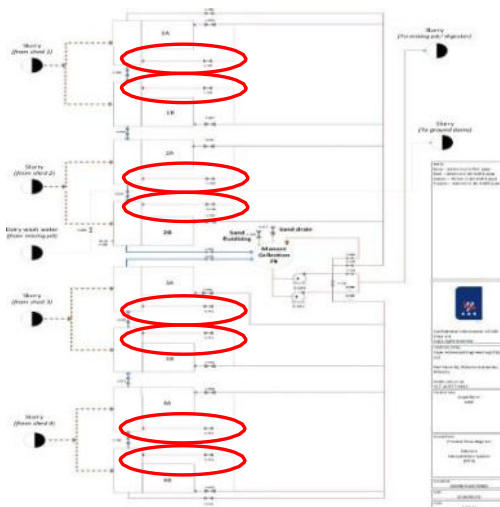


Figure 4: Manure transport system (*Source: Namibia Dairies (Pty) Ltd and Cape Advanced Engineering (Pty) Ltd, 2019*).

The liquid manure slurry is then pumped into the bio-digester (see Figures 5, 6, and 8) (note that no dry manure goes into the bio-digester). The bio-digester retains the manure slurry for approximately 45 days during which period it is mixed and heated to 30-37 degrees Celsius (°C) to facilitate maximum destruction of the suspended and dissolved volatile solids. The bio-digester is also managed to ensure maximum biogas yield. The bio-digester carries over 8,300 tonnes of slurry to provide for recycling of manure fibre. A body of this mass contained within the ground would stabilise at a temperature equal to the average ambient temperature over the preceding few months on the basis that solar heat gained in the day is largely negated by radiation into space at night. Heating is thus required, even in mid-summer. The equipment used for heating and mixing of the bio-digester is designed to be serviceable while the bio-digester is operational and without requiring decommissioning of the plant.

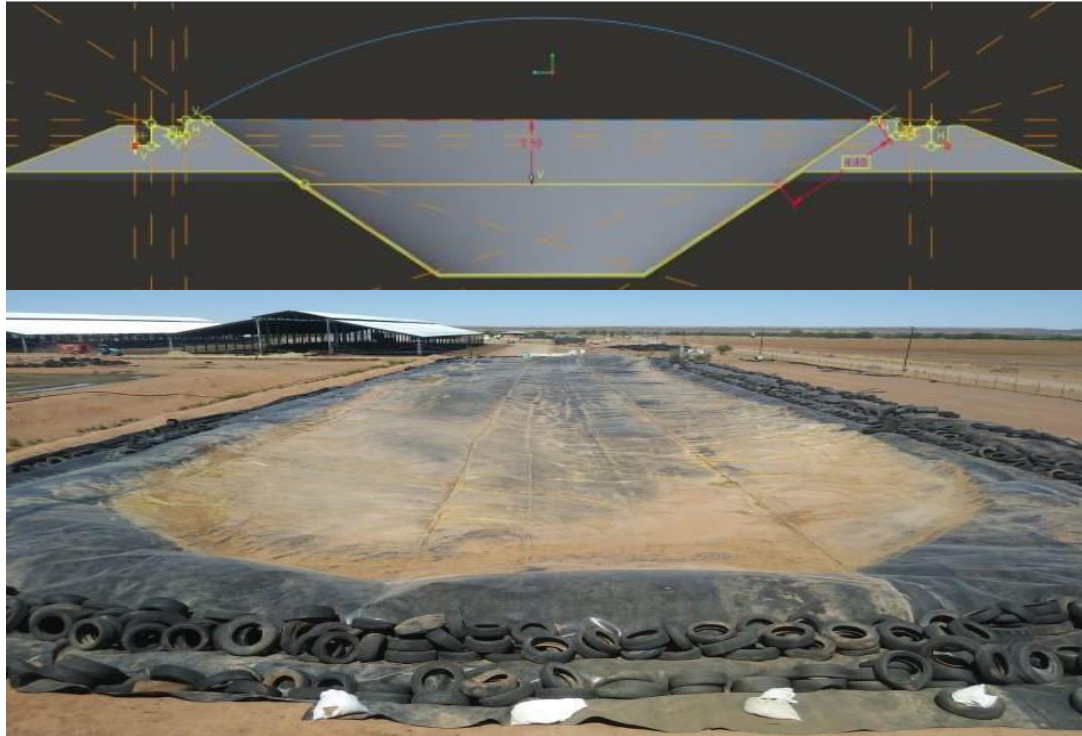
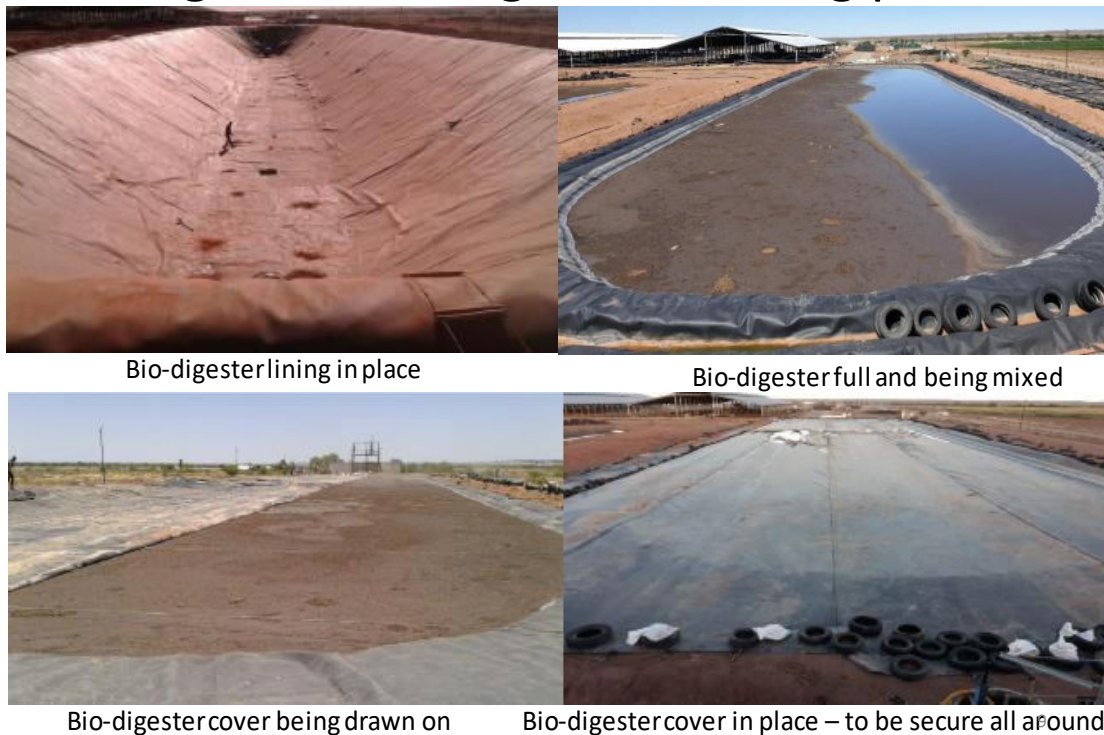


Figure 5: The bio-digester: from design to site (Source: Namibia Dairies (Pty) Ltd and Cape Advanced Engineering (Pty) Ltd, 2019).



Bio-digester lining in place

Bio-digester full and being mixed

Bio-digester cover being drawn on

Bio-digester cover in place – to be secure all around

Figure 6: The bio-digester: filling and covering process (Source: Namibia Dairies (Pty) Ltd and Cape Advanced Engineering (Pty) Ltd, 2019).

Digestate leaving the bio-digester will be passed through a solid separator (see Figures 7 and 8) which will recover all the suspended solids and fibre for use as sterile bedding in the cow sheds, and/or for land application as bio-fertiliser. This requires the operation of a conventional solid manure spreader. This manure spreader transports the bio-fertiliser and applies it directly on the land in the Mariental area as a value added service.



Figure 7: Picture showing the solid separator or screw press (Source: Miss Gloudi de Beer, August 2022).

After use as bedding, the separated solids can also be applied to land as bio-fertiliser. The liquid portion from the separator will be directed into a (lined) fertiliser dam (see Figures 3 and 8). The fertiliser dam can hold 1,000 cubic metres (m³), and overflows (occasionally) into the dam just north of the liquid fertiliser dam (see Figure 8).

The liquid fertiliser, which still contains significant plant nutrients, is then pumped to irrigation systems for land application, preferably in a diluted form.

Bio-fertiliser from cow manure will have approximately 5 to 10% NPK (nitrogen (N), phosphorus (P) and potassium (K)) content which are referred to as macro nutrients. The remainder of the digestate consists of organic material (carrying carbon) and natural minerals or micro nutrients originating from the animal feed. The micro nutrients include Boron (B), Cobalt (Co), Copper (Cu), Chlorine (Cl), Iron (Fe), Manganese (Mn), Molybdenum (Mo), Nickel (Ni), Selenium (Se), and Zinc (Zn). The digestate from the bio-digester will consist of approximately 10% bio-fertiliser and 90% water. The solids separator will yield bio-fertiliser cake with 40% to 60% solids after stacking, thus between 2 and 6% NPK on a total mass basis.

At the pump and mixing house (machine room) (see Figure 8), water is pumped in/out of the bio-digester, and gas (methane) is pumped, via an intermediate pump station, to the generator (to produce electricity) (see Figure 8). Excess methane is to be flared (EnviroSolutions, 2014), but this process has not been required to date (Mr Gunter Ling, Managing Director, Mariental BioEnergy (Pty) Ltd, pers. comm., 29 September 2022).

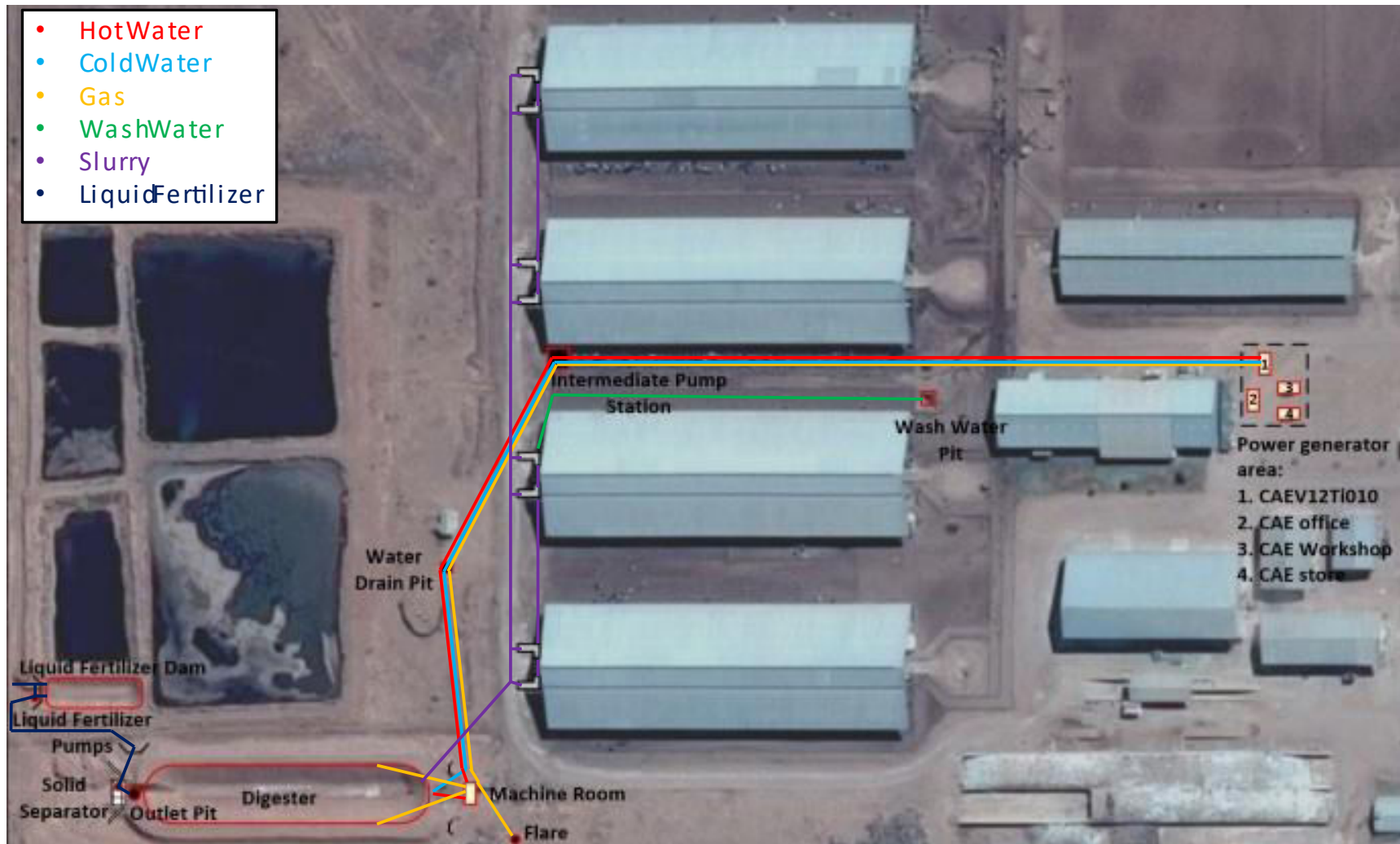


Figure 8: Plant layout (Source: Namibia Dairies (Pty) Ltd and Cape Advanced Engineering (Pty) Ltd, 2019).

2.3 Challenges

The following challenges are being experienced and in order to find the best solutions, dialogue between the operational managers from Namibia Dairies (Pty) Ltd and Mariental BioEnergy (Pty) Ltd would be required:

1. Overflow at the central mixing pit;
2. Sanitary wastewater; it is advised that, if feasible, the sanitary wastewater be re-directed to a separate wastewater treatment system;
3. The design of the eight (8) manure (collection) pits is not optimal as it leads to the accumulation of manure (before it can be collected and pumped to the bio-digester); it is advised to, if feasible, have one (1) central manure collection system only (so that the accumulation of manure can be better managed) (Mr Franz Homsek, Manager: Operations, Namibia Dairies (Pty) Ltd, pers. comm.); and
4. In case of excess liquid manure slurry (from the milk parlour and cow houses), the latter sometimes have to be pumped into the evaporation ponds (see Figure 3).

3 Environmental Management Plan: Implementation and Compliance

3.1 Introduction

As part of the EMP Performance Review / Update, the following actions were carried out:

- i) Review of the following documents:
 - a. Environmental Clearance for the Environmental Impact Assessment and Plan for Proposed Establishment of a "Super-Farm", 7 km North of Mariental (05 August 2008);
 - b. Amended Environmental Impact Assessment June 2014 for the !Aimab Milk Farm Near Mariental for Namibia Dairies (Pty) Ltd and Mariental Bioenergy (Pty) Ltd (EnviroSolutions Safety & Environmental Consultants (EnviroSolutions), 2014);
 - c. Application for Amendment of Conditions of Environmental Clearance Certificate (03 July 2014);
 - d. Letter from the Permanent Secretary, MAWF (now MAWLR), to the Managing Director, Namibia Dairies (Pty) Ltd RE: THE CONSTRUCTION AND OPERATION OF A BIOGAS PLANT AT THE !AIMAB MILK FARM (17 July 2014);
 - e. Environmental Clearance for the Proposed Upgrading of Manure Handling by Means of Biogas Plant by Mariental BioEnergy (Pty) Ltd and by and at !Aimab Milk Farm, Mariental, Namibia (06 August 2014);
- ii) A meeting was held with Mr Gunter Ling, Managing Director, Mariental BioEnergy (Pty) Ltd, Mrs Leonie Prinsloo, Managing Director, Namibia Dairies (Pty) Ltd, and Miss Gloudi de Beer, Group Manager: Environmental, Ohlthaver & List Group, on 29 September 2022; and
- iii) A follow-up meeting was held with Mrs Jessica von Hase, Head: Group Risk and Miss Gloudi de Beer, Group Manager: Environmental, Ohlthaver & List Group, on 17 January 2023.

3.2 Compliance: Environmental Management Plan

In order to illustrate compliance with the EMP (see Table 1), the following colour codes were applied:

	Compliance/Completed
	In Progress/Ongoing
	Non-compliance
	Not (Currently) Applicable

Table 1: Compliance with the Proposed Mitigation Measures for the Biogas Plant at !Aimab Superfarm, Mariental, Hardap Region, Namibia (after EnviroSolutions, 2014).

Aspect	Impact	Description	Status	Mitigation	Comments
Socio Economic					
Socio-Economic	Impacts related to the economics of the Mariental area	Mariental has had a steady economic decline since floods in 2000 and 2006. There appears to be a continuous migration to larger towns. An investment like the Superfarm and now the biogas plant near Mariental is likely to give the area another economic boost.	Yellow		Ongoing.
		ND believes that the Superfarm and the integrated biogas plant will be a show- piece of development in the Namibian agriculture industry.	Green		Compliant and ongoing.
Socio-Economic	Impacts related to the Job Creation	Currently 120 fulltime jobs were created by the Superfarm with the addition of the biogas plant another 6-10 fulltime jobs will be created.	Green		Compliant and ongoing. Six people are currently employed by Mariental BioEnergy (Pty) Ltd / Cape Advance Engineering (Pty) Ltd (CAE; South African company) that operates the biogas plant: one manager; one team leader; two plant operators; one tractor driver; and one general worker (Mr Gunter Ling, Managing Director, Mariental BioEnergy (Pty) Ltd, pers. comm.).
		In the construction phase approximately 10-20 jobs will be created.	Dark Blue		It is uncertain as to how many jobs were created during the construction phase of the biogas plant.
		Secondary spin off jobs in the off-site service industry, could also lead to additional employment opportunities once the project has	Yellow		Compliant and ongoing.

Aspect	Impact	Description	Status	Mitigation	Comments
		been established (i.e. transport and others).			
		It is also envisaged to mainly source the labor requirements from the Mariental area.			Compliant and ongoing. Staff was sourced from the Mariental area (Mr Gunter Ling, Managing Director, Mariental BioEnergy (Pty) Ltd, pers. comm.).
Socio-Economic	Impacts related to secondary Business Opportunities	Since Superfarm produces about 50 - 65% of necessary fodder requirements there is an opportunity for independent growers. Small scale / emerging farmers could provide high quality fodder to Superfarm (e.g. Green Scheme, or smart partnerships). This especially applies to the planting of maize, lucerne and barley.			Ongoing; lucerne, maize and wheat (and not barley) are planted (Mr Gunter Ling, Managing Director, Mariental BioEnergy (Pty) Ltd, pers. comm.).
		Given that this project could affect the livelihood of many people in the Mariental area, these communities should be considered if any secondary business opportunities become available as a result of the project. Possible secondary business opportunities that could serve to support the project include the following: i) The provision and transportation services for supplies; ii) Transporting of employees between Mariental and the farm; iii) Electrical, maintenance, security and other services and; iv) Production of additional fodder for the Superfarm and the community; and v) Handling of bio-wastes and bio-fertiliser to community and adjacent farms			Compliant and ongoing. Mariental BioEnergy (Pty) Ltd staff is transported by bus, together with the Namibia Dairies (Pty) Ltd staff, between Mariental and !Aimab Superfarm on a daily basis (Mrs Leonie Prinsloo, Managing Director, Namibia Dairies (Pty) Ltd, pers. comm.). Electrical maintenance is carried out by CAE. The production of additional fodder for the Superfarm and the community and handling of bio-wastes and bio-fertiliser to community and adjacent farms are not yet feasible (Mr Gunter Ling, Managing Director,

Aspect	Impact	Description	Status	Mitigation	Comments
					Mariental BioEnergy (Pty) Ltd, pers. comm.). Note that there are very strict biosecurity measures in place at the !Aimab Superfarm (see Maartens, 2021).
		To ensure any secondary business opportunities benefit the local community as a whole as opposed to only a few individuals, it is recommended that this issue be further discussed amongst community leaders or local politicians (e.g. the mayors, the regional councilors) in order to initiate and implement any such plans.			
		It should be noted that the Municipality of Mariental is in full support for the Superfarm and the planned biogas plant. Refer to Appendix E.			
Environmental Health Impacts					
Access control measures to the Superfarm processing areas are important to manage the transfer of infection into or between components of the production systems. Employee hygiene is important to prevent the potential to spread diseases between animals, humans and the product.	Impacts related to Hygiene and Access Control to the processing areas			Access controls systems are used by ND include the establishment of ablution and laundry facilities at the entrances and exits of the processing areas to ensure employee personal hygiene is controlled. The ablution facilities will be provided with boot and clothing washing stations, showers and protective clothing at strategic points.	Compliant and ongoing.
				The bio-digester area will be fully fenced-off to provide unauthorised access.	Compliant and ongoing.

Aspect	Impact	Description	Status	Mitigation	Comments
<p>An operation of 3,100 cows in milk on the farm within a confined area could be regarded as very high density and the quantities of their waste products could also be regarded as high; about 875 m³ of manure is generated per week, i.e. 125 m³ per day (note: this is considerably less than the originally estimated 1 400 m³ of manure). There is the potential for harm to both cows and workers if airborne contaminants exceed the legal limits recommended.</p> <p>Of the airborne contaminants inside the houses, dust could be the most obvious. The cow house dust may be the product of feed, manure or litter. Employees exposed to dust can develop the following symptoms: cough, chest tightness, diarrhoea, eye irritation, fatigue, fever, headache, nasal irritation, nausea, and phlegm.</p>	Impacts related to Air Quality			A farm manager will be appointed to ensure that conditions are managed so that dust and ammonia levels are kept as low as possible. Ventilation systems design in the cow houses ensure that good air flow is maintained. The objective with the ventilation systems will be for cow cooling and to remove carbon dioxide and ammonia from the cow houses and to bring in oxygen.	Compliant and ongoing. Note that there are less cows at !Aimab Superfarm (vs in 2014): about 700 cubic metres (m ³) of manure is generated per week, i.e. 100 m ³ per day (Mr Gunter Ling, Managing Director, Mariental BioEnergy (Pty) Ltd, pers. comm.).
				Efforts are taken to reduce the employee-exposure time inside cow houses. Approved dust mask are provided to employees as required.	Ongoing.
				The planned biogas plant will reduce airborne contaminants as the manure will be fed to a closed / covered manure handling system. The manure will be collected regularly and mixed with used cow-house cleaning water to form a slurry that prevents airborne particles.	Compliant and ongoing.
				Methane and other gases are generated in the biodigester which is fully covered and handled in a closed system. Excess methane is flared to reduce air pollution.	This process has not been required to date (Mr Gunter Ling, Managing Director, Mariental BioEnergy (Pty) Ltd, pers. comm.).
Environmental Impacts					
It is important that the structures on the farm should not be a visual nuisance because the farm will be visible from the B1 national road	Impacts related to Visual amenity			ND ensured that the cow house structures that will be erected onsite compare with best practice. Same is applicable to the biodigester.	Compliant and ongoing.

Aspect	Impact	Description	Status	Mitigation	Comments
and the biggest dairy production facility in Namibia.				The lighting that will be used on the premises for security and other purposes is installed in such a manner that it does not cause annoyance to the neighbouring farm owners or main road users.	Compliant and ongoing.
				The power generator is containerised and an extremely neat and condensed installation which does not disturb the visual eye.	Compliant and ongoing.
<p>Manure is a natural by-product of the Superfarm operation. Manure can be a valuable component of a well-integrated agricultural operation. When properly handled, manure may be used as an excellent soil amendment.</p> <p>Manure from the cow houses are channeled to a central slurry pond and is converted from raw manure to bio-fertiliser for use as liquid and solid fertilizer on own fields but also available to the surrounding community. Treated liquid (liquid fertiliser) effluent will be used in diluted form for irrigation purposes. The high nitrogen and phosphorus content of manure could pollute groundwater if manure is stockpiled on the land and not treated effectively.</p> <p>Data show that 125 m³ manure per day is produced per 3 100 cows.</p>	Impacts related to Manure Management and Odour Control			<p>ND/MBE will be constructing a fully integrated biogas / slurry management handling and separation system. All waste water from the cows will be gathered in slurry ponds. Solids will continuously be separated from the liquids. Bio-fertiliser will be made from the liquids and solids and used as fertilizer on the 260 ha of fodder producing land of O&L and be made available to the community of Mariental. The liquids will be used for dosing the existing fields with nutrient matter directly from the Superfarm. The Superfarm and all related slurry management activities will be at least 2 km from the Fish River which is in compliance with the requirements of the Water Resources Act that it should at least be 1 km from the nearest river.</p> <p>The digester is fully covered and the excess methane and remaining gases are flared preventing odors.</p>	<p>Compliant and ongoing.</p> <p>The production of additional fodder for the Superfarm and the community and handling of bio-wastes and bio-fertiliser to community and adjacent farms are not yet feasible.</p> <p>To date, it has not been necessary to flare excess gases (Mr Gunter Ling, Managing Director, Mariental BioEnergy (Pty) Ltd, pers. comm.).</p>
The normal expected mortality rate is about 1.5 % / annum. Successful methods of carcass disposal prevent the spread of	Impacts related to dead cows and the disposal carcasses			There are various methods that are currently available for disposal of carcasses. ND is currently using decomposing pits for carcass disposal.	N/A to Mariental BioEnergy (Pty) Ltd.

Aspect	Impact	Description	Status	Mitigation	Comments
pathogens and contamination of surface or ground water.				Decomposing pits are environmentally acceptable in soils where movement of nitrogen into groundwater is not a problem.	Maartens (2021) advised that, since the deceased animals are buried on-site, the groundwater in the area be tested for dioxins and furans.
				Carcasses provide an excellent source of energy for the biodigester and are properly degraded in the biodigester, also preventing any pollution of ground water.	N/A; the bio-digester is a closed system.
Waste water will be generated from the ablution facilities at the offices and the processing facility. Currently it is estimated that about 100 m ³ / day of fresh water will be produced on the Superfarm from raw dam water and about 50m ³ / day of effluent will be generated.	Impacts related to waste water disposal			ND/MBE envisages constructing a fully integrated slurry management separation system. Compost will be made from the solids and used as fertilizer on the 260 ha of fodder producing land of O&L. The liquids will be used for dosing the existing fields with nutrient matter directly from the Superfarm. The Superfarm and all other related slurry management activities will be at least 2 km from the Fish River which is in compliance with the requirements of the Water Resources Act that it should at least be 1 km from the nearest river.	Compliant and ongoing.
				Effluent from the Offices will also be channeled to a septic tank and transported to the Mariental sewage works for treatment and disposal.	N/A to Mariental BioEnergy (Pty) Ltd.

4 Conclusions and Recommendations

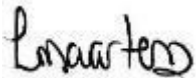
The positive impacts of the Biogas Plant, commissioned by Mariental BioEnergy (Pty) Ltd at the !Aimab Superfarm in September 2018, include, amongst others:

- Utilisation (re-use and recovery) of animal and human waste and wastewater;
- Reduction of emissions of methane (a Greenhouse Gas (GHG)) from the manure;
- Promotion of sustainable use of resources: biogas (methane gas) is a renewable source of energy; during June 2022, 124.4 kilowatt (kw) of electricity was used at the !Aimab Superfarm: 94.1 kw from the Mariental Municipality (76%) and 29.8 kw from Mariental BioEnergy (Pty) Ltd (24%); and
- Production of liquid, bio-fertiliser (for pumping to the fields for agronomy) and sterile bedding.

The following is advised that:

- An Emergency Preparedness and Response Plan (risk of explosion) be prepared, implemented and maintained; all emergency response personnel to be trained in the documented procedure; and
- Dialogue between the operational managers from Namibia Dairies (Pty) Ltd and Mariental BioEnergy (Pty) Ltd is established in order to find the best solutions for the challenges (overflow at the central mixing pit, the possible re-direction of the sanitary wastewater to a separate wastewater treatment system, design of the manure collection pits, and excess liquid manure slurry) that are experienced.

It is advised that Mariental BioEnergy (Pty) Ltd (and their employees and contractors) should implement and observe the Environmental Management Plan on an ongoing basis. Environmental performance should be regularly monitored (so that the lessons learnt can be incorporated into the improvement of the Environmental Management Plan over time) and corrective measures taken as or when required.



Dr Lima Maartens
LM Environmental Consulting

5 References

- De Beer, G. 2021. *Draft Environmental Management Plan – Namibia Dairies Avis Manufacturing Plant*. Unpublished Report. 71 pp.
- EnviroSolutions Safety & Environmental Consultants (EnviroSolutions). 2014. *Amended Environmental Impact Assessment June 2014 for the !Aimab Milk Farm Near Mariental for Namibia Dairies (Pty) Ltd and Mariental Bioenergy (Pty) Ltd*. 38 pp.
- Maartens, L. (LM Environmental Consulting). 2021. *Environmental Management Plan for the !Aimab Superfarm, Mariental, Hardap Region, Namibia*. Prepared for Namibia Dairies (Pty) Ltd. 39 pp. (plus 2 Annexures).
- Namibia Dairies (Pty) Ltd and Cape Advanced Engineering (Pty) Ltd (CAE). 2019. *MBE Project Status Update*. PowerPoint Presentation.
- Ohlthaver & List Group. 2020. *Integrated Annual Report 2020*. 47 pp.