

**NAMIBRAND NATURE  
RESERVE  
INTERNATIONAL DARK SKY  
RESERVE**



**Annual report and light audit  
2017**



Photo: P. Russel (Resident astronomer: Sossusvlei Desert Lodge)

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**'Only in the darkness can you see the stars'  
Martin Luther King**

## INTRODUCTION

### **International Dark Sky Association – NamibRand Nature Reserve Annual light audit report**

Since the 2016 NamibRand Nature Reserve (NRNR) Dark Sky audit, we have been making a concerted effort to pay more attention to our night skies. Not only the stars and the milky way, but also the satellites, eclipses and occasional meteorites, these small moments in time, which we experience with enormous clarity are special and not to be taken for granted. After witnessing a partial lunar eclipse in Cape Town recently, and seeing it from a light polluted environment, we were reminded of the importance light management plays in experiencing phenomena like this. While humans are adaptable and generally get used to what they do regularly, a change in sky quality and light/dark can have a profound effect on biological rhythms and wellbeing. It is not uncommon to hear about people commenting about the moon affecting them – while it does have a mystical and magical quality, it often times boils down to the brightness of the moon. In an area like NRNR, a full moon sheds an immense amount of light and changes the whole landscape, simply by rising. Sleep patterns are disrupted and broken. If, even this natural light source has such a profound effect on the darkness and how people relate to it, light pollution is not an event to be taken lightly.

Cities across the world are filled with artificial, constant and irregular lighting. Offices, homes, shopping malls are all lit up all the time with florescent and harsh lighting. In ancient times, people went to sleep when it got dark and woke when the sun rose, there was no need to stay up, there was no reason not to follow the natural patter of the earth.

These days, with lives being full and busy, lit up constantly by tasks and to do lists, artificial lighting is helpful, in allowing us to achieve what needs to be achieved. Dark Sky spaces are a retreat, a 'safe zone' so to speak. They become a place where those with busy lives can sit and back and loose themselves for a small amount of time, they can restore the balance that is lost in everyday life and they can watch the remarkable way the stars and sky change in a short space of time.

It is very noticeable, how guests and visitors from light polluted areas, respond to the darkness. There is a change in sleeping patterns, a change in energy levels and of course the realisation for some that in the greater scheme of things our presence, as humans, is really negligible on a universal scale.

These visitors in the area allow us to open up a dialogue about the Dark Skies, the magic they hold and the importance of them. It is an opportunity for us, guides, land owners and all involved to enlighten people and show them the impact conservation has. It is a chance to remind people that all things and beings are connected – when the balance of one is not right, the balance of many will be out.

It is for this reason, and many more that the preservation of Dark Sky Reserves across the globe is vital to the environments, the people and the eco systems. The preservation of the NamibRand Nature Reserve is an ongoing task, one which we apply ourselves to seriously. The concessionaires do too, and without their and the landowner's dedication to the conservation of our skies it would be near impossible manage.

Taking the measurements is an important part. However, it is also an incredible time – a time where one is out during the darkest and quietists moments of the night. The moments where

one is fully at one with the immediate area, where silence is almost infinite and the darkness seems endless – it is a time where one is reminded of the importance and value of Dark Skies.

In the course of this report we will go into detail of equipment used, light audits done, light fixtures changed and of course the readings taking and where they were taken.

## Reserve expansion

While there have been no new additions to the NamibRand Nature Reserve in 2017, the owners of the newly acquired farm of Dina (mentioned in the last annual report) have decided to build a small house for their personal use during their visits to the Reserve. An extensive Environmental Assessment was conducted before the construction began. Part of the EIA process was to ensure that the new dwelling conformed with the Reserve Lighting Management Plan. As it is there will be no electrical lighting at the house and light will be provided by paraffin lamps and Consol Solar jars. This is the express wish of the owners, to preserve the ambience and to fully appreciate the beauty of the night sky.

## Monitoring

Compliance with the Reserve's Lighting Management Plan is ensured through a variety of monitoring mechanisms. Ongoing engagement is vital to ensure that all stakeholders understand the importance and benefits of limiting external lighting instead of seeing it as unnecessary and irritating regulation. These mechanisms are described below.

### 1. External lighting audit

The control warden of NRNR conducts an annual external lighting audit. However, he is also aware of and involved in any changes made within the Reserve as they occur. This allows the opportunity to address potential impacts before any significant investment is made which may not fit in with the Reserve's Lighting Management Plan. The concessionaires are also required to send a report detailing any changes that have been put into effect, for our records as well as to assist with annual audit. An extensive record of this audit is maintained at the Reserve's headquarters in the northern part of the Reserve. This year there were a few changes made by a couple of the concessionaires, these are listed below.

During this year's lighting audit, and in consultation with the resident astronomer at one of the lodges it was discovered that some of the light fittings along the walkways, while conforming to the Reserve Lighting Management Plan and fitted with red bulbs, were resulting in a significant amount of light spill as at the bottom of the image below.



Photo: P. Russel (Resident astronomer: Sossusvlei Desert Lodge)

While light in this spectrum does not have a marked impact on the human eye, many animals see in wavelengths different to human eyes and such reflected light could have a negative impact on them. In addition, an increasing number of visitors are interested in astrophotography for which they use much longer exposures. These visitors are attracted to the Reserve because of its Dark Sky status and it is therefore important for us to address this issue, which the Reserve and Management is in the process of doing, in order that we reduce this excessive light spill.

For a complete list of all light fittings on the NamibRand Dark Sky Reserve, please refer to [Appendix 2](#).



### 3. SQM readings throughout the Reserve

A portable SQM (Unihedron Sky Quality Meter with Lens - Narrow Field of View SQM-L), purchased in October 2013 is used to take SQM readings at the sites where the quality of the night sky was originally measured when our submission was made. These readings are done annually and are shown in Table 1 below.

Uncharacteristically high winds during the months of August and September have hampered the collection of data due to the large amount of dust that has been suspended in the atmosphere. Fortunately, a few days where the dust had settled allowed for the darkness of the sky measured on the nights of 25,26 and 27 September 2017. As in previous years, this was done at fixed, strategic locations spread throughout the Reserve. These points are indicated on the map in Appendix 1. At each location 3 readings are taken and an average reading is worked out and used for the report.

These reading are taken at a distance of 10m, from vehicles, buildings, light fittings or structures. This allows for the most honest reading. It is worth noting that at no point is the reading to be taken by pointing at the Milky Way.

Table 1 below shows the Dark-Sky reading taking on the nights of the 25 to 27 September 2017 compared to previous years. As mentioned above, these locations are kept as they are, to provide consistency and accuracy for reporting purposes.

**Table 1**

Location	Latitude	Longitude	SQM reading 2014	SQM reading 2015	SQM reading 2016	SQM reading 2017
C19 to D845 Intersection*	24° 41' 55.95"S	16° 1' 13.42"E	-	21.37	21.56	21.75
C27 to D845 Intersection*	24° 42' 25.40"S	15° 52' 56.24"E	21.74	21.62	21.61	21.72
C27 Road at Northern Reserve Boundary	24° 45' 14.16"S	15° 53' 46.68"E	21.69	21.75	21.65	21.72
Sossusvlei Desert Lodge Staff Quarters	24° 45' 43.52"S	15° 53' 30.56"E	21.70	21.79	21.65	-
Sossusvlei Desert Lodge	24° 46' 45.06"S	15° 53' 18.72"E	21.73	21.80	21.64	-
C27 Road at Entrance to Sossusvlei Desert Lodge	24° 46' 51.84"S	15° 54' 13.02"E	21.70	21.79	21.68	21.72
C27 Road at Entrance to Kwessiegat	24° 50' 11.52"S	15° 54' 35.58"E	21.72	21.80	21.70	21.71
C27 Road at Entrance to Camp Mwisho	24° 52' 59.88"S	15° 57' 16.19"E	21.73	21.79	21.70	21.73
C27 Road at Entrance to Keerweder	24° 57' 32.74"S	16° 1' 26.33"E	21.75	21.79	21.73	21.72
C27 Road at Entrance to Wolwedans	24° 59' 46.19"S	16° 3' 27.45"E	21.73	21.79	21.64	21.80
C27 Road at Entrance to Toekoms	25° 2' 7.39"S	16° 5' 41.08"E	21.68	21.74	21.73	21.82
Wolwedans – Ohorong Waterhole	25° 5' 36.50"S	15°58'46.93"E	21.78	21.81	21.70	21.72
C27 Road at NRNR Motor Gate	25° 6' 19.69"S	16° 6' 7.66"E	21.64	21.54	21.73	21.82
C27 Road at Entrance to NaDEET*	25° 12' 11.81"S	16° 9' 31.60"E	21.62	21.60	21.71	21.81
NaDEET Centre (within Core)	25° 13' 42.49"S	16° 3' 37.35"E	21.71	21.60	21.70	21.82
NaDEET/Tokk Tokkie Trails Base	25° 14' 30.20"S	16° 3' 43.43"E	-	21.65	21.69	21.79
C27 Road at Entrance to Aandstêr	25° 19' 0.50"S	16° 10' 13.92"E	21.57	21.54	21.70	21.73
Aandstêr	25° 21' 40.44"S	16° 5' 59.74"E	21.62	21.77	21.69	21.75
Springbokvlakte – Two Pumps	25° 26' 15.94"S	16° 1' 36.10"E	21.64	21.67	21.61	21.71

(\* Reading taken outside the boundary of the Reserve)

Notes on the NamibRand Nature Reserve (NRNR) SQM measurements:

- Readings tabled in order of north to south.
- Readings were done by NamibRand staff members.
- A Unihedron Sky Quality Meter with Lens - Narrow Field of View was used to take the readings.
- Readings were taken with the SQM pointing towards the zenith.
- Measurements were made on two consecutive nights in 2017, the night of September 25-26 and the night of September 26-27.
- Conditions for all measurements were clear and cloudless. The Milky Way was between the zenith and the horizon.
- Readings were taken after moonset.



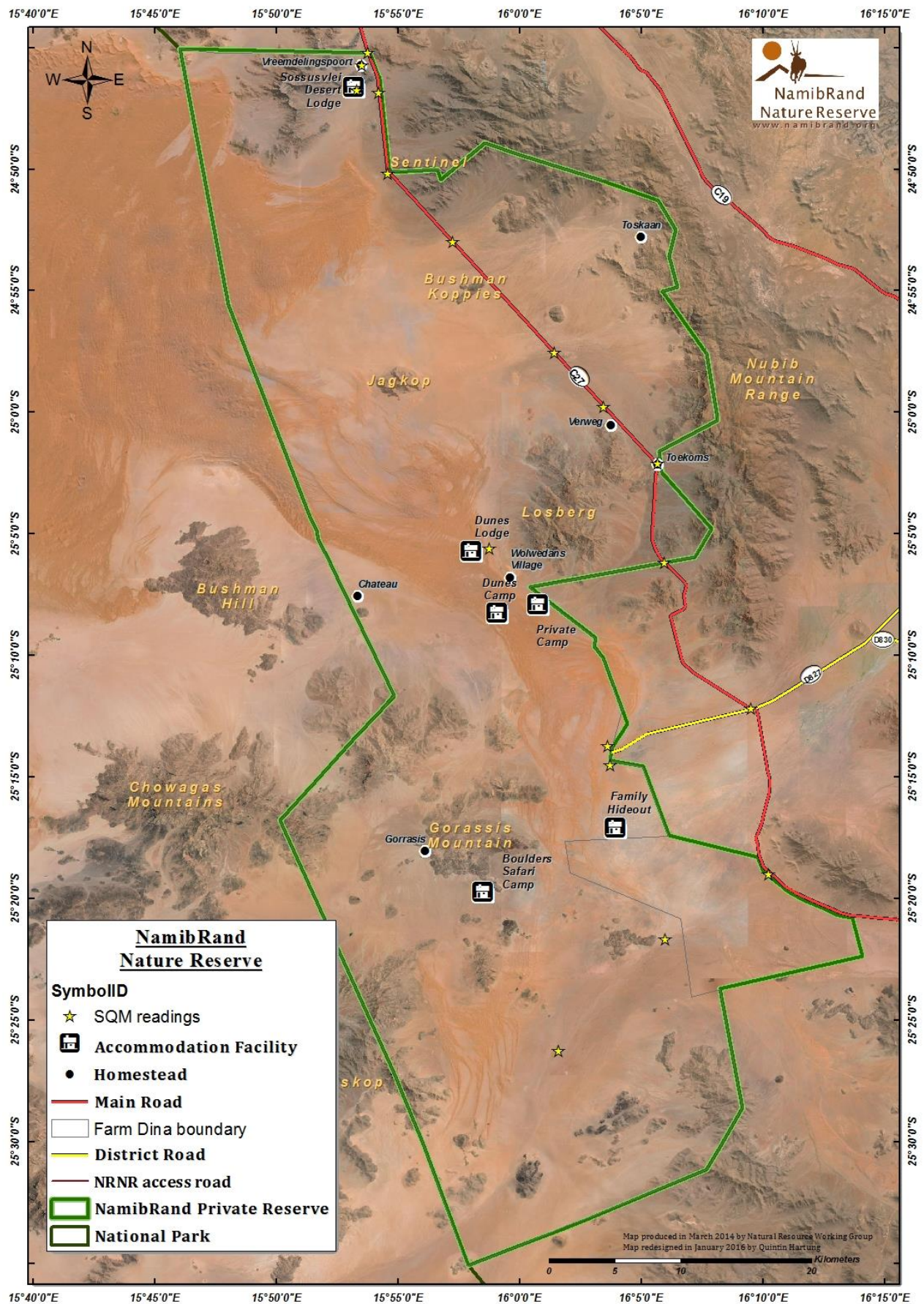
## Activities planned for 2018

In January the Reserve will host two students from the Namibian University of Science and Technology (NUST). They will be present on the Reserve for a period of 5 months, during which time it is expected that they will conduct an extensive survey of all visitors to the Reserve to determine what impact the Dark Sky Reserve status is having on visitor numbers. Detailed logs of visitors participating in stargazing or other related activities will be kept and verified by the two students in order that the Reserve can properly assess whether the status of NamibRand as a Gold Tier Dark Sky Reserve is being fully and effectively utilised by the lodges. Hopefully we will be able to identify areas in which we as a Reserve as well as individual lodges can improve the products that are offered to visitors.

Over the next couple of months, it is the intention of the Control Warden to compare the sky quality readings of the fixed point Sky Quality Meter with USB interface located at the Warden's residence with the readings of the portable Unihedron Sky Quality Meter and the readings from the Dark Sky Meter App for iPhone. If the results do not vary by too great a degree, then it represents a fantastic opportunity for other institutions on the Reserve to add to the data across a broader area of the Reserve as many people have access to an iPhone and it alleviates the cost factor for some of the smaller organisations to involve visitors in the appreciation and monitoring of the night sky.

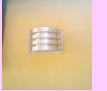





# Appendix 1:







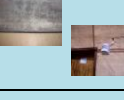





## Appendix 2:




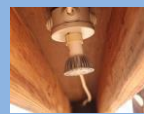
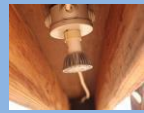

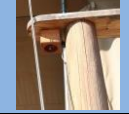





Location	Area	Number of Lights	Fixture, Wattage and Type	Fully-Shielded	Application	Image 2015	2016	Notes
<b>Sossusvlei Desert Lodge Staff Village (on map shown as Vremdelingspoort)</b>	Staff Quarters	22	Wall Light 7W CF 400 lumens	Yes	Building Egress		Remain Unchanged since 2014	Remain unchanged
	Walkways	11	Post Light (Bollard) 15W Red CF		Safety Lights on Walkways		Remain unchanged since 2014	90 lumen red bulbs - Remain unchanged
	Workshop	2	Wall Light 7W CF 400 lumens	Yes	Building Egress		Remained unchange since 2014	Remain unchanged
	Staff Quarters	1	Wall Light 7W CF 400 lumens	Yes	Building Egress		Remain unchanged since 2014	Remain unchanged
	Chef's Quarters	1	Wall Light 7W CF 400 lumens	Yes	Building Egress		Remain unchanged since 2014	Remain unchanged
	Chef's Quarters	2	Wall Light 7W CF 400 lumens	Yes	Building Egress		Remain unchanged since 2014	Remain unchanged
	Ranger's Quarters	2	Wall Light 12W Red CF	Yes	Building Egress		Remain unchanged since 2014	166 lumen red bulbs - Remain unchanged
	Ranger's Quarters	1	Wall Light 12W Red CF	Yes	Building Egress		Remain unchanged since 2014	166 lumen red bulbs - Remain unchanged

Location	Area	Number of Lights	Fixture, Wattage and Type	Fully-Shielded	Application	Image 2014	2015	Notes
<b>Kwessiegat</b>	Residence	2	Wall Light 7W Amber CF 300 lumens	Yes	Illuminate Porch		Remain Unchanged since 2014	Remain unchanged
	Residence	2	Overhead Light 7W Amber CF 300 lumens	Yes	Illuminate Porch		Remain Unchanged since 2014	Light Fixture was changed but is still shaded and at the same location
<b>Toekoms</b>	Residence 1	1	Wall Light 7W Amber CF 300 lumens (1 light removed)	Yes	Egress		Remain Unchanged since 2014	Remain Unchanged and fully shielded
	Residence 2	1	Wall Light 7W Amber CF 300 lumens (1 light removed)	Yes	Egress		Remain Unchanged since 2014	Remain Unchanged and fully shielded









Location	Area	Number of Lights	Fixture, Wattage and Type	Fully-Shielded	Application	Image 2014	2015	Notes
Keerweder	Guest House	1	Wall Light 7W Amber CF 300 lumens	Yes	Egress		Remain Unchanged since 2014	Remain Unchanged and fully shielded
	Guest House	1	Wall Light 7W Amber CF 300 lumens	Yes	Egress		Remain Unchanged since 2014	Remian unchanged and fully shielded
	Warden's Residence	3	Wall Light 7W Amber CF 300 lumens	Yes	Egress		Remain Unchanged since 2014	Remain unchanged and fully shielded
	Warden's Residence	3	Bare Bulb 7W Amber CF 300 lumens	Yes	Egress		Remain Unchanged since 2014	Fully Shielded by Structure - Remain unchanged
	Workshop	0	No Light, Removed from Service	NA	NA		Remain Unchanged since 2014	Remian unchanged and fully shielded
	Student Residence	1	Wall Light 7W Amber CF 300 lumens	Yes	Egress		Remain Unchanged since 2014	Remain Unchanged and fully shielded
	Workers' Quarters	1	Wall Light 7W Amber CF 300 lumens (1 light removed)	Yes	Egress		Remain Unchanged since 2014	Remain unchanged and fully shielded
	Workers' Quarters	1	Wall Light 7W Amber CF 300 lumens	Yes	Egress		Remain Unchanged since 2014	Remain Unchanged and fully shielded
	Butchery	1	Wall Light 7W Amber CF 300 lumens	Yes	Work area illumination		Remain Unchanged since 2014	Remain Unchanged and fully shielded
Waterhole	0	No Light, Removed from Service	NA	NA	Light Removed	Remain Unchanged since 2014	Remain Unchanged and fully shielded	






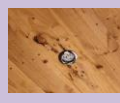
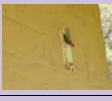

Location	Area	Number of Lights	Fixture, Wattage and Type	Fully-Shielded	Application	Image 2014	2016	Notes
Wolwedans Base	Workshop	0	No Light, Removed from Service	NA	NA		Remain Unchanged since 2014	Remain unchanged
	Workshop	6	Wall Light 14W CF	Yes	Work area illumination		Remain Unchanged since 2014	Remain unchanged
	Workshop	1	Overhead Light 72W Fluorescent	Yes	Work area illumination		Remain Unchanged since 2014	Remain unchanged
	Reception	1	55 Watt Warm White	Yes	Varenda Reception		Remained unchanged since 2014	Fully Shielded
	Reception Coffee Lounge	1	55 Watt Warm White	Yes	Coffee Lounge		Remained unchanged since 2014	Fully Shielded - Newly fitted light fixture
	Kitchen	2	55 Watt Warm White	Yes	Kitchen Varenda/Dining Area		Remained unchanged since 2014	Fully shielded
	Front of Kitchen	2	55 Watt Warm White	No	In front of the Kitchen		Remained unchanged since 2014	Remain Unchanged
	Laundry Varenda	1	55 Watt Warm White	Yes	Laundry Varenda / Dining area		Remained unchanged since 2014	Light were replaced by a fully shielded light
	Farm Shop	1	18 Watt Warm White	Yes	Farm Store Varenda		Remained unchanged since 2014	Light was replaced with a new fully shielded light fixture
	Store Room	1	11 Watt Warm White	Yes	In Front of the Store		Remained unchanged since 2014	Put in after first Audit
	Back of Guide Room	2	11 Watt Warm White	Yes	Varenda		Remained unchanged since 2014	Put in after first Audit
	Welding Workshop	2	2 x 1185 Watt Bulb		Used for occasional night welding		Remained unchanged since 2014	Not used very often Half Shaded - Put in After first audit
	Car Park	1	85 Watt Cool White				Remained unchanged since 2014	Not used very often Half Shaded
	Student (DA) House	6		Yes			Remained unchanged since 2014	Shaded by the Building Roof - Put in After first audit
Walkways	8	Cool White LED	Yes	0		Remained unchanged since 2015	Added in 2015	

Location	Area	Number of Lights	Fixture, Wattage and Type	Fully-Shielded	Application	Image 2015	2016	Notes
<b>Wolwedans Dune Lodge</b>	Main lodge	1	W all Light 15W Incandescent	No	Porch Lighting		Remained unchanged since 2014	Remain Unchanged and fully shielded
	W alkways	13	Mounted Under Benches 15W Incandescent	Yes	Illumination of W alkways		Remained unchanged since 2014	Remain Unchanged and fully shielded
	Guest Chalets	10	W all Light 7W Amber CF 300 lumens	No	Egress		Remained unchanged since 2014	Remain Unchanged and fully shielded
	W alkways	9	Flood Lamp 3W LED Mounted Under Benches	Yes	Illumination of W alkways		Remained unchanged since 2014	Remain Unchanged and fully shielded
	Guest Rooms	20	Flood Lamp 3W LED Mounted Under Benches	Yes	Egress		Remained unchanged since 2014	Remian unchanged and fully shielded
	W alkway Lights	15	Solar Jar Lamps	Yes	Illuminaiton of W alkways		Remained unchanged since 2014	Added in 2015
<b>Wolwedans</b>	Old Dune Camp	9	Under Railing Mounted 5W Incandescent	Yes	Illumination of W alkways		Remained unchanged since 2014	Remain Unchanged and fully shielded
	W alkways	10	Unpressurized Oil Lantern	No	Illumination of W alkways		Remained unchanged since 2014	Remain Unchanged
<b>Wolwedans Private Camp</b>	W alkways	9	Unpressurized Oil Lantern	No	Illumination of W alkways		Remained unchanged since 2014	Remain Unchanged
	New Room	5	W all Mount 3watt warm white LED 60 Lumens	Yes	Lights up the Deck		Remained unchanged since 2014	New external light fixtures to new Private Camp Room
	Deck LED Strip	2	W all Mount 3watt warm white LED 60 Lumens	Yes	Light up the deck		Remained unchanged since 2014	New external light fixtures to new Private Camp Room
	W alkways		Unpressurized Oil Lantern	No	Illumination of W alkways		Remained unchanged since 2014	Remain Unchanged

Location	Area	Number of Lights	Fixture, Wattage and Type	Fully-Shielded	Application	Image 2014	Image 2015	Notes
<b>NaDEET Centre</b>	Main Building	1	Wall Light 11W CF	Yes	Egress		Remained unchanged since 2014	Unchanged since 2011
		1	Wall Light 11W CF	Yes	Dish Washing		Remained unchanged since 2014	On motion detector/timer (foil around fixture) Unchanged since 2011
<b>NaDEET (Die Dune)</b>	Base	1	Overhead Bare Bulb 14W CF	Yes	Front Office		Remained unchanged since 2014	Unchanged since 2011
	Director's Residence	1	Wall Light 5W CF	Yes	Veranda lighting		Remained unchanged since 2014	Fully Shielded By Building Unchanged since 2011
	Director's Residence	1	Wall Light 5W CF	Yes	Veranda lighting		Remained unchanged since 2014	Fully Shielded By Building Unchanged
	Base	1	18 Watt Warm White	Yes	Work Area		Remained unchanged since 2014	Unchanged since 2011
	Little House	1	Wall Light 15 Watt CF	Yes	Veranda lighting		Remained unchanged since 2014	Unchanged since 2013
	Back Rooms	1	Overhead Bare Bulb 11W CF	Yes	Residence Veranda Lightning		Remained unchanged since 2014	Unchanged since 2011



Location	Area	Number of Lights	Fixture, Wattage and Type	Fully-Shielded	Application	Image 2014	Image 2015	Notes
Die Dunie Tok Tokkie Trails	Base	1	Wall Light 5W CF	Yes	Veranda lighting		Remain unchanged since 2014	Shield Added
	Base	1	Wall Light 14W CF	Yes	Egress		Remain unchanged since 2014	On motion detector/timer Unchanged since 2011
	Base	1	Overhead Bare Bulb 11W CF	Yes	Work Area		Remain unchanged since 2014	Shield was changed to cover the whole light
	Base	1	Wall Light 10 Watt CF	Yes	Veranda lighting		Remain unchanged since 2014	Foil removed and Shield painted black
	Horseshoe Camp	2		Yes	Campsite		Remain unchanged since 2014	Both lights shielded by the roof - Newly fitted fixtures
	Horseshoe Camp	1		Yes	Campsite		Remain unchanged since 2014	Fully Shielded - Newly fitted light fixture
	Horseshoe Camp	1			Campsite		Remain unchanged since 2014	Not Shielded - Newly fitted Light fixture
	Horseshoe& Schafsberg Camp	4			Campsite		Remain unchanged since 2014	Not Shielded - Newly fitted Light fixture
	Horseshoe& Schafsberg Camp	2			Camp site		Remain unchanged since 2015	Parafin Lamps replaced with solar lamps
	Schafberg	1			Campsite		Remain unchanged since 2014	Fully Shielded - Newly fitted light fixture
Campsites	2					Remain unchanged since 2014	Not Shielded - Newly fitted Light fixture	

Location	Area	Number of Lights	Fixture, Wattage and Type	Fully-Shielded	Application	image 2014	Image 2015	Notes
<b>Family Hideout</b>	Residence	1	Wall Light 9W CF	Yes	Porch Lighting		Remained unchanged since 2014	Fully Shielded By Building unchanged since 2011
	Campsite 1 (Orion)	1	Wall Light 5W CF	Yes	Dish Washing Station		Remained unchanged since 2014	Unchanged since 2011
	Campsite 1(Orion)	4	Wall Light 5W CF	Yes	Dish Washing Station		Remained unchanged since 2014	Unchanged since 2014
	Campsite 2 - New Campsite (Venus)	1	Wall Light 5W CF	Yes			New Light fixtures added in 2015	
	Campsite 2 - New Campsite (Venus)	1	Wall Light 5W CF	Yes			New Light fixtures added in 2015	
Location	Area	Number of Lights	Fixture, Wattage and Type	Fully-Shielded	Application	Image 2014	Image 2015	Notes
<b>Aandster</b>	Residence	8	Recessed Ceiling Light 3W LED	Yes	Porch Lighting		Remain unchanged since 2014	Remain Unchanged
	Annex	0	No Lights, Removed from Service	NA	Egress		Remain unchanged since 2014	Remain Unchanged
	Annex	1	Wall Light 40W Incandescen t	Yes	Egress		Remain unchanged since 2014	Fully Shielded By Building
	Annex	0	No Light, Removed from Service	NA	Security		Remain unchanged since 2014	Remain Unchanged
	Garage	1	Wall Light 40W Incandescen t	Yes	Security		Remain unchanged since 2014	Remain Unchanged

Location	Area	Number of Lights	Fixture, Wattage and Type	Fully-Shielded	Application	Image 2014	Image 2015	Notes
<b>Springbokvlakte</b>	Bunk House	2	11A Under roof	Yes			Remain unchanged since 2014	Shielded By Building - Remain unchanged
	Main House	2	7 A Exposed	Yes			Remain unchanged since 2014	Shielded By Building - Remain unchanged
	Main House	3	65mA Orange Light	Yes			Remain unchanged since 2014	Shielded By Building - Remain unchanged
	Main House	12	Under Roof	Yes			Remain unchanged since 2014	Shielded By Building - Remain unchanged
	Staff Quarters	2	Under Roof	Yes			Remain unchanged since 2014	Shielded By Building - Remain unchanged
	Pool Area	4	75Ms Under roof	Yes			Remain unchanged since 2014	Shielded By Building - Remain unchanged