

**Captive Management of Sumatran rhinoceros (*Dicerorhinus sumatrensis*)
Tabin Wildlife Reserve**

December 2017

Paddock Staff

1. Wilson Kuntil (Head Keeper)
2. Justine Segunting (Rhino Keeper - RIF)
3. Marikus Suyat (Rhino Keeper – RIF)
4. Samat Gubin (Rhino Keeper – RIF)
5. Ronald Jummy (Rhino Keeper - RQF)
6. Rasaman Jaya (Rhino Keeper - RQF)

* RQF: Rhino Quarantine Facility
RIF : Rhino Interim Facility
RFP : Rhino Food Plantation

Sumatran Rhinoceros

No.	Animal ID	Sex	Accession No
1.	Kretam	Male	SWD 002
2.	Iman	Female	SWD 004

1. Husbandry

1.1 Animal Management

The heavy rainfall in December 2017, continuing from November 2017, hit 700 mm. It rained for 29 days, with a highest of 73 mm on the 28th December 2017. The impact on heavy rain is clearly seen in the paddocks, mainly on the rhino trails to and from the wallows. Significant amount of erosions and waterlogged areas were observed in the paddocks.

The negative impact is on both the rhinos. Kretam has more frequent hoof problems (hoof cracks and chipping) and abrasions. In general, the problem with hoof cracks resolved with frequent treatment and oral medication.

On the contrary, the clear impact on Iman is on the uterine pathology and subsequent bleeding in the uterus. The trails in her paddock becomes deep, narrow trenches

that she has to go through daily to get to the night stall for her twice daily feedings. In addition, some of the gradients were in excess of 45° and puts a lot of physical stress on her to climb. Vaginal discharges were seen on 12th and 14th December 2017, starting with just mucous, progressing to blood respectively.

Trails to and from nights stall were filled up with sand bags. Kretam doesn't mind using these sand bags along his path to the night stall. However, Iman does not use any trails that is laden with sand bags. An alternative route was created using the third night stall. Simple modification had to be made to the electric fence system (Plate 1 – 2).



Plate 1. The deep trail that Iman had to use to get to her night - stall



Plate 2. The sand bags used to fill up the deep trails

The heavy also rain disrupts the keepers routine task of gathering food plants for the rhinos. It limits their ability to climb tall trees to collect some of the rhinos' (especially Iman) favorite species

(*Tambirok, Pau, Mikrofon* etc). Similarly, vehicles could not transverse into deeper parts of the plantation or forest fringes as the roads are bad. Some species of figs (*Ara epal*) were not collected due to this.

1.2 Body Weight

The body weights were taken twice a month, using a TruTest® electronic weighing scale. However, in December 2017, only Kretam was weighed. Iman was not weighed when she succumbs to the bloody vaginal discharge and was undergoing treatment. Her estimated body weight is 500 kilograms.

Kretam averaged 656 kilograms in December 2017. However, in 2017, his average weight is 659.2 kilograms with a minimum of 652 kilograms (Figure 1).

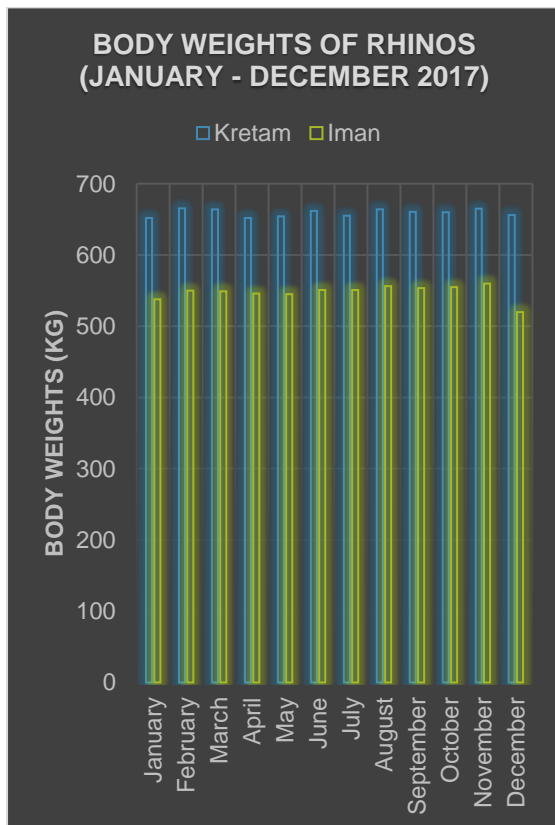


Figure 1. Bodyweights of Kretam and Iman (January – December 2017)

2. Animal Health

The body scores of Kretam was maintained at around 2.5 – 3.0. Iman’s body score was

≥2.5 in early December but deteriorated after mid-December to about 1.5. This was due to the bloody vaginal discharge she had on the 14th December 2017 and her refusal to eat or drink for four consecutive days.

Kretam was observed to mount the log or “earth mount” within his enclosure on the 14th and 31st December 2017 (Plate 3).



Plate 3. Kretam mounting the log inside his paddock.

Usually, when Kretam displayed such behavior, his feed intake for that day (morning or evening) would be disrupted.

Iman had a bloody vaginal discharge (Category 3) on the 14th December 2017, which worsen (Category 4) throughout the month.

Routine sampling for health checks were carried out for both rhinos on the 10th December 2017 (Sunday) and submitted to the Veterinary Diagnostic Laboratory and Public Health Laboratory in Kepyayan, Kota Kinabalu on the 11th December 2017, before noon.

Soil sampling were done around the night stalls. Floor swabs were taken randomly inside the night stalls, focusing in areas where water accumulates after washing. Blood, urine, fecal samples were collected from the rhinos. Sampling for urine is always a challenge as the bull sprays his urine most of the time. Water from water tanks were sampled for coliform counts, particularly *E.coli*.

Except for the coliform counts, which would take about a week, the other analysis took between 1 – 3 days.

2.1 *Kretam*

a. Deformity of posterior horn

The posterior horn, although improved with topical anti-fungal treatment (Lamisil®) and oral supplementation with Hoofmaker TRM®, showed deformities. The horn matrix grew in height around the periphery of the horn but was depressed and deformed in the center (Plate 4).



Plate 4. The posterior horn was deformed at the center but grew in height (arrow)

b. Corrugated food pad

All four footpads were corrugated, resembling small round craters. The lesions were generalized and does not go beyond the epidermis. There was no pain or adverse effect on his gait or stance. Apart from povidone spray, no other treatment was carried out on the lesions and it resolved after two weeks (Plate 5).



Plate 5. The “crater feet” (above) and the lesions after two weeks (below)

I have seen similar lesions in the wild Sumatran rhinoceros in Peninsular Malaysia. It has to do with very wet condition with long periods of rainfall. Similarly, povidone was sprayed on the lesions as a precaution, with condition resolving after 2 – 3 weeks.

c. Hoof cracks

As with Iman, when she had severe hooves' cracks, the healing process involved new growth of the dermal layers ventrally. The cracks observed in *Kretam*, mainly involved areas below the coronary bands. With topical and oral medication, the lesions were observed to slowly disappear (erode) ventrally (Plate 6).



Plate 6. The healing process of the cracked hoof in November (above) and December (below)

The daily treatment consisted of topicals (antiseptics, 2% formalin and coal tar) twice daily and supplementation of biotin and methionine (20 grams Hoofmaker TRM®), once daily in the afternoon. Hoof crack treatment are usually long term.

2.2 *Iman*

a. Reproductive tract pathologies

The first discharge was observed on the 12th December 2017. It was clear, mucoid and estimated about 10 – 15 ml. It was voided after her defecation. Her other parameters were normal (appetite, urine, bowel and vocalization). No treatment was given but she was put under observation. She was let out to wallow and returned back to the night stall for her usual feedings. Subsequently, on the 13th December 2017, the discharge was observed to contain a small amount of blood mixed with mucous (15 ml), and similarly voided after defecation (Plate 7).



Plate 7. The mucoid discharge on the 12th December 2017 (above) and the subsequent bloody discharge on the 13th December 2017 (below). Note the difference in fecal consistencies.

Her appetite was low and no vocalization was heard. She defecated and urinated. After her feeding and medication (Tranexamic acid and Sangobion), she was let out to the wallow. *This is the fifth incidence of bloody vaginal discharge. The last four was treated and resolved. Two were in Category 4, one in Category 3 and two in Category 2 severity assessment. Several were in Category 1 that only requires observation. The longest treatment duration being one week.*

Iman refused to come out of her wallow to be fed inside her night stall, the same evening. She was completely off – feed and

did not consumed any water. She was showing a lot of signs of pain and discomfort and used the wallow to cushion (buoyancy) herself. She would charge at anyone coaxing her to come out of the wallow. The site is totally muddy, especially with non – stop rainy season. Treatment via intramuscular injections were administered while she was in her wallow (Plate 8).



Plate 8. The veterinarians giving the intramuscular injection (anti-inflammatory) to Iman.

The keepers tried to gently coax her out of the wallow. It was only on the 18th December 2017 that the keeper managed to get her to move into some shrubs, allowing us to cordon the wallow with black shade netting and sand bags. Subsequently she was coaxed by the keeper to enter her night stall. She was allowed to rest before being reassessed and treated symptomatically.

She was diagnosed with severe dehydration, anemia, inappetence, malnourishment, infection (including pyometra) constipation and was in a lot of pain. When she had rested and drink more water (vitamin – mineral supplement), a drip line was secured and fluids administered (Plate 9)



Plate 9. The intravenous line that was set up to administer electrolytes and other medication

She was also given intravenous antibiotics, analgesics, hematinic, electrolytes and vitamin K. In addition, medication to ease her bowel and reduce stomach acid production was also given via the same IV line. Each session would require between six to nine hours. She would eat small amounts of food (1 – 3 kg per day) during the first few days. The amount increased very slowly each day. However, she drank ample amount of water each day. She would bleed in large volumes into her discharge, some are mixed with mucous and dead cells.

Several pieces of constipated fecal materials were removed from her rectum and a laxative enema (Lactulose®) was given per rectum to soften her stools. Once

removed, more were voided out later on. The stools were covered with a layer of mucous or epithelium (Plate 10).



Plate 10. The pieces of constipated feces removed from Iman on the 18th December 2017 (above) and those she defecated later on (below)

She was observed to be very lethargic and would often sleep standing during feeding or she would use her head to lean on the wall or in between the bars. She continued to bleed and frank blood was also evident on several occasions. The bloody discharge would be expelled when she lies down (sternal or lateral), after urination and after defecation. The volume ranges from 50 – 500 mls each time (Plate 11).

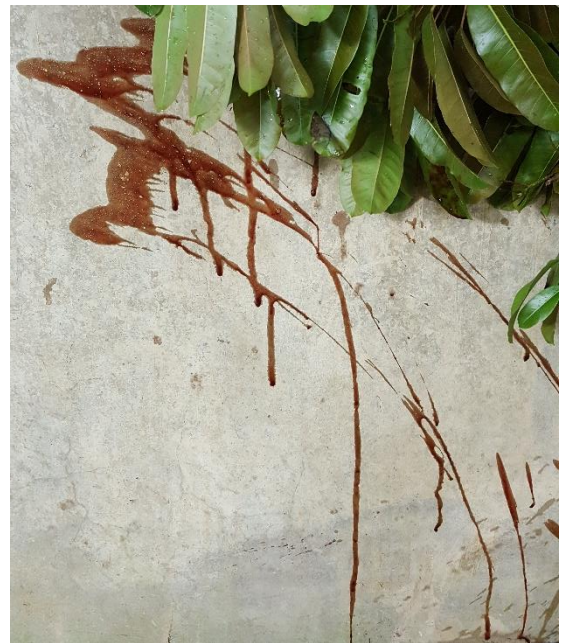


Plate 11. The bloody discharge as she lies down (above), she defecates (middle) and when she sprays urine (below)

She showed very erratic signs of recovery with daily bleeding, pain and lethargy. Several experts (wildlife and equine surgeons) were contacted for opinion (s) to deal with the critical situation. They included: -

Save the Survivors and their colleagues – Dr. Zoe Glyphis, Dr. Johan Marais. Dr. Morne de la Rey (Embryo Plus, Africa); **Sudan the Rhino fans** and their colleagues – Erin O’Brien. Dr Michael Briggs (Global Veterinary Consultancy, USA), Dr. Dean A Hendrickson (Colorado State University, USA); Cornell University – Dr. Robin Radcliffe; **Institute Zoo and Wildlife Research** – Prof. Thomas Hildebrandt; **Hong Kong Ocean Park** – Dr. Paolo Martelli

Her foot pads were sloughed off and exposed the raw and soft underneath. She was also experiencing pain and discomfort when walking inside the night stall. The under running of the soles could have been due to toxins from the uterine pathologies or dehydration or malnutrition. All four feet experienced this detachment which was treated with topical antiseptics (Plate 12).



Plate 12. The under running of the soles showing severe detachments

Subsequently, on the 30th December 2017, Iman voided a large piece of tissue (leiomyoma) together with her bloody discharge. The tissue was oval in shape, measuring 25 x 10 x 5 cm. It is soft on palpation, encapsulated and resemble tissue rather than a blood clot or fat. The cut surface also showed structures and consistencies of a tissue (Plate 13).

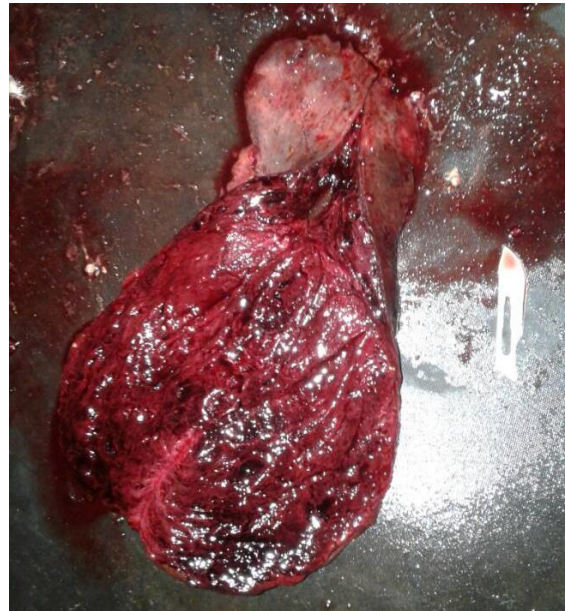


Plate 13. The piece of tissue that was voided with the bloody discharge (above) and the cut surface (below)

The tissue was send for histo – pathology to determine its origin.

Her prognosis was grave due to the constant bleeding, anemia, inappetence, pain and possible septicemia.

3. Feed and feeding

In December 2017, the amount of rain is enormous with a total of 700mm. The amount of browse was adequate, both from the forest, oil palm plantation as well as from the Rhino Food Plantation.

However, when Iman became very ill, the species of foliage were selected based of her preference. Fresh foliage was also collected from the RFP for her morning feeding. As she was very selective and off feed, a lot of the unfinished foliage were fed to Kretam. Her food preference changed significantly and she would consume mainly Putih Sebelah (*Leucosyke capitellata*), Kelawit (*Uncaria spp*), Earth fig (*Ficus spp*) dan Nangka (*Artocarpus heterophylus*). In addition, other species were gathered for Iman each day to entice her to consume more foliage (Plate 14).



Plate 14. At least 10 species of food plants were gathered and prepared to be hand fed to Iman

3.1 Forages

The total amount of forage fed to the rhinos were high (4350 kg estimated) due to those gathered specifically for Iman, after the 18th December 2017. A lot of the forage that were hung for her inside the night stall were constantly replaced every 12 hours, if not consumed (Plate 15).



Plate 15. Iman browsing on the foliage hung inside her night stall

Some of the species collected includes Gatal berbulu (*Ficus francisi*), Putih Sebelah (*Leucosyke capitellata*), Maitap (*Neonauclea spp*), Tarap (*Artocarpus spp*) Nangka (*Artocarpus heterophylus*), Kemansi (*Artocarpus camansi*) Sadaman (*Macaranga spp*), Daun akar (*Merremia spp*), Binuang (*Octomeles sumatrana*), Ludai (*Balakata baccatum*), Ara Ajinomoto (*Ficus spp*), Ara kapal (*Ficus spp*), Ara piring (*Ficus brunneoaurata*), Nangka Air (*Ficus spp*) and Kelawit (*Uncaria spp*), Tambiroq, Pau, Akar Iman and Manis – manis.

The amount of rhino food plants harvested (June – December 2017) from Tabin Wildlife Reserve, Rhino Food Plantation (BORA), Permai plantation and KL – Kepong plantations totaled 27, 427.5 kg (SD: 277 kg). The amount of browse consumed by the rhinos in was 16, 010.5 kg (Figure 2).

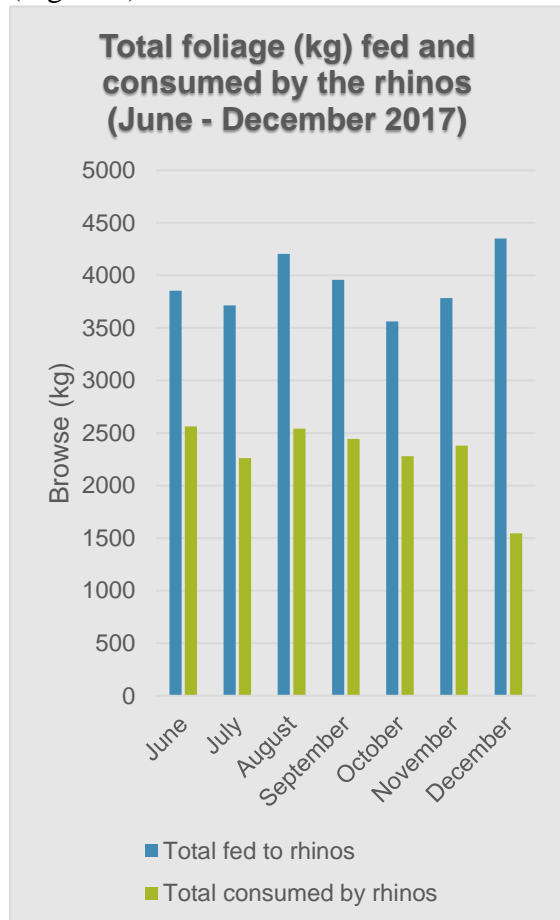


Figure 2. The total browse offered and consumed by the two rhinos (June – December 2017)

3.1 Voluntary Feed Intake (VFI)

The amount of forage consumed vary significantly in December 2017 when Iman came down with severe internal bleeding from her uterine pathologies. She was off – feed for four days. Subsequently, her feed intake was reduced by about 80%.

Kretam’s feed intake is within the normal range and varies from 1206 – 1454.5 (June – December 2017). The factors that affect feed intake is the number of days (morning and evening), he returned for feedings.

Iman’s feed intake was affected by the severe pain and weakness due to the severe bleeding of the uterine pathologies. She was anemic and lethargic and spends most time resting or leaning against the wall. She was also inappetence and did not consume most of the foliage hand – fed to her. Even though a lot of the foliage were offered and hung up for her (more than those for Kretam), she ate very little (Figure 3).

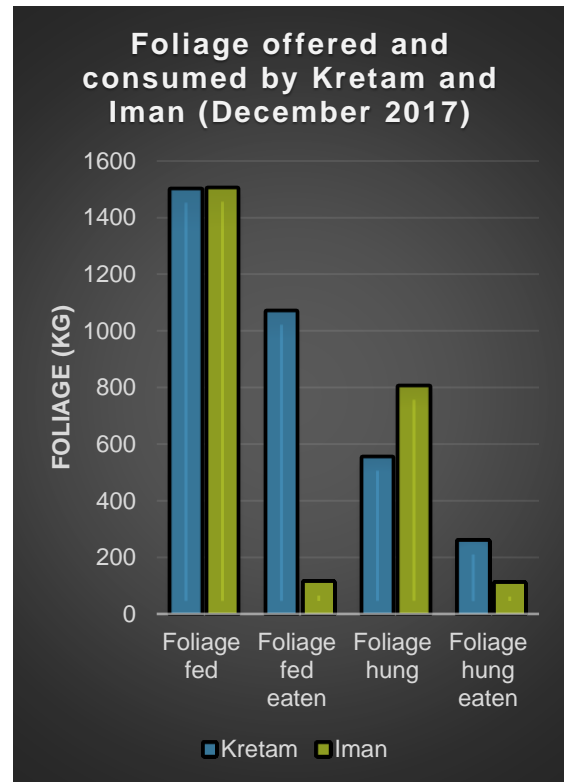


Figure 3. The amount of foliage consumed by the two rhinos in Tabin

The amount of browse that was hand fed to Kretam and Iman were 1497 and 1500 kg respectively. The amount consumed were 1066.5 (71.2 %) and 112 (7.5%) kg respectively. Similarly, the browse hung out for Kretam and Iman totaled 552 and 800 kg respectively. The total amount fed to the rhinos (hand fed and hung out) in December 2017 is 4350 kg. Of this, 69% consisted of those hand fed, with 31% constituting those that are hung out in the paddock (Kretam) or night stall (Iman) for night or early morning feeding.

16 - 17 species of plants were fed to the rhinos daily (morning and evening). The

rhinos were also supplemented with horse pellets (Gold coin®). Kretam gets 500 grams daily.

Ripe banana (155 kg each per month) were provided as part of their daily diet. Small amount of skinned pumpkins (500 – 1000 grams) and papaya were also provided as a supplement. Depending on fruit season, they will also be fed mangoes (or wild mangoes) when in season and laran fruits (*Neolamarckia cadamba*) when it is fruiting.

4. Biosecurity/health monitoring

The biosecurity is maintained as a routine to control and prevent spread of any diseases in managing the rhinos. Apart from monitoring the feed and feed intake, other measures are in place to ensure there is no introduction of potential diseases from outside the center.

The samples were mainly for isolation of pathogenic bacteria (particularly *E.coli*, *Bukholderia pseudomonas* and *Salmonella*) and general health checks of the rhinoceros. The water from 17 tanks were tested for total coliform counts and *E.coli* as half of these tanks were for human consumption.

4.1 Hematology

Blood was collected into EDTA tube from the digital plexus, for a complete blood count (CBC). Kretam's CBC was compared with his previous results. Iman's temperament and stress factors were reasons as to why blood was not collected from her for now.

The values for Kretam were compared with his previous hematological index in November 2017 and those from other Sumatran rhinoceros. The values were within normal range for the Sumatran rhinoceros (Table 1).

Table 1. Blood parameters for Kretam in November and December 2017

Parameters	Animal (Kretam)	
	13 Nov	10 Dec
Hemoparasites	Neg	neg
RBC (X10 ¹² /L)	5.90	5.78
WBC (1000/UL)	8.31	7.67
Hb (G/DL)	13.6	14.2
PCV (%)	45	44
Seg. Neutrophils (%)	78	64
Eosinophils (%)	13	17
Lymphocytes (%)	5	16
Monocytes (%)	1	2
Basophils (%)	3	1

4.2 Bacteriology

Of the 20 floor swabs from the night stalls, swabs 5 and 8 had abundance *Proteus spp*, swabs 6 and 9 had few *Staphylococcus spp* while the rest had few *Bacillus spp*.

The 17 soil samples taken from various locations surrounding and inside the rhino enclosures were negative for *Bukholderia pseudomallei*. The five samples from the wallows were also negative for *Bukholderia pseudomallei*.

The two tyre baths contained few *Aeromonas salmonicida*. Samples from the sumps had few *E. coli*.

There were no pathogens isolated from the feces of the two rhinoceros.

The water samples taken from 17 tanks at the RIF, RQF and main storage tanks had a total bacterial count ranging from 50 – 800 cfu/ml. Total coliform count only ranged from 0 – 50 cfu/ml. The *E.coli* count was surprisingly low with 20 cfu/ml in tank 17 (Table 2).

Table 2. The total bacterial, coliform and *E.coli* counts in 17 water tanks (cfu/ml) for the month of December 2017

Tank	Total bacteria	Total coliform	<i>E.coli</i>
1	330	0	0
2	800	0	0
3	600	0	0
4	200	0	0
5	100	0	0
6	120	0	0
7	70	0	0
8	200	0	0
9	80	0	0
10	80	0	0
11	130	0	0
12	250	0	0
13	50	10	0
14	300	0	0
15	120	20	0
16	40	20	0
17	270	50	20

There were no *Salmonella sp* isolated from the water samples.

The monthly fluctuations in bacterial and *E.coli* counts will always remain as long as the water supply comes from the Lipad river and its tributaries.

The samples from the horse pellets had high bacterial count (4000 – 21,600 cfu/ml) but was negative for pathogens.

4.3 Parasitology

The fecal samples from both rhinos were negative for endoparasites and parasitic egg count.

4.4 Routine prophylaxis

Routine liming (application of calcium/magnesium – rich materials) was carried out mostly around the rhino dung piles outside the enclosure and the sumps for water run – offs from the night stalls. Liming was also carried out when required around the staff quarters.

5. Reproductive assessments

Kretam mounted the log on two occasions, on the 17th and 30th December 2017. Both of the incidence occurred in the evening.

5.1 Ultrasonography

5.1.1 Iman

The scanning carried out on Iman was mainly to determine the cervical canal for the purpose of inserting the Foleys catheter during her illness.

Iman is due to be vaccinated with Improvac® on the 9th March 2018.