



## **MANAGEMENT, MONITORING AND EVALUATION OF THE CRADLE OF HUMANKIND FOSSIL SITES**



UPDATED FOSSIL SITE MANAGEMENT PLAN  
FOR

**BOLT'S FARM : KLINKERTS**

2009 - 2013



## KLINKERT'S SITE

### UPDATED SITE MANAGEMENT PLAN FOR BOLT'S FARM PORTION 32, KLINKERT'S SITE FOR PERIOD 2009 - 2013

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## **SUMMARY OF KEY ISSUES**

- The fossil locality known as Bolt's Farm extends over three properties, all subdivisions of the farm Sterkfontein 173-IQ (Figs 1, 2)
- Portion 12 belongs to Mr Jonathan Gaylord, and is referred to as 'Greensleeves' Portion 32 belongs to Ms Charlene Klinkert, and is referred to as "Klinkert's" (Figs. 2, 3)
- Portion 38 belongs to Ms Suzette Fourie, and is referred to as 'Fourie's'
- Because the management issues differ quite widely between these three sites, separate management plans have been written for each of them. The objectives and method in each plan are identical.
- There is today in fact no property that is still known as 'Bolt's Farm' except in the historical scientific literature. Many Bolt's Farm fossil localities cannot be accurately pinpointed, and the name Bolt's Farm is no longer particularly useful. However, it is a long-standing published name in the scientific literature, and at a scientists' meeting of 28 January 2009, it was decided that the Portion numbers should be included when referring to these sites. The National Heritage Site declaration of Bolt's farm' defines three separate portions with separate proclamation diagrams. However, agreed alternative names for the separate properties need to be chosen, and used as qualifiers to 'Bolt's Farm'.
- Furthermore, the 'Bolt's Farm Fossil Site' is really a series of 25 or more discrete and separate 'sites' which probably have nothing to do with each other, palaeontologically speaking, beyond the fact that they once fell within the boundary of a property known as Bolt's Farm (itself a portion of Sterkfontein 173-IQ) and which now are spread between Portions 9 (the Bolt's Farm Quarry), 12, 32 and 38. The Pits and their contents, where known, and their locations are shown in the table below and on the plans, (Fig. 4).
- The name 'Bolt's Farm' derives from the fact that a Mr. Bolt used to own the property now known as "'Greensleeves'" (source: Loffie and Linda van der Gryp of Sterkfontein Melkery).
- The sites represent a series of natural and/or artificially enlarged or opened natural avens, some of which are the weathering remains of ancient caverns and some of which are test pits in the prospecting and exploration sense. Some of the sites have associated subterranean caves, mostly with openings which have become closed by roof collapse or rubble infill.
- The Bolt's Farm Quarry itself (Portion 9), from which some of the original fossils were recovered, including some collected by Broom, is not included in the National or World Heritage Site because almost all of the significant deposits have been destroyed in the course of mining.
- The fossils collected thus far indicate an age of between 1.5 and 4.5 million years, thus making Bolt's Farm the oldest of the sites discovered so far in the COH WHS.
- Bolt's Farm Klinkert's has a looming problem of access if not addressed, because it is a 'landlocked' property
- Excavations are extremely problematic because everything has to be carried two kilometers or more into the site and out again. This becomes difficult and cumbersome

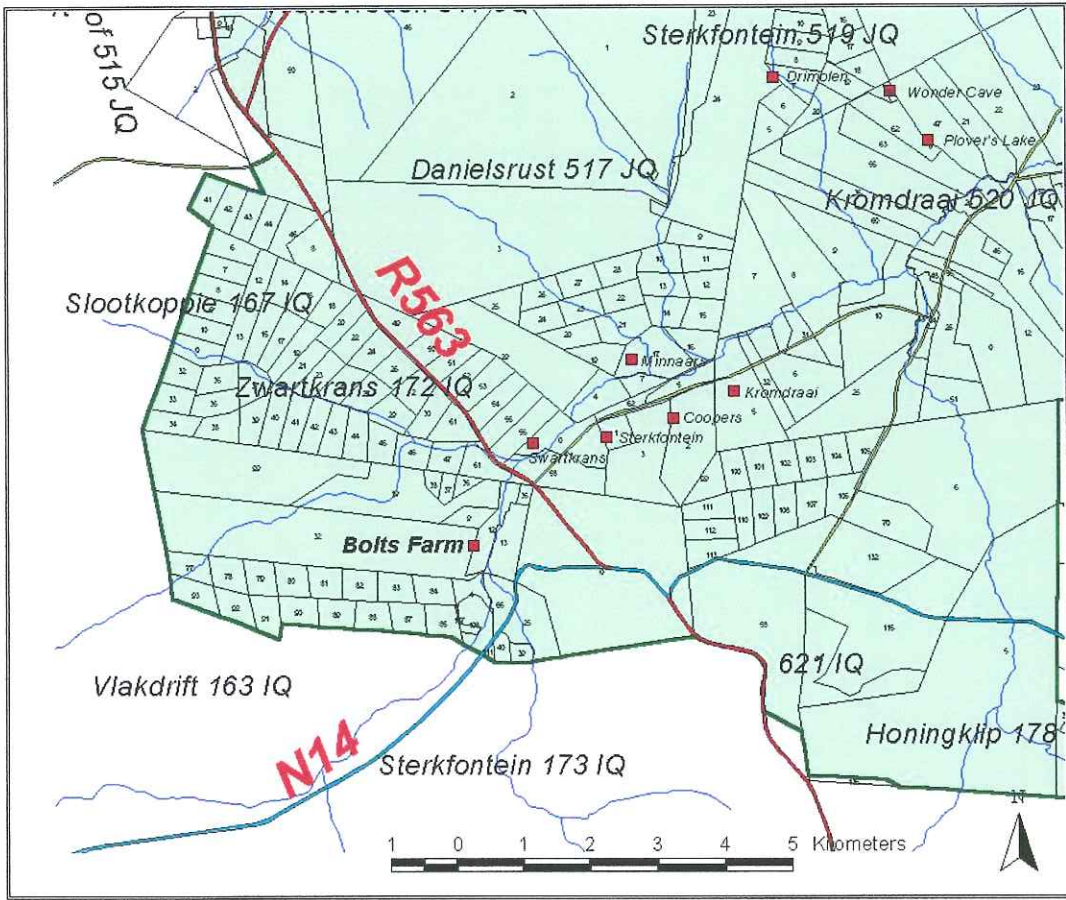
because fossil material is heavy. A solution to this problem would be a registered servitude across the Goldsmith's property with a track to the site cluster.

- Any work that is contemplated on the natural habitat (for example the termite mound experimental work envisaged) will need the necessary permits from GDACE in terms of the NEMPAA requirements and other legislation.

**PITS AND THEIR NAMES, CONTENTS AND LOCATION: after Cooke 1991, Thackeray pers. comm. 2007**

<b>PIT NUMBER</b>	<b>Local name of pit</b>	<b>Fossils recovered</b>	<b>Portion number, Sterkfontein 173-IQ or Bolt's Farm</b>
Pit 1	Kraal Pit		
Pit 2	Kiln. Has no name	Microfaunal breccia only	
Pit 3	"African" Beer Cave – now Bees' Cave	Suid cranium	Portion 12 ('Greensleeves')
Pit 4	Smith Cave/Garage Ravine Cave – there is a discrepancy between the Cooke reporting and Thackeray. Cooke refers to pit 4 as Garage Ravine Cave and pit 5 as Smith Cave		Portion 12 ('Greensleeves')
Pit 5	Smith Cave		Portion 9 (Quarry)
Pit 6	Baboon Cave		Portion 32 (Klinkert's)
Pit 7	Elephant Cave/ Bridge Cave		Portion 32 ('Klinkert's')
Pit 8	No name cave	Rodent breccia and two fragmentary fossils	unknown
Pit 9	-sterile-?	-sterile-?	Portion 12 ('Greensleeves')
Pit 10	Grey Bird Pit/ "Main Quarry		Main Quarry, Portion 9
Pit 11	-scraps -		Portion 32 ('Klinkert's')
Pit 12	-scraps -		Portion 32('Klinkert's')
Pit 13	-scraps-		Portion 12 ('Greensleeves')

Pit 14	Bench Mark Pit		Portion 12('Greensleeves')
Pit 15	-scraps-		
Pit 16	Equine Pit		
Pit 17	No info, no worthwhile material		
Pit 18	No info		
Pit 19	No info		
Pit 20	No info		
Pit 21	No info		
Pit 22	No info		
Pit 23	Tit Hill (adjacent to Femur Dump)	Pit 23 is probably the source of Femur Dump material	Portion 32 ('Klinkert's')
Pit 24	-scraps-		
Pit 25	Gazelle Pit		
Old breccia Dumps (near the kilns)	Femur Dump (probably derived from Pit 23)	Fossil dumps, 11 breccia blocks collected 2006 and 8 in 2007	Portion 32 ('Klinkert's')
Waypoint 160	Waypoint 160	Fossil dump, 45 pieces breccia in 2006 and 137 in 2007	Portion 32 ('Klinkert's')
Alcelaphine site	Adjacent to Waypoint 160		
Dom's Site	Adjacent to Waypoint 160		

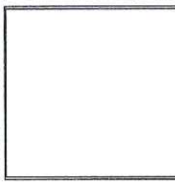


**BOLT'S FARM  
MANAGEMENT  
PLAN**

- Legend**
- Fossil sites
  - Arterial Road
  - National Road
  - Secondary Road
  - Farm boundaries
  - River
  - World Heritage Site

**BOLT'S FARM  
Klinkert's  
(Portion 32)**

Figure 1  
Locality map







**BOLT'S FARM  
MANAGEMENT  
PLAN**

**Legend**

N approximate  
position of  
site boundary

**BOLT'S FARM  
Klinkert's  
(Portion 32)**

Figure 2  
Aerial view  
of site

PROCLAMATION DIAGRAM

REGISTRATION COPY

SIDES metres		ANGLES OF DIRECTION	CO-ORDINATES		
			Y	System: WG.27	X
			Constants +0,00 +2 800 000,00		
A B	350,01	277.47.50	A	-71 333,32	+80 175,24
B C	736,70	15.54.56	B	-71 680,09	+80 222,73
C D	54,99	18.13.40	C	-71 478,07	+80 931,19
D E	418,07	96.16.48	D	-71 460,87	+80 983,43
E A	815,04	200.41.38	E	-71 045,31	+80 937,69

SG No.  
2293/2004

Approved



J.S. WEYERS  
for

SURVEYOR-  
GENERAL  
2004-04-16

TRIGONOMETRICAL BEACONS		
STERKFONTEIN B	84 Δ	-75 558,23   +74 089,49
KRUG 117	412 Δ	-69 559,89   +81 488,68

BEACON DESCRIPTIONS  
A, C, D, E .... 20mm iron peg  
B ..... 10mm iron peg

BOLTS FARM (Portion 32) PALAEOANTHROPOLOGICAL SITE

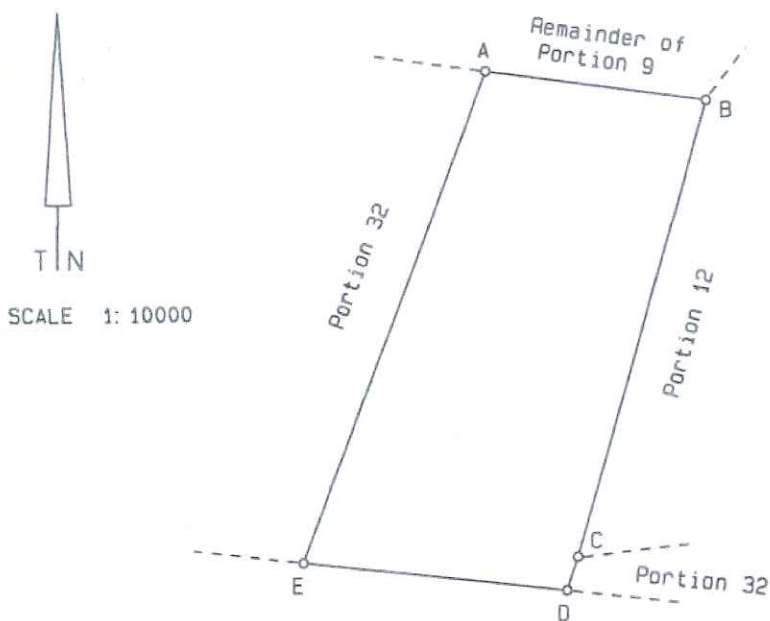


Figure 3  
Proclamation  
diagram

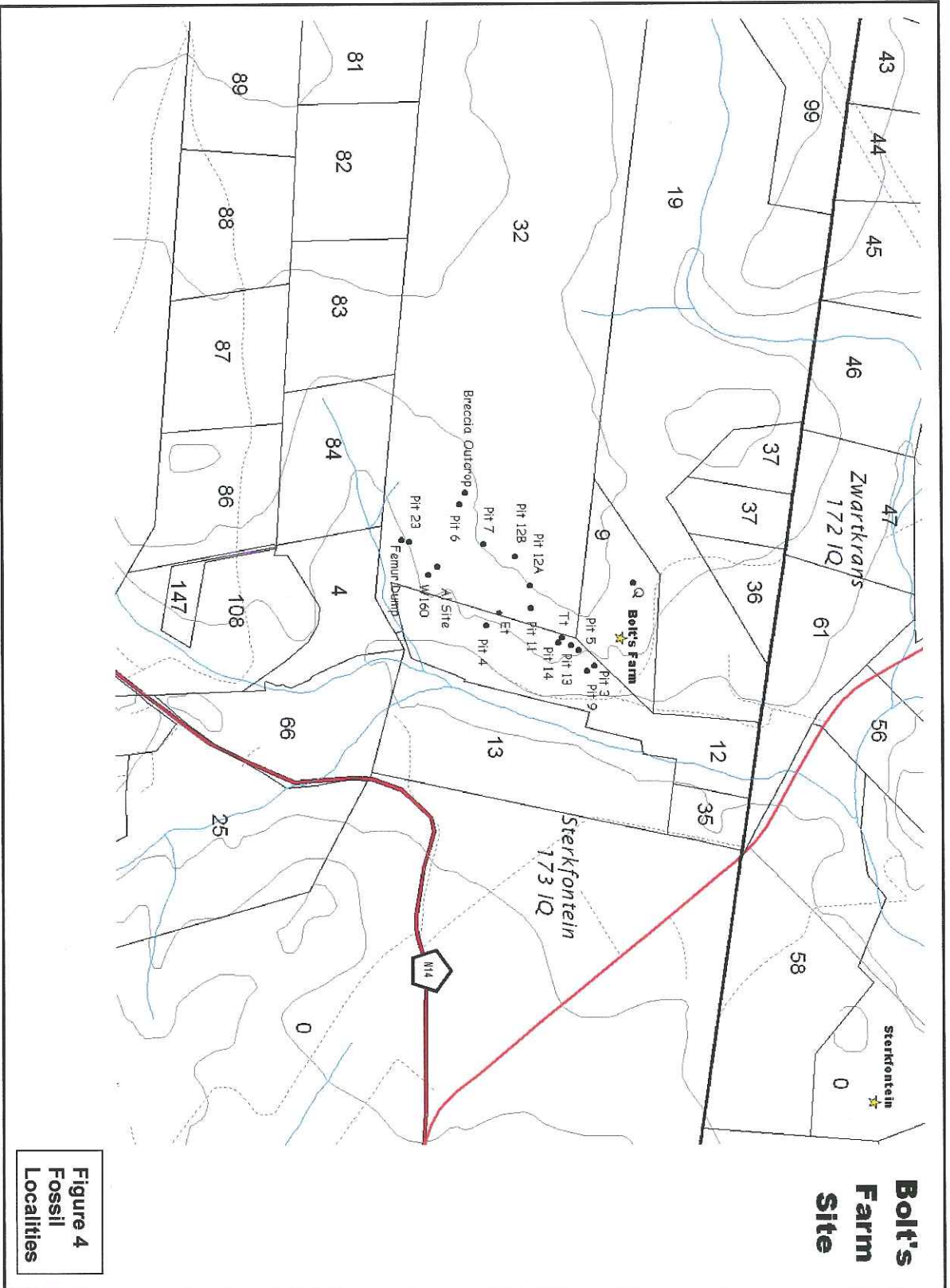
The figure A B C D E A represents 30,2924 hectares of land being a declared area over Portion 32 of the farm STERKFONTEIN No. 173-IQ Province of Gauteng

Framed for National Heritage Site declaration purposes in terms of the National Heritage Resources Act No 25 of 1999



Surveyed in January 2004 by me P.H. KOHRS Professional Land Surveyor PLS0314

This diagram is annexed to No. d.d. i.f.o. Registrar of PTA deeds	The original diagram is No. A 3543/1943 Transfer No. T4599/1944 Grant C.C.T.	File -/29 222/2004 S.R. No. T.P. Comp. IQND - 2
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**Figure 4**  
**Fossil**  
**Localities**

## INTRODUCTION

The Bolt's Farm Klinkert's site is situated on Portion 32 of Sterkfontein 173-IQ, about 3.0 km west-south west of Sterkfontein. The property is 'landlocked' in that it cannot be accessed from the north (the landowner is opposed to both pedestrian and vehicular access from that side), and in any case, there is no negotiable road that leads into the site from the north. On the east side of the property is 'Greensleeves', and a sturdy metal fence prevents access from that side. Furthermore, the landowner of 'Greensleeves' is averse to users of 'Klinkert's' site approaching it from his property and using it as a thoroughfare, which is quite understandable. On the south is a row of private properties, some of them security fenced. One – a property known as Goldsmith's site – is not fenced and provides a pedestrian route through to portion 32. It is up for sale, and should it be sold, access to the site would be cut off from that side.

The access via Goldsmith's has to be reached by going all the way round via the P 126-1W and taking a gravel road which skirts between the row of private properties. The Klinkert's site is accessed by means of an informal pathway across Goldsmith's Fossil Site (another unprotected fossil locality on private land) and across the southern extremity of Mrs Klinkert's farm to reach the fossil pits.

Pit 6 (Baboon Cave), Pit 7 (Elephant Cave or Bridge Cave), Pits 11 and 12, Pit 23 (Tit Hill), Femur Dump, Waypoint 160, the Alcelaphine Site and Dom's Site all occur on Portion 32, or 'Klinkert's'.

It is recommended that legal and physical access to these sites is secured immediately, before the Goldsmith's site is sold. A possibility that Mrs Klinkert might donate an area of land to a public institution should be pursued. A possible alternative access via the Quarry (Portion 9) might be possible.

Access to the property via Goldsmith's (pedestrian – there is no road) is not in any way controlled from this southern end. From the northern or farmhouse end, Mrs Klinkert strictly controls access on account of her poultry business: poultry diseases can be extremely destructive to her business and this is the reason why she wants no access from that side. That there is regular unauthorised access and transit through her property from the south is attested by the clear-cut pathway running towards the north; its terminus is probably the informal settlement north of the Bolt's Farm Quarry and other settlements and work places in that direction.

There are no structures on the area of the farm where the fossil pits are, and no residents who might provide some surveillance. Adjacent property owners are also too far away to provide any deterrent to persons wishing to cross the property.

### **1.1 Objectives**

- To preserve the full range of natural and cultural heritage values, the site significance and authenticity of the Bolt's Farm Klinkert's fossil site
- To identify and understand the issues that threaten site significance and to provide management measures and monitoring to address them
- To balance opportunities for research, education and tourism without compromising the integrity of the site or the aspirations of the landowner, and considering the needs of residents on site
- To recommend appropriate infrastructure and management strategies to achieve the above goals
- To preserve as much as possible of site context and sense of place in an area that is subject to unprecedented development. Bolt's Farm 'Klinkert's' is an interesting property

with a number of collapsed caves and sinkholes, which were exploited for lime in the early part of the last century.

- To foster and maintain communication links between management bodies, landowners and researchers as partners in management and conservation of the fossil site.

## **1.2 Method**

- Consultation with landowners, researchers, repository institutions and support institutions to reveal concerns, contentious issues, requirements and future plans
- Research and understand the full range of natural, cultural, scientific, educational and ecological values of the site. Collation of information gained from a series of fossil site inspections has been incorporated.
- Provide an updated list of site values
- Refresh statement of site significance, in consultation with scientists
- Provide an illustrated status quo report against which change can be assessed
- Update the list of risks and threats
- Articulate desired states and management outcomes, and suggest strategies by means of which the desired states might be reached
- Provide a new management table with management strategies backed, where possible, by operational guidelines for use in the field
- Monitor and evaluate progress at each fossil site inspection, review management strategies where necessary

## **1.3 Administrative information and legal status**

<b>Site:</b>	Bolt's Farm: 'Klinkert's'
<b>Farm Name &amp; No.:</b>	Sterkfontein 173 IQ, Portion 32, Known as Bolt's Farm, Klinkert's site (Figs. 1 and 2)
<b>Owner:</b>	Mrs Charlene Klinkert P O Box 551 Rant-en-Dal 1751
<b>Contact Details:</b>	As for landowner
<b>Legal Status:</b>	National Heritage Site, November 2004; World Heritage Site 1999
<b>Servitudes and Restrictions:</b>	Unknown
<b>NHS Boundary:</b>	See Proclamation Diagram, a polygon A,B,C,D,E,A representing 30.2924 ha, A,C,D and E marked with 12 mm iron pegs and B with a 10mm iron peg. Adjoins portion 12 (also proclaimed) along the eastern boundary of the site (Figs. 2 and 3)
<b>Co-ordinates:</b>	See proclamation diagram, Fig 3
<b>Area:</b>	30.2924 ha
<b>Permit Holders:</b>	Dr Francis Thackeray, permit expired, new permit application submitted
<b>Designated Repositories:</b>	Transvaal Museum
<b>Access to Public:</b>	Not open to the general public. Site largely unknown

#### **1.4 Existing site management**

- There is very little existing site management, apart from the monitoring inspections which take place twice a year.
- There is no control over pedestrian access
- The property is incompletely fenced
- There is no fence around the 30 ha of the fossil sites (it is suspected that this figure, given in the proclamation diagram, may be erroneous: compare size with that of 'Greensleeves', which is noted as being only 5.5443 ha)
- The pits, sinkholes, avens and cave entrances are densely infested with alien vegetation and weeds, *Pyracantha* in particular
- Fire management appears to be ineffective, and the fossil site area burns at random, almost on an annual basis. Fire is a consideration in rangeland condition but does not threaten the fossil sites themselves.
- Erosion is not a problem, and there appear to be no management interventions. The only erosion is adjacent to a small drainage line to the south of the property, adjacent to the Goldsmith's Site
- The site is vulnerable to visual impacts because it has an almost 360 degree vista and a large viewshed. Visual impacts are monitored by the COH WHS MA who scrutinize all development plans for impacts of this nature
- There is no scientific work going on at the moment although Dr Thackeray has submitted a project proposal and permit application to SAHRA. There is therefore no up-to-date landowner-researcher agreement in place at present.
- Site safety does not appear to be an issue at present
- The site is not open to the general public so no site interpretation on site is necessary.

Apart from the management of the site provided by the landowner, the following management measures are in place:

- A SAHRA Permit Committee member inspects the site on a twice-annual basis,
- The site inspection team, including COH WHS MA, SAHRA and GDACE officials, plus a contracted specialist service provider, inspects the site at this time, monitoring the management criteria noted in the generic site management plan (see Table 1, generic management plan) and particularly Table 1 of this document.
- The COH WHS MA monitors development within the surrounding COH WHS properties with a view to protecting heritage values such as sense of place and visual aesthetics.
- A site safety inspection has been provided for.
- GDACE is available for advice to landowners regarding erosion control, fire management, alien vegetation and weed clearance, and preservation of biodiversity.

## **2 SITE DESCRIPTION: PHYSICAL FEATURES, VALUES AND SIGNIFICANCE**

The fossil site management plan adopts a values-based approach and seeks to ensure that the various values of the site are conserved. Site values extend beyond those formally recognized as being of 'universal value' and this section seeks to provide an updated list of old, new and previously unrecorded or unrecognized values (3.1). Section 3.2 provides an updated statement of site significance which was prepared in consultation with permitted scientists working on site.

The archaeological and palaeontological significance of the site remains improperly realized. Preliminary results from the new excavations have been promising and in all probability, Bolt's

Farm 'Klinkert's' site has as much scientific significance as any of the other sites. However, at the moment, it is merely a collection of holes in the ground with little or no apparent heritage significance to the average visitor.

## **2.1 General site description**

See also Introduction above.

The site, or rather sites, are scattered over a wide area mostly on the south and south-easterly facing aspect of a low hill which rises to the west of the 'Greensleeves' property. It is accessed by driving a few kilometers along the P 126-1W before turning off and taking a gravel track which has been constructed to access the many properties adjacent to Klinkert's (Portion 32) on the south. To reach Klinkert's, one is obliged to cross private property, the 'Goldsmith's Site' (Portion 82, see Fig 4) and walk approximately 2 kilometres or more to reach the nearest sites (Fig 5).



*Fig 5: View towards Klinkert's Site from Goldsmith's (foreground).*

The site is situated in open Highveld grassland, which, because it is not being systematically grazed, builds up quite high fuel levels. There are a great many geophytes, and the grassland flora appears to be richer than at some of the other sites in the COH WHS.

The Klinkert's site fossil localities comprise a large number of half-choked avens and entrances to subterranean caves, exploration pits and dumps of material abandoned by lime miners (Fig 1, 2). The fossiliferous pits and dumps occur scattered on an exposed south-facing flank of a low landform (Fig 5). There is not much to tempt people to visit the site, except the most dedicated rock-hound or fossil collector.

The Klinkert's site was prospected for its lime deposits in the early part of the last century. There are many prospecting test excavations and the remains of a stretch of wagon track. The fact that this is a wagon road is proved by the distance between the tire tracks which is greater than that of the average motor vehicle. The scientific literature mentions old kilns on the site.

During the course of prospecting for lime, fossils were discovered and discarded in dumps on the hillside. These were later discovered by palaeontologists of the University of California African

Expedition, led by Charles Camp and Frank Peabody in 1947. The area described as 'Bolt's Farm' by Camp and Peabody is nowhere very precisely defined, and since there are at least 25 fossiliferous pits and workings in the area, the only hominin tooth found at Bolt's farm has no specific locality. No hominins have been found since then. The American Expedition resulted in the identification of extinct fossil elephant, pig and antelope species from the area. In fact, Bolt's Farm as a whole is the Type Locality for several type specimens of fossil mammals found nowhere else in the Cradle of Humankind. These sites may well be amongst the oldest of all.

The Klinkert's site is as yet incompletely explored and its real potential is neither unknown as it has not been properly assessed. What has been found to date provides more than enough incentive to research the site further, as site potential appears to be great.

The landowner is not interested in mass tourism as she is fully occupied with her present commercial enterprise. She has no objection to scientists working on the site provided that permission is obtained before all visits, and people keep clear of her chicken batteries.

A previous offer to dispose of the fossiliferous sector of her property to a public institution connected with the fossil exploration of the site should be pursued by management partners.

## **2.2 Site values**

Certain values, particularly the World Heritage Values are well documented but others have not been sufficiently recognized until now. Seven sets of values have been identified for this site: landscape values, palaeontological and archaeological values, mining and historical values, research values, biodiversity and ecological values, educational and tourism values and social values. The relative importance of these values differ – there are several that have allowed for World Heritage Status and National Heritage Site status while others are of a more regional or local value.

### **2.2.1 Landscape: Geological and geomorphological values**

- Open relatively gently sloping landscape results in mainly vertical and inclined shaft type of cave entrance typical of such landscape (hilly situations show lateral entrances, like Gondolin and Gladysvale). These vertical shaft entrances have taphonomic consequences (bones in the cave catchment can drop into the cave)
- Avens, both open and choked, can be demonstrated.
- There are no prominent outcrops of note
- "Tank trap" dolomite and chert formations are common
- Any open area is becoming valuable in the light of increasing high-density development

### **2.2.2 Palaeontological and archaeological values**

- Bolt's farm has yielded a hominin tooth but it is not known from which pit it was derived
- Bolts Farm Klinkert's has yielded a species of rodent, *Boltimys*, which shows affinities with a similar species from the West Coast fossil locality of Langbaanweg and indicates an age of about 4.0 - 4.5 million years
- The fossil was recovered from the 'Waypoint 160' dumps
- This surprisingly old date makes Bolt's Klinkert's the oldest yet recorded in the COH WHS
- Bolt's farm Klinkert's has yielded fossil baboons of the genus *Parapapio* (also from Waypoint 160) indicative that *Australopithecus* might also be present. The discovery of



similar fossil baboons at Taung in North West Province and at Sterkfontein and Makapansgat in Limpopo presaged the discovery of *Australopithecus* at these sites.

- The potential presence of hominins of more than one species, including *Australopithecus* and *Homo* confers considerable research potential on the site.
- The extreme age suggests that other rare and extinct and as yet unknown species might be recovered
- Many of the dumps are richly fossiliferous

### **2.2.3 Mining and historical values**

- There is an old wagon road
- There are no standing structures relating to the mining period but a thin scatter of occupational debris
- The nearest well-preserved kilns are at 'Greensleeves', but the scientific literature mentions the presence of kilns near the Klinkert's Dump sites.

### **2.2.4 Research values**

- There is considerable research potential, not the least of which is to make sense of the relationships and age of the different pits: which ones are part of the same cavern system? How do the different systems differ in age?
- The dumps and in situ deposits are hardly touched and there exists a strong chance that additional hominins might be present
- The site is the oldest discovered so far. There is a good chance of unearthing a different and older fauna than exists elsewhere in the Cradle of Humankind

### **2.2.5 Biodiversity and ecological values**

- The site has a number of interesting plant species, notably geophytes.
- The site is being collected for edible species (notably *Hypoxis*)
- The open grassland is relatively unspoilt and is not overgrazed or over-utilised
- The full biodiversity and ecological potential cannot be realised without further study and recording

### **2.2.6 Educational, tourism and economic values**

- The landowner is not in favour of open tourism but not entirely opposed to smaller educational groups. This would need to be at her consent and in accordance with her wishes
- There are some educational values but these are not overtly apparent and the site lacks the visual interest of some of the other sites.
- The site is difficult of access and there is a long, and in summer, very hot and exposed walk to the sites
- There is no easily accessible shade
- There is no water – a deterrent to both scientific exploration and to tourism
- There are few opportunities for this site apart from a tantalizing scientific potential as the oldest of the sites yet discovered and the possibility of finding further extinct species of mammal and further hominin fossils

- Given the fact that there are many sites with greater opportunities which are more visually attractive and easier of access, it is unlikely that Klinkert's will offer much for tourism, except for special interest tours for visiting academics.

### 2.2.7 Social values

- The site is the preferred pathway for considerable numbers of pedestrians who use it as a short cut to and from work and the nearest shops.
- People appear to use the site to gather plant material

### 2.3 Original statement of site significance (J Deacon 2002)

"Bolt's Farm comprises a cluster of at least 23 solution cavities with fossiliferous breccia that accumulated in the time period of the Late Pliocene and Early Pleistocene when humans evolved in the Cradle of Humankind. Although no hominin remains have been found there, the sites are a significant component of the World Heritage Site because they give evidence of the age of the deposits and of the environment in which early hominins lived in this part of Southern Africa.

It was recommended by ICOMOS in 1999 that the fossil sites in the Cradle of Humankind be declared a World Heritage Site because they "contain an exceptionally large and scientifically significant group of sites which throw light on the earliest ancestors of humankind. They constitute a vast reserve of scientific information, the potential of which is enormous."

In terms of the criteria set out in Section 3(3) of the National Heritage Resources Act (Act No. 25 of 1999), and specified for Grade I national heritage resources in the draft SAHRA Regulations on Grading System and Heritage Resources Assessment Criteria, Bolt's Farm qualifies for national heritage status because of its:

- Importance in the pattern of South Africa's history.** Although no hominin fossils have yet been found at any of the sites in the Bolt's Farm complex, vertebrate fossils from *in situ* deposits, decalcified breccias and lime mining dumps indicate that the breccias filling the solution cavities in this area formed in the same time range as those in which the remains of australopithecines, paranthropines and early *Homo* sp. have been found elsewhere in the Cradle of Humankind.
- Possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage.** Deposits in which Late Pliocene and Early Pleistocene fossils have been well preserved are rare throughout Southern Africa. The wealth of fossils in the Bolt's Farm breccias therefore makes them uncommon and rare examples of the fauna of that time period.
- Potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.** Studies of the fossils from the Bolt's Farm breccias indicate that they have potential to contribute to a better understanding of the environment in which early hominins lived in the Cradle of Humankind
- Importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects.** As each of the fossiliferous breccias has a slightly different history, together they contribute to an understanding of the principal characteristics of Late Pliocene and Early Pleistocene palaeo-environments.
- Importance in exhibiting particular aesthetic characteristics valued by a community or cultural group.** The aesthetic qualities of the limestone caves on Bolt's Farm were destroyed by lime mining activities in the early twentieth century.
- Importance in demonstrating a high degree of creative or technical achievement at a particular period.** No stone or bone tools have yet been found at Bolt's Farm.

- (g) **Strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.** The history and contents of the breccias in the Cradle of Humankind are important to all South Africans who are interested in the history of our species.
- (h) **Strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.** No special association has yet been established.' (J Deacon 2002)

### **3 SITE ANALYSIS: STATUS QUO, RISKS AND THREATS, JULY 2008**

In order to provide a basis against which change can be assessed, a status quo report is necessary. Ideally, change is assessed by means of comparison of 'fixed point photography' and such fixed points are in the process of being selected and installed. For the purposes of the Status Quo report for this site, fixed point photography is almost unnecessary at the present time: there is no active work on site and little changes from year to year. The only exception is the control of alien vegetation and fixed point monitoring will be set up to assess improvements in this regard where necessary.

#### **3.1 Physical Environment: Surface**

This section addresses the status quo, risks and threats of seven elements of the physical environment, namely physical and legal access to the property, rangeland or veld condition, erosion, fire management, rare plants and animals, alien invasive species and visual aesthetics.

##### **3.1.1 Access**

Status quo:

- Physical and secure legal access to these sites is problematic, as also detailed on the Summary of Key Issues, the Introduction and Site Description
- There is no direct access road. The nearest road is some 2 kilometres away from the main fossiliferous sites.
- Vehicles left parked on this road are at risk while owners are 2 km away on the fossil site
- From here, access is via a private property over which there is no registered servitude
- Access from other directions is not an option as detailed in the sections mentioned
- The lack of direct access means that all equipment has to be taken in, and carried out again as well as any fossiliferous material gathered. Working on this site is perhaps the second most difficult of all the sites in the COH WHS – only Haasgat is more difficult.
- The acquisition of a registered servitude, or at least some form of guaranteed right of way, is a top priority
- Unauthorized pedestrian site users are prevalent, but they are not a problem as far as the fossil sites are concerned. Their pathways cross quite close but the dumps are not of interest to them.
- The public access gravel road itself is not a management issue
- The landowner has no objection to scientists working on her property provided that they notify her in advance of planned visits.
- Access is a sensitive issue because of the risk of poultry disease. The landowner does not want site visitors to use the northern entrance, and the 'Greensleeves' landowner has closed access from the east by installing a security fence.
- The details of management issues and considerations regarding access that should be included in the researcher-landowner agreements required in terms of the Heritage

Agreement ( at such time as a permitted scientists seeks to excavate or explore deposits on the property) have been noted in the generic management plan as they are generic to all the fossil sites.

Threats and risks:

- There is a risk that the currently used access route may become cut off if the Goldsmith's property is sold.
- Scientific exploration is made extremely difficult without direct access to the site

### 3.1.2 Rangeland

Status quo:

- Klinkert's is situated in a patch of relatively undisturbed Highveld grassland which is not overgrazed, but which burns on an almost annual basis. The soils are shallow in places as indicated by the presence of 'bobbejaanstert' (*Xerophyta* formerly *Vellozia retinervis*), which has a preference for seasonally waterlogged soils. There are also many species of *Hypoxis* which have tuberous rootstocks and many of which are eagerly sought after as a source of food. They have a preference for rocky deeper soils and are conspicuous after burns. They are also the favoured food of many species of animal such as warthogs, porcupines and baboons, as well as humans. The relatively low incidence of the aloe *A. greebii* var. *davyana*, which often forms dense stands in overgrazed areas of grassland, indicates that the veld is not overgrazed. The area is not infested with steekgras, another indicator of overgrazing.
- The grassland is species rich and over 500 species are known to occur (Mogg 1975). Many of these are important plants because they are edible (like *Hypoxis*, *Grewia*, *Brachystelma* ), medicinal (like *Scadoxus* and *Boophane*) or toxic (like *Boweia*, an arrow poison), but there is as yet no record of plant species and of where significant plants are located on the landscape. Many species are the target of traditional medicine users and impacts on their numbers through harvesting cannot be assessed without a field survey. It is one of the outstanding pieces of research work in the COH WHS generally.

Risks and threats:

- Overly frequent uncontrolled fire may cause rangeland quality to deteriorate

### 3.1.3 Erosion

Status quo:

- Erosion is not a problem and no fixed point photography is required to monitor this.

Risks and threats:

- None

### 3.1.4 Fire management

Status quo:

- Fire management is a landowner responsibility
- There are many informal settlements and the cottages of farm workers nearby. Uncontrolled fires escaping from domestic heating and cooking fires is an ongoing problem. Fires also start along adjacent roads and spread rapidly over the grassland. Because there is no sustained grazing of the Klinkert's site, there is usually considerable fuel build-up and fires sweep through the site regularly.
- Repeated an over-frequent burning causes rangeland deterioration, and the loss of fire-sensitive species

- The heritage assets are not at risk from fire, but its prevalence places restrictions on the sort of structures that can be contemplated, should development of the site ever reach that stage.

Risks and threats:

- Deterioration of rangeland quality

### **3.1.5 Red Data Species, rare plants and animals**

Status quo:

- See rangeland status quo above. There are many important and rare species which are not on the Red Data list.
- There are no botanical or faunal lists for Klinkert's and no record of medicinal, edible or poisonous plants. Such lists, and a record of the whereabouts of particular species, are essential to baseline studies of, for example, the impact of fire or collection by traditional users.
- Rare species have not yet been mapped. Rare plants and animals are difficult to protect if their whereabouts are unknown. A likely rare species is the bat *Miniopterus natalensis*, whose numbers are declining. The status of bats in the various Klinkert's caves is unknown.
- It is recommended that species lists of plants and animals be drawn up and the occurrence of economically significant species as well as medicinal and poisonous plants recorded on a map. Impact of collection and use should be noted.

Risks and Threats:

- There is no up-to-date faunal or plant species list or mapping of vegetation – over 500 species of plants are known to occur in the Sterkfontein area (Mogg 1975) in this type of Highveld grassland. Rare and endangered species cannot be protected if not located and mapped.
- Edible, medicinal and toxic plant species not recorded – full values of site not clearly understood
- Indigenous plant utilization of site is unknown

### **3.1.6 Alien vegetation**

Status quo:

- Almost without exception, the avens, sinkholes, pits and excavated areas are thickly choked with alien species. The open grassland is not good tree habitat because of frequent fires which destroys young saplings when they are still tender, and heavy winter frosts and cold winds which kill young plants. The fire and frost-protected habitat within sinkholes and at the entrances to avens and caves allows trees to grow, the commonest of the large trees being the white stinkwood, *Celtis africana*. However, this same habitat is favoured by alien invasive species and in particular, *Pyracantha*, the fire-thorn. It is a declared invader, with a 'transformer' invasive status. This plant has robust stiff spiny stems and branches and forms impenetrable thickets. This prevents access and impedes visibility. Clearance and prevention of re-infestation is a long-term management challenge. The seeds are poisonous to humans, and the pricks from the spines cause an irritating burning sensation, hence the name 'fire-thorn'.
- There are numerous other declared weeds and invasive species but at the time of reporting, no list of species has yet been drawn up, either for this or any other of the COH WHS.

- Infestations have not been plotted and mapped, nor have they been prioritized for clearance. Clearance is a landowner responsibility.
- At the time of reporting, no wider plan to contain or eradicate invasive species from the COH WHS has yet been devised
- GDACE is available for technical advice on clearance of invasive species

Risks and threats:

- Continued levels of invasive aliens, re-infestation on uncontrollable or difficult to control infestation levels

### **3.1.7 Visual aesthetics, site context**

Status quo:

- The site is pleasantly situated on an undeveloped grassy slope which offers good views down the Blaauwbank river valley and eastwards towards Swartkrans and Sterkfontein. The viewshed is highly sensitive to visual impact because subdivision of the surrounding properties has meant that many landowners are building country homes and fencing their properties and planting exotic trees as windbreaks and privacy screens. These impact on the visual integrity of the site.
- The COH WHS MA scrutinizes and monitors all new development in the cradle in the attempt to curb inappropriate development and visually intrusive structures without encroaching on the landowners' rights. However, this is an ongoing battle as relentless development mushrooms and infill buildings increase each year.
- There are no derelict structures or redundant infrastructure which require removal from the Klinkert's site

Risks and threats:

- Impairment of sense of place, impacts on visual integrity

## **3.2 Physical Environment: Subterranean**

Status quo:

- There are several subterranean caves but these are only frequented by the caving fraternity at this stage. The caves *per se* are not of interest to the researchers at present
- There are no excavations in subterranean situations at present
- Cave environments are not being disturbed by researchers and there are no impacts from this quarter
- Site safety of the subterranean environments is not a management issue at present

Risks and threats:

- None at present

## **3.3 Infrastructure**

### **3.3.1 Access roads, culverts, bridges, etc.**

Status quo:

- There is no direct access road. The public gravel road is not problematic

Risks and threats:







See 3.1.1

### **3.3.2 Fencing and gates**

Status quo:

- The fossil site property is not adequately fenced and unauthorized access is possible and in fact takes place as attested by well-marked footpaths over parts of the site
- There is no gate or boom
- The fossil sites themselves are not fenced but are not attractive to local passers-by
- The sites are open to all who chose to come that way
- There are no close neighbours who could provide an element of surveillance
- A perimeter fence around the fossil sites would have to enclose all 30-plus hectares, a length of some 2 375 metres – over 2 kilometres of fencing.

Risks and threats:

- open access means that scavenging or fossils is a possibility but this does not seem to be a threat at present

### **3.3.3 Parking**

Status quo:

- Site visitors park on the gravel road providing access to the adjacent properties and walk two kilometers to the fossil sites.
- Researchers vehicles are at risk to theft and tampering while parked unattended

Risks and threats:

- Thefts of vehicles or their contents whilst researchers are two kilometers away out of sight

### **3.3.4 Built environment**

Status quo:

There is no infrastructure and no built environment at Klinkert's

#### ***Sheds and storage***

None

#### ***Accommodation***

None

#### ***Pathways, walkways and viewing platforms***

None

#### ***Tourist-related, including signage***

None

#### ***Ablutions and storage***

None

Risks and threats:

- None at present

### 3.3.5 Waste Management

Status quo:

#### **Sewage**

There is no toilet

#### **Litter**

The researchers have to carry everything in and out.

Risks and threats:

- Site pollution if the site is going to be regularly scientifically explored, depending on the number of users. The lack of a toilet means that site users are obliged to use the veld as a toilet

### 3.3.6 Energy

Status quo:

None

### 3.3.7 Water

Status quo:

None

### 3.3.8 Telecommunications

Cellular phone reception is good. There is a repeater tower a few hundred metres away

## 3.4 Research Environment

### 3.4.1 Previous and ongoing research and excavations

Status quo:

The history of scientific interest in the Bolt's Farm sites is complex. From the time of the first recognition and collection of fossils by broom (between 1936 and 1951) there have been four periods of scientific enthusiasm.

#### **1) The Broom period (between 1936 and 1951)**

As early as 1936, the year that he discovered *Australopithecus* from Sterkfontein, Broom collected fossils from an area referred to as 'Bolt's Farm' – which as has been pointed out, comprises some 25 or 26 fossiliferous pits. Several Holotypes have been described from Bolt's including a sabre-toothed cat, an Elephant shrew, a number of beautiful suids including an almost intact cranium

**2) The California African Expedition 1947-1948**

This expedition created much of the knowledge we have about the Bolt's Farm Sites as a whole. The expedition was led by Dr C Camp who undertook collection of fossils from each of the many fossiliferous localities at Bolt's Farm. The majority of fossils collected are unfortunately still in the United States. Several pieces were subsequently donated to the Transvaal Museum but these represent only a small part of the collection that was made at the time. Collection records were detailed and enabled Dr H B S Cooke to publish a map (Cooke 1991) showing all the sites of Bolt's farm as well as the contents of each pit (See Table, Introduction). Cooke described carnivores, proboscideans, suids, antelopes and completed the Freedman (1957, 1965) studies of the Primates.

**3) The Vrba period of the 1980's**

Dr U Ripamonte of the University of the Witwatersrand collected fossils from the Main Quarry of Bolt's farm. There were studied by E Vrba and her team but there are no publications concerning the material studied. The whereabouts of the material is unknown to the present author, but enquiries are being made

**4) The Palaeontology Expedition to South Africa (PESA)**

Between 1996 and 1999, some fieldwork and collecting was undertaken at Bolt's Farm. Waypoint 160 was discovered by B Senut, M Pickford and J Michaux. Between 1997 and 1999, F Senegas and A Keyser collected blocks from Waypoint 160 and Bridge Cave (Pit 7). The results of the microfaunal study from Waypoint 160 indicates that to date, it is the oldest of all the sites in the COH. *Boltimys*, a rodent, has affinities with Langebaanweg rodents dated 4.5 million years.

**5) The new excavations**

Dr Francis Thackeray has submitted a permit to continue with the work on Bolt's farm, focusing mainly on Klinkert's sites such as Waypoint 160, Bridge Cave, Baboon Cave and Femur Dump.

**Risks and threats:**

- Lack of funding inhibits research and site potential remains locked
- Lack of dedicated heritage officer in Management Authority prevents follow-through after site inspections and management issues remain unattended – a problem generic to all the fossil sites in the COH WHS.



*Fig 6: A typical fossiliferous Dump at Klinkert's'. It is from situation such as this one that most of the fossil material recovered so far has been obtained*

### **3.4.2 Excavation edges**

Status quo:

- This management concern is not applicable at present. There are no active excavations on site

### **3.4.3 Excavation walls**

Ditto

### **3.4.4 Access to excavations: steps, ladders, etc.**

Ditto

### **3.4.5 Erosion**

Ditto

### **3.4.6 Compliance with conditions of excavation permit**

Status quo:

Although a permit has been applied for, there is no open permit on this site at the present time. When permitted scientists are active, a large number of aspects of research activities are inspected by SAHRA for compliance. These are detailed in the Generic Management Plan.

### **3.4.7 Witness sections**

Status quo;

- There have been no excavations at this site of the type that would expose witness sections. Most of the material collected has come from *ex situ* dumped material abandoned by lime workers long ago.

### **3.4.8 Dumps**

Satus quo:

- There are very many dumps at this site, many of them fossiliferous.
- Most of the Dumps have names and some are adjacent to named pits, which were probably their source. Much work still needs to be done matching dumps to in situ source breccia
- All of the dumps and pits are committed to plan, all have co-ordinates.
- A great deal of matching needs to be done, attempting to ascertain which dump yielded which of the early specimens collected. This emphasizes the need for considered preparation of fossil material so that there is always some of the adherent matrix retained. This will enable future matching to residual breccias that are in situ, when advanced trace element and micro-analytical techniques become available

Risks and threats;

- Loss of information concerning provenance and contents of dumps if they are not recorded.

### **3.4.9 Repository**

- The repository of the material collected hitherto is mainly the University of California and the Transvaal Museum. The material collected by U. Ripamonte is being traced.

Risks and threats:

- Off-shore type specimens makes local research difficult (Types at the University of California)
- Long-term security of artefacts and fossils collected

## **3.5 Site safety and security**

Site Safety and security needs to be considered from a number of perspectives: Firstly, the physical stability of the valuable site fabric itself, and then from the perspective that site stability (or instability) impacts on the safety of researchers and those visiting the site. The safety of surface features, infrastructure and the special safety risks of subterranean environments all need special consideration.

Site Stability is affected by two different threat sources: Firstly, by natural causes which include the ongoing weathering and decalcifying processes, and secondly from man-made influences such as the alteration of surface drainage and poor excavation techniques, or by mining activities which create unstable voids, and blasting, which shatters rock and created fractures. However, it is only by the inherently destructive twin processes of mining and excavation that site significance was or can be realised.

Site security refers to man-made threats to personal and property safety, such as crime.

### **3.5.1 Physical safety**

Ever since the attack and assault of an excavator at Swartkrans nearby, personal safety cannot be taken for granted and surveillance is necessary. There are, however, no management steps that can be taken to prevent crime on this site.

### **3.5.2 Safety of surface and built environment**

Not a management issue at present

### **3.5.3 Safety of excavation area**

Not a management issue at present

### **3.5.4 Subterranean safety**

Not a management issue at present.

## **3.6 Presentation of site values**

The presentation of site values to a wider public and the organization of educational programmes is a requirement of the WHC. Giving heritage a meaning in the lives of the general population and resident communities is a requirement of the NHRA.

### **3.6.1 Site interpretation**

Status quo:

- The site is not open to the general public
- As one of the more difficult sites to access and one of the less attractive, Bolt's Farm Klinkert's is little used by persons operating educational tours
- There is no site interpretation either on site or off. The fact that Bolt's Farm Klinkert's is almost 4.5 million years old – almost twice as old as parts of Sterkfontein, is a little known fact.

Risks and threats:

- Lack of presentation of site values to a wider audience prevents information concerning site significance from reaching public psyche
- Public not educated about full range of COH WHS values

### **3.6.2 Visitor numbers**

Status quo:

- There is no regular mechanism for recording and reporting visitor numbers as yet

Risks and threats:

- None at present as official visitation is extremely low

## **4 MANAGEMENT OBJECTIVES, DESIRED OUTCOMES**

This section notes desired states and management outcomes, and the section and Table that follow (Section 5) describe the management strategies required to achieve such outcomes. The management objectives have the preservation all site values as a goal.

#### **4.1 Physical environment, surface**

Management objectives and desired outcomes include:

*Access:*

- To take steps to ensure that continued access to this site is possible in the event of the Goldsmith's site being sold and fenced. This includes investigation of alternative routes in via portion 9 (the Quarry) or via 'Greensleeves'

*Rangeland:*

- To ensure that contextual veld conditions and rangeland in immediate vicinity of fossil site is maintained in as good a condition as possible.

*Erosion:*

- To ensure that the fossil site and its environs are free from active erosional problems and that existing areas of erosion are analysed, remedied, rehabilitated and monitored for follow-up action if necessary

*Fire management:*

- To ensure that a proper fire regime appropriate to Bankenveld is maintained on the fossil site.
- To ensure that fossil site users (when the site is active) are aware of fire hazards and can control on-site fires.
- To ensure that the fossil site and its environs do not constitute a fire hazard and that activities taking place there do not create fire hazards
- To ensure that the basic data necessary to assess the long-term impact of frequent fires is available, which information is necessary to feed back into appropriate fire management

*Biodiversity, rare plants and animals:*

- To ensure that a database of plant and animal species present on site is available, because biological values are as yet poorly understood
- To assess which of these are target species for use as food, medicines, economic reasons, etc., and to what extent they are being collected
- To identify, record and map special species in order to ensure their protection

*Alien vegetation:*

- Desired outcome is a fossil site which is free from alien invasive species, and, as far as possible, from weeds that are troublesome.

*Visual aesthetics:*

- Desired outcome is protection of viewshed and contextual environment, which includes protection of existing trees, and screening of unsightly elements.

#### **4.2 Physical environment, subterranean**

There are no desired outcomes in this management area at present

#### **4.3 Infrastructure, built environment**

There are no desired outcomes in this management area at present

#### **4.4 Research environment**

Desired outcomes include the following:

- To ensure that lack of funding does not inhibit research opportunities and prevent site potential from being realised
- To ensure that the Management Authority has in-house heritage expertise which allows for the follow-up of fossil site inspection observations and recommendations
- To ensure that all dumps, old and new, are committed to plan, with appropriate annotations
- To ensure that a site plan which shows the main site features, pits, caves, sinkholes, kilns, breccia dumps etc. and the heritage boundary is drawn up.

#### **4.5 Site safety and security**

- Desired outcomes include the provision of safety interventions recommended by the professional site safety officer after inspection of the surface and subterranean environment has taken place to ensure safe working and visiting conditions

#### **4.6 Presentation of site values**

Desired outcomes include:

- To ensure that the many heritage and natural values of the site are interpreted and made available to as wide a public as possible
- The appropriateness of erecting a site plaque requires further debate

### **5 MANAGEMENT AND MONITORING TASKS**

The following are operational management tasks and issues that need to be addressed now or in the future as part of on-going management actions. Their funding is still problematic.

The development of research at the fossil sites has been limited by the unfortunate perceptions that the State may not fund development on privately owned property and that the scientists are 'site-users'. This needs to change as it must be seen as the responsibility of the authorities to foster research and necessary associated development on these sites. It is recommended that in future, scientists be viewed rather as 'value adders' and thus eligible for some easement for the funding of heritage site management interventions which they are currently expected to fund, for example, fencing. In effect, the state has been expecting others to finance the protection of the COH WHS fossil sites.

Sites which have no active scientist are generally neglected – this is an indication of the positive influence which scientists have on fossil sites.

The following table has been drawn up with the specific aim of clarifying who should do what, and when, on the heritage site. The Table also provides some indication of priority ratings. It has been constructed in such a way as to incorporate all the key management issues, strategies and monitoring criteria so that it may be used independently of the text.

The relative priority of the management measures has been identified based on ICCROM definitions as follows:

- Immediate – to be attended to urgently as it constitutes a danger to the public or a resource;

Deleted: -



- Urgent - to be attended to urgently to protect the resource;
- Necessary - to be attended to, to protect the resource;
- Desirable to be attended to from a development perspective;
- Keep watch - to be monitored to see if the problem is serious.

**TABLE 1 FOLLOWS:  
MANAGEMENT MEASURES AND MONITORING CRITERIA**

**6 TABLE 1 MANAGEMENT AND MONITORING TASKS FOR THE BOLT'S FARM 'KLINERTS' FOSSIL SITE**

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
<b>Surface environment</b>						
Access - legal access to property	<ul style="list-style-type: none"> <li>• Pedestrian access is a sensitive issue, particularly from the north</li> <li>• Poultry enterprize is vulnerable to diseases transmitted by humans</li> <li>• Adjacent landowners are particular about access ('Greensleeves' owner does not want people to access Klinkert's via his property)</li> <li>• Access via Goldsmith's may become impossible if the property is sold</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Maintenance of cordial relations with landowner regarding access (*)</b></li> <li>• Ensure that properly negotiated preferably written letters of permission are obtained by all site users or permit holders for both Klinkert's and Goldsmith's (condition of SAHRA permit)</li> <li>• Management Authority to attempt to obtain guaranteed right of access to Klinkert's via Goldsmith's</li> <li>• Management Authority to investigate alternative access routes via Quarry or 'Greensleeves'</li> <li>• Investigate the possibility of acquiring the 30 ha of land – Comment please</li> </ul>	Necessary	All site users, COH WHS MA	<ul style="list-style-type: none"> <li>• Check if access issue has been addressed in MOU's between landowner and research scientists</li> <li>• Check if tour operator and tourist guides have same permissions</li> <li>• Ensure that site users have permissions from both landowners involved</li> </ul>	Ongoing
Unauthorised access	<ul style="list-style-type: none"> <li>• Removal of rock, fossils breccia and artefacts</li> <li>• Removal of edible and medicinal plants</li> <li>• Theft of moveable property (when researchers are working on site)</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Access to fossil sites controlled (*)</b></li> <li>• Landowner to maintain surveillance</li> <li>• Research and field staff to maintain surveillance</li> </ul>	Desirable	Permitted scientists, field staff, landowner	<ul style="list-style-type: none"> <li>• Check stockpiled breccia</li> <li>• Check for signs of digging out of plants</li> <li>• Maintain surveillance over moveable property</li> </ul>	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Rangeland condition	<ul style="list-style-type: none"> <li>Deterioration of rangeland due to overstocking, trampling or too frequent fires</li> </ul>	<ul style="list-style-type: none"> <li><b>Rangeland in optimum condition (*)</b></li> <li>GDACE can advise</li> <li>Plan for acquiring baseline data against which impacts can be assessed</li> <li>Plant species list required noting edible, medicinal, toxic and economically significant species</li> </ul>	Desirable	Landowner, GDACE (for species lists)	<ul style="list-style-type: none"> <li>Check for trampled bare areas</li> <li>Check for loss of palatable grasses and forbs</li> <li>Check for increase in unpalatable species, especially 'hard' grasses like steekgras, <i>Aristida canescens</i></li> <li>Check for encroachment by <i>Aloe greatheadii</i> var. <i>dayana</i></li> <li>Check for bush encroachment</li> </ul>	Ongoing
Retention of topsoil, surface drainage, surface erosion	<ul style="list-style-type: none"> <li>Loss and dispersal of topsoil makes re-vegetation difficult</li> </ul>	<ul style="list-style-type: none"> <li><b>Fossil site free of erosion (*)</b></li> <li>Check all tracks and pathways for erosion</li> <li>Check for surface drainage and distribution of runoff over surface</li> <li>Check for signs of surface erosion</li> <li>Implement erosion control ass suggested in generic management plan operational guidelines</li> </ul>	Necessary	Research scientists (within research area)	<ul style="list-style-type: none"> <li>Check for erosion gulleys in tracks and pathways</li> <li>Check for patches of exposed soil</li> </ul>	Ongoing
Fire Management	<ul style="list-style-type: none"> <li>Too frequent fires have a negative effect on vegetation</li> <li>Blackened areas are unsightly.</li> <li>Fire is a threat to moveable property</li> </ul>	<ul style="list-style-type: none"> <li><b>Proper fire regime for Bankenveld maintained, site free from fire hazards (*)</b></li> <li>Implement a fire management policy which includes firebreaks</li> <li>Record fire frequency and intensity</li> <li>Take precautionary measures to contain domestic fires started on site</li> <li>Brief residents on what to do in such a situation</li> <li>Ensure that suitable beaters for research staff and farm workers are available</li> </ul>	Desirable	Landowner, GDACE	<ul style="list-style-type: none"> <li>Set up rangeland study for base data against which fire impact can be assessed</li> <li>Set up a fire frequency recording programme</li> <li>Check firebreaks</li> <li>Ensure that beaters are always on hand</li> </ul>	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Red data species, rare and economically significant plants	<ul style="list-style-type: none"> <li>Loss of edible and medicinal plants, and botanical information.</li> <li>Many important plant species are not on RED DATA list.</li> </ul>	<ul style="list-style-type: none"> <li><b>Preservation of biodiversity (*)</b></li> <li>Surveillance of indigenous plant use</li> <li>Draw up a species list of medicinal, poisonous, edible and economically significant species</li> <li>Map occurrence and preferred microhabitats</li> <li>Monitor collection and utilization</li> </ul>	Desirable	Landowner, research scientists (in work environment)' GDACE	<ul style="list-style-type: none"> <li>Check for signs of digging geophytes out by the roots</li> <li>Check local roadside vendors for plants on sale</li> </ul>	Ongoing
Invasive alien plant species.	<ul style="list-style-type: none"> <li>Invasion of avens and other habitats by alien species</li> <li>Loss of biodiversity</li> <li>Unattractive landscape</li> <li>Inaccessible breccias</li> <li>Obscure deposits and makes them difficult to assess</li> </ul>	<ul style="list-style-type: none"> <li><b>Fossil site free of invasive alien species (*)</b></li> <li>Make a list of all invasive plant species</li> <li>Map and prioritise infestations</li> <li>Determine best eradication or control programme. GDACE available for assistance</li> <li>Assess costs and find budget</li> <li>Begin control according to guideline provided in generic management plan</li> <li>Enlist expertise of GDACE</li> <li>Implement control and clearance programme</li> <li>Monitor and follow up as required</li> </ul>	Desirable	Landowner, research scientists (in excavation environment)	<ul style="list-style-type: none"> <li>Visual checks for infestations and incidence density</li> <li>Monitor with fixed point photography</li> </ul>	Ongoing
Weeds & shrub growth in excavation site	<ul style="list-style-type: none"> <li>Roots destabilize breccias in time</li> <li>Plants reduce visibility of noteworthy sections</li> <li>Weeds give a negative visual experience and project an air of dereliction</li> </ul>	<ul style="list-style-type: none"> <li><b>Weed-free fossil site or site in which weeds are not problematic (*)</b></li> <li>Pull weeds by hand, or 'skoffel'</li> <li>Destroy in a manner that does not spread seed further</li> </ul>	Desirable	Landowner, research scientists (in excavation environment)	<ul style="list-style-type: none"> <li>Visual checks for weed infestations</li> <li>Fixed point photography for controls</li> </ul>	Ongoing

<b>Issues</b>	<b>Threats or Risks</b>	<b>Desired outcomes (*) and Management Measures</b>	<b>Priority</b>	<b>Responsibility</b>	<b>Monitoring Criteria</b>	<b>Monitoring frequency</b>
Development in 'viewshed'	<ul style="list-style-type: none"> <li>Negative visual impact</li> </ul>	<ul style="list-style-type: none"> <li>Preservation of sense of place and natural qualities of viewshed (*)</li> <li>COH WHS to monitor all new development plans</li> </ul>	Desirable	COH WHS MA	<ul style="list-style-type: none"> <li>Check new development plans for visual impact on viewshed of site</li> </ul>	Ongoing
Habitat protection: Removal of stromatolites.	<ul style="list-style-type: none"> <li>Loss of Heritage material and site significance.</li> <li>Loss of micro-habitats (mosaic of sunny and shady areas).</li> </ul>	<ul style="list-style-type: none"> <li>Preservation of <i>Pelindaba stone, stromatolites and associated microhabitats</i></li> <li>Landowner, Research scientists and field staff to maintain surveillance</li> <li>Heritage Monitors to be alerted</li> </ul>	Desirable	Landowner, permitted scientists, field staff, Heritage Inspectors	<ul style="list-style-type: none"> <li>Check for signs of disturbed soil, exposed patches of soil, overturned and disturbed rock</li> </ul>	Ongoing
<b>SUBTERRANEAN ENVIRONMENT</b>						
Presence of breeding colonies of bats	<ul style="list-style-type: none"> <li>Loss of colony – sensitive to human interference</li> <li>Species involved (<i>Miniopterus natalensis</i>) is declining in numbers</li> </ul>	<ul style="list-style-type: none"> <li>Preservation of breeding colonies of <i>Miniopterus</i> (*)</li> <li>Take care when extending excavations into cave and aven entrances to underground systems</li> <li>Ensure that excavation only takes place when risk of disturbing breeding season is low</li> <li>Ensure that bats have free access into and out of caves and avens</li> <li>GDACE can offer advice</li> </ul>	Future concern	Research scientists, GDACE to monitor. Future concern	<ul style="list-style-type: none"> <li>GDACE to establish monitoring criteria for breeding colony</li> <li>Check for presence and numbers of bats</li> <li>Check that bat entrance and egress is unimpeded</li> <li>Check for noxious fumes (e.g. from generator) which could be drawn into cave</li> </ul>	Future concern, breeding season
Porcupine lairs and owl roosts	<ul style="list-style-type: none"> <li>Disturbance and displacement of animals</li> <li>Porcupine lairs and owl roosts are important as modern analogues for taphonomic processes of the past</li> </ul>	<ul style="list-style-type: none"> <li>Preservation of porcupine lairs and owl roosts for actualistic studies (*)</li> <li>Protect any porcupine lairs and roosts on site</li> <li>Encourage that their behavior and lair contents are studied without disturbing animals</li> </ul>	Desirable	All site users	<ul style="list-style-type: none"> <li>Check that porcupine lairs remain active – note presence of quills, droppings, gnawed bones</li> </ul>	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
<b>INFRASTRUCTURE</b>						
Toilets, ablution	<ul style="list-style-type: none"> <li>Lack of toilet is a problem to research scientists</li> <li>Toilet almost impossible to install, or even to bring a portaloos onto site</li> </ul>	<ul style="list-style-type: none"> <li><b>Site free from pollution, best practice (*)</b></li> <li>VIP or Environloo to be installed in time,</li> <li>Management is required to ensure that this would not burn down in frequent fires</li> </ul>	Necessary, when excavation and collections start	Researcher, (for excavators) and research staff	<ul style="list-style-type: none"> <li>Check type of toilet installed</li> <li>Check efficacy, odours, flies</li> </ul>	Ongoing
Waste management and disposal	<ul style="list-style-type: none"> <li>Litter</li> <li>Cattle and wild animals die from ingesting plastic bags</li> </ul>	<ul style="list-style-type: none"> <li><b>Site free from litter (*)</b></li> <li>Provide litter bins or holders</li> <li>Collect and remove all litter regularly</li> <li>Best practice would require sorting and recycling litter</li> </ul>	necessary	All site users	<ul style="list-style-type: none"> <li>Check for left litter</li> <li>Check that litter bins have been installed</li> <li>Check removal schedule</li> <li>Check that litter stored on site cannot be wind distributed</li> <li>Encourage recycling</li> </ul>	Ongoing
Site plaque recognizing World Heritage Site status and National Heritage Site Status	<ul style="list-style-type: none"> <li>Required in terms of the WHC Act and NHRA</li> <li>Enhances site status</li> <li>Interrogate whether or not this particular site would benefit from such a plaque</li> </ul>	<ul style="list-style-type: none"> <li><b>Site plaque appropriately installed (*)</b></li> <li>Interrogate the need for such a plaque at this site, if yes, then</li> <li>Select appropriate position, agreed by researchers and landowner</li> <li>Ensure wording appropriate and agreed, checked by SAHRA</li> <li>Ensure that both SAHRA and WHS logos appear</li> <li>Acquire budget</li> <li>SAHRA to install</li> </ul>	Desirable?	SAHRA	<ul style="list-style-type: none"> <li>Check plaque condition and safety (brass plaques liable to theft)</li> </ul>	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Signage: adequacy	<ul style="list-style-type: none"> <li>Poor tourist/visitor experience if site not adequately interpreted</li> </ul>	<ul style="list-style-type: none"> <li><b>Appropriate site interpretative signage (*)</b></li> <li>Site not open to general public, specialist tour operator and permitted scientist provide site interpretation</li> </ul>	Future concern	Researchers	<ul style="list-style-type: none"> <li>Check quality of signage</li> <li>Check quality of site interpretation</li> </ul>	Future concern
Visitor impacts	<ul style="list-style-type: none"> <li>Littering</li> <li>Pollution</li> <li>Erosion of pathways</li> <li>Disturbance of excavations</li> <li>Theft of fossils</li> <li>Graffiti</li> </ul>	<ul style="list-style-type: none"> <li><b>Mitigation or elimination of visitor impacts (future)</b></li> <li>These potential impacts are not pertinent to Klinkert's at the present time</li> <li>Toilet facilities are non-existent</li> </ul>	Future concern	Researchers, tour operator	<ul style="list-style-type: none"> <li>Check for littering</li> <li>Check for pollution of site</li> <li>Check all walkways for wear and tear</li> <li>Check for visitor disturbance of excavations or equipment</li> <li>Check for tampering with and removal of stored fossils</li> <li>Check for graffiti</li> </ul>	Future concern
Infrastructure : water	<ul style="list-style-type: none"> <li>All has to be carried in by hand</li> <li>Inadequate water supply inhibits excavation</li> <li>Water needed for drinking and ablutions</li> <li>Water needed to control dust</li> </ul>	<ul style="list-style-type: none"> <li><b>Provision of sufficient water to enable research (*)</b></li> <li>It is extremely difficult to solve the water problem on this site, or to recommend a management strategy</li> </ul>	Necessary	Researchers	<ul style="list-style-type: none"> <li>None at present</li> </ul>	Future concern
<b>RESEARCH ENVIRONMENT: Many issues not pertinent at present – check Generic Issues for other research-related items requiring management</b>						
Compliance with terms and conditions of permit	<ul style="list-style-type: none"> <li>Loss of information and site significance</li> </ul>	<ul style="list-style-type: none"> <li><b>Excavations in accord with ROD of permit (*)</b></li> <li>Check all terms and conditions written into the permit ROD, when excavations are resumed</li> </ul>	Necessary, when excavation are resumed	SAHRA, researchers	Check all terms and conditions written into the permit such as:	At each site inspection

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Witness sections	<ul style="list-style-type: none"> <li>• Loss of information and site significance</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Defined and stabilized witness sections, where relevant (*)</b></li> <li>• Ensure that selection of appropriate witness sections are a requirement in terms of the permit</li> <li>• Ensure that the researcher provides adequate criteria for the election of witness sections</li> <li>• Ensure that all significant features are covered by on included in witness sections proposed</li> <li>• Ensure that witness sections are not prone to collapse and that they are stabilized on closure of excavation</li> <li>• Ensure that witness section is committed to plan</li> </ul>	<p>Necessary, when excavation are resumed unless collection of material is all that is being done</p>	<p>Researcher, SAHRA</p>	<ul style="list-style-type: none"> <li>• Check that a witness section has been defined in all excavations into <i>in situ</i> deposit</li> </ul>	<p>Future concern</p>



Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Dumps	<ul style="list-style-type: none"> <li>Mixing of old and new dumps so that contents are unknown</li> <li>Loss of information concerning source and contents of dumped material (NB)</li> <li>Footprint site of dumps not checked for significant plants</li> <li>Position unacceptable to landowner</li> <li>Position obscures significant part of deposit</li> <li>Dump built over cave infill</li> <li>No proper toe to dump or careless containment</li> <li>Dump is cascading due to incorrect angle of repose</li> <li>Dump origin not recorded</li> <li>Dump contents not recorded</li> <li>Duration of dump on site not recorded</li> <li>Dump built over or too close to drainage line</li> </ul>	<ul style="list-style-type: none"> <li>Mapped and recorded dumps, on site plan. Properly constructed dumps (*)</li> <li>SAHRA to request that the scientist explain how dumped material – whether sterile or fossiliferous and 'in transit' – is to be managed. This dump management plan to become part of permitting requirement</li> </ul>	Future concern	SAHRA, researchers	<ul style="list-style-type: none"> <li>Check placement of dump on landscape</li> <li>Ensure that positioning is acceptable to landowner</li> <li>Check planned position and ultimate size for possible problems with visibility of significant site features</li> <li>Check to ensure dump is not planned to be situated over cave fill</li> <li>Check that dump has containment toe</li> <li>Check footprint area in relation to planned height – cascading must not happen</li> <li>Check that source of material is recorded</li> <li>Check that contents of dump are recorded</li> <li>Check that dump does not slump or erode into drainage line</li> <li>Check that all dumps are recorded and annotated on a plan of the site</li> <li>Monitor all the products of excavation, their recording (3D) and storage</li> </ul>	Future concern

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Sieved residues, sterile	<ul style="list-style-type: none"> <li>• Could be placed where they will inconvenience landowner</li> <li>• Placed where they will constitute a visual impediment</li> <li>• Built in such a way that they will erode or become unstable</li> <li>• See points recorded for dumps above</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Appropriate disposal of sieved waste (*)</b></li> <li>• Could be used for pathway and erosion repair if really sterile and in places suited to nature of sieved waste residues</li> <li>• Sieved material EIA to become part of permit application – see recommendation regarding dumps above</li> </ul>	Future concern	SAHRA, researchers	<ul style="list-style-type: none"> <li>• Check location of sieved waste material</li> <li>• Check for stability and erosion</li> <li>• Apply same monitoring criteria as noted for dumped breccia above</li> </ul>	Future concerning
Security of breccia piles	<ul style="list-style-type: none"> <li>• Exposed fossiliferous breccia is at risk to scavenging by souvenir hunters, many small pieces lying about</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Fossils safe from theft and tampering (*)</b></li> <li>• Portable blocks should be removed to safety</li> <li>• Tourist groups should not free-range: provide site guide</li> <li>• Keep groups to a size than can be properly supervised</li> <li>• Importance of every fossil should be taught – signage that outlines appropriate behaviour</li> <li>• Control access to excavation area strictly</li> </ul>	Future concern	Researchers, SAHRA	<ul style="list-style-type: none"> <li>• Monitor for security of fossiliferous breccia. Only non-portable blocks should be left in accessible places</li> <li>• Monitor site for vulnerable pieces and remove for safe keeping</li> </ul>	Future concern
Repository	<ul style="list-style-type: none"> <li>• Poor repository policies can result in information loss</li> <li>• Poor repository policy can result in problems of locating fossils</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Safe long-term conservation and curation of artefacts and fossils (*)</b></li> <li>• Monitor repositories according to 'Minimum Standards for Repositories' guideline as prepared by SAHRA</li> </ul>	necessary	SAHRA	<ul style="list-style-type: none"> <li>• Monitor repositories according to 'Minimum Standards for Repositories' guideline as prepared by SAHRA</li> </ul>	Ongoing
<b>Site safety, security and stability</b>						

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Signage, site safety and warnings	<ul style="list-style-type: none"> <li>Lack of appropriate signage can expose visitors to unexpected hazards, e.g. that there is a bees' nest</li> </ul>	<ul style="list-style-type: none"> <li><b>Compliance with Public Health and Safety requirements when this becomes necessary (*)</b></li> <li>Install appropriate behavior modifiers and site safety signage as and when this becomes necessary, or verbally caution site users</li> <li>Appropriate safety signage is a requirement of Public (Occupational) Health and Safety Act</li> </ul>	Future concern	Researchers, landowner, tour operators	<ul style="list-style-type: none"> <li>Check for installation and appropriate wording</li> <li>Check for appropriate location of signs, design and durability</li> </ul>	Future concern
Subterranean environments at Klinkert's pits and adjacent caves	<ul style="list-style-type: none"> <li>Instability due to previous mining activities and blasting</li> <li>Natural instability</li> </ul>	<ul style="list-style-type: none"> <li><b>Subterranean areas safe or off-limits (*)</b></li> <li>No-go areas for tourists; specialist caving groups only</li> <li>Not an issue at Klinkert's t present</li> </ul>	Future concern	Researchers, tour operators	<ul style="list-style-type: none"> <li>Check that no-go instruction is being obeyed</li> </ul>	Future concern
Bees, "Kransbye", Wasps	<ul style="list-style-type: none"> <li>The numerous cavities and hollows are home to several bee hives and wasps' nests. Many people are allergic to bee stings in particular.</li> </ul>	<ul style="list-style-type: none"> <li><b>Site safe for all site users (*)</b></li> <li>Ensure that the necessary antihistamines are on hand.</li> <li>Destroy or have hives removed if these are where people frequently work.</li> <li>Post warning signage or verbally caution</li> <li>Provide first aid post when site is active</li> </ul>	Future concern	Researcher, Tour Operator	<ul style="list-style-type: none"> <li>Monitoring should include checking the route for insect problems.</li> <li>Monitor speed at which an emergency case could reach appropriate medical help</li> <li>Check first aid provisions</li> </ul>	Future concern
Theft, crime	<ul style="list-style-type: none"> <li>The isolated situation makes the site particularly prone to petty theft of excavation and other equipment.</li> </ul>	<ul style="list-style-type: none"> <li><b>Site safe for all site users (*)</b></li> <li>Little can be done at this isolated site</li> </ul>	Future concern	Researchers, landowner, site residents	<ul style="list-style-type: none"> <li>Security checks</li> </ul>	Future concern

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
<b>GENERIC ISSUES RELATING TO FOSSIL SITE EXCAVATIONS: Not issues at Klinkert's at present but may be when excavations resume – see Generic Management Plan</b>						

## 7 BIBLIOGRAPHY

- Brain, C.K. 1981. *The hunters or the hunted? An introduction to African cave taphonomy*. Chicago: University of Chicago Press.
- Camp, C.L. 1948. University of California Expedition – Southern Section. *Science* 108:550-552.
- Cooke, H.B.S. 1985. *Ictonyx bolti*, a new mustelid from cave breccias at Bolt's Farm, Sterkfontein area, South Africa. *South African Journal of Science* 81:618-619.
- Cooke, H.B.S. 1991. *Dinofelis barlowi* (Mammalia, Carnivora, Felidae) cranial material from Bolt's Farm, collected by the University of California African Expedition. *Palaeontologia Africana* 28:9-21.
- Cooke, H.B.S. 1993a. Fossil proboscidean remains from Bolt's Farm and other Transvaal cave breccias. *Palaeontologia Africana* 30:25-34.
- Cooke, H.B.S. 1993b. Undescribed suid remains from Bolt's Farm and other Transvaal cave deposits. *Palaeontologia Africana* 30:7-23.
- Cooke, H.B.S. 1996. Sexual dimorphism in *Antidorcas recki* from Bolt's Farm, in the University of California collections. In: Stuart, K.M. & Seymour, K.L. (eds) *Palaeoecology and palaeoenvironments of Late Cenozoic mammals – tributes to the career of C.S. (Rufus) Churcher*. 537-553. Toronto: University of Toronto Press.
- Freedman, L. 1957. The fossil Cercopithecoidea of South Africa. *Annals of the Transvaal Museum* 23:122-262.
- Freedman, L. 1965. Fossil and subfossil primates from the limestone deposits at Taung, Bolt's Farm and Witkrans, South Africa. *Palaeontologia Africana* 9:19-48.
- Gommery, D., S n gas, F., Thackeray, J.F., Potze, S., Kgasi, L., Claude, J. and Lacruz, R. In press. 2008. Plio-Pleistocene fossils from Femur Dump, Bolt's Farm, Cradle of Humankind World Heritage Site. *Annals of the Transvaal Museum*.
- Mogg, A.O.D. (1975) Important Plants of Sterkfontein. Witwatersrand University press, Johannesburg. pp1 - 179
- S n gas, F. & Avery, M. 1998. New evidence for the murine origins of the Otomyinae (Mammalia, Rodentia) and the age of Bolt's Farm (South Africa). *South African Journal of Science* 94:503-507.
- S n gas, F. & Michaux, J. 2000. *Boltimys broomi* gen. nov., sp. nov. (Rodentia, Mammalia), nouveau Muridae d'affinit  incertaine du Plioc ne inf rieur d'Afrique du Sud. *Comptes Rendus de l'Acad mie des Sciences de Paris* 330:521-525.
- S n gas, F., Thackeray, J.F., Gommery, D. & Braga, J. 2002. Palaeontological sites on 'Bolt's Farm', Sterkfontein Valley, South Africa. *Annals of the Transvaal Museum* 39:65-  
Thackeray, J.F., Gommery, D., S n gas, Potze, S., Kgasi, L., McCrae, C., and Prat, S. In press (2008). A survey of past and present work on Plio-Pleistocene deposits from Bolt's Farm, Cradle of Humankind, South Africa. *Annals of the Transvaal Museum*