

REVISED UPDATED SITE MANAGEMENT PLAN FOR PLOVER'S LAKE FOR PERIOD 2009 – 2013

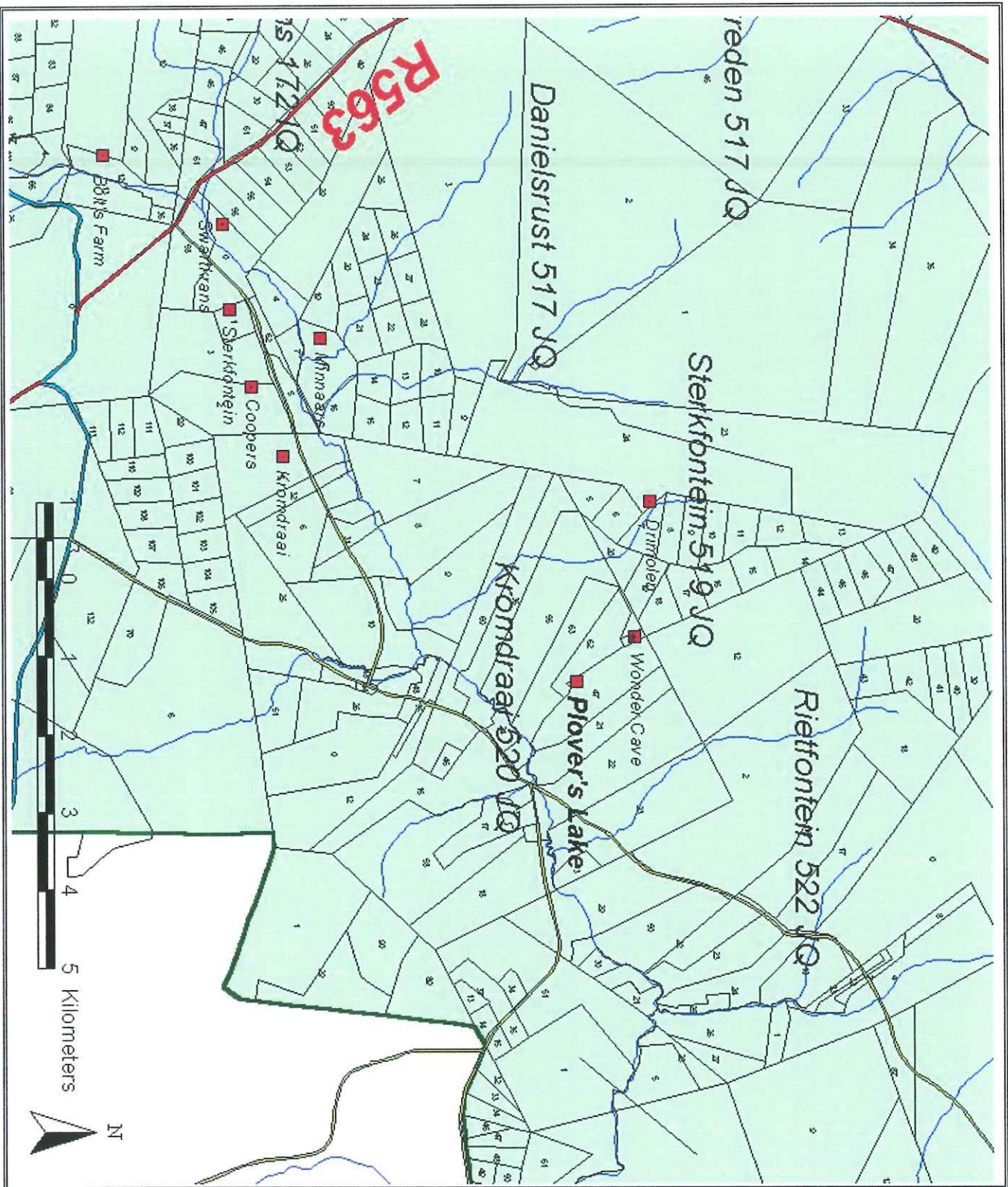
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SUMMARY OF KEY ISSUES

- Records pertaining to this site indicate that it has an additional legal protection in the form of declaration as a Natural Heritage Site (M Read, 25 Aug 2002)
- The correct spelling of Plover's Lake (i.e. with the apostrophe, and not just 'Plovers') needs to be agreed and made the official spelling of the site name for consistent use in all documents
- The landowner is not in favour of the site being fenced and neither is this necessary as access is adequately controlled
- No general tourism is envisaged: the many educational values of the property are available to special visitors who are always accompanied, usually by the landowner or one of his immediate family. No free-range public tourism is allowed.
- Plover's Lake is one of only a few fossil sites which is open by special request, and there are only two other sites which are available to the general public (Sterkfontein and Wonder Cave).
- Excavation at the site was closed in 2005 at the request of the landowner
- At this time, in response to the permit application to close excavations by the permit holder, it was requested by SAHRA (letter of 4 Oct 2005) that 'proper army bags sewed into geotextile sausages' be used to replace the temporary nylon/plastic woven grain bags filled with sand that were used. This was not done, and the temporary bags were trampled by people and animals, ripped by warthogs or simply disintegrated.
- Slit bags were finally emptied and removed by the landowner (2008, as reported at a meeting with the landowner on 20 November 2008, attended by P Mills of the Management Authority and J Maguire, a specialist service provider). It is not known which source of sediment had been used to fill the bags in the first place, and it should be noted that the contents of the bags, whatever their origin, is now mixed with *in situ* cave sediment.
- Redundant infrastructure (a reed shelter of sorts) erected by the scientific team was also not removed and the site was not rehabilitated. In the opinion of the landowner, the site was not professionally closed, and no closure report was received.
- The same letter (SAHRA 4/10/05) requested a ground plan of the heritage site with scientifically significant areas on it, locating the 6 surface and 5 subterranean deposits. This plan, if submitted, has not been made available to the present reviewer. An opportunity to discuss these issues at first-hand with the permitted scientist, landowner and SAHRA has thus far not been possible to arrange. A further update of information contained in this document may be necessary.
- The fossil site inspection team has not inspected all six surface and all five subterranean deposits in the presence of the previous permit holder and many aspects of this site are still unclear, including the source and future destiny of some of the breccia piles.
- It needs to be noted by management partners and permit holders that landowners need to be kept informed about discoveries made and publications resulting from the scientific exploration and sampling of the fossil sites that they own, both verbally and in writing.
- The environmental management of the site is regularly undertaken by the landowner, who manages rangeland (originally left overgrazed by a former landowner), erosion control, fire management (one in four year burn cycle), alien vegetation and weed control (pompon weed and *Mirabilis jalapa* problematic)
- The Plover's Lake site is highly significant and holds much scientific promise.



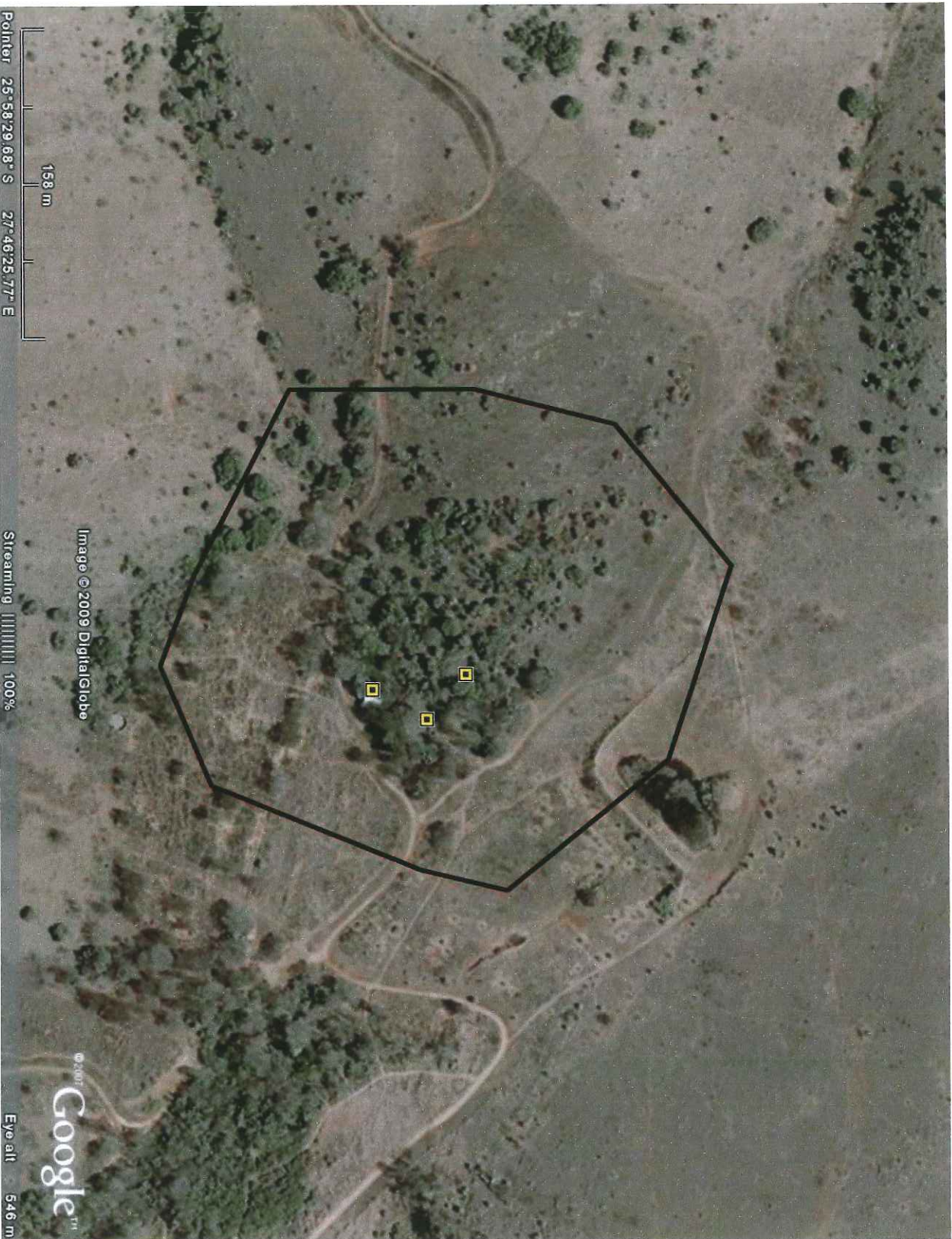
**PLOVER'S LAKE SITE
MANAGEMENT
PLAN**

Legend

- Fossil sites
- M Arterial Road
- M National Road
- M Secondary Road
- Farm boundaries
- ~ River
- World Heritage Site

**PLOVER'S
LAKE**

**Figure 1
Locality map**



**PLOVER'S LAKE SITE
MANAGEMENT
PLAN**

Legend

-  approximate position of site boundary
-  contours
-  palaeontological site

PLOVER'S LAKE

Figure 2
Aerial view
of site

Pointer 25°58'29.68" S 27°46'25.77" E

158 m

Image © 2009 DigitalGlobe

Streaming 100%

© 2007 Google™

Eye alt 646 m

SIDES metres	ANGLES OF DIRECTION	CO-ORDINATES			
		Y	System: WG.27	X	
		Constants	+0, 00	+2 800 000, 00	
A B	103, 43	290.01.10	A	-77 733, 62	+74 428, 16
B C	106, 56	322.56.20	B	-77 830, 80	+74 463, 57
C D	45, 05	16.17.40	C	-77 895, 02	+74 548, 60
D E	114, 03	23.54.00	D	-77 882, 38	+74 591, 84
E F	53, 85	44.58.10	E	-77 836, 18	+74 696, 09
F G	71, 59	92.53.00	F	-77 798, 12	+74 734, 19
G H	122, 32	132.03.10	G	-77 726, 62	+74 730, 59
H J	92, 50	181.41.20	H	-77 635, 80	+74 648, 66
J K	74, 93	195.48.00	J	-77 638, 52	+74 556, 20
K A	93, 33	233.10.10	K	-77 658, 92	+74 484, 10

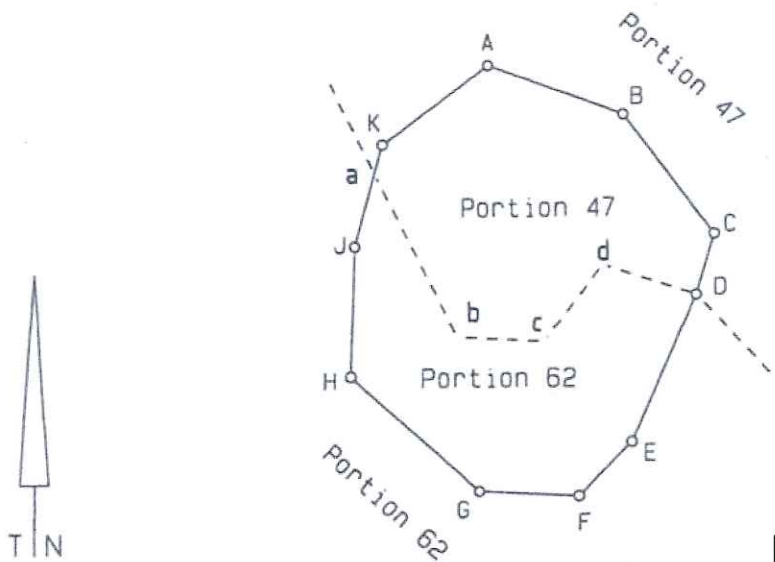
TRIGONOMETRICAL BEACONS			
STERKFONTEIN B	84 Δ	-75 558, 23	+74 089, 49
KRUG 117	412 Δ	-69 559, 89	+81 488, 68

SG No.
2300/2004

Approved
J.S. Weyers
J.S. WEYERS
for
SURVEYOR-
GENERAL
2004-04-16

BEACON DESCRIPTIONS
A, B, C, D, E, F, G, H, J, K .. 20mm iron peg

PLOVER'S LAKE PALAEOANTHROPOLOGICAL SITE



SCALE 1:5000

Figure 3
Proclamation
diagram

The figure A B C D E F G H J K A represents 5,7022 hectares of land being a declared area over Portion 47 and Portion 62

of the farm KROMDRAAI No. 520-JQ 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.

PTA
Registrar of deeds

The original diagrams are
No A528/1982, T29559/1982
Transfer and 12749/1995,
Grant T98242/1996
C.C.F.

File -/45
S.R. No. 922/2004
T.P.
Comp. JQSY - 44

1 INTRODUCTION

The Plover's Lake site is situated against the northern flank (south-facing) of the valley created by the Blaauwbank stream, some 6 km downstream from Swartkrans and Sterkfontein, and 2.4 km north of the Kromdraai store, part of which used to be the old Kromdraai Farm School, once attended by Gert Terblanche of *Paranthropus robustus* fame.

It is situated low down on the flank of a dolomite hillside, at the upper end of which, on top of the rising landform, is situated the Wonder Cave Fossil site - within an easy hiking distance (Figs. 1, 2).

1.1 Objectives

- To conserve the full range of natural and cultural heritage values, the site significance and authenticity of the Plover's Lake 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
- 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. Plover's Lake is excellently situated to demonstrate the Highveld rocky grassland habitat and biological interactions characteristic of this biome
- 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

- Consult 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
- Define desired states and management objectives
- 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

Site:	Plover's Lake
-------	---------------

Farm Name & No:	Portions 47 and 62 of Kromdraai 520 JQ (Figs 1 and 2)
Co-ordinates:	25 .58. 38 S 27 .46. 36 E, for site, for co-ordinates, see Fig 3
NHS Boundary	A polygon A,B,C,D,E,F,G,H,J,K representing 5.7022 ha marked with 20 mm iron pegs (Fig 3)
Area:	5,7022 ha
Owner:	Mr. Mark Read, Private Bag X5 Parklands 2121
Servitudes and restrictions:	Unknown
Access	By special arrangement only, special interest persons only
Contact details:	011 788 4805 011 914 6885 (F) 011 788 5914 Cell 083 3793797 E-mail: mark@everard.co.za
Contact person:	Mark or Christine Read
Permit Holder:	L. Berger – held last permit
Designated Repository:	Bernard Price Institute, University of the Witwatersrand
Legal Status:	Declared Natural Heritage Site (date?) World Heritage Site 1999 National Heritage Site, November 2004

1.4 Existing site management

Access to the site is controlled and is by appointment only. There is a security fence and a locked gate with a guard or estate manager at the Sterkfontein-Lanseria tar road (the D 540) and all visitors are required to arrange for access directly with the landowner. The landowner-scientist agreement, which will become necessary when excavations resume, normally stipulates types of vehicle, times of permitted entry and exit, numbers of visitors, and prior knowledge of visits. Management items connected with the landowner-scientist agreement have been detailed in the generic management plan.

The landowner's preference is for as natural an appearance possible and he is opposed to a perimeter fence (i.e., a fence erected on the gazetted heritage boundary around the site), which in his opinion, would detract from the natural landscape. Such fencing is unnecessary because the site is secure from unauthorized visitors.

Many management functions are provided by the landowner and his reserve manager, such as rangeland and erosion management, upkeep of access roads, culverts and drains, control of alien vegetation and weeds, game management and fire management (although Plover's Lake has been subject to several devastating fires in the past).

Plover's Lake is notably less infested with alien invasive species and weeds than many of the other fossil sites, although there are a few problem areas. Site inspections have revealed that control is taking place at appropriate times (before seeding) and that the landowner is well aware of the problem.

Visual impact is a potential issue at the Plover's Lake fossil site because it is situated in a basin with rising landforms all round, all with exposed ridgelines. Not all the area visible within this viewshed belongs to the landowner (for example Wonder Cave) and new development at the latter locality, at least, is likely (replacement of burnt-out restaurant). Parts of the contextual environment are sensitive to visual impact. ESKOM power lines are conspicuous along the northern horizon, and represent a generic visual impact on the whole of the COH WHS. Long-term planning to address the power-line issue ought to be initiated, as suggested in the original environmental planning documents.

Additional existing site management includes:

- Visitors are confined to a non-sensitive route through the site, and are under constant supervision of the landowner or his deputy, and in the past, by the permitted scientist.
- A SAHRA Permit Committee member inspects the excavation site and ongoing/suspended excavations on a twice-annual basis, particularly with a view to assessing compliance with terms and conditions of the permit
- The site inspection team, including COH WHS MA, SAHRA and GDACE officials, plus a contracted specialist service provider, inspects the whole site on a twice-annual basis, monitoring the management criteria noted in the generic site management plan (see Table 1, generic management plan) and particularly Table 1 of this document (site-specific management issues).
- 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. This is meant to take place on an annual basis and an inspection will take place shortly. The subterranean heritage areas of the site are not at present being explored or excavated.
- GDACE is available for advice to landowners regarding erosion control, fire management, alien vegetation and weed clearance, and preservation of biodiversity
- The landowner burns firebreaks from time to time, but uncontrolled fires entering the property from outside sometimes occur and these have the potential to cause extensive and expensive damage. Huts and storage facilities built of combustible materials are at risk. The site is near the base of a natural fire corridor.
- The Heritage Agreement and the Landowner-Scientist agreement between landowners and permitted scientists addresses issues of mutual management concern and is an important management tool – see generic management plan.

2 SITE DESCRIPTION: PHYSICAL FEATURES, VALUES AND SIGNIFICANCE

The first part of this section provides a brief description of the site; Section 3 outlines present site conditions in the form of a status quo report, and notes risks and threats to site values.

The fossil site management plan adopts a values-based approach and seeks to ensure that the many and various values of the site are conserved. Site values extend beyond those formally recognized as being of 'universal value' and Section 2 seeks to provide an updated list of old, new and previously unrecorded or unrecognized values (2.2). Section 2.3 provides an updated statement of site significance which was prepared in consultation with permitted scientists working on site.

2.1 General site description

The Plover's Lake site encompasses a complex of fossiliferous breccias, six of which are exposed at the surface because the roofs of the original caves have eroded away, leaving only the weathered remains of their ancient sedimentary fills. There are a further five discrete below-ground fossiliferous

deposits. The whole complex occupies approximately 100 000 sq m, equivalent to a square with a side of approximately 316 m. A sub-surface cave system with decalcified breccia includes numerous Middle Stone Age artefacts but no recorded hearths. The area within the National Heritage Site boundary (Fig 2) includes several tantalising breccias that have not yet been excavated. The geological relationships between the seemingly discrete bodies of breccia are as yet not fully understood. Preliminary investigations at the site by Brain (1981), Thackeray and Watson (1994) and Berger (1995) seem to indicate that the deposits are younger than 1.5 Ma.

The site complex is unusual in that it boasts a hilltop stone-walled Late Iron Age site known as the "Iron Age Site", with low stone walling and a scatter of Iron Age relics.

The site complex is situated almost at the foot of a dolomite spur, close to the convergence of two marked drainage lines (Fig 2). A third drainage line also feeds into the valley bottom, creating "seep" conditions and seasonally waterlogged soils unsuitable for building developments. The subterranean water flow from these three drainage ways probably contributes to the maintenance of the dolomitic 'spring eye' which occurs in the dense cluster of trees south-east of the site (Fig 2). The physical extent of the seep area with seasonally waterlogged soils can be seen on the orthophoto as a colour and textural change which denotes a different wetland plant community of mainly grasses and sedges. It is likely that a number of 'bulb' species of plant will occur in this habitat. The lush and dense growth of trees around the nose of the spur (north of the farm track through the site, Fig 2) is probably due to the accessibility of the subterranean waterflow to tree roots.

Visitor access to the site is from the east via a farm track which passes down the middle of a firebreak (Fig 4).



Fig 4: Access track to the Plover's lake fossil site (middle distance, in cove of trees centre and right)

2.2 Site values

Certain values, particularly the World Heritage Values, are well documented but others have not been sufficiently recognized until now. Six sets of values have been identified: landscape values, palaeontological and archaeological values, mining and historical values, research values,

biodiversity and ecological values and finally, educational and tourism 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

- The site demonstrates many aspects of the formation, processes of sedimentation, calcification, decalcification and weathering of dolomitic caves. There are both surface and subterranean examples.
- The geology of the various sites is mostly well stratified and matches in completeness the deposits represented at Gladysvale
- The site can also be used to illustrate taphonomic processes such as bone accumulation in cave catchments and subsequent removal to deeper recesses by a variety of taphonomic processes. Porcupines and owls are still present on site and their role as bone accumulators can be demonstrated
- The site shows a substantial volume of residual fossiliferous breccia which is weathering, and in which fossil bones belonging to diverse animal taxa can be seen
- The geology of the host rock - dolomites and cherts of the Transvaal Supergroup – can be shown, particularly with reference to stromatolites, pisolites and cherts.
- The spring or 'eye' is typical of karst landscapes and is of geomorphological interest
- Travelling across the site has a great deal of aesthetic value as a 'wilderness' type experience in an increasingly built-up surrounding area.

2.2.2 Palaeontological and archaeological values (Fig 5)

- At least 6 above-ground fossiliferous breccia sites, which represent the remains of the fills of collapsed and de-roofed ancient caverns, most of which remain unexplored
- There are in addition five discrete below-ground fossil deposits
- Fossil preservation is relatively good and there is a diversity and abundance of animal taxa preserved
- Plover's Lake 1 (Brain, 1981, Thackeray and Watson 1994) is a fossiliferous deposit dated to around 1.0 Ma. The fossil material, as at many of the other de-roofed fossil sites in the COH WHS, are preserved either in decalcified ancient cavern fills, or in breccia that is still partially calcified. Fossils identified from this site are mainly bovid, although fossils of the extinct equid *Equus capensis* are exposed. Carnivore damage to many bones in the form of punctuate depressions and gnawing marks attest to carnivore involvement in their accumulation, but one fossil bovid foot bone still in situ shows unmistakable cut marks indicating at least some human involvement as well.
- Plover's Lake 2 is some 40 m above Plover's Lake 1 and contains significant quantities of fossil bone plus a few stone tools of MSA type. This possible occupation site (or its catchment area), dating to between c 250 000 BP and 35 000 BP is rare if not unprecedented in the COH WHS
- Three human teeth were discovered from Plover's 2, from between flowstone layers dated to approximately 68 – 80 000 BP and 88 – 92 000 BP. The date of the younger flowstone was independently confirmed by the results of ESR dating based on tooth samples – once again, a rare piece of evidence for the southern African MSA.
- The Plover's Lake internal deposits are the first absolutely dated sequence of Late Middle Pleistocene fossils from the COH WHS. The possibility of uncovering deeper deposits, possibly into the Acheulean (up to 1.6 My BP), remains
- A deeper system immediately below Plover's Lake 1 exposes several hundred fossils on a surface along the ceiling and walls of an old mined-out lime-workers drive which extends about 100 m into the hillside at a depth of about 30 m below surface. The breccias are part of

Plover's Lake 3. At the time of writing, Plover's Lake 3 is considered to be roughly contemporaneous with Plover's Lake 2 but representing a discrete accumulation episode, possibly related to hyaena or big cat activity

- The so-called 'Bones Cave' 200m north of Plover's 1 is incompletely explored, but promising.

(Not yet provided by scientist)

Fig 5: Site plan showing sites of archaeological and palaeontological interest and breccia dumps (this was specifically requested by SAHRA in 2005 (4/10/2005 p4) and must be on file somewhere by now. To be inserted here)

2.2.3 Mining and historical values

The site was mined for calcite in the early part of the previous century, which activity disclosed the presence of fossils. Professor Tobias drew attention to the possible potential of the site and it was worked by C K Brain in the 1980s and F Thackeray in early 1990. In 2002 Lee Berger and a team from Duke University led by Steve Churchill extended the exploration to the underground deposits which date to around 60 000 - 120 000 years BP (Before Present). Excavation was still in progress at the 'cave site' in July 2004, and had not reached completion. Excavation ceased in 2005 at the request of the landowner.

- There are the remains of two or three kilns but the firebricks from these have been almost totally removed and they have collapsed to the point that most visitors would not recognize them as such. The remains of upper and lower loading ramps and platforms can be seen, in the form of thousands of calcite chips embedded in calcined limestone to provide suitable flat surfaces.
- There are substantial and potentially fossiliferous breccia dumps left by lime-workers

2.2.4 Research values

- The research potential of this site is considerable, at least as diverse in its potential to answer significant research questions as the larger more important sites in the COH WHS such as Swartkrans, Gladysvale or Drimolen.
- Only a very small proportion of a very extensive potentially fossiliferous deposit has been explored and excavated. The site most definitely holds research potential for many decades to come.
- It is recommended that the COH WHS MA do all in its power to secure funding for pursuing the possibility of continuing excavations at Plover's Lake, in order that the scientific potential locked in the sediments can be realised.

2.2.5 Biodiversity and ecological values

The Highveld grassland biome of the Gauteng Province is everywhere subject to pressure from rampant development. This gives the open space of the Plover's Lake property an enhanced value as an open area and as a Natural Heritage Site, particularly one which has the added asset of a hominid site and protected National Heritage Site status.

The grassland around Plover's Lake is likely to contain at least 500 species (Mogg 1975) and there is an adjacent wetland, a stream with riverine vegetation, and an edaphic grassland to push species numbers up. It is recommended that a plant and animal species list be drawn up for Plover's Lake because at the time of writing no such species lists (except perhaps for mammals) were available.

The rocky grassland is likely to harbour many significant edible, medicinal, poisonous and otherwise economically important species such as 'Mrs Ples' food (Mogg 1975), the tuberous *Brachystelma barberae*, usually found well-concealed on rocky grassland hillsides, the medicinal and poisonous *Boophane disticha* and *Eucomis autumnalis*, as well as *Haemanthus* spp. and *Scadoxus puniceus*, both used medicinally.

Within the central heritage area and adjacent mining areas, the positions of sinkholes and vegetation-choked avens is marked by typical dense copses of vegetation, notably *Celtis* trees, as well as *Olea* and *Cussonia*. The wetland at the foot of a dolomite spur, close to the convergence of two marked drainage lines (Fig 2) supports "seep" conditions and the seasonally waterlogged soils mentioned above. The wetland soils support special vegetation which includes several species with rootstocks. The vlei grassland community is particularly vulnerable to burning. The adjacent drainage ways will function as fire corridors, allowing uncontrolled fires to sweep uphill. The vlei depression is presently dominated by non-woody vegetation such as sedges (*Carex*, *Leersia*, *Cyperus* spp.), it is too dry for extensive reed beds), vlei grasses such as *Hemarthria*, *Aristida*, *Andropogon* and *Monocymbium* spp.

The lush and dense growth of trees around the nose of the spur is probably due to the accessibility of the subterranean waterflow to tree roots.

The underground systems have several active biological processes still intact. The caves are known to have hosted breeding colonies of two species of bat, *Miniopterus schreibersii* (now *M natalensis*) and *Rhinolophus clivosus*. The first species is becoming rapidly rare, and it is recommended that care be taken when and if excavation is extended into the region of subterranean systems because human presence could displace any resident bat colonies. The present status of the colonies is unknown as the subterranean systems have not been visited for nearly 2 years. A project broader than that of site level plans is required in order to address the bat status issue effectively.

Porcupines use the caves from time to time as evidenced by their droppings and shed quills, as well as the occasional gnawed bone. Porcupines are important taphonomic agents and it is an additional bonus that this element of site interpretation can be authentically demonstrated on site.

Barn owls (*Tyto alba*) appear to sporadically use cave entrance areas as roosts and owl regurgitations can be demonstrated, in this way showing visitors how 'rodent breccias' are accumulated – a modern analogue for an ancient taphonomic process

The biodiversity values of this site are incompletely understood and it is recommended that faunal and plant species lists be drawn up in order that these values can be better understood, protected and interpreted.

Summary:

- Resident bat colonies and possible breeding hibernacula, two species
- Resident porcupines
- Owl roosts(sporadic)
- Free-ranging large mammals on property
- Many species of edible, medicinal and economically significant plants
- Open grassland with Highveld trees
- Rocky grassland
- Three different plant communities occur in the heritage area: a savanna-type community representative of the Bankenveld, dense riverine thicket and woodland, and an edaphic grassland.
- Game animals

2.2.6 Educational, tourism and economic values

Even though the landowner does not envisage public tourism at present, he does allow visitors by appointment. The following values are significant to Plover's Lake:

Summary:

- The site offers an unique combination of tourism and educational attributes for site visitors
- The site offers special and unique educational and student and technical training opportunities, with regard to the excavation of decalcified and hard breccias.
- The site preserves a substantial volume of fossiliferous breccia which will provide research opportunities for decades to come
- The site is authentic, with many geological, palaeontological, mining and historical heritage assets preserved on site
- Active excavation could be a major draw card
- A full range of fossil site attributes (geological, geomorphological, palaeontological, archaeological and historical) can be demonstrated in an authentic way
- The landowner or other knowledgeable guides are usually on site when tourists visit and can give first hand high quality and accurate information regarding the site
- Visitors can have a close look at a real excavation site (remains of such an excavation) because there is no intervening fence and direct interaction with the environment is possible.
- The adjacent subterranean systems provide visitors with a modern analogue for ancient cavern systems which makes the Plover's Lake weathered and de-roofed cavern fills more easily understood.
- Mining relics on-site help visitors to understand the connection between mining and fossils
- Sense of place is potent and the relative remoteness of the site provides a wilderness type of experience for most tourists
- The site is situated in grassland biome which has the bonus attraction of resident large mammals such as rhino, baboons, warthogs, porcupines and small antelope
- Many biological interactions are still present: there is on-site active bat breeding activity, owls, porcupines, warthogs, etc.

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

In the absence of a revised, updated statement of site significance the original statement is provided verbatim:

"The deposits in at least seven caverns at Plover's Lake contain both consolidated breccias and decalcified deposits that date to the Middle and/or Late Pleistocene and include Middle Stone Age artefacts, fossils and molar teeth from at least one anatomically modern human.

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, Plover's Lake qualifies for national heritage status because of its:

- (a) **Importance in the pattern of South Africa's history.** *The fossil sites at Plover's Lake demonstrate the on-going formation of solution cavities and the gradual filling of these by the products of natural processes of erosion that include bones brought into the site by*

- carnivores. Stone tools made by modern humans are found in the consolidated and unconsolidated deposits.
- (b) **Possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage.** Hominin fossils are rare worldwide because of their limited geographical distribution and the rarity of natural conditions for fossilisation and preservation. The find of *Homo sapiens* teeth suggests more such remains may be found at Plover's Lake.
- (c) **Potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.** There has been no detailed analysis of the fossil fauna found at Plover's Lake.
- (d) **Importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects.** Plover's Lake has potential for further research.
- (e) **Importance in exhibiting particular aesthetic characteristics valued by a community or cultural group.** The aesthetic qualities of Plover's Lake as a limestone cave were partly destroyed by lime mining activities in the early twentieth century, but some calcite formations remain.
- (f) **Importance in demonstrating a high degree of creative or technical achievement at a particular period.** Stone tools have been found at Plover's Lake.
- (g) **Strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.** Plover's Lake is 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.
- (i) **Significance relating to the history of slavery in South Africa.** The age of the deposits at Plover's Lake places it well before the time period of slavery in South Africa."

(J Deacon, 2002, original National Heritage Site nomination)

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 scientific excavations, the datum point has been used where possible.

In order to assess the management strategies that may be necessary in order to preserve site values, threats and risks to site values have been analysed as part of the status quo, and the next section (Section 4) describes desired states and management outcomes.

3.1 Physical Environment: Surface

This section addresses the status quo 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:

- Access is strictly controlled by the landowner, and is by special appointment only.
- The host property to the proclaimed heritage site is fenced and there is a manned entrance gate

- Unauthorized access does not appear to be a problem, and the risks normally attendant with this are not a factor at this site

Risks and treats;

- None at present

3.1.2 Rangeland, wetland, vlei and riverine thicket

Status quo:

- The above-mentioned habitats are managed by the landowner, who oversees grazing pressure, veld utilization and rotation, stocking rates, etc.
- The fossil site area is from time to time utilized by rhinos
- In order to assess future impacts, species lists and fixed point photography might be necessary. Species lists for rocky grassland, valley and drainage line vegetation, tree copse, vlei and stream thicket (the only habitat which does not occur within the designated fossil site) should be compiled. These habitats or landscape facets have distinctive plant and animal communities. This would enable impacts of fire, grazing, desiccation etc to be better assessed
- Only a small portion of the vlei area is contained within the fossil site boundary, but rangeland management needs to be holistic, and cannot be effective if it is piecemeal.

Risks and Threats:

- The vlei is vulnerable to over-frequent burning, which will impact negatively on its vegetation, water-storage capacity, streamflow regulation, and soil erosion.
- The vlei is vulnerable to invasion by moisture-loving invasive alien weeds
- Over abstraction of groundwater – whether within the host property or further afield – may eventually lower the groundwater table and reduce stream flow.

3.1.3 Erosion

Status quo:

- As with rangeland management, erosion has to be holistically managed in order to identify its causes and effects and to implement remedies, maintenance and monitoring. The landowner responsibly manages erosion on the host property, including the fossil site. The fossil site itself does not have any significant erosion problems.

Risks and threats:

- None at present

3.1.4 Fire management

Status quo:

- The grassland biome is a fire-prone ecosystem, and fire management needs to address fire frequency, seasonality and intensity. Without fire, there is an increase in shrub and tree density and loss of grass sward.
- Fire management of the property is a landowner responsibility. However, a major problem is uncontrolled fire which enters the property from outside. This is a generic problem affecting all the properties within the COH WHS. Some areas have community fire management associations and these organisations attempt to maintain a fire regime appropriate to the Bankenveld (about one burn every four years), or more correctly, the Carletonville Dolomite Grassland (Gh15) of Mucina and Rutherford (2006). Little can be done at the fossil site level

except to ensure that scientific activities within the site do not create a fire hazard, or to ensure that the area does not harbor items which are a fire hazard (stores of fuel, e.g.).

Risks and threats:

- None at present, within the fossil site

3.1.5 Red Data Species, rare plants and animals

Site inspections of the past have not revealed utilization of economically significant plant species. However, there were no botanical or faunal lists available for Plover's Lake and no record of the medicinal, edible or poisonous plants that occur, although such economically important plants are known to be represented in the area (see 2.2.5, Biodiversity and ecological values, above). Such lists, and a record of the whereabouts of particular species, are essential to baseline studies of, for example, the impact of fire or wetland degradation.

Rare species have not yet been mapped. Rare plants and animals are difficult to protect if their whereabouts are 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.

Status quo:

- See summary for rangelands.
- Many important and rare plants are not on the Red Data list

Threats and risks:

- There is no up-to-date list or mapping of vegetation – over 500 species 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, and target species difficult to protect

3.1.6 Alien vegetation

Status quo:

Plover's Lake is somewhat less infested with alien vegetation and weeds than most of the other sites. There is as yet no species list of alien species for the Plover's Lake fossil site and it is recommended that such a list should be compiled. The moist soils at the bottom of the drainage lines and the vlei area are particularly prone to invasion.

Infestations have not yet been mapped and prioritized and this needs to be done, species by species, in order that systematic clearing and follow-up clearance can be done. It is further recommended that fixed point photography be set up to monitor infested patches. This will need to be done on a patch by patch basis.

The (rare on this site) occurrence of *Opuntia* (prickly pear) is interesting – it has been suggested that the lime workers (who were often from the poorer sector) planted and encouraged these plants because of their fruit. Many *Opuntia* plants are associated with old lime-mines may be considered as 'historical plantings'. However, the digestion-resistant seeds are spread by baboons – and probably also humans - which eat the fruit and spread seed widely. The species is a scheduled invasive and control is a legal requirement. It is recommended that the occurrence of prickly pear be recorded, after which it should be eradicated according to eradication procedures recommended by GDACE.

GDACE has field operational guidelines for some species of alien plants; these are noted in the generic site management plan Appendix. A guideline on the use of herbicides is also being prepared.

Weed management at Plover's Lake is usually excellent and there are few weeds in the excavation area or elsewhere on site. These tend to make their appearance after excellent rains but should be cleared prior to seeding.

Status quo:

- There is no list of alien invasive species or of weeds occurring on Plover's Lake fossil site
- Infestations by different species have not yet been mapped
- Infestations have not been prioritized for clearance
- Field operational guidelines for appropriate eradication treatments for each species are not yet fully available
- There is no broader plan for alien vegetation control covering the COH WHS as a whole so that re-infestation is likely (by baboons and other widely-ranging mammalian seed dispersal agents)
- Photographic monitoring for clearance programme needs to be set up.
- Weeds in and around the excavation site are being effectively controlled by the landowner and his field staff

Threats and risks:

- Continued presence and spread of invasive species throughout individual sites and COH WHS, making eradication and control ever more difficult and expensive.

3.1.7 Visual aesthetics, site context

The key sensitivities, management precautions and some solutions to issues concerned with visual aesthetics are provided in the Generic Section of COH fossil site Management Plans. .

The Plover's Lake fossil site, situated as it is with rising landforms all around, still has a significant viewshed. Current land use of the surrounding area is rangeland for game animals and at present and fences and power lines are the only intrusive structures (Fig 6).

Status quo:

- Contextual landscape of the site is visually pleasing
- The COH WHS MA screens all proposed new developments and protects visual integrity wherever possible
- The strongest visual impact is from the Eskom power lines and fences

Threats and risks:

- Open rolling grassland country with 360-degree views increases sensitivity of contextual area to visual impact of new developments on adjacent properties
- Inappropriate structures and land use have the potential to spoil the relatively unspoilt sense of place.



Fig 6: The Eskom power lines are an unfortunate visually intrusive feature of this site and of other sites in the Cradle of Humankind. It might be possible to address this issue at some time in the future and plan for re-routing the power grid to avoid the World Heritage Site

3.2 Physical Environment: Subterranean

Status quo:

There are at least 5 subterranean fossil deposits and associated subterranean voids at Plover's Lake. Some of these have been stripped of their calcite decorations by lime mining activities in the early part of the previous century. Blasting operations at this time would have weakened the ceilings and other fabric, rendering them unsafe for site users. A site safety inspection of the subterranean environments is long overdue at this site.

Excavation was in progress in at least one subterranean cave until 2005, and this locality should be inspected by a professional site safety officer prior to work being resumed there.

The excavation work necessitated the installation of wooden stairs and walkways, and if these are not going to be used in the short term, they should be removed in the interests of best practice for cave environments, because wood rot and dry rot fungi have the potential to impact negatively on cave environments. Several other small items have been left behind by the excavators, and if no further work is envisaged in the short term, these should also be removed

Bats, porcupines and owls are recorded as using some of the caves and their droppings are a major source of nutrients in these otherwise relatively sterile cavern substrates. Their continued presence is important, both from a cave biota perspective and as a taphonomic modern analogue for past bone accumulating processes. The same is true of bird species which use trees growing in the catchment area of caves.

Risks and threats:

- Site safety has not been inspected and there is a risk of collapse. Subterranean safety needs to be professionally determined, and caution demands that these environments be considered unsafe for all site users until declared otherwise by a professional
- Bat colonies are sensitive to interference which can take the form of physical disturbance, noise, changed light intensity, altered air-flow, smoke, changed temperature, fumes from generators and other sources, dust from sieving being drawn into the cave, and raised carbon dioxide levels. Blockage or partial blockage of cave entrances or other points of egress can be deleterious to bat colonies.
- Porcupines and owls are likewise sensitive to disturbance
- Abandoned infrastructure installed in the Plover's Lake Cave, if left indefinitely, will pose a threat to cave environment, apart from dry rot or rusting of metal structures gradually rendering it unsafe for site users.

3.3 Infrastructure

3.3.1 Access roads, culverts, bridges, etc.

Status quo:

- The access road is the responsibility of the landowner. However, its use and the kind and number of vehicles which may use it, should be written into any future landowner-researcher agreement.
- The landowner and his field staff take care of road maintenance and clear mitre drains and drainage humps.
- The fact that the last part of the access road to Plover's Lake is on a steep slope will mean that the road tracks are inclined to channel runoff and this will need to be watched.
- Culverts and road crossings of drainage lines are the responsibility of the landowner and are maintained by the reserve manager. The drainage lines in the vicinity of the fossil site are significant and throughflow should not be impeded in any way

Risks and Threats:

- None within the fossil site itself

3.3.2 Fencing and gates

Status quo:

Not applicable at the fossil site itself.

3.3.3 Parking

Status quo:

There is no formally defined parking area, and the low volume of traffic means that there are no risks and threats at present.

3.3.4 Built environment

Status quo:

Sheds and storage

There is a small shed-like building on site which functions from time to time as an environmental education venue and as a small natural history and fossil site museum. It is ideally situated to be

upgraded into an on-site interpretation centre. It was not built as a store, although it could possibly also function in this capacity. It is in a reasonable state of repair.

Accommodation

There is no formal accommodation facility on site

Pathways, walkways and viewing platforms

There are safe roughly defined pathways through the site located on non-sensitive areas. The cave which was excavated has internal boardwalks and platforms which provide functional access to excavation sites deep within its recesses, but these should be removed if no further work in the short-term is envisaged

Tourist-related, including signage

There is no tourist-related signage or interpretation boards on site

Ablutions and toilets

There are no flush toilets, pit toilets or enviroloops on site at present. Should any further excavation work be envisaged, it will be necessary to install a portaloo or other toilet system for the duration of the dig and ensure that it is cleaned and removed periodically.

Risks and threats:

- None at present; except that a toilet will become necessary if scientific work resumes on site so that site pollution is to prevented.

3.3.5 Waste Management

Sewage

Not relevant until excavations are resumed. See above

Litter

Not relevant until excavations are resumed. Litter management within the fossil site is the responsibility of the permit holder. At such times when excavations are in progress. At other times, the landowner is responsible. Site inspection has shown that there is not a litter problem

3.3.6 Energy

Not relevant at this stage.

3.3.7 Water

There is no formal water supply to the site and site users must provide for this requirement.

3.3.8 Telecommunications

Cell phone reception only. Communication is necessary if any future tourism is to take place.

3.4 Research Environment

The most recent permit to excavate was issued to Prof L Berger, who undertook some work at the site which yielded some promising preliminary results. Excavations ceased in 2005 and have not resumed since. The final report is due.

3.4.1 Previous and ongoing research and excavations

Lime mining activities in the early twentieth century discovered the presence of fossils. In the 1980s, Professor Philip Tobias drew attention to the site and test excavations were done in the consolidated breccias exposed on the surface by staff of the Transvaal Museum under Dr C.K. Brain. No hominid fossils were found. In the 1990s, field work was continued by Dr Francis Thackeray from the Transvaal Museum, who concluded that the larger mammalian fossils were derived from leopard lairs. The site has yielded many bones of antelope, an extinct wildebeest, suids (pig family), baboons, carnivores and rodents.

A new phase of work, under the direction of Dr Lee Berger, began from 1998 and excavations in unconsolidated breccia in the underground cavern system began in 2002. Preliminary examination of these deposits and the associated fauna suggests that most of the unconsolidated breccias are younger than 0.5 my. Middle Stone Age artefacts have been found in Plover's Lake 1 so that at least part of the fossil accumulation is probably in the region of 100,000 years old. Human teeth found in July 2002 suggest that further human remains may be recovered from that time period.

3.4.2 Excavation edges

Status quo:

The powdery excavation edges were inadequately shored and protected when excavations ceased. The sandbags used were in themselves unstable and ruptured soon after being installed. Trampling by people and animals hastened their deterioration. By varying stack height, a set of steps providing safe access to the cave and excavation area could have been constructed if the recommended brown army-type sandbag wrapped in geotextile had been used.

New sediment is washing and slumping into the cave (a natural process) and covering the sandbags as well as the sediments exposed by excavation. There was no provision for an interface between old exposed sediments and recent hillwash.

Subsequently the sandbags were emptied of their spilling contents by the landowner and their remains removed from the cave. It is not known where the sandbag filling had been sourced and to what extent the cavern interior is now 'contaminated' with sediment derived *ex situ*.

Risks and threats:

- Collapse of excavation edges and slumping into excavated area
- Mixing of surface-derived materials with *in situ* materials
- Vulnerable sediments are exposed to heavy pedestrian traffic because the excavation is right at the entrance to the cave

3.4.3 Excavation walls

Status quo:

See above. The excavation walls are powdery and unconsolidated and prone to collapse and slumping. Shoring and sandbagging were inadequate to prevent this, even though the excavation had

not reached any great depth. There was no provision made for providing an interface between the excavated surface reached and material which would slump or wash in after excavation ceased.

Risks and threats:

- Collapse of excavation walls and slumping into excavated area
- Mixing of surface-derived materials with *in situ* materials on excavation floor
- Obliteration of excavation surface reached, covering of sedimentary stratified sections exposed in excavation walls
- Spillage of sandbags, if filled with externally derived materials, introduces earth foreign to the cave which might affect the results of sediment-based analyses. In any case, this is not best practice.

3.4.4 Access to excavations: steps, ladders, etc.

Status quo;

There is a wooden walkway and platforms inside the Plover's Lake Cave, and a metal ladder. See built environment for details.

3.4.5 Erosion in excavation areas

Status quo:

- The unintended consequence of excavation and removing material has been to create a series of pits or sumps where rainwater can collect.
- Interventions aimed at preventing sediment from being washed into lower deposits and the excavated area have so far proved futile – a 'threshold' of geotex covered sandbags is required. It is recognized that washing of sediment is a natural process but until the excavation area has been properly recorded, shored and sandbagged, this is not desirable.
- Drains around the excavation aimed at directing water away from the sumps need to be put in wherever possible.

Risks and Threats:

- Rainwater accumulating in excavation bases may eventually destabilize the footwall
- Rainwater may wash surface-derived sediments into the underground deposit

3.4.6 Compliance with conditions of excavation permit

Status quo:

A watching brief is kept by the SAHRA permitting representative. Most items are standard for all excavations and researchers (see generic management plan) and include:

- Recording method (a lazer theodolite or 'Total Station' is used at this site)
- Check that the position of all excavations has been committed to plan (plan not yet received)
- Check witness section and its stability (not yet defined or committed to plan)
- Check that lodging of standard site record form with the repository (IHE, University of the Witwatersrand) has taken place
- Check receipt of progress report
- Check that copies of all published papers have been lodged with SAHRA
- Check accessioning and preparation backlogs
- Check that witness sections have been committed to plan

- Check that breccia dumps have been committed to plan (annotated plan of dumps not yet received)

Risks and Threats:

- Excavation is inevitably a destructive process. Inappropriate excavation techniques, recording techniques, recovery techniques, preparation techniques, inadequate subsequent publication and indifferent conservation of artefacts recovered are perhaps the greatest threats to the fossil sites. This is an issue generic to all the sites in the COH WHS, hence the SAHRA twice-yearly inspections. Non-compliance with some items of the permit conditions has been an issue at this site, more particularly the closure procedures.

3.4.7 Witness sections

Status quo:

- Researchers have been alerted to the fact that they need to retain witness sections in order that conclusions may be verified as new techniques become available and as further excavation allows them to better understand the deposit. It is possible that at this site excavation had not sufficiently advanced in order that witness sections could be defined – no site plan with witness sections marked has been received as yet.

Risks and Threats:

- Stratigraphic conclusions reached should be independently verifiable. If no witness sections are preserved, this would not be possible
- Dating results need to be independently verifiable. If witness sample sections are not preserved, this will not be possible
- New techniques and analytical procedures are perpetually coming to light. These need to be applied to sites from which earlier conclusions were obtained, in order to verify and expand understanding. If there are no witness sections, this cannot be accomplished.

3.4.8 Dumps

Status quo:

- There are several piles of breccia dumps at this site, most of them probably the dumps discarded long ago by lime workers and relocated by investigators of the site (Fig xx)..
- There is no possibility of storing this material, fossiliferous as it is or may be, elsewhere at present and new excavations are going to add to the problem.
- The siting of new dumps needs to be discussed with the landowner, when or if excavation is resumed.
- Sieve heaps also need to be accommodated
- The dumps encapsulate a great deal of significance in the form of the fossils they contain. This is true even of old historic dumped material removed by lime workers.
- As new techniques such as trace element analysis become better understood, there is a strong chance that it will become possible to match specific areas of *in situ* material and also to date them

Risks and Threats:

- Loss of information concerning the source, author and content of dumps
- Loss of or languishing information, because dumps are not processed for fossil content
- Dumps become a bottleneck to research, because funding often does not permit the employment of dedicated and well-trained fossil preparators to remove fossils from their breccial matrix, and fossiliferous dumps are left for protracted periods unattended on site.



Fig 7: Breccia piles need to be committed to plan and annotated as to source and their future

3.4.9 Repository

Status quo:

- The University of the Witwatersrand IHE is the designated repository of the fossil material and artefacts recovered. This institution has been accredited by SAHRA as it has all the necessary controls in place and it conforms to the minimum standards laid down by SAHRA

Risks and Threats:

- Loss of, or deterioration of artefacts
- Loss of information concerning artefacts
- Lack of publicized information about artefacts

The institution concerned has a dedicated collections manager at present and the above risks do not apply.

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 secondly, 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 creates 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.

The site has not been subject to a site safety inspection by a professional and the subterranean environments are in particular need of such inspection. In order for this management plan to be complete, the recommendations of the site safety officer after the inspection has taken place will need to be incorporated into planning.

3.5.1 Physical safety

Status quo:

Ever since the attack and assault of an excavator at Swartkrans nearby, personal safety cannot be taken for granted and surveillance is necessary.

The Plover's Lake site is remote from main roads and access is strictly controlled. There is excellent surveillance by a dedicated reserve manager. Physical safety is not a factor as it is at some of the other sites.

The site is situated within an area where most people know each other and access is tightly controlled, and personal security is not likely to be a problem. Should this situation change, however, personal security could become a problem because of the isolation of the site, far away from the nearest residents

Risks and Threats:

- None at present

3.5.2 Safety of surface and built environment

Status quo:

The only potentially unsafe infrastructure is the metal and wooden ladderways, platforms and walkways into and within the subterranean cave.

Risks and threats:

- The metal internal ladderway is prone to rusting in the humid cave environment
- The wooden boardwalks and stairs are prone to wood rot and dry rot and may become unsafe

3.5.3 Safety of excavation area

There is no active excavation area at present. Potential future excavation sites will be commented on by the site safety officer at the time of the safety inspection.

3.5.4 Subterranean safety

Old mines and dolomitic caves are inherently unstable and collapse, subsidence, sloughing and slumping will continue until a new equilibrium has been reached. This process undoubtedly puts the site at risk, as major collapses destroy stratigraphy and bury fossiliferous horizons. However, to stabilise old mines and caves is costly beyond practicality and decisions have to be taken as to which parts are worth stabilizing or saving.

Status quo:

- There are five subterranean systems at Plover's Lake. The shape of these subterranean caves is controlled by the positions of major faults in the host dolomite and by the presence of

major chert bands, as well as by collapse – this is particularly well demonstrated at the nearby Wonder Cave, where large blocks of roof collapse, defined by bedding planes and joints, are now lying coated with travertine on the cave floor..

- Blasting by lime workers has probably caused weaknesses in the walls and roof of the cave by shattering the rock and adjacent sedimentary deposits.
- Normal cleavage along bedding planes and other lines of weakness such as joints is also occurring. Huge slabs of roof rock – termed ‘coffin lids’ by the caving fraternity – can part along bedding planes and collapse
- Normal down-weathering of the hillside and decalcification of overlying deposit is further weakening roof stability.
- Mining operations have created some deep vertical drops where material was excavated to access the thick travertine floor of the cave. The trenches and excavated pits are unprotected
- Poor lighting conditions (no electricity on site) exacerbates the safety risks within the dark parts of the larger subterranean environments
- There is an extremely rough and unpredictable substrate
- Low headroom in the furthest recesses
- Water entering via holes in the roof creates muddy and slippery substrates
- The presence of further subterranean chambers below the upper cave means that much of the floor is ‘perched’ and portions of the cave floor could collapse into the lower cavern.
- The metal ladderway is rusting in the humid conditions and needs to be checked. Metal, except for stainless steel, is not suitable for use in subterranean situations
- The existing wooden infrastructure needs regular checking if it is to be used in the short-term, or removed, as it will deteriorate and become unsafe
- The heritage agreement calls for an annual site safety inspection by a professional safety officer but this has not taken place for some years. A site safety inspection is urgently required, especially because the caves are visited by groups from time to time, and excavations may possibly resume in future. An inspection is due shortly.
- Given the presence of bat hibernacula, it is highly likely that histoplasmosis is present
- Violin spiders which are venomous (and can give a medically significant bite), are known to occur in the cave system
- Subterranean system should be a no-go area to all but specially insured scientific investigators. Current use of the subterranean system does not warrant the installation of expensive safety interventions. However, the recommendations of the professional site safety officer will have to be followed. Public Health and Safety Act Requirements will also have to be adhered to.

Risks and Threats:

- The report of the professional site safety officer is awaited, for both surface and subterranean safety

3.6 Presentation of site values

3.6.1 Site interpretation

Status quo:

- There is no site interpretation in the form of mounted on-site signage or interpretation boards. There is natural history material and site interpretative material inside the small shed on site for the use of visiting groups
- Limited tourism and thus limited site interpretation is taking place
- Site interpretation is entirely oral by the landowner or visitor guide (or formerly, the permitted scientist)

- The site does not have its many significant heritage values presented anywhere else in the Cradle of Humankind and very few people know of the significant discoveries that have been made at this site. Much new information has come to light and this needs to be made public if palaeoanthropology is to be kept vital in the public psyche
- Any official tourism needs to have the written approval of the landowner
- Tourist activities on World Heritage Sites and National Heritage Sites need the approval of the Management Authority and SAHRA
- The NHRA places certain restrictions on filming and capturing images in World Heritage Sites, but these do not apply to the landowner

Risks and Threats:

- Lack of presentation of site values to a wider audience prevents information concerning site significance from reaching public psyche
- Potential funders might not know about site significance
- 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

- The tourist numbers are required by management and are not currently available on record

4 DESIRED STATES AND MANAGEMENT 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

Desired outcomes include:

Rangeland:

- To ensure that contextual veld conditions and rangeland in the immediate vicinity of fossil sites is maintained in as good a condition as possible, with regard to appropriate land use and management. Rangeland management is a landowner function, and cannot function at the small scale (5,7022 ha) of the fossil site. As yet, there exist no strategies by means of which landowners may be compelled to adopt appropriate land use, or to champion land care, and although optimum veld condition is a desired outcome, no practical strategy can be put in place to achieve this outcome. The highveld grassland is considered 'vulnerable' as much of it has been transformed by agriculture, urban sprawl, mining activities and dam construction and because there are few statutory and private conservation areas and the Cradle of Humankind is therefore a significant chance to conserve remaining relics of this vulnerable biome.

Erosion:

- To ensure that the fossil site and its environs are free of 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. Fire management is a landowner function, but perhaps the time is appropriate for a generic fire management plan for the COH WHS to be instigated. See comments in Status Quo section.
- 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 does not harbor or create fire hazards.
- To ensure that the necessary fire-fighting equipment is on hand in the event of a runaway 'internal' fire (rubber flails and beaters)
- To ensure that the basic data necessary to assess the long-term impact of frequent fires is made available or collated, 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 purposes (such as thatch, firewood, 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 troublesome weeds. Alien vegetation clearance is a landowner function but once again, because sources of re-infestation are beyond the borders of the COH WHS (e.g. *Mirabilis jalapa*), a generic plan to address the issue needs to be put in place.

Visual aesthetics:

- Desired outcome is protection of viewshed, sense of place and contextual environment in order that the site does not become an island in a sea of inappropriate development or land use.

4.2 Physical environment, subterranean

- A desired outcome is a subterranean environment in which the cave atmosphere, substrate, biota and appearance is kept in as undisturbed and natural a condition as possible
- The removal and rehabilitation of the infrastructure and forgotten items in the excavated cave, and its restoration to pre-excavation condition.
- A further desired outcome is a subterranean environment which, if it is being visited or excavated, is safe for all site users.
- A further desired outcome is the conservation of the still-resident bat populations, owl roosts, porcupine dens and refugia of other troglodytes

4.3 Infrastructure, built environment

There is little in the way of infrastructure at Plover's Lake fossil site. The building already on site is the responsibility of the landowner and there are no other permanent structures. Desired outcomes include:

- The existing metal walkways need to be watched for rusting and safety

- The wooden infrastructure needs to be checked for safety, and for deterioration due to wood-rotting micro-organisms and fungi
- All redundant structures should be properly demolished and the site rehabilitated and all traces removed. This applies also to minor items left forgotten in the Plover's Lake cave

4.4 Research environment

Desired outcomes include the following:

- To ensure that the activities of scientists on site are perceived as 'adding value' rather than seeing them as 'site users', and that authorities take cognizance of this, particularly with regard to funding items which are not directly research or science-orientated, such as the purchase of shipping containers for storage and accommodation, which items have little hope of being funded by the NRF or other funding bodies
- To ensure that lack of funding does not inhibit research opportunities
- 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 the mapping, recording, conservation and broader presentation of the historical mining relics on site - not only kilns but loading ramps, pathways, exploration pits, relics and artefacts, and old wagon routes.
- To ensure that all structures, excavations and site features are committed to a site plan which includes the gazetted National Heritage Site boundary
- To ensure that all dumps, old and new, are committed to plan, with appropriate annotations as to source, content and authorship
- To ensure that new dumps are appropriately sited and properly constructed
- To ensure that excavations are safely executed and compliant with permit terms and conditions
- To ensure that appropriate witness sections are left and stabilized
- To ensure that sample sites are properly recorded and that results are independently verifiable
- To ensure safe excavation edges, walls and bases, and that these are properly stabilized when work ceases
- To ensure that fossils are carefully and properly prepared, catalogued, curated and housed in a safe repository
- To ensure that regular site safety inspections take place

4.5 Site safety and security

Desired outcomes include:

- A surface environment, subterranean environment and work environment which is safe for all site users
- It is desirable that an evacuation policy in the event of accident or medical crisis be drawn up and that a basic first aid kit is available on site
- Desired outcomes also include the provision of safety interventions recommended by the professional site safety officer after inspection of the surface and subterranean environment has taken place.

4.6 Presentation of site values

A desired outcome is:

- To ensure that the many heritage and natural values of the site are interpreted and made available to as wide a public as possible. Since tourism is in the hands of the landowner, a large part of the responsibility will fall to him, but interpretation of site values should also be available at some central point
- The erection of the site plaque requires to be finalised

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 in order to achieve the desired outcomes recorded above. 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 tables have been drawn up with the specific aim of clarifying who should do what, and when, on the heritage site. The tables also provide some indication of priority ratings. They incorporate all the key management issues, strategies and monitoring criteria so that they 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;
- 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

TABLE 1: MANAGEMENT AND MONITORING TASKS

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Surface environment						
Access - legal access to property	<ul style="list-style-type: none"> • Possibility of compromising researcher-landowner relations 	<ul style="list-style-type: none"> • Maintenance of cordial relations with landowner regarding access (*) • Ensure that properly negotiated preferably written letters of permission are obtained by all site users or those in charge • Unauthorized access is not a management problem at Plover's Lake at present 	Keep watch	All site users	<ul style="list-style-type: none"> • Check that access issue is addressed in any future agreement between landowner and Permitted scientists • Check if tour operator and tourist guides have same permissions 	Annual
Unauthorized access	<ul style="list-style-type: none"> • Removal of rock, fossils breccia and artefacts • Removal of edible and medicinal plants • Theft of moveable property, as above • Tampering • Graffiti • Littering 	<ul style="list-style-type: none"> • No unauthorized visitation to site (*) • Not a problem at Plover's Lake at present • Research (when present) and field staff to maintain surveillance 	Keep watch	Permitted scientists (if present), field staff, landowner	<ul style="list-style-type: none"> • Check stockpiled breccia • Check for signs of digging out of plants • Maintain surveillance over movable property • Check for tampering 	Ongoing
Rangeland condition	<ul style="list-style-type: none"> • Deterioration of rangeland due to overstocking, overgrazing, trampling or too frequent fires – not a threat at present 	<ul style="list-style-type: none"> • Rangeland in optimum condition (*) • GDACE can advise if necessary • Plan for acquiring baseline data against which impacts can be assessed • Plant species list required • Rangeland condition not problematic at present 	Keep watch	Landowner. Reserve manager does all that is necessary	<ul style="list-style-type: none"> • Check for trampled bare area • Check for loss of palatable grasses and forbs • Check for increasing density of succulents such as <i>Aloe davyana</i> 	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Retention of topsoil, surface drainage, surface erosion	<ul style="list-style-type: none"> Loss and dispersal of topsoil makes re-vegetation difficult 	<ul style="list-style-type: none"> Fossil site free of erosion (*) Check all tracks and habitual car park Check for surface drainage and distribution of runoff over surface Check for signs of surface erosion 	Necessary	Landowner, Permitted scientists (if present), within fossil site	<ul style="list-style-type: none"> Check for worn patches of vegetation where cars habitually park Check for erosion gulleys in tracks Check for patches of exposed soil Check for pedestalling of plant roots 	Ongoing
Fire Management	<ul style="list-style-type: none"> Too frequent fires have a negative effect on vegetation Too few fires have the effect of shrub and tree encroachment Fire is a threat to moveable property 	<ul style="list-style-type: none"> Proper fire regime for Bankenveld maintained (*) Implement a fire management policy Record fire seasonality, frequency and intensity Take precautionary measures to contain domestic fires started on site Brief excavators and colleagues on what to do in such a situation Provide suitable beaters for research staff 	Necessary	Landowner, Permitted scientist (if present, within fossil site), GDACE (generic, for COH WHS)	<ul style="list-style-type: none"> Ensure that rangeland study for base data against which fire impact can be assessed is set up Ensure that a fire frequency recording programme is set up Ensure that beaters are always on hand 	Ongoing
Red data species, rare and economically significant plants and animals	<ul style="list-style-type: none"> Loss of edible and medicinal plants. Many important plant species are not on RED DATA list. Loss of colonies of <i>Miniopterus natalensis</i> 	<ul style="list-style-type: none"> Preservation of biodiversity (*) Surveillance of indigenous plant use Draw up a species list of medicinal, poisonous, edible and economically significant species Map occurrence and preferred microhabitats Monitor collection and utilization Be thoroughly aware of the impacts of excavation (dust, noise, excessive movement, fumes from generator, etc) can have on the bat colony 	Necessary	GDACE, Landowner, and their staff	<ul style="list-style-type: none"> Check for signs of digging geophytes out by the roots Check local roadside vendors for plants on sale Check bat numbers against previously recorded numbers Check position of generator relative to 'breathing holes' of the underground system Check noise levels Check lighting and possible disturbance Check increasing CO₂ levels 	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Invasive alien plant species.	<ul style="list-style-type: none"> Invasion of avens and other habitats by alien species Loss of biodiversity Unattractive landscape 	<ul style="list-style-type: none"> Fossil site free of invasive aliens(*) Make a list of all invasive plant species Map and prioritise infestations Determine best eradication or control programme. GDACE available for assistance Assess costs and find budget Begin control according to guideline provided in generic management plan Enlist expertise of GDACE Implement control and clearance programme Monitor and follow up as required 	necessary	Landowner, Permitted scientists (if present in work environment)	<ul style="list-style-type: none"> Visual checks for infestations and incidence density Monitor with fixed point photography 	Ongoing
Weeds & shrub growth in excavation site	<ul style="list-style-type: none"> Roots destabilize breccias in time Plants reduce visibility of noteworthy sections Weeds give a negative visual experience and project an air of dereliction 	<ul style="list-style-type: none"> Weed-free fossil site (*) Pull troublesome weeds by hand, or 'skoffel' Destroy in a manner that does not spread seed further Do not consider seed-banked soil from weed-infested areas for use, spreading or fills elsewhere 	Necessary	Landowner, Permitted scientists (if present, in work environment)	<ul style="list-style-type: none"> Visual checks for weed infestations Fixed point photography for controls 	Ongoing
Development in 'viewshed'	<ul style="list-style-type: none"> Negative visual impact 	<ul style="list-style-type: none"> Pristine viewshed and 'sense of place' maintained (*) Not a problem at present COH WHS to monitor all new development plans 	Keep watch	COH WHS MA	<ul style="list-style-type: none"> Check plans for visual impact on viewshed of site 	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Habitat protection: Removal of stromatolites.	<ul style="list-style-type: none"> Loss of Heritage material and site significance. Loss of micro-habitats (mosaic of sunny and shady areas). 	<ul style="list-style-type: none"> Preservation of Pelindaba Stone and Stromatolites (*) (Generic to COH WHS) Landowner. Permitted scientists and field staff to maintain surveillance Heritage Monitors to be alerted 	Necessary	Landowner, permitted scientists (if present), field staff; Heritage Inspectors	<ul style="list-style-type: none"> Check for signs of disturbed soil, exposed patches of soil, overturned and disturbed rock 	Ongoing
SUBTERRANEAN ENVIRONMENT						
Interpretation of subterranean environment	<ul style="list-style-type: none"> Lack of information regarding the significance of caves to science of palaeontology Lack of appreciation of the significance and sensitivities of the subterranean environment 	<ul style="list-style-type: none"> Well-interpreted subterranean environment (*) Incorporate caves and ecology of subterranean environment into site interpretation Liaise with caving groups and request assistance with education if necessary. Caving groups often have surveyed plans of underground systems 	Necessary	Landowner permitted scientists (if present), tourist guides (if present)	<ul style="list-style-type: none"> Check that subterranean environments are suitably interpreted 	Ongoing
Presence of breeding colonies of bats	<ul style="list-style-type: none"> Loss of colony – sensitive to human interference Species involved - (<i>Myotis natalensis</i>) is declining in numbers 	<ul style="list-style-type: none"> Conservation of bat colony (*) Take care when extending excavations into cave areas possibly used as hibernacula Ensure that excavation only takes place when risk of disturbing breeding season is low Ensure that bats have free access into and out of cave GDACE can offer advice 	Necessary	GDACE to monitor	<ul style="list-style-type: none"> GDACE to establish monitoring criteria for breeding colony Check for presence and numbers of bats 	Ongoing, breeding season

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Porcupine lairs and owl roosts	<ul style="list-style-type: none"> Disturbance and displacement of animals Porcupine lairs and owl roosts are important as modern analogues for taphonomic processes of the past 	<ul style="list-style-type: none"> Preservation of porcupine lairs and owl roosts (*) Protect any porcupine lairs and owl roosts on site by alerting site users to their presence and explaining appropriate behaviour Encourage that their behavior and lair contents are studied without disturbing animals Check for snares 	Necessary	All site users	<ul style="list-style-type: none"> Check that porcupine lairs remain active – note presence of quills, droppings, gnawed bones Check for snares 	Ongoing
INFRASTRUCTURE						
Access road	<ul style="list-style-type: none"> See erosion above 	<ul style="list-style-type: none"> See erosion above 			<ul style="list-style-type: none"> 	
Culverts, bridges, drainage line crossings	<ul style="list-style-type: none"> Impeded flow along drainage line, upstream damming and downstream channel cutting; desiccation of vleis areas 	<ul style="list-style-type: none"> Unimpeded flow along drainage courses (*) Provide pipes of appropriate diameter under road crossings, rather than using fill and compaction as an engineering strategy Keep bridges free of flotsam and driftwood which impede flow 	desirable	landowner	<ul style="list-style-type: none"> Check culverts for stream flow blockage 	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Toilets, abluition	<ul style="list-style-type: none"> Inadequate or improper sewage disposal could pollute groundwater Poor toilet facilities create a poor visitor impression Single pit toilet for all site users and visitors is inadequate Unscreened , lack of privacy 	<ul style="list-style-type: none"> Environmentally suitable male and female toilets available on site (*) VIP or Environloo to be installed in time as and if excavations resume 	Necessary	Landowner, permitted scientists (if present), (for excavators and tourists)	<ul style="list-style-type: none"> Check type of toilet Check efficacy, odours, flies 	Ongoing
Waste management and disposal	<ul style="list-style-type: none"> Litter Cattle and wild animals die from ingesting plastic bags Water pollution 	<ul style="list-style-type: none"> Litter-free fossil site (*)if excavations in operation Provide litter bins, more when extra people are expected Collect and remove all litter regularly Best practice would require sorting and recycling litter 	necessary	All site users	<ul style="list-style-type: none"> Check for left litter Check that litter bins have been installed Check removal schedule Check that litter stored on site cannot be wind distributed Encourage recycling 	Ongoing
Pathways for site users and visitors	<ul style="list-style-type: none"> Pathways too close to excavations can cause excavation edges to collapse Visitors/children falling into excavations, avens or miners' excavations Pathways can cause erosion 	<ul style="list-style-type: none"> Safe pathways not too close to excavation edges (*) Capping with thin layer of cement as at Drimolen Psychological barriers Use safe retaining area for visitors Provide anti-erosion measures at sensitive areas 	Done	Landowner Permitted scientist (if present)	<ul style="list-style-type: none"> Check visitor pathways, boardwalks, viewing platforms for safety - of visitors and of site fabric Check pathways for wear and tear and channeling/erosion 	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Site plaque recognizing World Heritage Site status and National Heritage Site Status	<ul style="list-style-type: none"> Required in terms of the WHC Act and NHRA. Enhances site status 	<ul style="list-style-type: none"> Site Plaque finally installed (*) Landowner has indicated they would prefer in the vicinity of the building at the site SAHRA has had wording approved by scientists Establish agreement regarding type of plinth Ensure that both SAHRA and WHS logos appear Acquire budget. SAHRA to install 	Necessary	SAHRA	<ul style="list-style-type: none"> Check plaque condition and safety (brass plaques liable to theft) 	Ongoing
Signage: adequacy	<ul style="list-style-type: none"> Poor tourist experience if site not adequately interpreted 	<ul style="list-style-type: none"> Adequate interpretative signage of site (*) (possible future requirement) Site not open to general public, specialist tour operator and permitted scientist provide site interpretation 	Future	All	<ul style="list-style-type: none"> Check quality of signage Check quality of site interpretation 	Ongoing
Visitor impacts	<ul style="list-style-type: none"> Littering Pollution Erosion of pathways Disturbance of excavations Theft of fossils Graffiti 	<ul style="list-style-type: none"> Elimination or minimization of visitor impacts(*) The potential impacts listed all adequately attended at Plover's Lake for current visitor levels Toilet facilities still inadequate 	Future	All	<ul style="list-style-type: none"> Check for littering Check for pollution of site Check all walkways for wear and tear Check for visitor disturbance of excavations or equipment Check for tampering with and removal of stored fossils Check for graffiti 	

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Infrastructure : water	<ul style="list-style-type: none"> Used to be supplied by drum or bowser Inadequate water supply inhibits excavation Lack of water slows down breccia preparation Water needed for ablutions Water needed to control dust 	<ul style="list-style-type: none"> Future planning – not an issue at present Nothing can be done about this at present 	Future	Permitted scientists (if present)	<ul style="list-style-type: none"> Buried pipeline Concealed/screened storage tank gas and when possible) 	
Infrastructure : Energy	<ul style="list-style-type: none"> Lack of energy reduces excavation speed and efficiency 	<ul style="list-style-type: none"> Future planning – not an issue at present If brought to site, bury cable underground 	Future	Landowner, Permitted scientists (if present)	<ul style="list-style-type: none"> None 	
Telecommunications	<ul style="list-style-type: none"> Telephone necessary for responsible tourism No landline 	<ul style="list-style-type: none"> Future planning – not an issue at present 	Future	COH WHS MA	<ul style="list-style-type: none"> Check cellphone reception 	
RESEARCH ENVIRONMENT						
Alteration of surface topography, drainage	<ul style="list-style-type: none"> Excavation creates sumps, into which water is directed Collapse of the footwall in subterranean situations is a risk. 	<ul style="list-style-type: none"> Excavation area free of drainage and erosional problems(*) Create appropriate drainage in area peripheral to excavations which directs runoff away from sumps Situation appears to be in hand at the site 		Permitted scientist (if present)	<ul style="list-style-type: none"> Monitor sumps for floodwater and ponding (usually drains underground) 	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Safety of heritage material, pathways	<ul style="list-style-type: none"> • Trampling by visitors 	<ul style="list-style-type: none"> • Fossils safe from trampling (*) Check a suitable route around excavations for exposed fossils and provide a safe pathway that can be relocated as excavation develops 	Done	Permitted scientist, (if present) landowner	<ul style="list-style-type: none"> • Monitor site for trampling, particularly in pathway areas 	Ongoing
Safety of heritage material, trampling	<ul style="list-style-type: none"> • Trampling by warthogs and other animals 	<ul style="list-style-type: none"> • Fossils safe from trampling (*) • Not a problem at present 	Keep watch	SAHRA, Landowner, Permitted scientist (if present)	<ul style="list-style-type: none"> • Monitor animal trampling in site 	Ongoing
Excavation edges	<ul style="list-style-type: none"> • Decalcifying breccia results in the excavation walls having friable edges • Very powdery substrates (such as fine cave fills) results in unstable edges and walls • Unstable edges collapse • This poses a risk of physical danger as well as of information loss 	<ul style="list-style-type: none"> • Safe and stable excavation edges (*) • provide physical barrier or psychological barrier to prevent visitors getting too close • do not site pathways too close to excavation edges • cap unstable edges with lime cement if friable and shore and pack with sandbags if powdery 	Necessary	Permitted scientist(if present)	<ul style="list-style-type: none"> • Researchers to monitor every time they are digging • Monitor for fallen and slumped wall deposit. Check footwall for fallen debris. • Annual professional assessment 	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Excavation walls	<ul style="list-style-type: none"> • Unstable walls, particularly if decalcified tend to slump and collapse • Powdery sediments slump (see above) • Collapse poses a threat to site users below unstable areas • Collapse poses a threat to site significance because of mixing • Very high walls are difficult to stabilize when excavation is terminated or completed • Very high walls are susceptible to problems noted above 	<ul style="list-style-type: none"> • Safe and stable excavation walls (*) • Excavation walls at Plover's Lake Cave are not acceptable at present • Deep excavations should be "Benching", quarry-style. • Unstable walls should be stabilised - geotextile or sandbagging with 10% cement mixed with sand filling • Brow edges to be shored and covered with sandbagging. 	Keep watch	Permitted scientist (if present)	<ul style="list-style-type: none"> • Check degree of calcification of breccia – hard breccia can take higher walls than decalcified material • Check unsupported wall height and recommend benching out if it appears unstable • Check wall for loose rocks and boulders and bar down if necessary • Bevel off friable excavation edges 	Ongoing
Access to bottom of excavation	<ul style="list-style-type: none"> • Steps, ladders, etc. must be safe and stable • Falls and injury 	<ul style="list-style-type: none"> • Safe access to excavation base (*) • Make benching shallow enough to use as steps • Create and cap steps with protective layer • Ensure ladders, stairs and their handrails are safe 	Necessary	Permitted scientist (if present)	<ul style="list-style-type: none"> • Check access routes to excavation base for safety and stability 	Ongoing
Compliance with terms and conditions of permit	<ul style="list-style-type: none"> • Loss of information and site significance 	<ul style="list-style-type: none"> • Excavations in accord with ROD of permit (*) • Check that all terms and conditions written into the SAHRA permit are being adhered to. 	necessary	SAHRA, permitted scientist (if present)	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"> • Loss of information and site significance 	<ul style="list-style-type: none"> • Defined and stabilized witness sections (*) • Ensure that selection of appropriate witness sections are a requirement in terms of the permit • Ensure that the researcher provides adequate criteria for the election of witness sections • Ensure that all significant features are covered by or included in witness sections proposed • Ensure that witness sections are not prone to collapse and that they are stabilized on closure of excavation • Ensure that witness section is committed to plan 	Necessary	Permitted scientist (if present)	<ul style="list-style-type: none"> • Check that witness sections have been defined and are left standing in a stabilized condition 	

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

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

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Domestic cooking fires (when excavation is active)	<ul style="list-style-type: none"> Gas cylinders can explode Domestic cooking fires are a potential source of uncontrolled fire 	<ul style="list-style-type: none"> Fossil site which does not constitute a fire hazard (*) Provide appropriate beaters in the event of a grass fire Burn suitable firebreaks around fossil site and infrastructure 	Necessary	Permitted scientist (if present), in consultation with landowner	<ul style="list-style-type: none"> Check that firebreaks are in place if landowner has recommended this Check that there are sufficient beaters on site 	At each fossil site inspection
Signage, site safety and warnings	<ul style="list-style-type: none"> Lack of appropriate signage can expose visitors to unexpected hazards, e.g. that there is a bees' nest (for if and when larger student groups are on site, e.g. field schools) 	<ul style="list-style-type: none"> Compliance with Public health and safety requirements (*) Install appropriate behavior modifiers and site safety signage as and when this becomes necessary Appropriate safety signage is a requirement of Public (Occupational) Health and Safety Act (Maropeng even warns against possible presence of snakes) 	Keep watch	Permitted scientist (if present), landowner, tour operators	<ul style="list-style-type: none"> Check for installation and appropriate wording Check for appropriate location of signs, design and durability 	Ongoing
Subterranean environments at Plover's Lake and adjacent caves	<ul style="list-style-type: none"> Instability due to previous mining activities and blasting Natural instability Rockfalls Unprotected drops 	<ul style="list-style-type: none"> Subterranean areas safe or off-limits (*) No-go areas for tourists: specialist caving groups and permitted scientists only Use tape to mark off sudden drops in surface underground 	Necessary	Permitted scientist (if present), tour operators	<ul style="list-style-type: none"> Check that no-go instruction is being obeyed Check that sudden or hidden drops are protected Check for suitable psychological barriers 	Ongoing

Issues	Threats or Risks	Desired outcomes (*) and Management Measures	Priority	Responsibility	Monitoring Criteria	Monitoring frequency
Bees, "Kransbye", Wasps	<ul style="list-style-type: none"> The numerous cavities and hollows are home to several bee hives and wasps' nests. Many people are allergic to bee stings in particular. 	<ul style="list-style-type: none"> Site safe for all site users (*) Ensure that the necessary antihistamines are on hand. Destroy or have hives removed if these are where people frequently work. Post warning signage Provide first aid post Take kransbye seriously as the nearest emergency help is far away and reaction time slow 	Necessary	Permitted scientist (if present), Tour Operator	<ul style="list-style-type: none"> Monitoring should include checking the route for insect problems. Monitor speed at which an emergency case could reach appropriate medical help 	Ongoing
Accidental falls	<ul style="list-style-type: none"> Students, visitors, staff or tourists suing the operator or PI 	<ul style="list-style-type: none"> Site safety (*) Ensure that walkways are as even as possible. Provide handrails and steps at vertical drops and changes of level. Keep group sizes small enough to control at all times 	Necessary if tourism is taking place on site	Tourist operator, permitted scientist (if present)	<ul style="list-style-type: none"> Monitor route by walking it regularly to check for flaws in routing, infrastructure 	Ongoing
Theft, crime	<ul style="list-style-type: none"> The isolated situation makes the site particularly prone to petty theft of excavation and other equipment. 	<ul style="list-style-type: none"> Site safety (*) Provide secure lock-up facilities on-site for researchers equipment – lock-up store required Control on all persons entering the area 	Necessary	Permitted scientist (if present), landowner, site residents	<ul style="list-style-type: none"> Security checks 	Ongoing

GENERIC ISSUES RELATING TO FOSSIL SITE EXCAVATIONS – see table in generic Issues Document

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7 MAPS AND FIGURES

Fig. 1: Locality Plan

Fig. 2: Aerial view of site

Fig. 3: Proclamation diagram

Fig. 4: Access track to Plover's Lake fossil site

Fig.5: Site plan showing significant exposures of breccias and approximate positions of subterranean sites.

Fig. 6: Power lines

Fig. 7: Breccia piles need to be annotated as to source, future plans and authorship