FULL PALAEONTOLOGICAL HERITAGE IMPACT ASSESSMENT REPORT ON THE SITE OF THE PROPOSED EXPANSION OF QUANTUM FOODS (PTY) LTD'S HBP HATCHERY ON PORTION 6 OF THE FARM HOUTKOP 43, NEAR HOLFONTEIN, NORTH WEST PROVINCE

15 November 2018

Prepared for:

Heritage Contracts and Archaeological Consulting CC

On behalf of:

Quantum Foods (Pty) Ltd

Postal address:
P.O. Box 13755
Hatfield
0028
South Africa

Cell: +27 (0) 79 626 9976
Faxs:+27 (0) 86 678 5358
E-mail: bmgeoserv@gmail.com

FULL PALAEONTOLOGICAL HERITAGE IMPACT ASSESSMENT REPORT ON THE SITE OF THE PROPOSED EXPANSION OF QUANTUM FOODS (PTY) LTD'S HBP HATCHERY ON PORTION 6 OF THE FARM HOUTKOP 43, NEAR HOLFONTEIN, NORTH WEST PROVINCE

Prepared for:

Heritage Contracts and Archaeological Consulting CC

On Behalf of:

Quantum Foods (Pty) Ltd

Prepared By:

Dr B.D. Millsteed

INDEMNITY AND CONDITIONS RELATING TO THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. BM Geological Services reserves the right to modify aspects of the report including the recommendations if, and when, new information becomes available from ongoing research or further work in this field or pertaining to this investigation.

Although BM Geological Services exercises due care and diligence in rendering services and preparing documents, BM Geological Services accepts no liability, and the client, by receiving this document, indemnifies BM Geological Services against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by BM Geological Services and by the use of the information contained in this document.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

COPYRIGHT

The client, on acceptance of any submission by BM Geological Services and on condition that the client pays to BM Geological Services the full price for the work as agreed, shall be entitled to use for its own benefit:

- The results of the project.
- The technology described in any report, and,
- Recommendations delivered to the client.

Should the applicant wish to utilise any part of, or the entire report, for a project other than the subject project, permission must be obtained from BM Geological Services to do so. This will ensure validation of the suitability and relevance of this report on an alternative project.

EXECUTIVE SUMMARY

Quantum Foods (Pty) Ltd is proposing to expand an existing HBP hatchery facility. The project area is located upon a portion of Portion 6 of the farm Houtkop 43. The site is situated approximately 5.3 km north of Holfontein (east of the R500 road), 10 km west of Brandvlei and 15 km south-west of Magaliesberg, Merafong City Local Municipality, Southern District Municipality, Randfontein Magisterial District, North West Province. The project area can be located within the confines of 1:50 000 topographic map 2627AB. The centre point co-ordinates of the project area are approximately 27° 28' 31.20"E and 26° 7' 21.38"S. The aerial extent of the project infrastructure is the hatchery (0.6 ha), Site 3 (3.6 ha), Site 4 (2.4 ha), Site 5 (1.42 ha), water pipeline (1000 m), water pipeline 1 (345 m), road to Site 3 (473 m), road to Site 4 (489 m) and the road to Site 5 (149 m).

Quantum Foods (Pty) Ltd has appointed Eco Impact legal Consulting (Pty) Ltd, as the independent environmental consultant, to undertake the required Basic Assessment (BA) and assess all the potential environmental impacts associated with the proposed project. Eco Impact legal Consulting (Pty) Ltd has appointed has appointed Heritage Contract and Archaeological Consulting CC to produce a Heritage Impact Assessment Report for the project that will form part of the BA documentation for the project. Heritage Contract and Archaeological Consulting CC has contracted BM Geological Services to provide a desktop Palaeontological Heritage Impact Assessment Report in respect of the proposed project that will form part of the final BA documentation.

A comprehensive, foot-based investigation of the palaeontological potential of the proposed HBP hatchery facility has been conducted by Dr Barry Millsteed on 25/10/2018. The investigation was conducted on the site the proposed infrastructure as identified by Quantum Food's farm manger. However, subsequent to the site investigation the location of proposed project infrastructure was changed for operational reasons. The project will consist of a new hatchery building, three layer complexes (named Sites 3-5), as well as three twin spoor roads providing access to Sites 3-5 and two water pipelines. The aerial extent of the project infrastructure is the hatchery (0.6 ha), Site 3 (3.6 ha), Site 4 (2.4 ha), Site 5 (1.42 ha), water pipeline (1000 m), water pipeline 1 (345 m), road to Site 3 (473 m), road to Site 4 (489 m) and the road to Site 5 (149 m). The change in location of a number of the infrastructure elements relative to the area investigated is not considered by the author to negatively impact upon any conclusions and recommendations made in this report.

Any negative impacts to the palaeontological heritage of the region will be limited to the footprint area of the construction of the project's infrastructural elements; the extent of any impact is accordingly characterised as local. Any negative impact upon fossil materials caused by the project will be permanent. It is anticipated, herein, that most infrastructural elements will only directly affect the surface of the site to a relatively

shallow depth (< 2m). Fossil materials that remain undiscovered after the construction of the project and which are located beneath the maximum depth of the anticipated excavations will only be negatively affected in so far as they will be unavailable for scientific study for the life expectancy of the infrastructural elements that comprise the project (i.e., long term to permanent).

The project area is completely underlain by dolomitic sediments of the Malmani Subgroup. These sediments are known to contain prolific assemblages of stromatolites. A layer of unfossiliferous regolith (Terra Rosa soil) was identified as overlying the Malmani Subgroup within the project area; the layer is of inconsistent thickness, with numerous outcrops of Malmani Subgroup visible. A third rock type is potentially present within the project area. This third group consists of discordant Pliocene karst infill deposits (breccia and flowstone deposits) hosted within the Malmani Subgroup rocks. These karst infill deposits are known to be fossiliferous within the adjacent Cradle of Human Kind World Heritage Site where they are known to contain hominin-bearing vertebrate fossil assemblages of world significance. However, no Pliocene karst deposits were located during the conduct of the site investigation. The possibility remains that these deposits may either be present within the subsurface of the Malmani Subgroup, but not crop out or that they may be present, but be located beneath the Cainozoic regolith cover.

There is no important negative impact on the palaeontological heritage of the project area that will be caused by the impacts of the project upon the Cainozoic regolith nor the dolomitic sedimentary rocks of the Malmani Subgroup. No Pliocene karst infill deposits hosted were located within the Malmani Subgroup dolomites during the site visit. However, a small chance exists that deposits of this type may exist in the subsurface but not be exposed (or may crop out beneath the regolith cover). If these karst deposits do exist and are fossil-bearing any negative impact upon them would be of the high scientific and cultural significance. The significance of the fossil assemblages they may contain is indicated by the fact that it is the presence of similar fossil assemblages that underpinned the creation of the adjacent Cradle of Human Kind World Heritage Site. Any damage that occurs to such fossil material during the excavation and construction phase of the project would be permanent and irreversible.

The potential negative impact to the palaeontological heritage of the area can be substantially mitigated by the implementation of appropriate mitigation processes. It is recommended that a close examination of all excavations be made while they are occurring within the Malmani Formation dolomites. Should any fossil materials be identified, the excavations should be halted and SAHRA informed of the discovery (as per legislation outlined in Section 3.3 herein). These examinations must be made by a professional palaeontologist and the investigation should be timed to coincide with the excavation of the trenches to accommodate building foundations. Conducting the investigation at this time would provide the greatest exposure of the Malmani Subgroup

rocks that host the karst infill deposits. Should fossil material be identified the palaeontologist should assess their significance and make further recommendations to mitigate any negative impacts. A significant potential benefit of the examination of the excavations associated with the construction of the project is that currently unobservable fossils may be uncovered. As long as the construction process is closely monitored it is possible that potentially significant fossil material may be made available for scientific study.

A potential positive outcome of these mitigation protocols could be that fossil materials become available for scientific study that would otherwise have been hidden within or beneath the regolith. Should such new palaeontological material be located as a result of this site investigation this could prove to have a positive effect on the understanding of the fossil record of South Africa and positively affect the palaeontological heritage of the country.

This study has not identified any palaeontological reason to prejudice the progression of the HBP hatchery expansion project, subject to the mitigation programs suggested, herein, being put in place.

TABLE OF CONTENTS

TABLE OF FIGURES

1 INTRODUCTION

Quantum Foods (Pty) Ltd is proposing to expand an existing HBP hatchery facility. The project area is located upon a portion of Portion 6 of the farm Houtkop 43. The site is situated approximately 5.3 km north of Holfontein (east of the R500 road), 10 km west of Brandvlei and 15 km south-west of Magaliesberg, Merafong City Local Municipality, Southern District Municipality, Randfontein Magisterial District, North West Province (Figure 1). The project area can be located within the confines of 1:50 000 topographic map 2627AB. The centre point co-ordinates of the project area are approximately 27° 28' 31.20"E and 26° 7' 21.38"S. The aerial extent of the project infrastructure is the hatchery (0.6 ha), Site 3 (3.6 ha), Site 4 (2.4 ha), Site 5 (1.42 ha), water pipeline (1000 m), water pipeline 1 (345 m), road to Site 3 (473 m), road to Site 4 (489 m) and the road to Site 5 (149 m).

Quantum Foods (Pty) Ltd has appointed Eco Impact legal Consulting (Pty) Ltd, as the independent environmental consultant, to undertake the required Basic Assessment (BA) and assess all the potential environmental impacts associated with the proposed project. Eco Impact legal Consulting (Pty) Ltd has appointed has appointed Heritage Contract and Archaeological Consulting CC to produce a Heritage Impact Assessment Report for the project that will form part of the BA documentation for the project. Heritage Contract and Archaeological Consulting CC has contracted BM Geological Services to provide a desktop Palaeontological Heritage Impact Assessment Report in respect of the proposed project that will form part of the final BA documentation.

2 TERMS OF REFERENCE AND SCOPE OF THE STUDY

The terms of reference for this study were as follows:-

- Identify all palaeontological materials located in the area of the project area.
- Quantify the palaeontological heritage significance of any fossil materials identified.
- Describe the possible impact of the proposed development on the palaeontological heritage of the site, according to a standard set of conventions.
- Propose suitable mitigation measures to minimise possible negative impacts, if any are identified, on the palaeontological heritage of the site.
- Provide an overview of the applicable legislative framework.

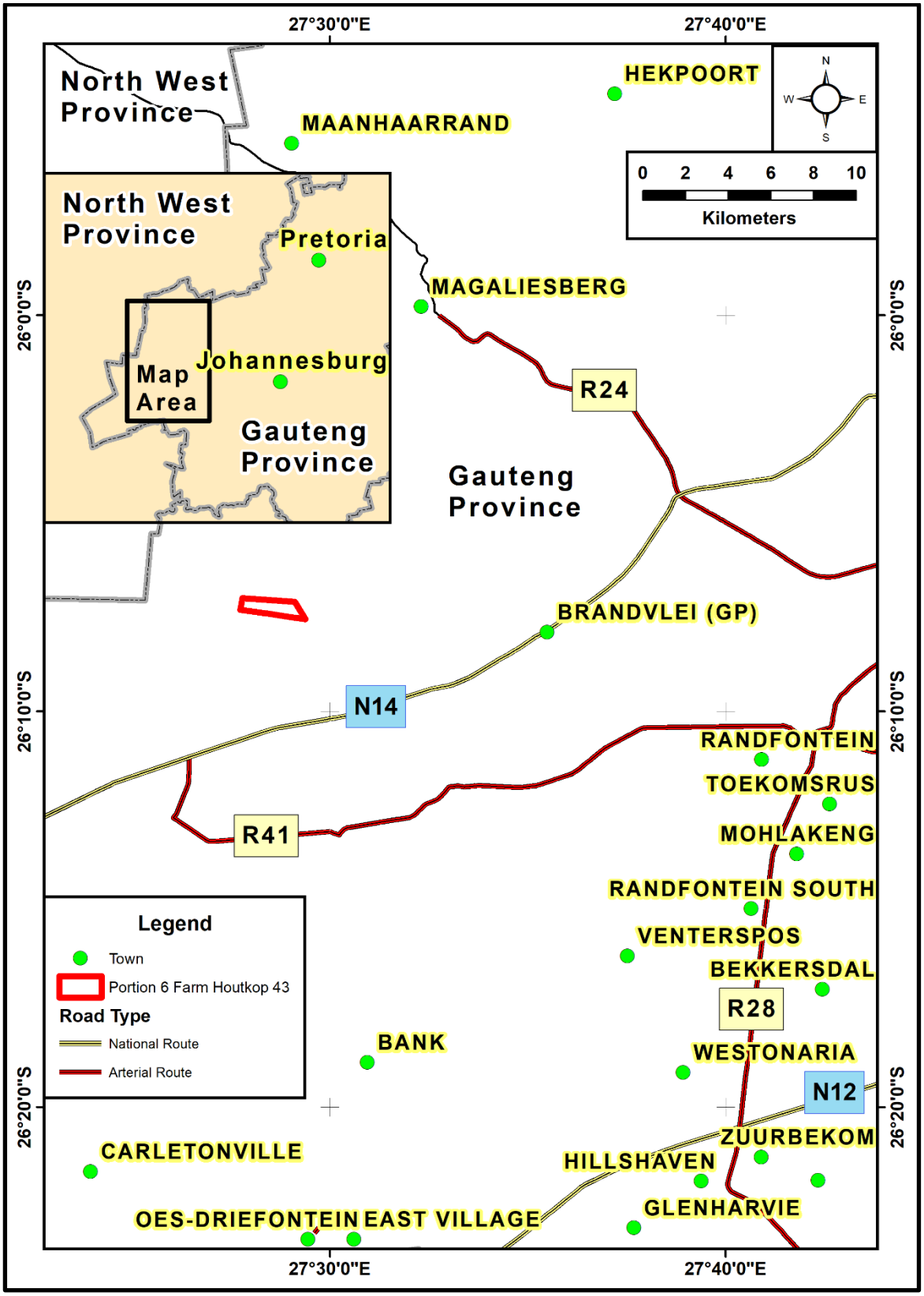

Figure 1: Location map showing the position of the proposed project.

3 LEGISLATIVE REQUIREMENTS

South Africa's cultural resources are primarily dealt with in two Acts. These are the National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998).

3.1 The National Heritage Resources Act

The following are protected as cultural heritage resources by the National Heritage Resources Act:

- Archaeological artefacts, structures and sites older than 100 years,
- Ethnographic art objects (e.g. prehistoric rock art) and ethnography,
- Objects of decorative and visual arts,
- Military objects, structures and sites older than 75 years,
- Historical objects, structures and sites older than 60 years,
- Proclaimed heritage sites,
- Grave yards and graves older than 60 years,
- Meteorites and fossils,
- Objects, structures and sites or scientific or technological value.

The Act also states that those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities. The national estate includes the following:

- Places, buildings, structures and equipment of cultural significance,
- Places to which oral traditions are attached or which are associated with living heritage,
- Historical settlements and townscapes,
- Landscapes and features of cultural significance,
- Geological sites of scientific or cultural importance,
- Sites of Archaeological and palaeontological importance,
- Graves and burial grounds,
- Sites of significance relating to the history of slavery,
- Movable objects (e.g. archaeological, palaeontological, meteorites, geological specimens, military, ethnographic, books etc.).

3.2 Need for Impact Assessment Reports

Section 38 of the Act stipulates that any person who intends to undertake an activity that falls within the following:

- The construction of a linear development (road, wall, power line, canal etc.) exceeding 300 m in length,
- The construction of a bridge or similar structure exceeding 50 m in length,
- Any development or other activity that will change the character of a site and exceed 5 000 m^2 or involve three or more existing erven or subdivisions thereof,
- Re-zoning of a site exceeding 10 000 m^2,
- Any other category provided for in the regulations of SAHRA or a provincial heritage authority.

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development. If there is reason to believe that heritage resources will be affected by such development, the developer may be notified to submit an impact assessment report. A Palaeontological Impact Assessment (PIA) only looks at the potential impact of the development palaeontological resources of the proposed area to be affected.

3.3 Legislation Specifically Pertinent to Palaeontology*

*****Note: Section 2 of the Act defines "palaeontological" material as "any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains".

Section 35(4) of this Act specifically deals with archaeology, palaeontology and meteorites. The Act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial):

- Destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite,
- Destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite,
- Trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
- Bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites,

- Alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above-mentioned palaeontological objects may only be disturbed or moved by a palaeontologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Further to the above point, Section 35(3) of this Act indicates that "any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority". Thus, regardless of the granting of any official clearance to proceed with any development based on an earlier assessment of its impact on the Palaeontological Heritage of an area, the development should be halted and the relevant authorities informed should fossil objects be uncovered during the progress of the development.

3.4 The National Environmental Management Act [as amended]

This Act does not provide the detailed protections and administrative procedures for the protection and management of the nation's Palaeontological Heritage as are detailed in the National Heritage Resources Act, but is more general in is application. In particular Section 2(2) of the Act states that environmental management must place people and their needs at the forefront of its concerns and, amongst other issues, serve their cultural interests equitably. Further to this point section 2(4)(a)(iii) states that disturbances of sites that constitute the nation's cultural heritage should be avoided, and where it cannot be avoided should be minimised and remedied.

Section 23(1) indicates that a general objective of integrated environmental management is to identify, predict and evaluate the actual and potential impact of activities upon the cultural heritage. This section also highlights the need to identify options for mitigating of negative effects of activities with a view to minimising negative impacts.

In order to give effect to the general objectives of integrated environmental management outlined in the Act the potential impact on cultural heritage of activities that require authorisation or permission by law must be investigated and assessed prior to their implementation and reported to the relevant organ of state. Thus, a survey and evaluation of cultural resources must be done in areas where development projects that will potentially negatively affect the cultural heritage will be performed. During this process the impact on the cultural heritage will be determined and proposals for the mitigation of the negative effects made.

4 METHODOLOGY

A site visit was conducted by Dr Millsteed in the company of Mr Piet Taljaard (farm manager) on 25/10/2018. Mr Taljaard indicated the areas where the infrastructure elements that will comprise the project were proposed to be located (i.e., where the site investigation was required). It was considered that the most effective methodology for determining the fossiliferous potential of the project area was to traverse the area by foot.

The bedrock underlying the study area consists of fossiliferous strata of the Malmani Subgroup (Figure 2). Clearly, the rocks of this stratigraphic unit comprise a primary target for this site investigation. It is also apparent from Figure 3 that the strata underlying the study area extend laterally into the adjacent Cradle of Human Kind World Heritage Site. Indeed, it is the rocks of the Malmani Subgroup that form the karst topography that host the majority of the world-renowned Pliocene fossil deposits that constitute the basis of the Cradle of Human Kind World Heritage Site. It is these secondary, geologically much younger, breccias and flowstone deposits that form a second, extremely significant target for the current investigation. Special attention was placed on the location of any such deposits that may occur within the project area.

The path of the foot traverse was recorded as a trackway on a hand-held GPS and is indicated in Figure 4. Photographs were taken and observations made were taken at a number of locations (see data waypoint locations in Figure 4). The location of the photographs and observation points was recorded using a hand-held GPS. Given budgetary constraints as well as the aerial extent of the proposed development it was impossible to visit every bedrock exposure within the project site within an acceptable timeframe. It is pertinent to accept that the field of view of the bedrock exposures available to Dr Millsteed was much larger than is indicated by the narrow trackway depicted in Figure 4; many more rock exposures were inspected than may appear to have been.

The area investigated by Dr Millsteed consisted of the total extent of the areas that will underly the new buildings as well as two linear zones that lie adjacent to power lines that were previously installed to provide power to the new buildings (Figure 4). These linear zones were identified by Mr Taljaard as being the approximate location of new roads that would provide access to the new layer buildings. Subsequent to the conduct of the site investigation the proposed location of a number of infrastructure elements was changed for operational reasons. It is apparent from Figures 4 and 5 that several of the proposed infrastructure elements now lie in area that were not specifically investigated during the site visit. This situation is not interpreted by the author to negatively impact upon the validity of any conclusions drawn in this report. Site 5 lies east of, but very proximal to (i.e., ca 200 m), of the area that was extensively investigated (Figures 4 and 5). The rocks that were observed showed no signs of

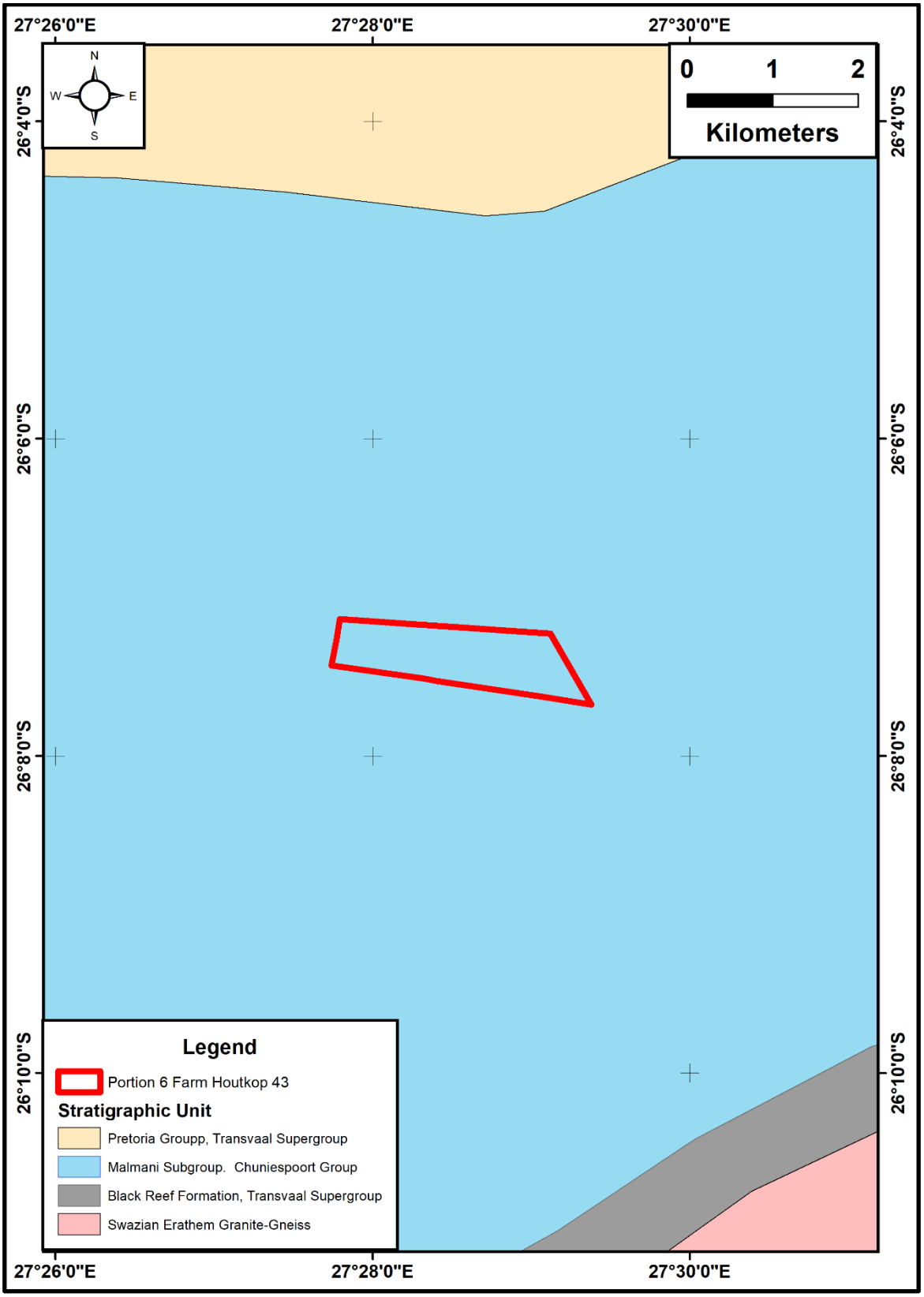

Figure 2: Map of the geology underlying the project area and the surrounding environs.

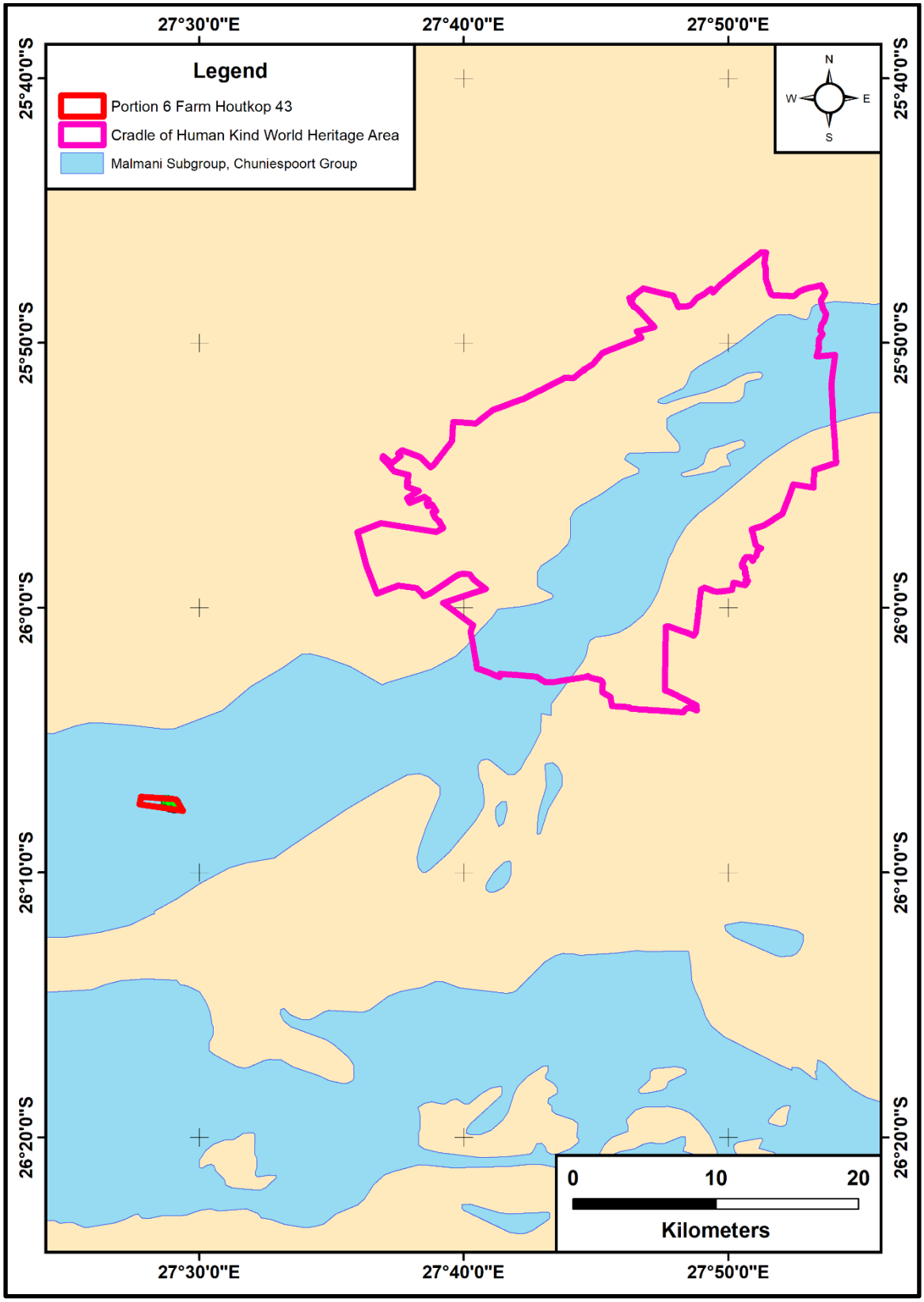

Figure 3: The outcrop distribution of the rocks of the Malmani Subgroup relative to the boundaries of the Cradle of Human Kind World Heritage Area and of Portion 6 of the farm Houtkop 43.

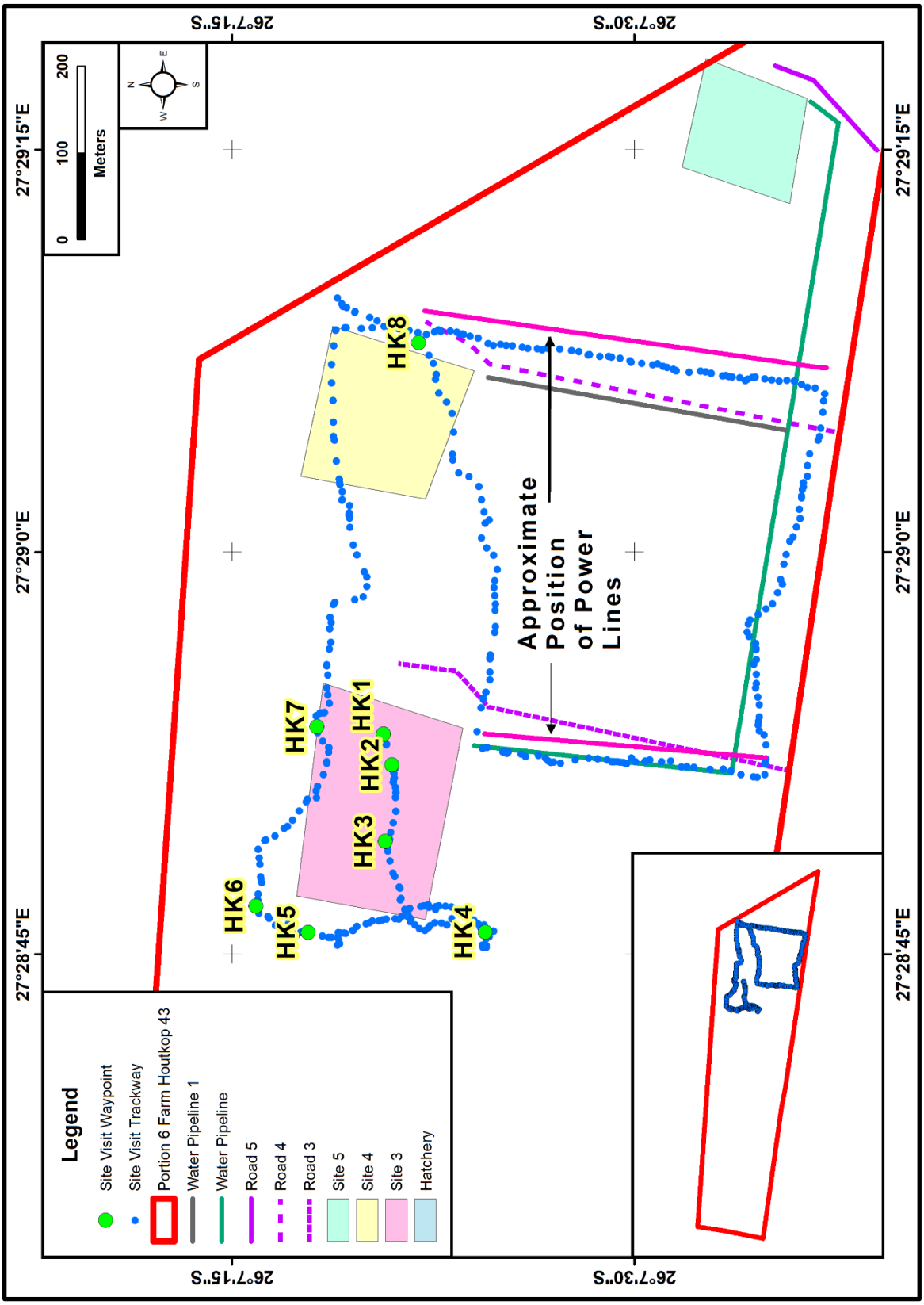

Figure 4: Map showing the location of the GPs trackway representing the location of the foot traverse conducted across the project area as well as the location of waypoints at which data was collected. Shown also is the approximate location of pre-existing powerlines that were emplaced to provide power to the project infrastructure.

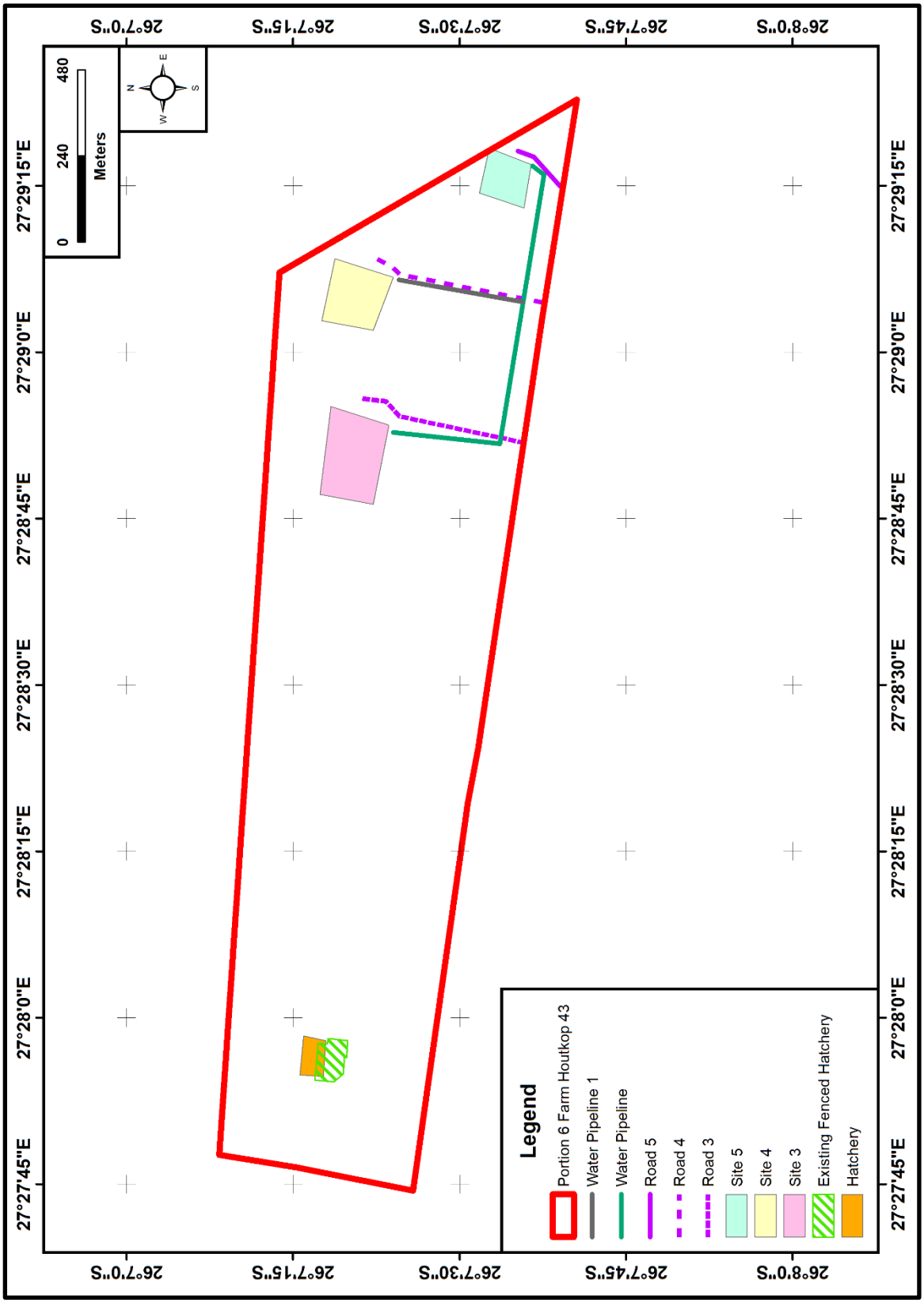

Figure 5: Map showing the location of proposed infrastructure elements that will comprise the project. The location of the infrastructure elements shown reflect the revised locations that post-date the site inspection.

containing any flowstone or breccia material. The stromatolites that are present within the rocks underlying Site 5 should not reasonably be expected to differ from those observed elsewhere in the project area. There is no reason to believe that the rocks underlying Site 5 would be any different. The second site that was not investigated (i.e., the new hatchery building) lies well to the west of the area that was investigated. However, inspection of Google earth imagery of the site (Figure 6) reveals that the southern extent of the hatchery area overlies ground that was historically cleared for the construction of the existing hatchery building. The central and northern portions of the ground upon which the new hatchery is planned appears to bear an extensive grass cover, suggesting a pervasive regolith cover. Similarly, no bedrock outcrops are visible in the Google earth imagery. Accordingly, an inspection of the area would not be expected to reveal any detail of the fossiliferous potential of the bedrocks underlying the proposed hatchery.

5 RELEVENT EXPERIENCE

Dr Millsteed holds a PhD in palaeontology and has previously been employed as a professional palaeontologist with the Council for Geoscience in South Africa. He is currently the principle of BM Geological Services and has sufficient knowledge of palaeontology and the relevant legislation required to produce this Palaeontological Impact Assessment Report. Dr Millsteed is registered with the South African Council for Natural Scientific Professions (SACNASP), is a member of the Palaeontological Society of South African, a member of the Association of Australasian Palaeontologists and is a Fellow of the Geological Society of South Africa.

6 ACCESS AND INDEPENDENCE

The area to be impacted by the proposed expansion of the HBP hatchery was identified by Mr P. Taljaard (farm manager) during the conduct of the site visit. The research was conducted completely free of any hindrance and, indeed, every help and assistance was provided. Access was freely available to all portions of the study area and the field visit was able to be conducted wherever it was deemed necessary for the satisfactory completion of the study. The land surface is flat and featureless, accordingly, as the observations were conducted on foot there were no areas that could not be easily visited and studied.

Figure 6: Google earth image showing the location of the proposed new hatchery building (white polygon) relative to the fenced area surrounding the existing hatchery building (blue polygon).

7 GEOLOGY AND FOSSIL POTENTIAL

Figure 2 shows that the project area is completely underlain by Neoarchaean to Eoproterozoic carbonate sedimentary rocks of the Malmani Subgroup, Chuniespoort Group. There is also a possibility of Pliocene karst infill deposits (i.e., breccia and/or flowstone) being present as discordant veins and pods within the Malmani Subgroup carbonates (Figure 3). The site investigation revealed the presence of a pervasive, but inconsistently thick regolith cover. A brief description of the geology of the Malmani Subgroup, karst infill deposits and the Cainozoic regolith cover and their potential palaeontological content is provided below.

6.1 Malmani Subgroup

6.1.1 Geology

The Malmani Subgroup forms part of the basin infill succession of the Transvaal Basin. The unit is up to 2 000 m thick and is subdivided into five formations. In order from oldest to youngest these formations are the Oaktree, Monte Christo, Lyttelton, Eccles and Frisco Formations (Eriksson *et al*., 2006). The name of the formation(s) that underly the project area is unknown. The characteristics of these units are as follow.

(a) **Oaktree Formation** – 176-320 m of dark gray to black, chert-free stromatolitic dolomite with thin interbeds of carbonaceous shale and quartzite in the lower part.
(b) **Monte Cristo Formation** – up to 740 m of pale gray, stromatolitic dolomite and chert, with frequent levels of chert breccia, carbonaceous shale and, in the lower part, oolite.
(c) **Lyttelton Formation** – 80-180 m of dark, fine grained, essentially chert-free, stromatolitic dolomite with thin carbonaceous shales.
(d) **Eccles Formation** - 240-500 m of pale gray, fine-grained, stromatolitic dolomites and cherts, with subordinate chert breccia, carbonaceous shale and oolite.
(e) **Frisco Formation** – a sporadically developed unit, up to 30 m thick, of dark chert-free stromatolitic dolomites and limestones interbedded with carbonaceous shale, tuff and iron-formation.

It is clear that the fundamental subdivisions of the Malmani Subgroup are based on the recognition of two main facies. The first is a pale grey, chert-rich dolomite and the second is dark grey to black, chert-poor, fine-grained dolomites and limestones, often in association with higher than normal amounts of clastic sediment. The pale chert–rich units are believed to comprise tidal-flat and shallow subtidal environments whereas the dark grey to black, chert-poor units represent deeper water subtidal deposits, as indicated by the large size of some of the contained stromatolitic mounds. These cycles represent transgressive-regressive macrocycles. Accordingly, the Malmani carbonates reflect three major transgressive-regressive macrocycles, upon which are superimposed a number of subordinate cycles. Each macrocycle commences with a chert breccia at the base of a thin carbonaceous shale and is capped by a thick succession of carbonates. The chert-breccia residues mark important regressive phases when the carbonates were subjected to intense chemical weathering and are believed to mark regional disconformities.

The site inspection revealed that the rocks of the Malmani Subgroup crop out as low, flat exposures across the project area (Figures 7 and 8). Within the project area the rocks comprising the subgroup consist of light grey dolomite interbedded with frequent, thin chert beds (Figures 8 and 9) and are, therefore, representative of the shallow water facies described above. The shallow-water deposition of these sediments is further attested to by the presence of small-scale, wave oscillation ripples within the sequence at waypoint HK5 (Figure 10). However, it is not known if the strata present are assignable to the Monte Cristo or the Eccles Formation.

7.1.1 Palaeontological potential

The discussion of the lithological characteristics of the formations comprising the Malmani Subgroup, above, makes it evident that stromatolites are ubiquitous throughout

the Malmani Subgroup (Figure 11). No other fossil types are known to have been preserved within the stratigraphic unit at the time that the unit was deposited.

7.2 Pliocene Karst Infill Deposits

7.2.1 Geology

It is evident from Figure 3 that the Malmani Subgroup crop out beneath the project area and that it also extends laterally and is distributed throughout the nearby Cradle of Human Kind World Heritage Site. It is the ancient development of karst topography and karst features such as fissures, sinkholes and cave structures within the carbonate sediments that comprise the second target for investigation in the present site investigation. Throughout the Cradle of Human Kind World Heritage Site, the geological infill of these structures is identifiable as breccias and/or flowstones present as discordant veins or pods within the Malmani Subgroup carbonates. This karst infill material has been dated to be as old as 3.64 Ma and possibly as old as 4.17 Ma (Partridge *et al*., 2003). The possibility of karst infill rocks occurring within the project area does exist. However, despite an extensive search for these rock types during the site investigation none were located. The possibility remains that these deposits may crop out beneath the Cainozoic regolith cover or be present within the Malmani strata but also not crop out.

6.1.2 Palaeontological potential

The karst infill deposits that occur within the Malmani Subgroup within the Cradle of Human Kind World Heritage Site are well known to contain Pliocene fossil assemblages of world significance (indeed this is the reason for the establishment of the Cradle of Human Kind World Heritage Site). The karst infill deposits are famous for containing a diverse assemblage of hominin fossils as well as a diverse associated mammalian fauna (including primates, pigs, antelope, equids and both large and small carnivores). Despite an extensive search during the site visit no Pliocene fossil materials were located.

7.3 Cainozoic Regolith

7.3.1 Geology

The regolith cover identified throughout the project area consists of reddish-brown, loamy, unconsolidated soils (i.e., Terra Rosa soils). Terra Rossa soils are known to form via the *in situ* weathering and decomposition of the underlying Malmani Subgroup carbonates. The soils were observed to be extremely variable in thickness, with extremely numerous Malmani Subgroup outcrops being observed (i.e., a regolith depth

Figure 7: Low, flat outcrops representative of the outcrop of the Malmani Subgroup carbonates (waypoint HK8; see Figure 4 for location).

Figure 8: Low, flat outcrops representative of the outcrop of the Malmani Subgroup carbonates (waypoint HK8; see Figure 4 for location). The very dark grey beds visible are chert layers while the light grey layers are dolomite.

Figure 9: Finely laminated light grey dolomites of the Malmani Subgroup (waypoint HK3; see Figure 4 for location).

Figure 10: Small-scale wave oscillation ripples within the carbonates of the Malmani Subgroup. These sedimentary structures speak to the shallow-water depositional environment that produced the unit (waypoint HK5; see Figure 4 for location).

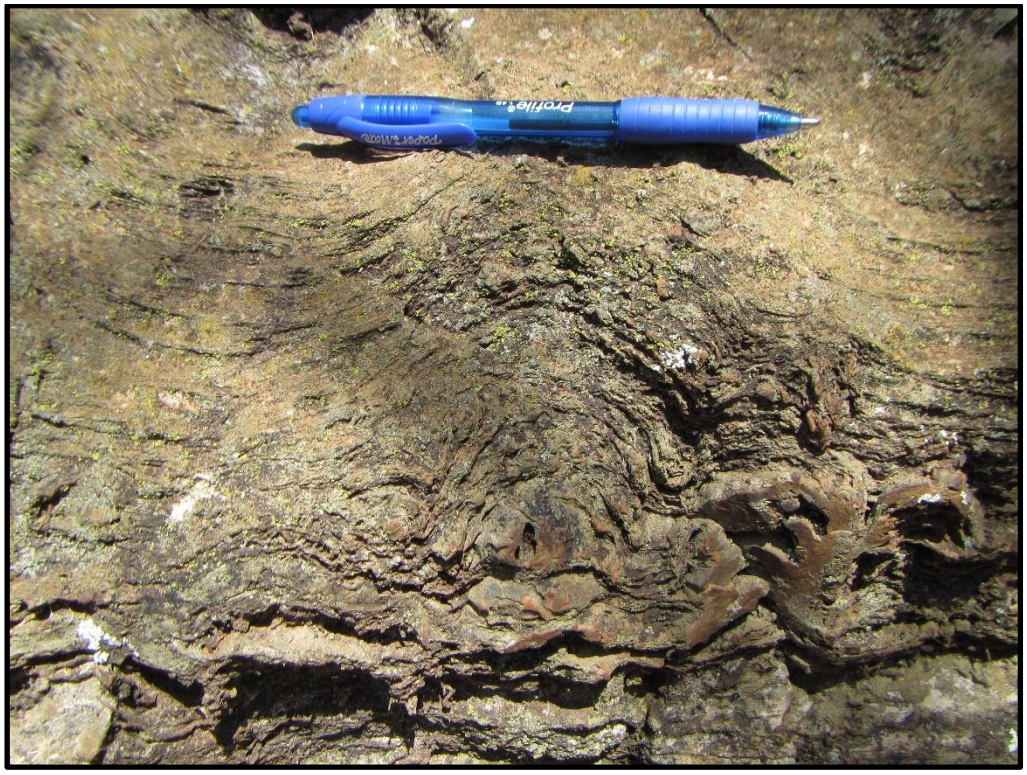

Figure 11: Lamellar and small-scale domal stromatolites present within dolomites of the Malmani Subgroup (waypoint HK4; see Figure 4 for location).

of 0 m) across the project area with other areas being observed in which the soil was thick enough to accommodate large warthog and jackal burrows.

7.3.2 Palaeontological potential

No fossil materials were observed to be present with the regolith and it is assumed to be unfossiliferous.

8 ENVIRONMENT OF THE PROPOSED PROJECT SITE

Inspection of Figure 12 indicates that the project area lies upon a flat, featureless land surface and that no significant fluvial drainage lines traverse the area. Mucina and Rutherford (2006) indicate that the project area is vegetated with a cover of the Carletonville Dolomite Grassland (Figure 13) and they further state that the conservation status of the Carletonville Dolomite Grassland is listed as vulnerable. Inspection of Google earth imagery reveals that the entire region surrounding the project area is utilised for agriculture, this being a mix of both cultivation and grazing (Figure 14). Figure 15 shows that the eastern half of Portion 6 of the farm Houtkop 43 is

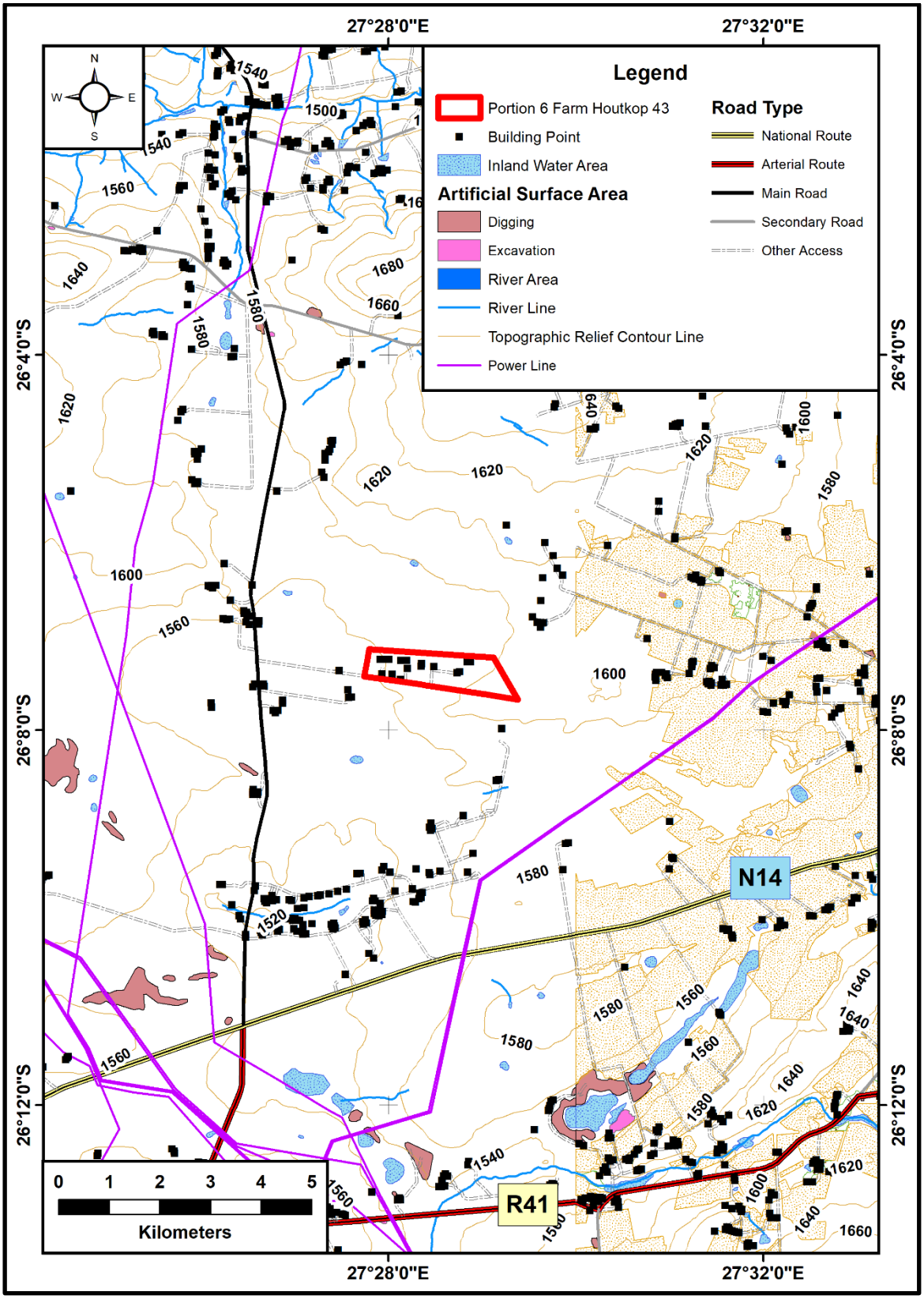

Figure 12: Map of the project area with topographic contours superimposed. The contour interval of the topographic contours is 20 m.

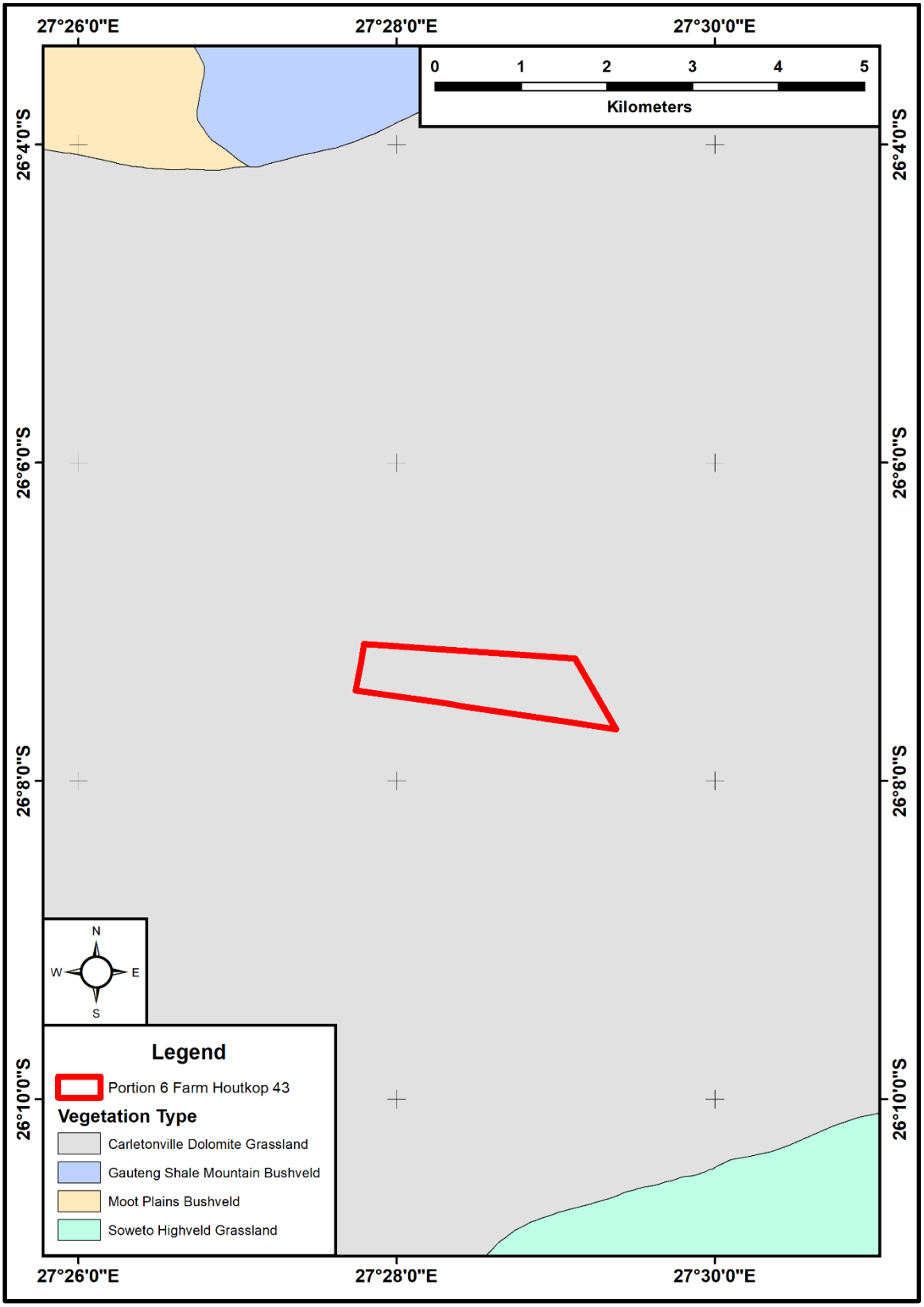

Figure 13: Map of the distribution of the vegetation veld types located within the project area and the surrounding environs (after Mucina and Rutherford, 2006).

Figure 14: Google earth image of Portion 6 of the farm Houtkop 43 (red polygon) and the surrounding environs. Access to the site is via N14 and then the R500 road.

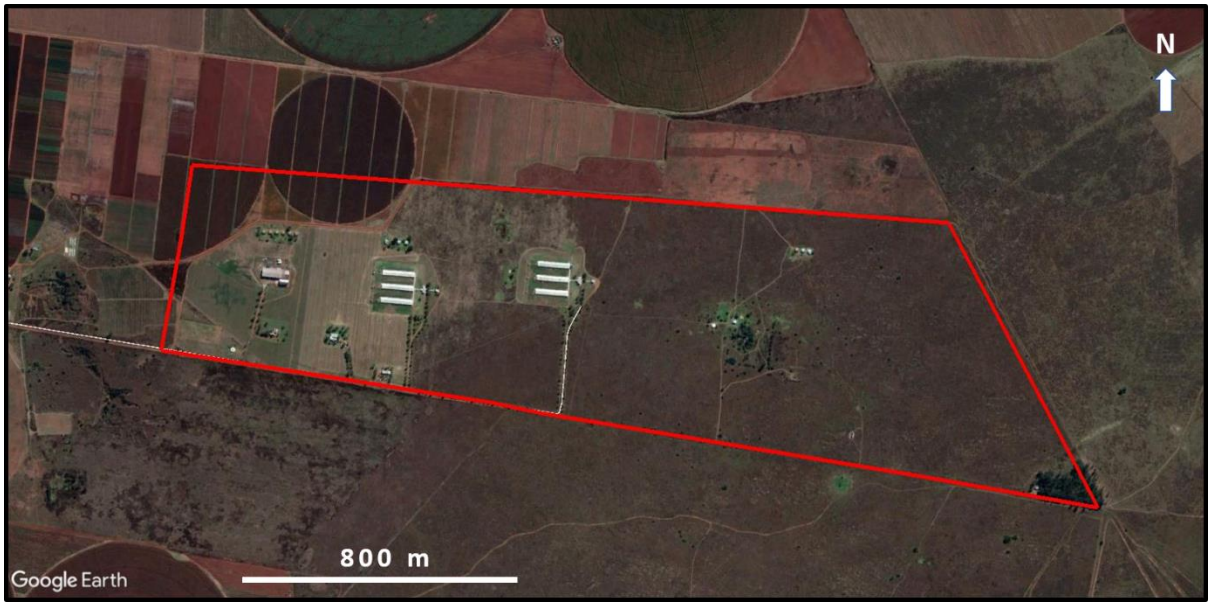

Figure 15: Google earth image of the immediate environs of Portion 6 of the farm Houtkop 43 (red polygon). It is evident that the western half of the area has been utilised for cultivation and chicken farming (the buildings). The darker coloured eastern half of the area is vegetated with grassland.

extensively vegetated with grassland suggesting that the original vegetation, and thus the land surface, remains undisturbed. Accordingly, any fossils that may have been present at surface should remain undisturbed. Access to the site is gained via the N14 highway and then the R500 road (Figures 12 and 14).

9 OVERVIEW OF SCOPE OF THE PROJECT

Quantum Foods (Pty) Ltd wishes to expand the existing hatchery and layer houses located upon Portion 6 of the farm Houtkop 43. It is anticipated that the emplacement of the required project infrastructure will require the following elements (Figure 4):

- A chicken hatchery immediately north of the existing hatchery (0.6 ha).
- Three layer house sites to be located upon sites of 2.5 ha each and identified as Sites 3 (3.6 ha), Site 4 (2.4 ha) and Site 5 (1.42 ha). Each site will contain three chicken layer houses (each house will be 15 m x 100 m = 1 500 m^2).
- Three access roads (twin spoor dirt roads); road to Site 3 (473 m), road to Site 4 (489 m) and the road to Site 5 (149 m).
- Two water pipelines; water pipeline (1000 m), water pipeline 1 (345 m).

It is anticipated, for the purposes of this report, that the emplacement of these above infrastructure elements the following impacts will be made upon the land surface and bedrock:

- Clearing and levelling of the land surface.
- Excavation of trenches to accommodate building foundations and water pipelines.

It is anticipated that the maximum depth of any negative impacts upon the land surface and bedrock will be <2 m.

10 IMPACT ASSESSMENT

The potential impact of the expansion of Quantum Foods (Pty) Ltd's HBP hatchery is categorised below according to the following criteria:-

10.1 Nature of Impact

- Damage or destruction of fossil materials during the construction of project infrastructural elements to a maximum depth of those excavations. Many fossil taxa (particularly vertebrate taxa) are known from only a single fossil and, thus, any fossil material is potentially highly significant. Accordingly, the loss or damage to any single fossil can be potentially significant to the understanding of the fossil heritage of South Africa and to the understanding of the evolution of life on Earth in general. Where fossil material is present and will be directly affected by the building or

construction of the projects infrastructural elements the result will potentially be the irreversible damage or destruction of the fossil(s).

- Movement of fossil materials during the construction phase, such that they are no longer *in situ* when discovered. The fact that the fossils are not *in situ* would either significantly reduce or completely destroy their scientific significance.
- The loss of access for scientific study to any fossil materials present beneath infrastructural elements for the life span of the existence of those constructions and facilities.

10.2 Extent of Impact

The possible extent of the permanent impact of the proposed project on the palaeontological heritage of South Africa is restricted to the damage, destruction or accidental relocation of fossil material caused by the excavations and construction of the necessary infrastructure elements forming part of the project. The possible source of a less permanent negative impact on the palaeontological heritage is the loss of access for scientific research to any fossil materials that become covered by the various infrastructural elements that comprise the project. The **extent of the area of potential impact is, accordingly, categorised as local** (i.e., restricted to the project site).

10.3 Duration of Impact

The anticipated duration of the identified potential impact is assessed as potentially **permanent to long term**. This is assessment is based on the fact that, in the absence of mitigation procedures (should fossil material be present within the area to be affected) the damage or destruction of any palaeontological materials will be permanent. Similarly, any fossil materials that exist below the structures and infrastructural elements that will constitute the expanded HBP hatchery enterprise will be unavailable for scientific study for the life of the existence of those features. The life of the project infrastructure is expected to be permanent to long term herein.

10.4 Probability of Impact

It is pertinent to realise that fossils are generally scarce and sporadic in their occurrence and, as such, the probability of any development affecting a fossil at any particular point on the land surface in relatively low. The Malmani Subgroup is known to be richly fossiliferous and the land surface underlying the project areas is relatively large. However, the depth of any negative impact caused by anticipated excavations is shallow (maximum <2 m) and the this is restricted to a limited number of narrow trench excavations and clearing/levelling of the land surface. Accordingly, the total volume of the rock and regolith to be negatively impacted upon by the project is relatively small.

However, given the richly fossiliferous nature of the Malmani Subgroup the probability of any fossils contained within the Malmani Subgroup is assessed as **high**.

It was identified in Section 7.2.1 above that the possibility exists for fossiliferous Pliocene karst infill deposits (breccia and/or flowstone deposits) to be located within the dolomites of the Malmani Subgroup. However, no karst infill deposits were identified during the conduct of the site survey. While such deposits may occur within the uppermost 2 m of the bedrock and not be exposed at surface it must also be accepted that the total volume of Malmani Subgroup strata that will be directly impacted by the project is small. In addition, it is a high possibility that, even should such deposits be present, they may not be fossil-bearing. Accordingly, the probability of any negative impact occurring upon the palaeontological heritage of the project area is **low**.

The presence of a Cainozoic regolith cover underlying the project area is confirmed by the site visit. It is anticipated that the origin of this this regolith is dominantly via *in situ* weathering of the underlying Malmani Subgroup sediments to form Terra Rosa soil. As such, any fossil materials that may have been present in the progenitor bedrock will have been destroyed in the weathering processes that produced the regolith. The probability of any fossil materials being originally present within the regolith is **negligible and none were identified during the site investigation**.

10.5 Significance of the Impact

The carbonate sediments of the Malmani Subgroup are known to contain prolific stromatolite assemblages and these stromatolites do exhibit morphological variation across the Transvaal Basin. This morphological variation is most obviously manifested in size variation and domal- verses laminar-morphology related to palaeowater depth at the time of formation. However, the morphology of the stromatolites in any particular area tends to be uniform, and remains uniform over large aerial extents. Accordingly, should stromatolite assemblages be destroyed within limited aerial extent within the project area the scientific significance of the loss would be **low**.

Should unexposed Pliocene karst infill deposits be present within the dolomites of the Malmani Subgroup and those deposits prove to be fossiliferous the scientific and cultural significance of those fossil materials would potentially be **high**. This assessment is based on a combination of the potential presence of fossil hominins and associated vertebrate fauna, the rarity of such fossils and the possibility that they may represent previously unsampled time periods. The significance of these fossil assemblages is indicated by the fact that it is their presence that underpinned the creation of the geographically adjacent Cradle of Human Kind World Heritage Site.

The regolith horizon that forms much of the land surface over much of the project area is interpreted to be unfossiliferous. Accordingly, the significance of any negative impacts

upon the palaeontological heritage of the unit that would be caused by the project is assessed as being **nil**.

The scientific and cultural significance of fossil materials is underscored by the fact that many fossil taxa (particularly vertebrate taxa) are known from only a single fossil and, thus, any fossil material is potentially highly significant. Accordingly, the loss or damage to any single fossil can be potentially significant to the understanding of the fossil heritage of South Africa and to the understanding of the evolution of life on Earth in general. Where fossil material is present and will be directly affected by the building or construction of project infrastructural elements the result will potentially be the irreversible damage or destruction of the fossil(s).

The certainty of the exact *in situ* location of fossils and their precise location within the stratigraphic sequence is essential to the scientific value of fossils. The movement of any fossil material during the construction of the facility that results in the exact original location of the fossil becoming unknown will either greatly diminish or destroy the scientific value of the fossil.

11 DAMAGE MITIGATION, REVERSAL AND POTENTIAL IRREVERSABLE LOSS

The degree to which the possible negative effects of the proposed project can be mitigated, reversed or will result in irreversible loss of the palaeontological heritage can be determined as discussed below.

11.1 Mitigation

The only fossil materials identified within the study area during the site visit were stromatolite assemblages of the Malmani Subgroup. These assemblages were uniform and similar to similar assemblages occurring throughout the wider region. Accordingly, no damage mitigation protocols are required to preserve these assemblages. Similarly, the Terra Rosa soils are unfossiliferous and no damage mitigation protocols are required to protect them.

No karst infill deposits were located within the dolomites of the Malmani Subgroup. However, the small possibility exists that they may occur, but not be exposed at surface. It is recommended that a close examination of all excavations be made while they are occurring within the Malmani Formation dolomites. Should any fossil materials be identified, the excavations should be halted and SAHRA informed of the discovery (as per legislation outlined in Section 3.3 herein). These examinations must be made by a professional palaeontologist and the investigation should be timed to coincide with the excavation of the trenches to accommodate building foundations. Conducting the investigation at this time would provide the greatest exposure of the Malmani Subgroup rocks that host the karst infill deposits. Should fossil material be identified the

palaeontologist should assess their significance and make further recommendations to mitigate any negative impacts. A significant potential benefit of the examination of the excavations associated with the construction of the project is that currently unobservable fossils may be uncovered. As long as the construction process is closely monitored it is possible that potentially significant fossil material may be made available for scientific study.

Should scientifically or culturally significant fossil material exist within the project area any negative impact upon it could be mitigated by its excavation (under permit from SAHRA) by a palaeontologist and the resultant material being lodged with an appropriately permitted institution. In the event that an excavation is impossible or inappropriate the fossil or fossil locality could be protected and the site of any planned construction moved.

11.2 Reversal of Damage

Any damage to, or the destruction of, palaeontological materials or reduction of scientific value due to a loss of the original location is **irreversible**.

11.3 Degree of Irreversible Loss

Once a fossil is damaged, destroyed or moved from its original position without its geographical position and stratigraphic location being recorded the **damage is irreversible and total**.

Fossils are usually scarce and sporadic in their occurrence and the chances of negatively impacting on a fossil in any particular area are low. However, any fossil material that may be contained within the strata underlying the project area is potentially of the highest scientific and cultural importance. Thus, the potential always exists during construction and excavation within potentially fossiliferous rocks for the permanent and irreversible loss of extremely significant or irreplaceable fossil material. This said, many fossils are incomplete in their state of preservation or are examples of relatively common taxa. As such, just because a fossil is present it is not necessarily of great scientific value. Accordingly, not all fossils are necessary significant culturally of scientifically significant and the potential degree of irreversible loss will vary from case to case. The judgement on the significance of the fossil must be made by an experienced palaeontologist.

12 ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

Fossils occur sporadically within geological units and their location cannot be accurately predetermined. Despite a comprehensive investigation of the project areas by foot it was impractical (within time and budgetary constraints) to visit all locations with the

confines of the infrastructure that will comprise the HBP hatchery project. The possibility remains that there may be fossil materials occurring at the surface that were not located, or within the subsurface of the Malmani Subgroup that could not be observed in the field.

13 ENVIRONMENTAL IMPACT STATEMENT

A comprehensive, foot-based investigation of the palaeontological potential of the proposed HBP hatchery facility has been conducted by Dr Barry Millsteed on 25/10/2018. The investigation was on the site the proposed infrastructure as identified by Quantum Food's farm manger. However, subsequent to the site investigation the location of proposed project infrastructure was changed for operational reasons. The project will consist of a new hatchery building, three layer complexes (named Sites 3-5), as well as three twin spoor roads providing access to Sites 3-5 and two water pipelines. The aerial extent of the project infrastructure is the hatchery (0.6 ha), Site 3 (3.6 ha), Site 4 (2.4 ha), Site 5 (1.42 ha), water pipeline (1000 m), water pipeline 1 (345 m), road to Site 3 (473 m), road to Site 4 (489 m) and the road to Site 5 (149 m). The change in location of a number of the infrastructure elements relative to the area investigated is not considered by the author to negatively impact upon any conclusions and recommendations made in this report.

Any negative impacts to the palaeontological heritage of the region will be limited to the footprint area of the project's infrastructural elements; the extent of any impact is accordingly characterised as local. Any negative impact upon fossil materials caused by the project will be permanent. It is anticipated, herein, that most infrastructural elements will only directly affect the surface of the site to a relatively shallow depth (< 2m). Fossil materials that remain undiscovered after the construction of the project and which are located beneath the maximum depth of the anticipated excavations will only be negatively affected in so far as they will be unavailable for scientific study for the life expectancy of the infrastructural elements that comprise the project (i.e., long term to permanent).

The project is completely underlain by dolomitic sediments of the Malmani Subgroup. These sediments are known to contain prolific assemblages of stromatolites. A layer of unfossiliferous regolith (Terra Rosa soil) was identified as overlying the Malmani Subgroup within the project area; the layer is of inconsistent thickness, with numerous outcrops of Malmani Subgroup visible. A third rock type is potentially present within the project area. This third group consists of discordant karst infill deposits (breccia and flowstone deposits) hosted within the Malmani Subgroup rocks. These karst infill deposits are known to be fossiliferous within the adjacent Cradle of Human Kind World Heritage Site where they are known to contain hominin-bearing vertebrate fossil assemblages of world significance. However, none of these karst deposits were located during the conduct of the site investigation.

There are no significant negative impacts on the palaeontological heritage of the project area that will be caused by the impacts of the project upon the Cainozoic regolith nor the dolomitic sedimentary rocks of the Malmani Subgroup. No Pliocene karst infill deposits hosted within the Malmani Subgroup dolomites were located during the site visit. However, a small chance exists that deposits of this type may exist in the subsurface but not be exposed (or may crop out beneath the regolith cover). If these karst deposits do exist, and are fossil-bearing, any negative impact upon them would be of the high scientific and cultural significance. The significance of the fossil assemblages they may contain is indicated by the fact that it is the presence of similar fossil assemblages that underpinned the creation of the adjacent Cradle of Human Kind World Heritage Site. Any damage that occurs to such fossil material during the excavation and construction phase of the project would be permanent and irreversible.

The potential negative impact to the palaeontological heritage of the area can be substantially mitigated by the implementation of appropriate mitigation processes. It is recommended that a close examination of all excavations be made while they are occurring within the Malmani Formation dolomites. Should any fossil materials be identified, the excavations should be halted and SAHRA informed of the discovery (as per legislation outlined in Section 3.3 herein). These examinations must be made by a professional palaeontologist and the investigation should be timed to coincide with the excavation of the trenches to accommodate building foundations. Conducting the investigation at this time would provide the greatest exposure of the Malmani Subgroup rocks that host the karst infill deposits. Should fossil material be identified the palaeontologist should assess their significance and make further recommendations to mitigate any negative impacts. A significant potential benefit of the examination of the excavations associated with the construction of the project is that currently unobservable fossils may be uncovered. As long as the construction process is closely monitored it is possible that potentially significant fossil material may be made available for scientific study.

A potential positive outcome of these mitigation protocols could be that fossil materials become available for scientific study that would otherwise have been hidden within or beneath the regolith. Should such new palaeontological material be located as a result of this site investigation this could prove to have a positive effect on the understanding of the fossil record of South Africa and positively affect the palaeontological heritage of the country.

This study has not identified any palaeontological reason to prejudice the progression of the HBP hatchery expansion project, subject to the mitigation programs suggested, herein, being put in place.

14 REFERENCES

Eriksson, P.G, Alterman, W and Hartzer, F.J., (2006). *The Transvaal Supergroup and its precursors*, in Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J. (eds) *The Geology of South Africa*, Johannesburg: Council for Geoscience, Pretoria: Geological Society of South Africa, pp. 237-260.

Mucina, L. and Rutherford, M.C. (Eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelizia* 19. South African National Biodiversity Institute, Pretoria.

Partridge, T.C., Granger, D.E., Caffee, M.W. and Clarke, R.J. (2003). Lower Pliocene Hominind Remains from Sterkfontein, Science, 300, pp. 607 – 612.

Republic of South Africa (1998). National Environmental Management Act (No 107 of 1998). Pretoria: The Government Printer.

Republic of South Africa (1999). National Heritage Resources Act (No 25 of 1999). Pretoria: The Government Printer.

Dr B.D. Millsteed

15th November 2018