27 April 2021

SLR Consulting
Fourways, Johannesburg
South Africa

For attention: Sharon Meyer, Associate Environmental Consultant

ENVIRONMENTAL ASSESSMENT OF SWAKOP URANIUM's PROPOSED HEAP LEACH PROJECT: ARCHAEOLOGICAL DESK ASSESSMENT

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DECLARATION

I hereby declare that I do:

(a) have knowledge of and experience in conducting assessments, including knowledge of Namibian legislation, specifically the National Heritage Act (27 of 2004), as well as regulations and guidelines that have relevance to the proposed activity;

(b) perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;

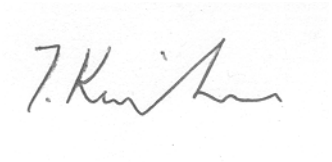
(c) comply with the aforementioned Act, relevant regulations, guidelines and other applicable laws.

I also declare that I have no interests or involvement in:

(i) the financial or other affairs of either the applicant or his consultant

(ii) the decision-making structures of the National Heritage Council of Namibia.

The purpose of this report is to assist the client in gaining consent under the National Heritage Act (27 of 2004) to proceed with at specific locations as defined herein. The report must always be quoted in full, and not in part, summary or précis form. The report may not be distributed or used for any other purpose by the client, the National Heritage Council of Namibia or any other party and remains the copyright of the author.



John Kinahan, Archaeologist

EXECUTIVE SUMMARY

A specialist desktop study was undertaken to assess the possible impact of new heap leach pads at the Husab Mine, on sites and/or materials protected under the National Heritage Act (27 of 2004). The desktop study is based on archaeological survey data from successive investigations carried out at the mine site and in the surrounding area during exploration, early development and current mining operations. These data are considered to be sufficient as a basis for the study.

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1. INTRODUCTION

1.1 Background

Swakop Uranium's Husab Mine is situated between the Khan and Swakop Rivers in the central Namib Desert. Following an extended programme of exploration which commenced in 2009, the Husab mine began producing refined uranium oxide in 2016[1]. During this period, a detailed environmental assessment was carried out to ensure compliance with the Environmental Management Act (No. 7 of 2007) and the Environmental Impact Assessment (EIA) Regulations (Government Notice 30 of 6 February 2012).

Archaeological remains in Namibia are protected under the National Heritage Act (27 of 2004) which makes provision for archaeological impact assessment of mineral exploration and mining projects such the Husab Mine. Prior to 2009, no archaeological investigation had been carried out in the Husab area, although available evidence from the surrounding area suggested that field survey would confirm the subregional occupation sequence dating from at least the late Pleistocene until the historic period.

A series of 13 archaeological studies were carried out between 2009 and 2014, covering EPLs 3138 and 3439 held by Swakop Uranium. These studies included baseline surveys, detailed site investigations with mapping, excavation and systematic surface collection. The studies were used as a basis for the compilation of mitigation programmes and site protection procedures. Details of these studies have been submitted with previous reports, including three heritage audits carried out between 2016 and 2018.

In 2016 Swakop Uranium contracted SGS Time Mining (Pty) Ltd to investigate options for the processing of lower grade ores that were unsuitable for treatment through the existing tank leach facility. A proposed solution of a heap leach facility would entail changes in both the design and the overall footprint of surface works at the Husab Mine. Consequently, SLR Consulting was engaged to carry out an environmental assessment. SLR appointed the undersigned, J. Kinahan, archaeologist, to carry out an archaeological assessment of the of the proposed heap leach facility.

1.2 Terms of Reference

The desk assessment reported here is intended to identify from existing field survey data sensitive archaeological sites that could be affected by of the proposed heap leach facility. Archaeological

[1] http://www.namibianuranium.org/husab-mine/

assessment forms the basis of recommended management actions to avoid or reduce negative impacts, as part of the environmental assessment. The study is intended to satisfy the requirements of the relevant legislation and regulations, in which the process of review and clearance may require further, or different mitigation measures to be adopted.

Specifically, the archaeological assessment addresses the following issues:

1. The identification and assessment of potential impacts on archaeological/heritage resources arising from the of the proposed heap leach facility and its construction.
2. The identification and demarcation of sensitive archaeological/heritage sites requiring special mitigation measures to eliminate, avoid or compensate for possible destructive impacts.
3. Formulation and motivation of specific mitigation measures for the project to be considered by the authorities for the issuance of clearance certificates.
4. Specification of permit requirements as related to the removal and/or destruction of heritage resources.

1.3 Assumptions & Limitations

Archaeological assessment relies on the indicative value of surface finds recorded in the course of field survey. Field survey results are augmented wherever possible by inference from the results of surveys and excavations carried out in the course of previous work in the same general area as the proposed project. Thus, where detailed information is available from existing field survey results these data are used to inform a desk assessment which would be augmented by further field survey should the authorities deem it necessary. On the basis of cumulative field records it is possible to predict the likely occurrence of further archaeological sites with some accuracy, and to present a general statement (see 3. Archaeological Setting, below) of the local archaeological site distribution and its sensitivity. However, since the assessment is limited to surface observations and existing survey data, it is necessary to caution the proponent that hidden, or buried archaeological or palaeontological remains might be exposed as the project proceeds. It is for this reason that the proponent is advised to adopt the Chance Finds Procedure set out in Appendix 3.

2. LEGAL REQUIREMENTS

The principal instrument of legal protection for archaeological/heritage resources in Namibia is the National Heritage Act (27 of 2004). Part V Section 46 of the Act prohibits removal, damage, alteration or excavation of heritage sites or remains. Section 48 *ff* sets out the procedure for application and

granting of permits such as might be required in the event of damage to a protected site occurring as an inevitable result of development. Section 51 (3) sets out the requirements for impact assessment. Part VI Section 55 Paragraphs 3 and 4 require that any person who discovers an archaeological site should notify the National Heritage Council. Heritage sites or remains are defined in Part 1, Definitions 1, as "any remains of human habitation or occupation that are 50 or more years old found on or beneath the surface".

It is important to be aware that no specific regulations or operating guidelines have been formulated for the implementation of the National Heritage Act in respect of archaeological assessment. However, archaeological impact assessment of large projects has become accepted practice in Namibia during the last 25 years, especially where project proponents need also to consider international guidelines. In such cases the appropriate international guidelines are those of the World Bank OP/ BP 4.11 in respect of "Physical Cultural Resources" (R2006-0049, revised April 2013). Of these guidelines, those relating to project screening, baseline survey and mitigation are the most relevant.

Archaeological impact assessment in Namibia may also take place under the rubric of the Environmental Management Act (7 of 2007) which specifically includes anthropogenic elements in its definition of environment. The List of activities that may not be undertaken without Environmental Clearance Certificate: Environmental Management Act, 2007 (Govt Notice 29 of 2012), and the Environmental Impact Assessment Regulations: Environmental Management Act, 2007 (Govt Notice 30 of 2012) both apply to the management of impacts on archaeological sites and remains whether these are considered in detail by the environmental assessment or not.

3. ARCHAEOLOGICAL SETTING

The Namib Desert has a long and remarkably comprehensive archaeological record, with the earliest securely dated evidence at 800 000 years Before Present (BP). Late Pleistocene and Holocene occupation of the desert reflects a series of pulse-like human responses to climatic amelioration, interrupted by periods of little or no activity[2]. The resulting pattern of archaeological site distribution shows a high degree of clustering in the vicinity of water and other resources, accompanied by a diminishing site density towards the Atlantic coast.

[2] see Kinahan, J. 2011 The archaeological background to Namibian history In Wallace, M. *A history of Namibia*. C. Hurst & Co., London; Kinahan, J. 2020. *Namib: the archaeology of an African desert.* Windhoek, University of Namibia Press; Mitchell, P. 2002. *The archaeology of southern Africa.* Cambridge.

One of the major goals of archaeological research in the Namib is the development of a detailed and securely dated sequence[3]. Fine resolution of the sequence by direct dating permits correlation with past climatic events which are of importance to the understanding of the Namib environment. The extreme aridity of the Namib, and the limited adaptive tolerance of human populations, means that all archaeological sites are proxies for climatic amelioration events. The Namib archaeological record is therefore an important cultural and environmental archive of global relevance.

Successive surveys of the Husab area located a total of 116 archaeological sites, representing a discontinuous sequence of human occupation from the late Pleistocene to the early colonial era. The variety of archaeological sites found in the project area is similar to that found in adjacent parts of the Namib, reflecting a number of highly specific human adaptations to this environment. Detailed reports on the main findings of the archaeological surveys are available from Swakop Uranium.[4]

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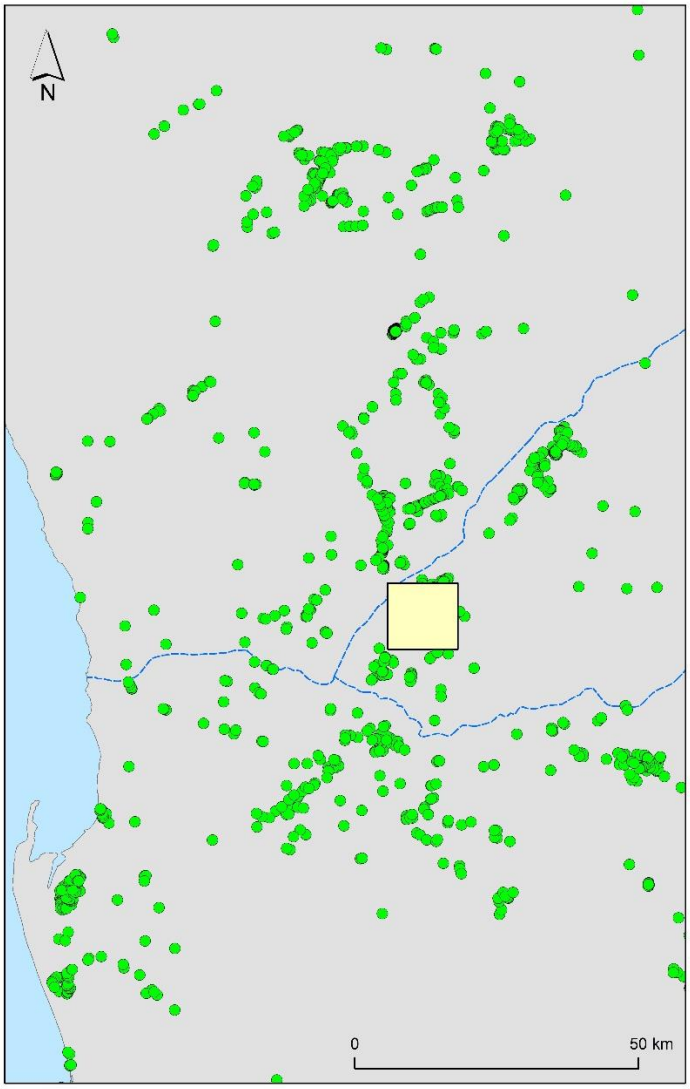
[3] See http://antiquity.ac.uk/projgall/kinahan325/

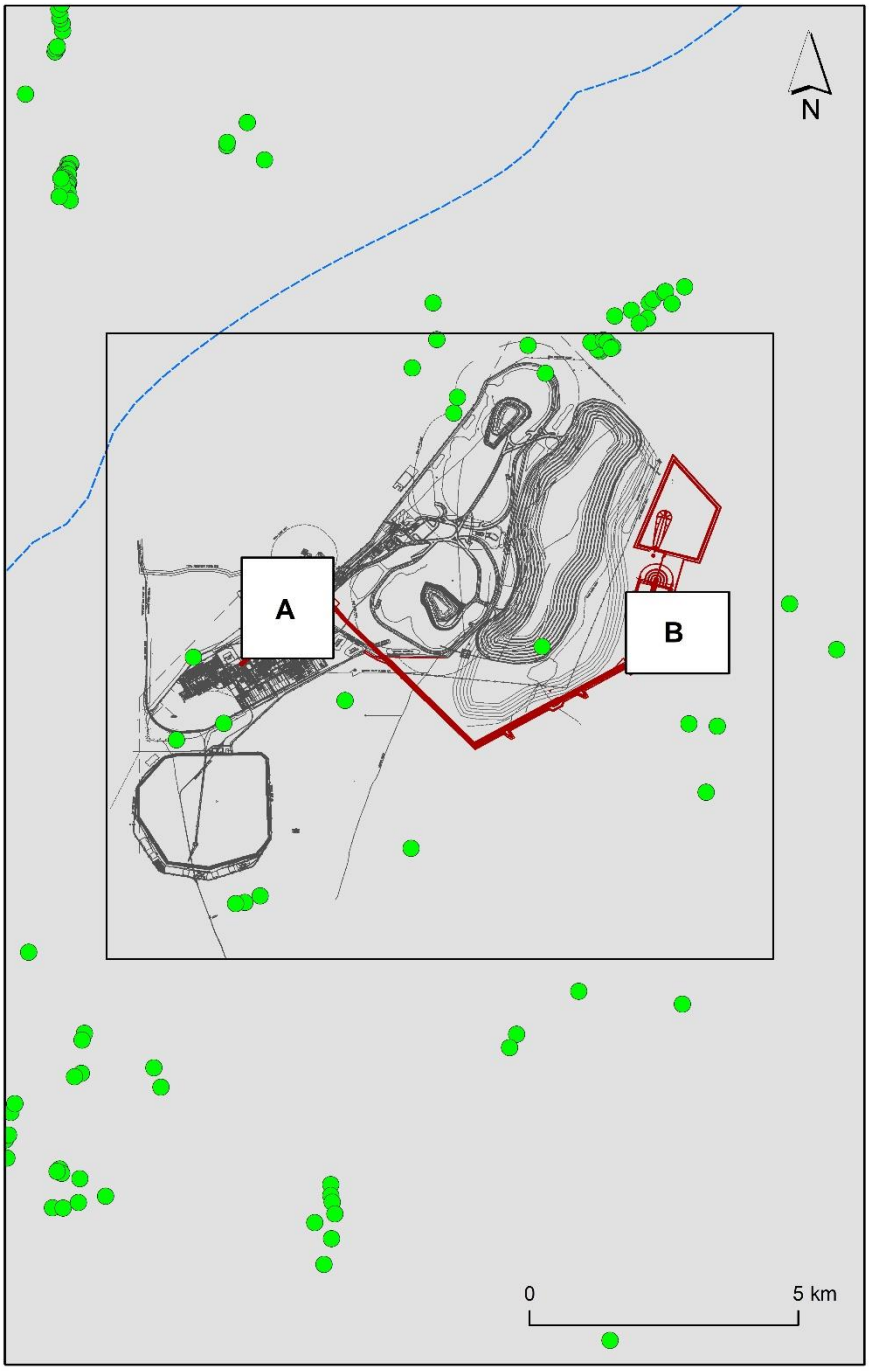
[4] QRS 105. *Archaeological reconnaissance of the Husab Uranium project area.* Commissioned by Extract Resources (Swakop Uranium)(2009). John Kinahan; QRS 109. *Specialist archaeological contribution to the Strategic Environmental Assessment of Uranium Mining in the Erongo Region.* Commissioned by the Southern African Institute for Environmental Assessment on behalf of the Ministry of Mines and Energy (2009). John Kinahan; QRS 131. *Archaeological assessment of linear infrastructure for the Husab Project.* Commissioned by Metago, South Africa. (2010). John Kinahan; QRS 132. *Kaiserliche Eisenbahnstation, Welwitsch*: mitigation survey of heritage resources. Commissioned by Swakop Uranium. (2011). John and Tim Kinahan; QRS 144. *Archaeological mitigation of the Rössing South Husab project.* Commissioned by Swakop Uranium (Pty) Ltd. (2011). John Kinahan; QRS 159. *Archaeological survey of borrow pits on the permanent access road to Husab Mine.* Commissioned by Swakop Uranium (Pty) Ltd. (2012) John Kinahan; QRS 166. *Radiocarbon dating of selected camelthorn* Vachellia erioloba *trees in a tributary of the lower Khan River, Erongo Region.* Commissioned by Swakop Uranium (Pty) Ltd. (2012). John Kinahan; QRS 176. *Specialist archaeological contribution to the proposed amendments to the Husab Mine plan and infrastructure.* Commissioned by SLR Consulting (2013). John Kinahan; QRS 183. *Additional archaeological tasks for Husab Uranium Project: Survey and assessment of Gen Botha's 1915 campaign camp.* Commissioned by Swakop Uranium (Pty) Ltd. (2013). John Kinahan.

Figure 1 indicates the location of the Husab Mine in relation to the known distribution of archaeological sites in the surrounding parts of the Namib Desert. The map shows that the Husab Mine lies within an area of high archaeological importance, with relatively high local site densities. The local site distribution in the area immediately surrounding the mine is shown in Figure 2 which illustrates the proximity of several known archaeological sites to the existing mine layout and the layout of the proposed heap leach facility. These sites are listed in Appendix 1.



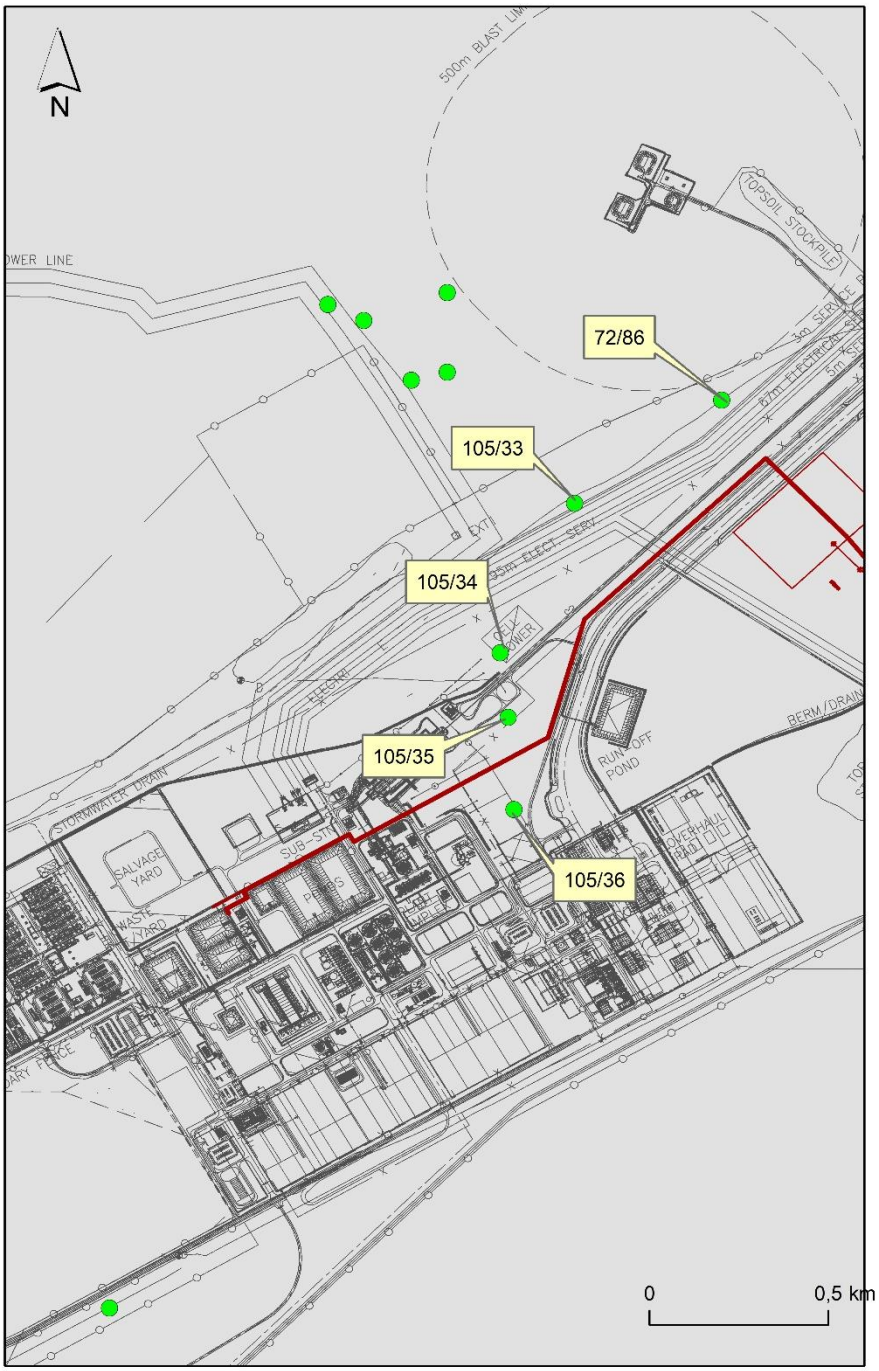
Cartography J. Kinahan April 2021

Figure 1: The location of the Husab Mine (yellow square) in relation to the distribution of archaeological sites in surrounding parts of the Namib Desert.



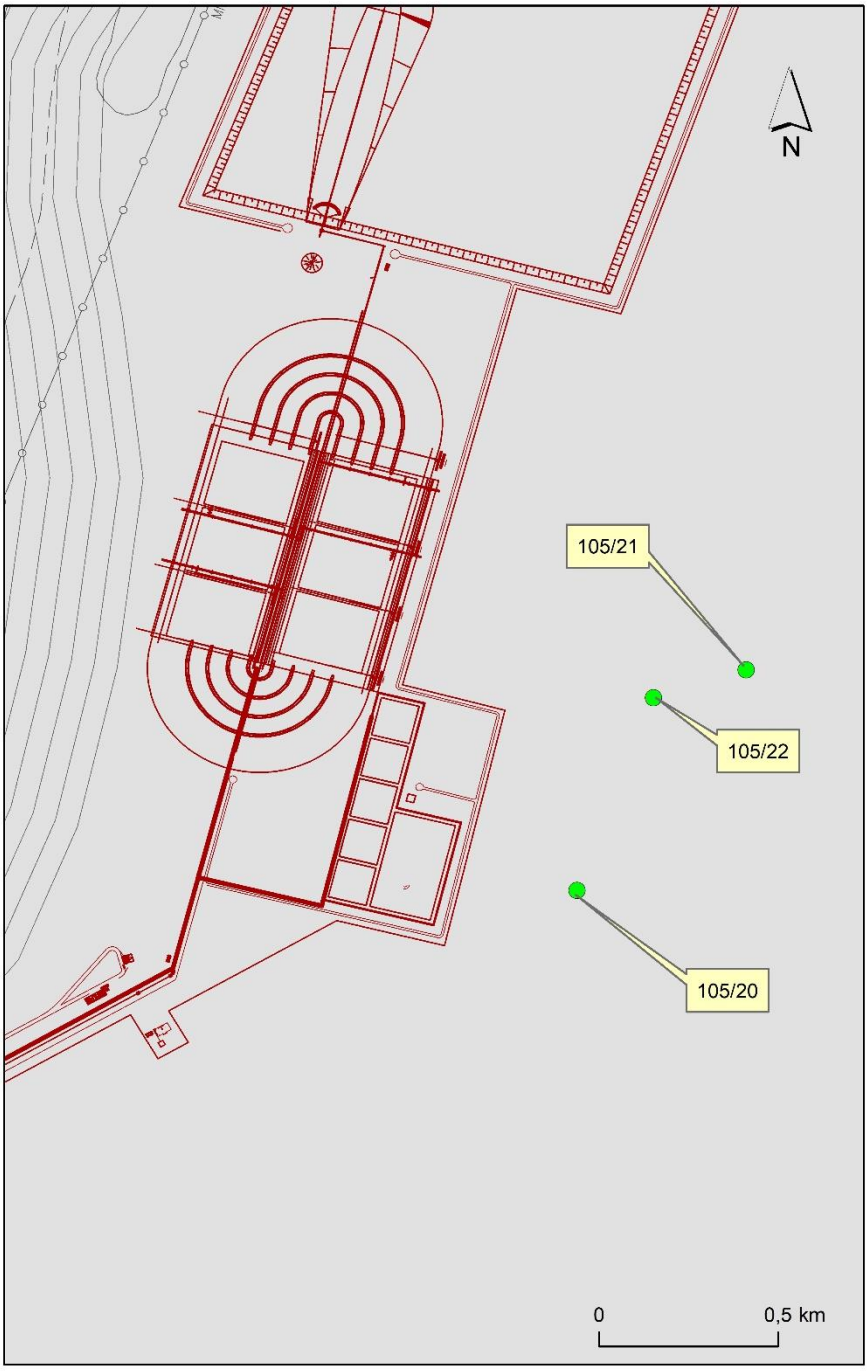
Cartography J. Kinahan April 2021

Figure 2: The existing Husab Mine surface works (in grey) and proposed heap leach facility (red brown) in relation to the local distribution of archaeological sites. The insets “A” and “B” are shown in detail in Figure 3 and 4.



Cartography J. Kinahan April 2021

Figure 3: Inset “A”: existing Husab Mine surface works (in grey) showing archaeological sites in close proximity to the proposed heap leach facility (red brown).



Cartography J. Kinahan April 2021

Figure 4: Inset “B”: existing Husab Mine surface works (in grey) showing archaeological sites in close proximity to the proposed heap leach facility (red brown).

All archaeological sites recorded in the course of the Husab surveys were assessed as to their Significance (0-5 scale) and Vulnerability (0-5 scale) (see Table 1, below) and where deemed necessary mitigation measures were adopted. These ranged from detailed recording of the sites (location, physical setting, estimation of age and affinity, and if appropriate, collection of material for dating and identification). In the case of archaeological sites with a low Significance ranking (2/<) basic field documentation is considered to provide a sufficient record of the site in the event that it might be disturbed or destroyed in the course of mining activity. All sites lying in close proximity to the now existing Husab Mine surface works indicated in Figure 2 were documented in sufficient detail to serve as a full record of the site if disturbed or destroyed.

Table 1: Archaeological Significance and Vulnerability Ranking

SIGNIFICANCE RANKING		**VULNERABILITY RANKING**	
0	no significance	0	not vulnerable
1	disturbed or secondary context	1	no threat posed
2	isolated minor find	2	low or indirect threat
3	archaeological site	3	probable threat
4	multi-component site	4	high likelihood of disturbance
5	major archaeological site	5	direct and certain threat

The eight sites indicated in Figures 3 and 4 lie in close proximity to the proposed heap leach facility and of these, five have a Significance ranking of 3 and are therefore considered to be of moderate archaeological Significance (see listing below). Site QRS 105/20 is part of the earthworks of the narrow-gauge railway built across the Namib at the end of the 19th century. Relatively little of the railway earthworks and related structures has survived, giving the earthworks in the Husab area a slightly elevated importance. Consequently, a detailed dGPS terrain survey of the earthworks related to the Welwitsch Siding was carried out ensuring that sufficient documentation of this feature would remain as a record in the event that the site was damaged or destroyed.[5]

Sites QRS 105/20-22 and QRS 105/33 and 34 are all related to the specialized exploitation of wild grass seeds as a mode of subsistence by hunter-gatherers in the Namib during the last one thousand years.

[5] QRS 132. *Kaiserliche Eisenbahnstation, Welwitsch*: mitigation survey of heritage resources. Commissioned by Swakop Uranium. (2011). John and Tim Kinahan

Archaeological evidence related to the exploitation of wild grass seed includes well preserved shallow diggings where caches of grass seed (still known today as *sâun* in Khoekhoegowab) were extracted from the nests of harvester ants (*Messor denticornis*). The seed was cleaned and stored in highly characteristic bag-shaped pottery vessels. Processing of the seed for cooking was carried out using grinding surfaces on granite outcrops, usually outcrops with cavities where supplies of rainwater collect after summer showers in the desert. These different components of the seed exploitation assemblage are usually found together in localized concentrations, thus QRS 72/86, 105/33 and 34 are all seed digging sites; QRS 105/21 and 105/35 are both the remains of small hut encampments linked to seed gathering, and QRS 105/22 is a seed grinding site.

Conditions on archaeological sites in the Husab area are generally not conducive to the preservation of organic remains suitable for dating. For this reason, some dating of Husab sites linked to seed gathering were dated by means of Optically Stimulated Luminescence (OSL).[6] OSL dating results for Husab sites are set out in Table 2, showing that seed gathering carried on in this area during the last three centuries, immediately prior to colonial occupation. The documentation and dating of these features was carried out to ensure that sufficient documentation would remain as a record in the event that the site was damaged or destroyed.

Table 2: OSL dating of Husab archaeological sites.[7]

Site	Dose (Gy)	Doserate (Gy/ka)	Age (years)
Husab	0.28±0.03	4.01±0.38	260±50
	0.28±0.03	5.38±0.51	230±60
	0.28±0.03	6.05±0.63	240±60

[6] OSL dating measures the residual energy of electrons trapped within the atomic spacing of a mineral grain such as of quartz sand to calculate the period of time elapsed since the sand grain was last exposed to sunlight.

[7] OSL dating was carried out at the Luminescence Dating Facility, University of Melbourne, and ages were calculated using models of Galbraith, R.F., Roberts, R.G., Laslett, G.M., Yoshida, H. & Olley, J.M. 1999. Optical dating of single and multiple grains of quartz from Jinmium Rock Shelter, northern Australia: Part I, experimental design and statistical models. *Archaeometry* 41(2): 339–6, and Olley, J.M., Roberts, R.G., Yoshida, H. & Bowler, J.M. 2006. Single-grain optical dating of grave-infill associated with human burials at Lake Mungo, Australia. *Quaternary Science Reviews*, 25 (19–20): 2469–74.

4. ASSESSMENT

The most likely impact of the proposed heap leach facility at Husab Mine on sites and materials protected under the National Heritage Act (27 of 2004) would be damage through inadvertent disturbance and possible destruction in the course of mechanical exploration and mining activities. The consequences of such impacts must be considered as permanent. However, all of the eight sites that lie in close proximity to the proposed surface works have been documented and investigated in sufficient detail that an adequate record exists in the event that the sites are destroyed.

Assessment of the proposed surface works on sites and materials protected under the National Heritage Act (27 of 2004) is based on the criteria in Appendix 2 which sets out the approach for determining impact consequence (combining nature and intensity, extent and duration) and impact significance (the overall rating of the impact). Following the criteria for ranking the NATURE & EXTENT of potential impacts, the project (without mitigation) is likely to have a **Very High (VH+) Negative Impact**. The EXTENT of this impact would be **Low (L)** in that its direct effect would be within the Husab Mine site itself. As with all impacts on archaeological sites, the DURATION is considered to be **Very High (VH)**, or permanent. Given the proximity of the sites to the proposed surface works that have been planned in detail, the PROBABILITY of the impact is considered to be **High (H)**. On the basis of the assessment criteria set out in Appendix 2, the SIGNIFICANCE of the impacts is negative and should be considered as either **Low (L)** or **Moderate (M)** since mitigation has already been applied. The consequence and significance of these impacts is potentially highly negative given the information at hand.

5. RECOMMENDATIONS

On the basis of this desk assessment it is concluded that construction of the proposed heap leach facility at the Husab Mine will have a Low to Moderate archaeological impact. Given that detailed documentation has already been carried out on the small number of sites that are likely to be affected by the proposed surface works it is not considered necessary to carry out further mitigation on these sites. For interim purposes, however, it is recommended that the project proponent should adopt the Chance Finds Procedure set out in Appendix 3, so that in the event that buried archaeological remains which are not visible to surface survey may be handled in accordance with the provisions of Part V Section 46 of the National Heritage Act (27 of 2004).

Appendix 1: Archaeological sites in proximity to the proposed heap leach facility at Husab Mine

QRS 72/86

Position (WGS 84) Lat. -22.5745 Long.15.0335

Precision	1
Significance	2
Vulnerability	1
Setting	calcretized gravel on gravel plain edge
Type/Affinity	seed digging
Records	site notes, locality data

QRS 105/20

Position (WGS 84) Lat. -22.58497 Long.15.09675

Precision	1
Significance	3
Vulnerability	2
Setting	gravel plain
Type/Affinity	earthworks for historical embankment of narrow gauge railway
Records	Field notes and locality data.

QRS 105/21

Position (WGS 84) Lat. -22.57943 Long.15.10100

Precision	1
Significance	3
Vulnerability	2
Setting	marble ridge
Type/Affinity	stone feature 2nd millennium AD, 2m diameter; built into south-west facing side of outcrop
Records	Field notes and locality data.

QRS 105/22

Position (WGS 84) Lat. -22.58013 Long.15.09867

Precision	1
Significance	3
Vulnerability	2
Setting	marble ridge
Type/Affinity	grinding surface, probably relates to previous
Records	Field notes and locality data.

QRS 105/33

Position (WGS 84) Lat. -22.57709 Long.15.02980

Precision 1

Significance 2
Vulnerability 1
Setting calcrete
Type/Affinity seed digging 4 diggings in 60m diameter area
Records Field notes and locality data.

QRS 105/34

Position (WGS 84) Lat. -22.58085 Long.15.02793

Precision 1
Significance 3
Vulnerability 2
Setting schist
Type/Affinity seed digging 3-4 diggings close together
Records Field notes and locality data.

QRS 105/35

Position (WGS 84) Lat. -22.58247 Long.15.02813

Precision 1
Significance 2
Vulnerability 1
Setting schist
Type/Affinity stone feature 2 hut circles
Records Field notes and locality data.

QRS 105/36

Position (WGS 84) Lat. -22.58479 Long.15.02828

Precision 1
Significance 2
Vulnerability 1
Setting schist
Type/Affinity seed digging
Records Field notes and locality data.

Appendix 2: Impact Assessment Criteria

IMPACT assessment criteria		
SIGNIFICANCE determination	**Significance = consequence x probability**	
CONSEQUENCE	**Consequence is a function of:** • **Nature and Intensity of the potential impact** • **Geographical extent should the impact occur** • **Duration of the impact**	
Ranking the NATURE and INTENSITY of the potential impact		
Negative impacts		
Low (L)	The impact has no / minor effect/deterioration on natural, cultural and social functions and processes. No measurable change. Recommended standard / level will not be violated. (Limited nuisance related complaints).	
Moderate (M)	Natural, cultural and social functions and processes can continue, but in a modified way. Moderate discomfort that can be measured. Recommended standard / level will occasionally be violated. Various third party complaints expected.	
High (H)	Natural, cultural or social functions and processes are altered in such a way that they temporarily or permanently cease. Substantial deterioration of the impacted environment. Widespread third party complaints expected.	
Very high (VH)	Substantial deterioration (death, illness or injury). Recommended standard / level will often be violated. Vigorous action expected by third parties.	
Positive impacts		
Low (L) +	Slight positive effect on natural, cultural and social functions and processes Minor improvement. No measurable change.	
Moderate (M) +	Natural, cultural and social functions and processes continue but in a noticeably enhanced way. Moderate improvement. Little positive reaction from third parties.	
High (H) +	Natural, cultural or social functions and processes are altered in such a way that the impacted environment is considerably enhanced /improved. Widespread, noticeable positive reaction from third parties.	
Very high (VH) +	Substantial improvement. Will be within or better than the recommended level. Favourable publicity from third parties.	
Ranking the EXTENT		
Low (L)	Local (confined to within the project concession area and its nearby surroundings).	
Moderate (M)	Regional (confined to the region, e.g. coast, basin, catchment, municipal region, district, etc.).	
High (H)	National (extends beyond district or regional boundaries with national implications).	
Very high (VH)	International (Impact extends beyond the national scale or may be transboundary).	
Ranking the DURATION		
Low (L)	Temporary/short term. Quickly reversible. (Less than the life of the project).	
Moderate (M)	Medium Term. Impact can be reversed over time. (Life of the project).	
High (H)	Long Term. Impact will only cease after the life of the project..	
Very high (VH)	Permanent	
Ranking the PROBABILITY		
Low (L)	Unlikely	
Moderate (M)	Possibly	
High (H)	Most likely	
Very high (VH)	Definitely	
SIGNIFICANCE Description		
	Positive	**Negative**
Low (L)	Supports the implementation of the project	No influence on the decision.
Moderate (M)	Supports the implementation of the project	It should have an influence on the decision and the impact will not be avoided unless it is mitigated.
High (H)	Supports the implementation of the project	It should influence the decision to not proceed with the project or require significant modification(s) of the project design/location, etc. (where relevant).
Very high (VH)	Supports the implementation of the project	It would influence the decision to not proceed with the project.

Appendix 3: Chance Finds procedure

Areas of proposed development activity are subject to heritage survey and assessment at the planning stage. These surveys are based on surface indications alone, and it is therefore possible that sites or items of heritage significance will be found in the course of development work. The procedure set out here covers the reporting and management of such finds.

Scope: The "chance finds" procedure covers the actions to be taken from the discovery of a heritage site or item, to its investigation and assessment by a trained archaeologist or other appropriately qualified person.

Compliance: The "chance finds" procedure is intended to ensure compliance with relevant provisions of the National Heritage Act (27 of 2004), especially Section 55 (4): *" a person who discovers any archaeological …. object ……must as soon as practicable report the discovery to the Council".* The procedure of reporting set out below must be observed so that heritage remains reported to the NHC are correctly identified in the field.

Responsibility:

Operator	To exercise due caution if archaeological remains are found
Foreman	To secure site and advise management timeously
Superintendent	To determine safe working boundary and request inspection
Archaeologist	To inspect, identify, advise management, and recover remains

Procedure:

<u>Action by person identifying archaeological or heritage material</u>

a) If operating machinery or equipment stop work

b) Identify the site with flag tape

c) Determine GPS position if possible

d) Report findings to foreman

<u>Action by foreman</u>

a) Report findings, site location and actions taken to superintendent

b) Cease any works in immediate vicinity

<u>Action by superintendent</u>

a) Visit site and determine whether work can proceed without damage to findings

b) Determine and mark exclusion boundary

c) Site location and details to be added to project GIS for field confirmation by archaeologist

Action by archaeologist

a) Inspect site and confirm addition to project GIS

b) Advise NHC and request written permission to remove findings from work area

c) Recovery, packaging and labelling of findings for transfer to National Museum

In the event of discovering human remains

a) Actions as above

b) Field inspection by archaeologist to confirm that remains are human

c) Advise and liaise with NHC and Police

d) Recovery of remains and removal to National Museum or National Forensic Laboratory, as directed.