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For attention: Mr Peter Roux, Principal Environmental Consultant

### **Archaeological assessment of Trekopje Mine access road, Erongo Region, Namibia**

#### **QRS Job 112**

Background: A proposed access road to the Areva Resources uranium mine at Trekopje will follow the existing route of a temporary water supply line from Arandis. The envisaged access road will be about 30km in total length, and tarred. Where possible the road will avoid cutting the dolerite ridges lying in its path, and to further minimize impact on the physical environment, fill material will be derived from five borrow pits along the length of the road itself. The life of the Trekopje mine is estimated at approximately 12 years, after which the road corridor will be restored to its natural state.

Archaeological surveys and assessments have been carried out at all stages of the Trekopje mine development, including the temporary water supply line corridor to be enlarged by the access road project<sup>1</sup>. Detailed archaeological surveys have also been carried out on adjacent uranium

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1. QRS Job 73. *Archaeological assessment of a proposed open-cast uranium mine at Trekopje, Erongo Region, Namibia.* Commissioned by Ferret Mining & Environmental Services on behalf of UraMin (Namibia) (Pty) Ltd. (2006).

QRS Job 76. *Archaeological assessment of water and power supply routes to the Trekopje licence area.* Commissioned by Turgis Consulting (Pty) Ltd. on behalf of UraMin (Namibia) (Pty) Ltd. (2006).

QRS Job 82. *Archaeological assessment of two water supply pipeline routes to Trekopje.* Commissioned by Turgis Consulting for UraMin (Namibia) Pty Ltd. (2007).

QRS Job 84. *Archaeological survey of EPL 3573, Erongo Region.* Commissioned by Colin Christian & Associates for UraMin (Namibia) Pty Ltd. (2007).

QRS Job 86. *Archaeological assessment of granite quarry sites on EPL 2218 (UraMin).* Commissioned by Turgis

exploration and mining leases. Although the Trekopje mine area is therefore considered to be well explored archaeologically, it has not been covered in sufficient detail that field survey can be dispensed with in the case of new projects. A detailed field survey was therefore undertaken, covering the route of the planned access road and the prospective borrow pit sites.

Scope of work: The field survey was to assess the current temporary pipeline route and the deviations as they occur at the dolerite ridges, as well as to assess the proposed borrow pit sites, all as per waypoint data supplied by Turgis. In addition, the survey was to assess the Arandis borrow pit / landfill site, and a temporary road approximately 500 meters to the north of Arandis. This road will link the landfill / borrow pit to the temporary pipeline route. Finally, the survey was to consider the best option to either create borrow pits or “onionskin” cut the dolerite / marble ridges.

Approach & methods:

The field survey followed the track data supplied by Turgis, paying special attention to the dolerite ridges and other potential terrain obstacles that might affect final design of the road. The five borrow pit sites and the possible Arandis land-fill site were examined in detail.

Positions of archaeological sites were determined by hand-held GPS, and the sites were recorded using standard criteria of description and terrain setting. The archaeological significance and vulnerability of the sites was rated according to standard criteria devised for Namibian conditions (see Appendix I).

Site attribute data were compiled as standard GIS *shp* files (Geographic, degrees decimals, WGS 84) to be submitted together with this report. A project field survey map based on these data was compiled to illustrate the report.

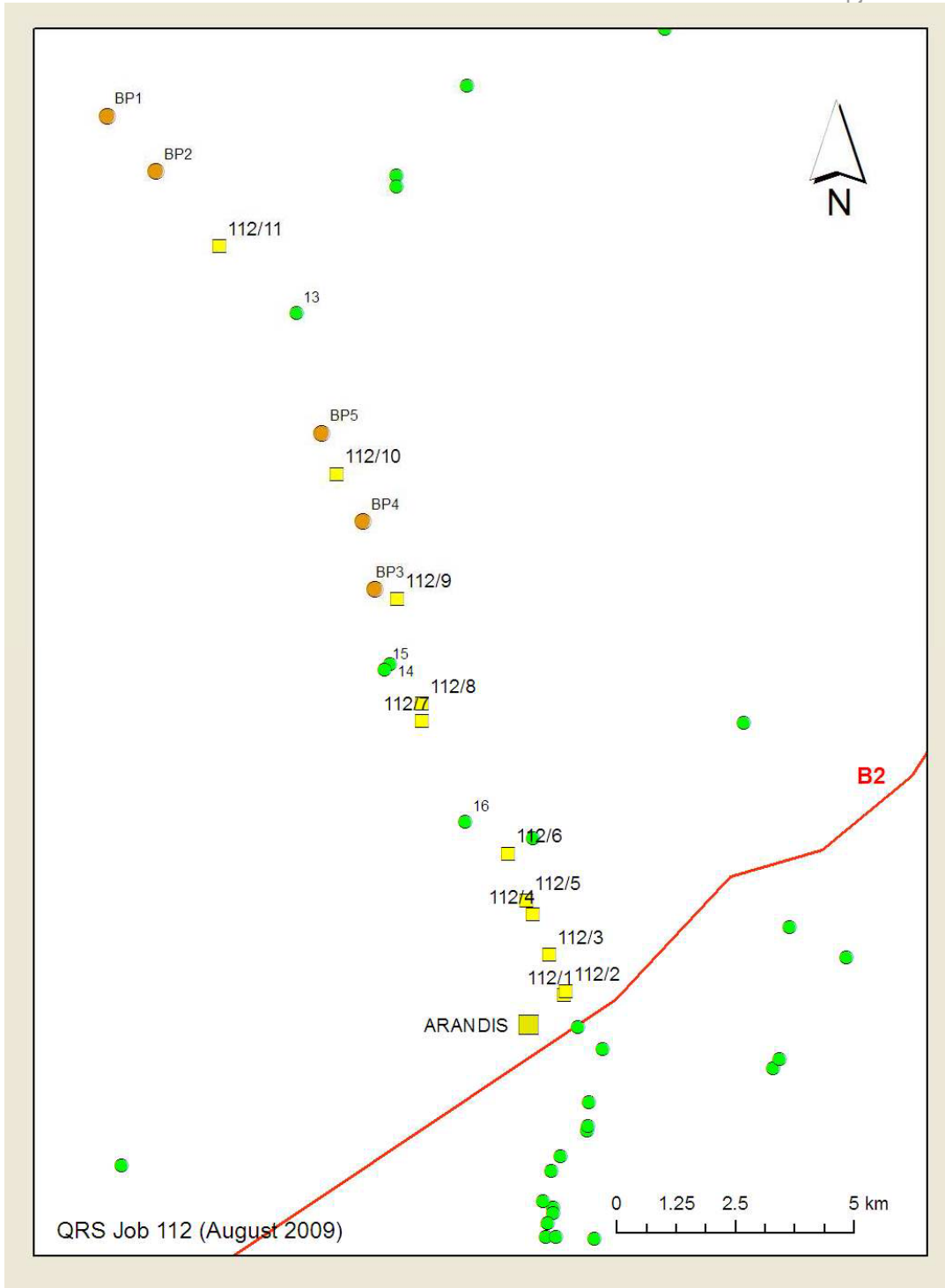
Observations:

The field survey identified a total of eleven archaeological sites. Nine were diggings associated with harvester ant seed caches, a common feature of human activity dating to within the last 1 000 years in this part of the Namib Desert. The seed diggings are not archaeological occupation sites, but rather indicators of the likely presence of such sites within a radius of approximate 4km. One of the remaining two sites was a small group of stone features associated with a dolerite ridge, and the other was an area of discarded World War I military food ration tins in the near vicinity of Arandis siding.

The area covered by the survey is characterized by a mixture of broad, braided stream drainage on colluvial gravels, low dolerite ridges aligned roughly northeast-southwest, and some rough terrain with outcropping granitic schist. The dolerite ridges, which are the most striking feature of the terrain, appear in most cases to be the remains of sills rather than dykes, with dense remnant accumulations of dolerite boulders lying on marble or calc-silicate sub-outcrop. There are no indications of perennial water, or even of ephemeral water impoundments such as would serve the needs of human settlement in this area.

Earlier surveys in the same general area located a number of important archaeological sites, with one group dating to between 4 000 and 5 000 years ago, and a later group dating to within the last 1 000 years. All of these sites were closely associated with granite outcrops and prominent dolerite ridges. Granite outcrops were apparently important attractors because they often have natural basins which store rainwater for periods of several weeks after summer showers. No significant granite outcrops were found during the present survey. The importance of dolerite ridges of which several examples occur in the present survey area, is that they were exploited as natural barriers to the movement of antelope, and elaborate hunting sites were sometimes constructed in low saddles and other crossing points.

Archaeological observations are listed below, including four sites located in the course of the earlier archaeological survey for the temporary water pipeline route from Arandis (QRS 82). The map, below, indicates the distribution of archaeological sites in relation to Arandis and the B2 highway. Also indicated on the map are the borrow pits sites examined in the course of the field survey.



The distribution of archaeological sites along the route of the Trekopje access road. The numbered yellow squares are the sites located in the course of the present survey (QRS 112); the numbered green circles are the sites located during an earlier survey of the temporary water pipeline route to the Trekopje mine. Unnumbered green circles are sites located during surveys of adjacent mining properties. The brown circles numbered “:BP” are the borrow pit sites examined in the course of the present survey.

**QRS 112/1**

Site coordinates: Lat. -22.42568 Long.14.99296

Setting: Gravel surface with coarse talus from adjacent dolerite ridge (Arandis Mtn.). The site lies within 250m of the present Arandis Siding, which is probably the same as that of the historical siding ca. 1915.

Description: Surface scatter and some discrete concentrations of World War I military ration cans, corned beef indicating South African troop presence and ham (probably Danish) indicating presence of German troops. The site was occupied by German troops and then taken by South African troops in late 1915.

Records: Field notes, locality data

Significance rating: 1

Vulnerability rating: 3

**QRS 112/2**

Site coordinates: Lat. -22.42498 Long.14.99332

Setting: Weathered granite outcrop

Description: Isolated seed digging site

Records: Field notes, locality data

Significance rating: 2

Vulnerability rating: 3

**QRS 112/3**

Site coordinates: Lat. -22.41805 Long.14.9902

Setting: Weathered granite outcrop

Description: Isolated seed digging site

Records: Field notes, locality data

Significance rating: 2

Vulnerability rating: 3

**QRS 112/4**

Site coordinates: Lat. -22.41045 Long.14.98697  
Setting: Gravel outwash  
Description: Group of four seed digging sites  
Records: Field notes, locality data  
Significance rating: 2  
Vulnerability rating: 3

**QRS 112/5**

Site coordinates: Lat. -22.40779 Long.14.98588  
Setting: Gravel outwash  
Description: Isolated seed digging site  
Records: Field notes, locality data  
Significance rating: 2  
Vulnerability rating: 3

**QRS 112/6**

Site coordinates: Lat. -22.39881 Long.14.98232  
Setting: Gravel outwash  
Description: Isolated seed digging site  
Records: Field notes, locality data  
Significance rating: 2  
Vulnerability rating: 3

**QRS 112/7**

Site coordinates: Lat. -22.37374 Long.14.96598  
Setting: Gravel outwash  
Description: Isolated seed digging site  
Records: Field notes, locality data  
Significance rating: 2  
Vulnerability rating: 3

**QRS 112/8**

Site coordinates: Lat. -22.37044 Long.14.966  
Setting: South slopes of dolerite ridge  
Description: Three possible stone hut features, without diagnostic artefact material  
Records: Field notes, locality data  
Significance rating: 3  
Vulnerability rating: 3

**QRS 112/9**

Site coordinates: Lat. -22.35036 Long.14.96127  
Setting: Marble/calc-silicate outcrop  
Description: Isolated seed digging site  
Records: Field notes, locality data  
Significance rating: 2  
Vulnerability rating: 3

**QRS 112/10**

Site coordinates: Lat. -22.32669 Long.14.9498  
Setting: Gravel deposit  
Description: Isolated seed digging site  
Records: Field notes, locality data  
Significance rating: 2  
Vulnerability rating: 3

**QRS 112/11**

Site coordinates: Lat. -22.28347 Long.14.92754  
Setting: Gravel deposit  
Description: Isolated seed digging site  
Records: Field notes, locality data

Significance rating: 2

Vulnerability rating: 3

### **QRS 82/13**

Site coordinates: Lat. -22.2961 Long.14.94208

Setting: Prominent schist ridge striking east-west.

Description: Thin surface scatter of ostrich eggshell, hydrothermal vein quartz flakes, and dolerite manuports associated with low rock shelter. The site overlooks a rocky streambed that may have some subsurface water or rock basins.

Significance rating: 2

Vulnerability rating: 3

### **QRS 82/14**

Site coordinates: Lat. -22.36294 Long.14.95995

Setting: Low rocky eminence

Description: Isolated seed digging site. No other associations.

Significance rating: 2

Vulnerability rating: 3

### **QRS 82/15**

Site coordinates: Lat. -22.36394 Long.14.95889

Setting: Low rocky eminence.

Description: Isolated seed digging site. No other associations.

Significance rating: 2

Vulnerability rating: 3

### **QRS 82/16**

Site coordinates: Lat. -22.39284 Long.14.97417

Setting: Marble ridge striking roughly east-west, with small south-facing shelter.

Description: Single dolerite lower grindstone on floor of shelter; no excavation potential.

Significance rating: 2

Vulnerability rating: 3

Assessment:

The survey reported here confirms the association of recent archaeological sites with dolerite ridges and other outcrop features, although in this particular instance no significant sites were found. The very low local density of seed digging sites agrees with observations from the surrounding area that indicate a steep decline in human activity west of Arandis. The only exceptions to this pattern are presented where water supplies are reliable. On the whole, therefore, the distribution of archaeological sites suggests that the 15° meridian is an approximate western limit for human occupation of the Namib Desert during the last 1 000 years.

Evidence of earlier human occupation is present, but generally scarce.

The impact of the Trekopje access road project on the archaeology of the area will be mainly in the context of construction work. Sites located in the path of the access road will be destroyed, and there may be further impacts resulting from a lateral propagation of disturbance on either side of the route itself. In either case, these impacts will result in the permanent loss of the archaeological sites. This loss of archaeological evidence has however, to be considered against the significance of the sites themselves, in terms of their rarity and the amount of additional evidence that might be conserved or gained by their preservation, or by carrying out detailed mitigation work. The significance rating of the sites as described above is between 1 and 2 on the zero to 5 scale employed in Namibian archaeological assessment (Appendix I). A rating of 1 signifies a disturbed or secondary context, while a rating of 2 signifies an isolated minor find. All seed digging sites are rated as 2, meaning that they do not justify mitigation.

In terms of vulnerability, all of the sites reported here are rated 3 on the scale employed in Namibian archaeological assessment (Appendix I). This rating indicates a probable threat of destructive impact. A higher rating can only be considered when the centerline of the access road is surveyed and marked and when the exact footprint of the borrow pits and construction tracks are known. However, even a maximum vulnerability rating would not necessarily justify mitigation measures to be taken in this case, since the significance of the sites themselves is very low.

As they relate to the impact criteria to be considered by Turgis for the project as a whole, the archaeological sites would be evaluated as follows:

- i) **Nature:** Destruction of minor archaeological sites mainly by earthmoving activity

in the course of road construction and borrow pit use.

- ii) **Extent:** Impacts would affect isolated individual sites ranging between 2m<sup>2</sup> and 20m<sup>2</sup> in extent. The intended access road will also disturb the integrity of the local archaeological landscape, as documented in the course of previous surveys.
- iii) **Duration:** Impacts would be expected to occur throughout the construction programme, tailing off when vehicle movement is confined to the completed road. Destructive impacts on archaeological sites should be considered as permanent.
- iv) **Intensity:** Any direct impact would result in total or near-total destruction of the archaeological site.
- v) **Frequency:** A single impact event would mean effective destruction of any site in the path of the intended access road.
- vi) **Probability:** There is a very high probability of impact for any site located in the path of the intended access road.
- vii) **Legal requirements:** The National Heritage Act (27 of 2004) requires that a permit should be obtained for any disturbance or destruction of archaeological sites.

#### Recommendations:

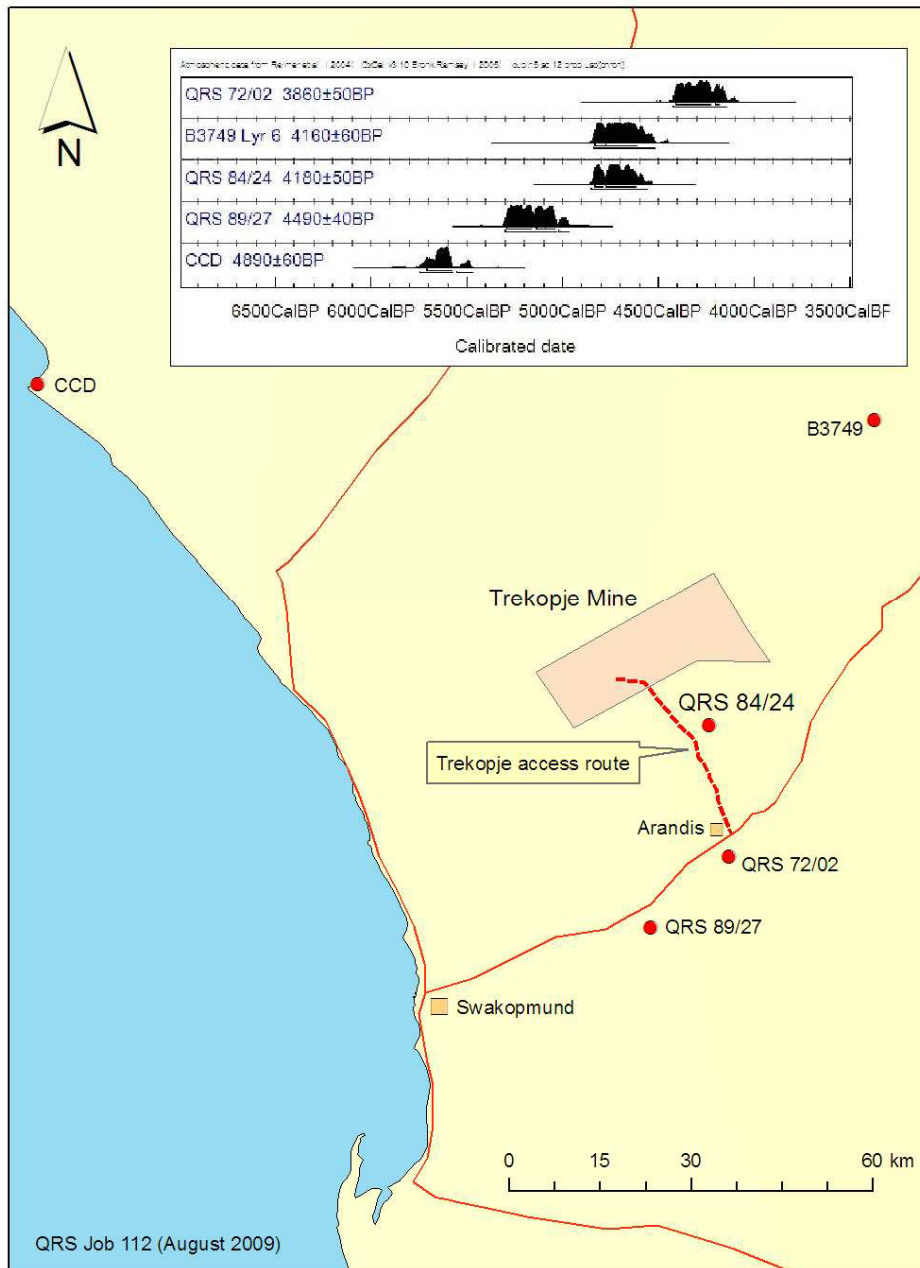
By itself, the archaeology of the access road alignment does not present a case for changing or reconsidering the project. The evidence gathered in the course of the field survey confirmed that the particular area to be affected by the project is peripheral to the main concentrations of archaeological sites in this area. Nonetheless, the presence of some archaeological sites means that the project will have to obtain clearance from the National Heritage Council. Although the results of the field survey and assessment indicate that archaeological impacts will be of low significance, the Heritage Council may impose some mitigation requirements.

A major consideration in heritage impact assessment of the Namib is the dissection and fragmentation of the archaeological landscape. Such fragmentation may have marked consequences even in areas where the archaeology is characterized by small sites which are individually of low significance. Human occupation of this region during the last few thousand years has produced an intricate web of linked occupation sites and resource localities such as waterholes and lithic raw material outcrops. To offset the disturbance of the landscape it is proposed that projects such as the Trekopje access road should include an offset benefit which would enhance the value of archaeological sites in the same area. In the present case, this could be achieved by commissioning a detailed study of one site in the area adjacent to the proposed

road.

Our earlier investigations have located several suitable sites for more detailed investigation, the most promising being QRS 84/24, a multi-component hunter-gatherer camp dating to within the last 4 000 years. This site is one of a small group that represent the reoccupation of this part of the Namib Desert at a time of above normal rainfall, known as the Mid Holocene Climatic Optimum. The sites are therefore valuable proxies for climatic events and where well preserved archaeological deposits exist, these can yield much useful information on environmental responses to climatic changes, as represented by the remains of the plants and animals that were exploited by people living in the area at the time.

The distribution of these sites and the available radiocarbon dating is presented in the diagram below, calibrated to years before present (BP). The site QRS 84/24 is dated to  $4180 \pm 50$  BP (Beta-238381), which places it approximately in the middle of the Climatic Optimum. The map shows the location QRS 84/24 within less than 5km of the new Trekopje access road. It is our recommendation that a systematic investigation of the site QRS 84/24 would be an appropriate offset for the archaeological landscape impact of the Trekopje access road. Our opinion is that the proposed offset would compensate for any damage that might be caused by the access road project, and that it would be a more constructive course of action than direct mitigation of the sites that lie in the path of the envisaged access road.



The distribution of archaeological sites dating to the period of the Mid-Holocene Climatic Optimum, shown in relation to Trekopje Mine and the proposed access road via Arandis. The site QRS 84/24 lies within less than 5km of the road and is recommended as a focus of investigation to offset the archaeological impact of the proposed access road on the archaeological landscape of this area.

The offset investigation of QRS 84/24 would comprise a detailed documentation of the site and at least two small scale excavations. The purpose of the excavations would be to recover environmental data and organic material suitable for radiocarbon dating. Evidence recovered from the excavation would be combined with evidence from related sites in the same region as a published scientific contribution to Namibian archaeology. An estimation of costs for the site investigation would be as follows:

**Proposed offset investigation QRS 84/24**

Professional fees:

Fieldwork 10 days @ N\$3 300	N\$33 300
Labwork 15 days @ N\$3 300	49 500

Overheads:

Field costs 10 days @ N\$750	N\$ 7 500
Laboratory costs 15 days @ N\$750	11 250
Radiocarbon dating 2 samples @ N\$6 000	12 000

Vehicle costs 1 200km @ N\$6	<u>7 200</u>
Total (excl. 15% VAT)	N\$120 750

I trust that you will find this report and proposal satisfactory, and look forward to your further instructions.

Yours sincerely



John Kinahan PhD MSAIE & ES

Partner

Appendix I:**Significance and Vulnerability Ranking of Archaeological Finds**

The evaluation and ranking of site significance and vulnerability is an essential component of archaeological impact assessment. QRS has developed an approach to significance and vulnerability estimation that combines accepted international practice<sup>α</sup> with the results of more than 80 field surveys we have carried out in Namibia and elsewhere.

Our standard procedure involves an estimate of the archaeological value and the risk of damage, using ordinal scales of zero to five. These separate values can be combined as a significance and vulnerability index, e.g. 3/2, 4/0. The same data are used in the preparation of archaeological sensitivity maps and predictive models which form the empirical basis of our time and cost estimates for archaeological field surveys.

It is important to realize however, that such estimates have a degree of subjectivity. For this reason, we estimate significance with specific reference to the value of the site as a component of the Namibian archaeological record, while our estimation of vulnerability refers primarily to the potential consequences of the development project under consideration.

**SIGNIFICANCE RANKING**

- 0 no archaeological significance
- 1 disturbed or secondary context, without diagnostic material
- 2 isolated minor find in undisturbed primary context, with diagnostic material
- 3 archaeological site forming part of an identifiable local distribution or group
- 4 multi-component site, or central site with high research potential
- 5 major archaeological site containing unique evidence of high regional significance

**VULNERABILITY RANKING**

- 0 not vulnerable
- 1 no threat posed by current or proposed development activities
- 2 low or indirect threat from possible consequences of development (e.g. soil erosion)
- 3 probable threat from inadvertent disturbance due to proximity of development
- 4 high likelihood of partial disturbance or destruction due to close proximity of development
- 5 direct and certain threat of major disturbance or total destruction

QRS has adopted the practice of identifying the specific research value of archaeological sites documented in the course of field surveys. This means that we evaluate the likely research benefits of more detailed investigations on sites of high significance, or local site clusters of potential research importance. We indicate the immediate benefits in terms of sequence resolution or yield of comparative material and present this in the form of an expected research dividend. Similarly, we evaluate the consequences of damage or destruction as an expected loss of research dividend. These estimates form part of our proposals for mitigation of impacts.

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<sup>α</sup> e.g. Banning, E. B. (2002) *Archaeological Survey*. Manuals in Archaeological Method, Theory, and Technique. Kluwer Academic, New York.