ENVIRONMENTAL MANAGEMENT PLAN

Interim Trap-door Spider Management Plan for Stages 1 and 2

Voyager Quarry Relocation, The Lakes WA.

Prepared for

BGC (Australia) Pty Ltd
18 Mount Street
Perth WA 6000

March 2007

MINISTERIAL CONDITIONS: RELOCATION OF VOYAGER QUARRY

URS
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1.1 Legal framework

The proposal for the relocation of the Voyager Quarry was assessed under Part IV of the *Environmental Protection Act 1986* (see below). In addition to Ministerial approval of the proposal (Statement 706), the proponent, BGC (Australia) Pty Ltd (BGC), will need to comply with a range of statutory requirements. Legislation that relates to the aspects of Condition 706:M9.3 is outlined in Table 1 below:

**Table 1. Statutory and policy requirements**

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Title</th>
<th>Applicability</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Legislation</td>
<td><em>Environmental Protection Act 1986</em></td>
<td>Ministerial Statement 706 was issued under Part IV of the Act.</td>
</tr>
<tr>
<td></td>
<td><em>Wildlife Conservation Act 1950</em></td>
<td>All native species in WA are protected under the Act. Although Gaius is not listed as either Scheduled or Priority Species, it was included in the assessment by the EPA and advice will be received from the Nature Conservation Division of DEC.</td>
</tr>
<tr>
<td>Department of Environment and Conservation (DEC)</td>
<td>Draft Guideline: Preparing Environmental Management Plans</td>
<td>This document has been prepared in compliance with the draft document.</td>
</tr>
</tbody>
</table>

The proposal, which was initially described within the proponent’s Public Environmental Review (PER) (URS 2003), was referred to the EPA on 19 December 2001 by the Commissioner for Soil and Land Conservation.

The proposed relocation of the quarry is to an area of land owned by the proponent (see Figure 1). In December 2001, the EPA determined the level of assessment for the proposal at PER, and this level of assessment was subject to a two week appeals process. A number of appeals against the level of assessment were considered by the Minister for the Environment and dismissed on 1 May 2002. The subsequent PER document released for public review for a period of eight (8) weeks from 6 January 2003, closing on 3 March 2003. An extension was then provided to allow for further public submissions until April 2003. Following a review of the submissions, the proponent modified its proposal and incorporated details of additional monitoring work and data within its Response to Submissions (URS 2004).

The proposal was approved by the Minister for the Environment with the signing of Ministerial Statement 706 on 16 December 2005. Relevant to this management plan is Condition 9 reproduced below.

*M9.1 Subject to Condition 9-2, no ground-disturbing activity shall occur in the area designated A on Figure 2* (see Figure 1).
M9.2 Where the proponent demonstrates to the satisfaction of the Minister the Environment on advice of the Environmental Protection Authority that:

(a) a similar sized population of the trapdoor spider present on Lots 11 and 14 Horton Road is present on other land; or

(b) the remaining population of the trapdoor spiders located on Lot 11 Horton Road and the portions of Lot 14 Horton Road to remain undisturbed will remain viable if the individuals located within Area A are removed; or

(c) the population can be successfully translocated to the wild,

then ground-disturbing activity may occur in Area A.

M9.3 Prior to clearing of vegetation or excavation of soil or rock, the proponent shall prepare an Interim Trap-door Spider Management Plan to ensure the protection of Trap-door spiders located within Area A from indirect impacts from quarrying activities.

This Environmental Management Plan (EMP) addresses Condition M9.3 such that the population of Trap-door Spiders within Area “A” (Figure 1) are protected until such time as the requirements of M9.2 are satisfied.

Other conditions of Ministerial Statement 706 that have relevance for this EMP include:

M5.2 The proponent shall prepare a performance review program and submit annual performance review reports to the Department of Environment which address:

1. the major environmental issues associated with the project; the environmental objectives for those issues; the methodologies used to achieve these; and the key indicators of environmental performance measured against those objectives;

2. the level of progress in the achievement of sound environmental performance including industry benchmarking, and the use of best available technology;

3. significant improvements gained in environmental management, including the use of external peer review; and

4. the proposed environmental objectives for the operations, including improvements in technology and management process.

M19.1 Prior to the finalisation of plans, strategies and programmes required by condition 8.1, 9.1, 10.1, 12.1, 13.1, 15.1, 16.1 and 18.1, the proponent shall make reasonable endeavours to establish a Community Liaison Group to the requirements of the Minister for the Environment.
1.2 Aspect of the environment to be protected

The environmental factor assessed by the EPA relevant to this management plan is “Invertebrate Fauna”.

Information provided in the PER (URS 2003) and in response to submissions (URS 2004) indicates that the “Voyager” *Gaius* Trap-door Spider, a population located within the proposed Voyager quarry relocation, may be a new species whose survival may be threatened by the construction of the proposed quarry. Following assessment of submissions received, the Minister set a condition (706:M9.3) that requires a proscribed area within the proposed quarry extension to be set aside and protected until further scientific work is conducted to establish the relationship of the Voyager population to other populations and whether a relocation program would be necessary (706:M9.2).

Seven surveys and studies of the Voyager *Gaius* population have been carried out to date. These include:


1.3 Limitations of this EMP

This EMP has a limited life span and will apply until the requirements of Condition 706:M9.2 have been satisfied.

Certain aspects of this plan that are overlapped by other requirements of the Ministerial Statement, such as management of fencing or fire management, will be retained within the other Environmental Management Plans.
2.1 The project

BGC purchased Lots 11 and 14 (Figure 1) Horton Road, The Lakes (Avon Location 1881), Shire of Northam, for the purpose of relocating the existing quarry currently located on adjacent cleared land immediately to the west of Lot 14. The proposal is for the development of the relocated Voyager Quarry on Lot 14.

The proposal affects approximately 85 hectares of remnant vegetation, and involves the quarrying of a resource which is an extension of a Key Extraction Area designated in the Western Australian Planning Commission’s Basic Raw Materials Planning Policy Statement. The proposed relocation of the quarry also has implications for the *Gaius* Trap-door Spider populations of the region.

2.2 Receiving environment

Information collected to date indicates that the “Voyager” *Gaius* Trap-door Spider population represents a previously undescribed taxon, exhibiting genetic divergence from its nearest known potential con-specific population (Biota 2005). A large proportion of mygalomorph (including *Gaius* sp.) in WA and elsewhere in Australia are unnamed. The distribution of named and unnamed taxa has not been not fully documented (York Main 2003).

A survey of Lots 11 and 14 between 10 and 24th March 2004 and follow-up work in July and August 2004 (URS 2003, App H) by York Main and Trent provided the following information:

- A detailed survey revealed an aggregation of 79 burrows within the project area (Figure 1, Area “A”);
- An additional 46 burrows were found in areas of Lots 11 and 14 that will not be disturbed by the proposed quarry; and
- Targeted searches in other areas with similar habitat discovered some 20 to 30 burrows located at the intersection of Beraking Pool Road and Brookton Highway (York Main 2003, 2004b, 2004c).

It is likely that the number of burrows on Lots 11 and 14 outside of the operational areas and for populations at Beraking Pool Road could be larger; however, additional searches would be required to establish a more accurate population size estimate.

Trap-door Spiders are poorly-dispersing, long-lived animals. Juveniles establish their own burrows within a short distance of the matriarchal burrow; consequently genetic distance between populations is likely to increase with geographic separation. Female Trap-door Spiders may live up to 30 years in the wild (pers com Dr P Runham, Biota) always inhabiting the same burrow.
Potential Impacts

The findings of Trap-door Spider survey work completed in 2004 for Lots 11 and 14 (Figure 1) indicated that the core population of matriarchal female spiders is located within the Project Area (subject to further survey), and that the long-term viability of the entire population may be dependent on this core population of breeding “matriarch” females. That is, the spider population may not be able to persist in the long term if the ‘core’ population is destroyed.

### 3.1 Potential environmental impacts of the project

The existing quarry (see Figure 1) is coming to the end of its commercially winnable resources and in order to maintain supplies, needs to expand or relocate. An extensive review of possible locations for the relocated quarry was undertaken by the proponent that determined that the nearest and most viable resource is situated on land located immediately to the west of the existing quarry in uncleared land on Lot 14 Horton Road (Figure 2) (URS 2003). Development of the proposed quarry will entail excavation of up to 2 million tonnes of gravel and approximately 12 million tonnes of clay from the quarry footprint. This will allow for approximately 60 million tonnes of granite to be excavated from the site over an estimated 50-year period.

The development of the quarry will require the clearing of 85 hectares of vegetation, and it is anticipated that the project’s development will occur in 5 stages over the life of the quarry, with Areas 1 and 2 (Figure 2) being initially developed to provide room for the new below ground level facilities and infrastructure. Subsequent stages (Areas 3 to 6; Figure 2) will then be developed as the need to access further granite resources arises. BGC intends to develop the core operational area in Areas 1 and 2 before moving operations into Areas 3 and 4 where the core Trap-door Spider population exists as shown in Figure 1. It will take at least two years to complete the relocation of the quarry operations into Areas 1 and 2 before clearing and overburden removal will take place for Areas three or four (URS 2004). Area 4 has granite resources closure to the surface and consequently would be the next area to be developed.

Although the long-term quarrying operations will not involve the total area of Lots 11 and 14 and will leave untouched the residual Trap-door Spider population the planned operations area will destroy the Gaius “core population” (York Main 2004b). Temporarily restricting initial quarry development to Areas 1 and 2 (Figure 2) will provide the means and sufficient time to fulfil all the requirements of Condition 706:M9. It not predicted that the quarry will have any direct impact on the residual Gaius population located outside of the operational area.

### 3.2 Identification of specific impacts

This Interim Management Plan limits the development of the proposed quarry to Areas 1 and 2 (Figure 2) until the requirements of Condition M9.2 are met.

Regardless of the fact that it will take at least two years for quarry operations to fully exploit the reserves located within Areas 1 and 2, the EPA assessment of the proposal has indicated that the proposed operations within Areas 1 and 2 could be a potential risk to the survival of the Voyager Gaius “core” population within Area “A” (Figure 1).
York Main (2004) has identified that a bush wild fire represents a potential risk to the Voyager population. Other potential risks to the Area “A” Trap-door Spider population would be uncontrolled access by either vehicles or pedestrian traffic through Area “A”.

The EPA’s (2005) assessment was that a “Trap-door Spider Translocation Program” be prepared and initiated as condition of the Minister’s approval. However, following the assessment of submissions (URS 2004), the Minister imposed a further condition (706:M9.3) that requires the proponent to prepare an “Interim Trap-door Spider Management Plan” to ensure the protection of Trap-door Spiders located within Area “A” from indirect impacts from quarrying activities until one of the options of Condition 706:M9.2 have satisfied.

Possible impacts on the core population include:

- **Fire**: The information to hand regarding the Voyager population indicates that these are susceptible to fire; however if left undisturbed may live for 30 or more years in the wild;

- **Habitat damage**: Accidental clearing or illegal vehicle incursions are risks to the survival of the core Voyager Trap-door Spider population. Human entry also increases the chance of fire; however, all possible measures will be taken to isolate Area “A” from quarry operations except for legitimate scientific, firebreak or fencing maintenance requirements; no fire-breaking activities will be taken through Area “A”;

- **Changes to the hydrological regime**: The Ground Water management plan required by Condition 706:M13 outlines the specific impacts caused by the creation of the void. Specifically, the drawdown is not expected to extend more than approximately 100 m beyond the edge of the void due to the unique hydrological regime of the locality. Area “A” is located beyond the expected draw down; consequently draw-down unlikely to impact the core Trap-door Spider population but remains an uncertainty;

- **Vibration from blasting**: The core Trap-door Spider population will probably experience vibration from blasting. These effects have been modelled in the plan required by Condition 706:M17. Blasting will take place at most once per week and will last for a few seconds in each case. Although the impacts cannot be stated with scientific certainty, it is unknown if these short term vibrations will adversely impact on the survival of the Trap-door Spider population in Area “A”;  

- **Dust dispersion from Quarry operations**: It is possible that considerable dust fallout could impact the long term survival of the “core” Trap-door Spider population within Area “A”. However, dust emissions were considered by the EPA assessment (EPA 2005) and a condition was set (706:M12.1) requiring a management plan to ensure that operations are managed to ensure that dust emissions do not impact on the amenity of nearby residents. The Dust Management Plan sets stringent conditions on operations and consequently dust is very unlikely to impact invertebrate fauna in adjacent bushland, but again remains an uncertainty. Monitoring of Area “A” will include observation of any accumulated dust that would be likely to adversely impact the Trap-door Spider population;
Potential Impacts

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- **Other factors**: These include clearing of large trees for Areas 1 and 2 and subsidence of topsoil at the margin of the quarry and fly-rock dispersion. The plan required by Condition 706:M17 includes the experience gained in the operation of the existing quarry in regard to fly rock and a review of extant studies conducted for the proposed study (URS 2003, 2004). Once again, the information indicates fly rock dispersal will be limited to at most a 100m radius. In regard to vegetation disturbance and soil subsidence, it should be noted that there is an approximate 200 m buffer between the edge of Area 1 and 2 operations and the boundary of Area “A” (Figure 1) which should provide a reasonable safety margin for subsoil disturbance. Once again total scientific certainty cannot be guaranteed.

- **Dieback**: The spread of dieback into Area “A” could possibly adversely impact the Trap-door Spider population in Area “A” due to changes in habitat. An area located on the southern boundary of Lot 14, adjacent to the Great Southern Highway, has been found to be infected with dieback fungus (Phytophthora cinnamoni). For both commercial and conservation necessities, this area is to be subject to strict quarantine measures so as not to spread the fungus to other areas of Lots 11 and 14. The proponent has undertaken a dieback survey and has committed to developing a Dieback Management Plan.

- **Surface water flows**: Changes in surface water flow could possibly adversely impact the Trap-door Spider population in Area “A”. The topography of the Lots 11 and 14 is such that the natural slope of the land is from north west to south east. Consequently water flow will not be interrupted by quarrying activities. However, it is important that road building and repair activities to the west of Area A, on the boundary of Lot 11, should not impact on surface water flows.

Due to various uncertainties regarding the ongoing survival of the “core” Trap-door Spider population, Area A will be subject to monitoring from time to time (Section 4.1) until the requirements of Condition 706:M9.2 are satisfied.

It should be recalled that Area “A” is located within 500 m of the existing quarry that has been in operation for approximately 18 years and this Trap-door Spider population has been subject to all of the indirect impacts of a nearby quarry without the protective measures provided by this Interim Management Plan. This interim Management Plan is to provide protection for Area “A” from operations within Areas 1 and 2 of the proposed quarry (Figure 2) which is a similar distance to Area “A” as to the existing quarry operations (Figure 1).
Figure 2: Division of Project areas with “core” population and Area “A” (Figure 1) indicated.
4.1 Principal environmental objectives

The EPA Objective relative to the Environmental Factor is to maintain the abundance, diversity, geographic distribution and productivity of fauna species at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge; to maintain and enhance habitat for native fauna.

The Ministerial Statement 706 does not provide environmental objectives for Condition 706:M9.3. However, it is clear from the EPA’s assessment and the wording of Condition 706:M9 that the objective of Condition 706:M9.3 is to provide “interim protection” for the Voyager *Gaius* population located in Area “A” from the indirect impacts from quarrying activities until such time that the requirements of Condition 706:M9.2 have been satisfied.

Consequently the objective of this document is to ensure the protection of the “core” Trap-door Spider population in Area “A” until the requirements of Condition 706:M9.2 can be satisfied. To achieve this objective:

- Disturbance to the “core” population, likely to arise from quarry operations, are to be kept to a minimum; and
- Area “A” and, as a control, Beraking Road population to be subject to a census at six-monthly to verify the success of the management plan.

Much of the work above has relevance to the requirements of Condition 706:M9.2 (see below).

The EPA’s assessment (EPA 2005, Section 3.4.3) follows:

> Trapdoor spiders are poorly-dispersing, long-lived animals. It is known that females of Trapdoor spiders may live at least 24 years in the wild, always inhabiting the same burrow. The findings of the additional survey work completed in 2004 for the Trapdoor spiders of Lots 11 and 14 found that the core population of spiders (approximately 79 burrows) is located within the Project Area, and that the long-term viability of the entire population (approximately 54 burrows left undisturbed on Lots 11 and 14) may be dependent on this core population of breeding “matriarch” females.

That is, the spider population may not be able to persist in the long term if the ‘core’ population is destroyed. Following extensive targeted searches in other areas with similar habitat, another population of Trapdoor spiders (some 25 burrows) was located at the intersection of Beraking Pool Road and Brookton Highway. It has not been determined at this time whether this population is the same species as those found at the project area.

Translocation of large populations of Trapdoor spiders has not yet been attempted in the field (although translocation to artificial accommodation such as flower pots of soil maintained in a laboratory has had some success with one specimen of another species being successfully transplanted). However the likely success of transplanting large numbers of individuals is unknown.
Condition 706:M9.2 flows from the above assessment. The condition provides three alternatives to provide enhanced surety for the long-term survival of the “Voyager” Trap-door Spider species. Clearing of Area “A” should not take place unless one of the following three options can be satisfied:

(a) If a similar sized population of the Trap-door Spider present on Lots 11 and 14 Horton Road is present on other land; or

(b) the remaining population of the Trap-door Spider present on Lots 11 and 14 Horton Road and the portions of Lot 14 Horton Road to remain undisturbed will remain viable if the individuals located within Area “A” are removed; or

(c) the population can be successfully translocated to the wild.

Dr Phil Runham has provided recommendations to satisfy the requirements of Condition 706:M9.2; these are included in detail in Attachment 2 and are paraphrased below and reprioritised in accordance with discussions held between URS and Biota on 11 October 2006.

To secure the long term survival prospects for the “Voyager” Trap-door Spider species the following work should be undertaken.

- **Condition 9.2(b):** Determine if the total undisturbed Voyager Trap-door Spiders population is of significant size compared to the “core” population within Area “A”; in which case the destruction of Area “A” would not represent a significant impact on the long-term survival of Gaius spiders in the Voyager locality. This would require a confirmatory survey of Area “A” and an intensive search for burrows within undisturbed areas of Lots 11 and 14 and if possible, nearby water catchment reserves that have Gaius habitat characteristics. Should no suitably sized populations be found nearby, it is recommended that monthly surveys be conducted in the first six months after overburden removal has commenced followed by six-monthly surveys. Should no change be noted after the second monthly survey, then no further survey need be conducted until the recommended six-monthly surveys. These surveys will confirm whether the effectiveness of the interim management plan.

- **Condition 9.2(a):** Survey the Beraking Pool Road population to determine more accurately the size of this population together with a morphogenic analysis of captured male spiders to determine the relatedness of this population to the Voyager population. Should the population be of insufficient size or have considerable morphogenic difference, a search for other populations may need to be undertaken on the basis of known habitat preference for the species. Verification of a population of the same species of similar size would provide surety of the long-term viability of the species found at the Voyager site.

- **Condition 9.2(c):** Should no other similar species be found outside of the Voyager population, the EPA has recommended that translocation trials be undertaken. This work would be time consuming and would have no guarantee of success, given that this has not been previously attempted.

The above are prioritised in terms of likelihood of success. Satisfying 706:M9.2(b) would require additional survey work. Condition 9.2(a) would require additional survey together with morphological
Environmental Objectives

studies which may show the Beraking Road population to be morphogenically divergent. The following provides time-limitation parameters on proposed work:

- Survey work may be undertaken at any time of the year and may proceed immediately.

- Morphogenic analysis requires examination of male spiders. These may be caught in pit-fall traps when male spiders leave burrow at the most propitious breeding times – the highest probability of capture is immediately prior to or after summer rainfall. Weather forecasts would be monitored and pit-fall traps installed prior to rainfall and examined directly after rainfall.

- Translocation work would need to be carried out in cooler months when soils are wet. However, this work may not be necessary given successful outcomes regarding conditions 9.2(b) or 9.2(a).

A possible outcome is that the requirements of Condition 706:M9.2 cannot be satisfied. In this case, it is recommended that work done on the Beraking Pool Road population be expanded to provide an offset against the loss of the Voyager “core” population and will therefore be detailed if and when the need arises.
5.1 Overall strategy to protect Area “A”

Protection of the Voyager Gaius population requires the development of satisfactory strategies to ensure the long-term protection of the core population (Figure 1, red boundary) located with Area “A” (Figure 1, green boundary) until the requirements of Condition 706:M9.2 can be satisfied.

Arising from the possible impacts identified in Section 3.2, the protection strategies below are interwoven in a common objective to protect habitat, whether this be for vegetation, invertebrate or vertebrate fauna:

- A Fire Management Plan (see Attachment 1).
- Area “A” to be clearly delineated.
- Fencing requirements.
- Restrictions on personnel movement.

Other possible impacts listed in Section 3.2 have been assessed as not being likely to have any significant adverse impact for the development of quarrying activities in Areas 1 and 2 (Figure 2). However, monitoring of the core population will assess the success of the management plan especially in regard to uncertain impacts due to quarrying (See Section 3.2).

Implementation of the above strategies is to be completed and verified in two stages as outlined in Table 3:

1. Prior to the commencement of clearing of Areas 1 and 2 (Figure 2); and
2. On completion of clearing and prior to overburden/quarrying operations.

Responsibility: The overall responsibility for implementing the above strategies will be the Quarry Manager, BGC Voyager Quarry, The Lakes.

Timing: All of the requirements of the above strategies, as detailed in Section 6, This Plan will only be in force until the requirements of Condition 706:M9.2 are satisfied.

Process: A compliance report will be submitted within three months of completion of clearing Areas 1 and 2; an Audit Officer of the Department of Environment & Conservation may undertake a site visit to verify compliance with this document.
The relevant standard for the assessment of this factor is the EPA objective:

To maintain the abundance, diversity, geographic distribution and productivity of fauna species at species and ecosystem levels through the avoidance or management of inverse impacts and improvement in knowledge; to maintain and enhance habitat for native fauna.

### 6.1 Fire Management Plan

York Main (2004) has identified fire as a major risk to the long-term survival of the core *Gaius* population within Area “A”.

The objective of the Fire management Plan (Attachment 1) is to minimise the risk of ignition in bushland, to minimise the risk of fire originating within operational areas spreading to adjacent bushland and to provide the means and readiness to combat a bushfire should this occur or spread from neighbouring areas.

A simple one-page “Fire Management Plan” to be distributed to notice boards is required that addresses the following issues:

- Safe practices.
- Smoking restrictions.
- Fire breaks.
- FESA liaison.
- Fire fighting resources.

### 6.2 Delineate and protect Area “A”

Those bushland areas of Lots 11 and 14 that lie outside of the operational Areas 1 and 2 are to be subject to special protection (as outlined in Section 5.1 and expanded in Section 6.1, 6.3 and 6.4). Consequently all undisturbed bushland areas will be subject to protection while these remain outside of operations. It will be necessary to provide additional protection to Area “A” from those personnel who have permission to enter bushland areas by clearly marking out and fencing Area “A”.

The objective of visually and physically delineating Area “A” is to ensure that this area is readily identified for the purpose of protecting the core Trap-door Spider population. Clear marking will:

- reduce the potential for accidental vehicle or pedestrian traffic across the area;
- facilitate ready recognition of the area by personnel who have approval to work within Areas 3, 4, 5 and 6, and
• facilitate scientific work by eliminating the need to traverse back and forth with a GPS to locate boundaries.

Both the “core” Trap-door Spider area and the perimeter of the Area “A” are shown in Figure 1. The inflection points on the boundary of Area “A” indicated in Figure 1 are reproduced in Table 2 below.

**Table 2. Location of Area “A” boundaries**

<table>
<thead>
<tr>
<th>Perimeter Inflection</th>
<th>Easting</th>
<th>Northing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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</tr>
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<td>8</td>
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</tr>
</tbody>
</table>

It is important that Area “A” is clearly delineated; however it is also important that the area is left open to allow native grazing animals, such the Grey Kangaroos and Western Brush Wallaby, to continue to move through and have access to Area “A”, thus maintaining natural grazing pressures and reducing fire risk.

Using the Eastings and Northings in Table 1, each inflection point of Area “A” should be marked with a 1.5 m star-picket with coloured surveyor’s tape marking the top of each star picket. Between each inflection point, star-pickets should be placed at intervals of approximately 10 m in a straight line between each inflection point, providing linear markers of the boundary of Area “A”. These should also be marked with surveyor’s tape.

A wire strands are to be strung between star pickets to ensure a vehicle or person does not inadvertently cross-the boundary into Area “A”. Use of wire strands, rather than secure fencing, will not obstruct native fauna that would normally utilise this area.

To facilitate scientific work, each star picket at an inflection point should have an aluminium tag attached with the Easting/Northing inscribed.
Fencing

The objective of enclosing any area with fencing for this proposal is to

- limit access for the purpose of protecting bushland/habitat; and/or
- prevent native fauna from straying into areas where they could be harmed.

However, fencing can, if not properly planned, have a negative impact on native fauna. Fencing may create biological “islands” for larger animals just as cleared agricultural areas may create islands for smaller and less mobile species.

Therefore, the invertebrate habitat of Area “A” is best protected by

- Visually marking Area “A” as per Section 6.2 using marked star pickets with interlinking wire strands. Include signage “Keep out, Trap-door Spider Area”;
- Enclosing quarry operational areas with “fauna proof” fencing; and
- Enclosing the outer boundaries of Lots 11 and 14 using stock-proof fencing as required by DEC to prevent stock access and illegal vehicle and pedestrian incursions.

Additional protection for Area “A” is outlined in Section 6.4 below.

The above requirements satisfy Ministerial Condition 706:M7.2 (below) and additionally provide habitat protection for Area “A”.

7.2 The proponent shall fence the perimeter of Lot 11 and Lot 14 Horton Road, and the perimeter of the operational boundary shown on Figure 3 (of Schedule 1), to the requirements of the Minister for the Environment on advice of the Department of Conservation and Land Management.

When Areas 1 and 2 (Figure 2) are initially cleared, the requirements of Condition M8.1 (Fauna Relocation and Habitat) need to be satisfied to ensure that native fauna in areas to be cleared are protected. In the initial stages of operations, fencing will ensure that larger fauna do not return to or traverse operational areas and to limit human access to bushland areas. In later stages when overburden and quarrying operations have proceeded, fencing will minimise the risk of native fauna from falling into the quarry.

Consequently the initial operational area (lower rectangle in Figure 1; Areas 1 & 2 Figure 2) is to be fenced off from adjacent bushland using recommended “fauna-proof” fencing methods. “Fauna-proof” fencing will minimise the risk of fauna falling into the quarry pit and will minimise risk to people who may be illegally in the undisturbed areas of Lots 11 and 14. However, the quotes on “fauna-proof” are included to indicate that most fences will not keep out certain fauna species that may be determined to

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1 Cyclone diamond mesh or equivalent to at 1.8 m height with 50 cm buried.
6.3 Personnel movement

The objective of restricting movement of personnel outside of the operational area is to ensure that vehicle and pedestrian traffic into Areas 3, 4, 5 and 6 and undisturbed areas of Lots 11 and 14 are restricted to those personnel who have valid reasons to be there. This will eliminate unauthorised vehicle tracking through bushland and reduce the probability of a fire that could be increased by unauthorised entry to bushland areas. Furthermore, stock-proof fencing will reduce illegal incursions by members of the public into Lots 11 and 14.

Areas 3, 4, 5 and 6 (Figure 2) and undisturbed areas of Lots 11 and 14 are to be declared out of bounds to all BGC employees and contractors except those who have approval by the Quarry Manager to work within these areas for specified activities. Such work is likely to encompass fire-break maintenance, fuel reduction and fencing construction and repair. Scientific investigators will also enter the bushland areas to do follow-up work on the Area “A” population.

All quarry staff will receive induction by management regarding the importance of preserving Area “A” until Condition 706:M9.2 has been satisfied and will also be inducted into the importance of preserving bushland areas as remnant native vegetation habitat.

The requirements of Section 6.3 will ensure that there is a clear delineation between operational and bushland areas.

The Quarry Permitting System is to be modified to include a permit system to allow authorised entry to bushland areas outside of the operational areas. Permits will apply to both BGC employees, contractors and visitors. The permit will also state, No access to the Trap-door Spider Area “A”, except for approved scientific investigation.

Signs are to be erected on bushland access gate(s) notifying that only permit holders are to have access. The signs will include the words “Access by Permit Only – see Quarry Manager”.

Signage to be erected at Area “A” to include the words “Keep Out, Trap-door Spider Area”
### Monitoring

**SECTION 7**

#### 7.1 Ongoing monitoring

Ongoing monitoring will be limited to

- Ensuring that fencing, gates and signs, as required by this document, are maintained in good order;
- A record is kept of Access Permits issued in regard to Bushland areas outside the operational area; and
- Compliance with the requirements of the Fire Management Plan (Attachment 1).

<table>
<thead>
<tr>
<th>Monitoring</th>
<th>Location</th>
<th>Parameter/Frequency</th>
<th>Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance with TDS Management Plan</td>
<td>All areas</td>
<td>Initial report</td>
<td>Within 3 months of completion of clearing.</td>
</tr>
<tr>
<td>Ensure gates are locked and signs and fencing is maintained in good order.</td>
<td>Periphery of Lots 11 &amp; 14.</td>
<td>Ongoing; as required by Condition 706:M7.3.</td>
<td>Inspect gates, fences and signs on weekly basis. Annual report to DEC verifying compliance.</td>
</tr>
<tr>
<td>Keep record of Access permits issued for entry to bushland areas.</td>
<td>Not applicable.</td>
<td>Ongoing until the requirements of Condition 706:M.</td>
<td>Maintain record for audit inspections.</td>
</tr>
<tr>
<td>Monitor “core” TD Spider population each month for first six months starting following clearing. Discontinue and revert to six-monthly if no significant change detected on second monthly monitoring.</td>
<td>Area “A”.</td>
<td>First six months. If no change detected in second survey – no need to do further monthly surveys. DEC will be notified ASAP in the event of any adverse impacts</td>
<td>Annual report to DEC. Notify DEC ASAP upon receipt of knowledge of adverse impacts on TDS Area “A” population.</td>
</tr>
<tr>
<td>Monitor “core” TD Spider population every 6 months as per S4.1.</td>
<td>Area “A”.</td>
<td>Every six months until Condition 706:M9.2 satisfied.</td>
<td>As above.</td>
</tr>
</tbody>
</table>
7.2 Contingencies

Possible incidents that may have occurred despite management actions being in place are considered below.

Fire Management: The environmental Officer will be responsible for reviewing the implementation of the Fire Management Plan should any fire incidents occur. The Quarry Manager will have ultimate responsibility for the implementation of the Fire Management Plan.

Fencing: Fencing, gates and signs to be inspected on a weekly basis for damage due to vandalism or fauna activity and to ensure that signs are in place and are legible.

Personnel Movement: Record any known breaches of bushland access permits for the purpose of reviewing the implementation of the access permitting system.

TD Spider Monitoring: Should monitoring indicate a significant decline in the Area “A” population following commencement vegetation and overburden removal, the possible causes of any indirect impacts of quarrying should be investigated.

The above actions are included in the Management Actions Table in Section 10.
8.1 Stakeholders

Mr N Caporn (Environment) and Dr M Geraklis (Ecologist, Swan Region). General discussions regarding other DEC contacts, fencing requirements.

Independent peer reviewers included Prof. B. York Main, Department of Zoology, University of WA.

8.2 Community liaison

Ministerial Condition M19.2 has been set in regard to communicating the outcomes of certain Ministerial conditions to a Community Liaison Group.

M19.2 Prior to the finalisation of plans, strategies, and programmes required by Conditions 8.1, 9.3, 10.1, 12.1, 13.1, 15.1, 16.1 and 18.1, the proponent shall make reasonable endeavour to establish a Community Liaison Group to the requirements of the Minister for the Environment.

The outcome of this requirement will be provided in a separate communication to Department of Environment and Conservation.

8.3 Ongoing liaison

The requirements of this Management Plan will remain in force until the Condition 706:M9.2 have been satisfied.

Liaison with the Environmental Management Division (Environmental Audit Branch) and the Nature Conservation Division of DEC in regard to the effectiveness of measures outlined in this management plan to protect trapdoor spiders in Area “A” from indirect impacts of quarrying activities and to resolve the outstanding issues of Condition 706:M9.2 will be required.
9.1 Auditing

**Pre-clearing audit**

- Delineation of Area “A” boundaries using star pickets and wire.
- Permitting procedure and documents in place for access to bushland areas outside of operational areas.
- Staff induction regarding the conservation value of bushland areas and the importance of protecting Area “A”.
- Fire Management: Site plan relevant to existing stage of development; fire-fighting resources in place and serviceable; notification provided to local Volunteer Fire Brigades.

**Post-clearing audit**

- Operational areas fully fenced on bushland access.
- Signs erected on bushland access gate(s) to include required wording (*no entry without permit; no smoking in bushland*).
- Fire breaks for Lots 11 and 14 maintained as required by the Shire of Northam.
- Fire Management Plan operational.

The Quarry Manager and Environmental Officer will be required to ensure that all management actions as per Section 10 of this document are carried out.

The DEC Environmental Audit Branch has a policy of conducting audits from time to time to verify compliance by proponents with Ministerial Conditions.

9.2 Review and Revision

Review and revision of this EMP will not be required due to the limited life span of the Plan. However, subject to the outcome of monitoring of Area “A” Trap-door Spiders, this plan may need to be revised accordingly.

9.3 Reporting

Within three months of the completion of clearing, a report will be provided to the DEC providing an outline of compliance with this Management Plan. Thereafter, Annual Reports will be required every
Ongoing Compliance Requirements

twelve months following completion of clearing. The Quarry Manager will notify the DEC, within the next working day, of any breaches of the provisions of this Interim Management Plan.

The experience gained during the first phase of the operations for Areas 1 and 2 will be documented and reported to the DEC Audit Branch in the first annual report as required by Condition 706:M5.1.
# Key Management Actions

## Table 4. Key Management Actions

<table>
<thead>
<tr>
<th>Issue</th>
<th>Key Mgt Action</th>
<th>When</th>
<th>Objective</th>
<th>DEC annual reporting/ evidence</th>
<th>Responsibility</th>
<th>Status [compl report]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fencing</td>
<td>Fence off operational area And boundaries of Lots 11 and 14.</td>
<td>Operational area fence before clearing Boundary fencing before operations commence.</td>
<td>Limit fauna and boundary crossing of operational area; prevent access to Area “A”.</td>
<td>Post-clearing report to DEC Audit Branch within 3 months.</td>
<td>Quarry Manager.</td>
<td></td>
</tr>
<tr>
<td>Personnel movement</td>
<td>Quarry Permit: authorised entry to bushland.</td>
<td>From the commencement of vegetation knock down.</td>
<td>Limit disturbance &amp; fire risk.</td>
<td>Record of permits issued. Record of any breaches of permits and action taken to resolve.</td>
<td>Quarry Manager.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Signs on bushland access gate(s) includes “Access by permit only &amp; no smoking”.</td>
<td>As above.</td>
<td>Limit disturbance &amp; fire risk.</td>
<td>1st annual report Photographs of access gate(s).</td>
<td>Environmental officer.</td>
<td></td>
</tr>
<tr>
<td>Review effective</td>
<td></td>
<td>As above.</td>
<td>To ensure access permits are working.</td>
<td>Report breaches of access.</td>
<td>Environmental Officer.</td>
<td></td>
</tr>
<tr>
<td>Implementation of</td>
<td></td>
<td>As above.</td>
<td>Report s actions arising from inspections.</td>
<td>Environmental officer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>permitting system</td>
<td></td>
<td>As above.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Notes
- DEC: Department of Conservation and Environment
- DEC Audit Branch: Responsible for overseeing the implementation of environmental management plans.
- Environmental officer: Responsible for ensuring compliance with environmental regulations.
- Quarry Manager: Responsible for managing quarry operations.
- 1st annual report: First annual report due after one year from the commencement of the project.
- Access by permit only: Access to bushland restricted to individuals holding valid permits.
- No smoking: Prohibited smoking in designated areas.
- Monitoring: Regular checks of fences, gates, and signs in good order.
## Key Management Actions

<table>
<thead>
<tr>
<th>Issue</th>
<th>Key Mgt Action</th>
<th>When</th>
<th>Objective</th>
<th>DEC annual reporting/ evidence</th>
<th>Responsibility</th>
<th>Status [compl report]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TD Spiders</td>
<td>Monitor population</td>
<td>Confirmatory survey prior to clearing, monthly surveys if required for first six months following clearing (no more than two initial surveys required in first six months if population stable) and six monthly surveys thereafter for life of the Interim Plan.</td>
<td>No adverse impacts due to quarry operations</td>
<td>Provide outcome in annual reporting.</td>
<td>Appropriately qualified Contractor</td>
<td></td>
</tr>
<tr>
<td>Fire MP</td>
<td>Safe practices and fire fighting resources as per plan are verified to be in place.</td>
<td>As above.</td>
<td>Fire safety.</td>
<td>Statement of compliance.</td>
<td>Environmental officer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintain fire breaks.</td>
<td>As above.</td>
<td>Fire safety &amp; access by fire crews.</td>
<td>Statement of Compliance.</td>
<td>Environmental officer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site plan to Volunteer Fire Brigade &amp; Notice Board.</td>
<td>As above.</td>
<td>Awareness by staff &amp; Volunteer Brigades.</td>
<td>Statement of compliance.</td>
<td>Environmental officer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fire fighting resources in place and in working order.</td>
<td>As above.</td>
<td>Fire safety.</td>
<td>Statement of compliance.</td>
<td>Environmental officer</td>
<td></td>
</tr>
</tbody>
</table>
# Key Management Actions

## SECTION 10

<table>
<thead>
<tr>
<th>Issue</th>
<th>Key Mgt Action</th>
<th>When</th>
<th>Objective</th>
<th>DEC annual reporting/ evidence</th>
<th>Responsibility</th>
<th>Status [compl report]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>Audit of Management Plan.</td>
<td>Annually.</td>
<td>EMP in place and operational.</td>
<td>Post-clearing report to DEC Audit Branch within 3 months.</td>
<td>Environmental officer</td>
<td></td>
</tr>
</tbody>
</table>


Limitations

URT Australia Pty Ltd (URT) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of BGC (Australia) Pty Ltd and only those third parties who have been authorised in writing by URT to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 10 August 2006.

The methodology adopted and sources of information used by URT are outlined in this report. URT has made no independent verification of this information beyond the agreed scope of works and URT assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URT was false.

This report was prepared between 14 August 2006 and 19 March 2007 and is based on the conditions encountered and information reviewed at the time of preparation. URT disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.
1. Safe Practices

- The only stored fuel on site will be diesel fuel which will be stored and bunded according to the requirements of the Department of Consumer and Employment Protection (DoCEP).
- No fires are to be lit within operations areas at any time.
- Plant and vehicles to be used in clearing and fire-break maintenance to be fitted with appropriate fire-prevention equipment such as spark arresters and spark shields. Exhaust systems shall be shielded or positioned such that contact with vegetation is not possible. All plant working in bushland areas to carry appropriate fire extinguishers.
- Welding and grinding activities are to be carried out behind spark shields and away from bushland areas. Fire extinguishers shall be kept close at hand when such operations are being conducted
- See Victoria Country Fire Authority Advice for fire protection advice regarding vehicles and work practices:

2. Smoking Restrictions

- For personnel authorised to enter bushland areas adjacent to operations areas, no smoking will be allowed in bushland areas.
- Signs located on access gates to bushland areas will carry the words “No Smoking in Bushland Areas”

3. Fire Break maintenance

- Fire breaks for all uncleared land within Lots 11 and 14 are to be maintained in accordance with the requirements of the Shire of Northam. Firebreaks should be of sufficient width to take water trucks and other equipment as may be made available by the Quarry Manager. Fire breaks should not contain dead ends; they should open at both ends to local road or other fire breaks to allow escape options for fire crews.

4. Fire & Emergency Services Authority (FESA)

The nearest Bush Fire Brigades:

- Chidlow Volunteer Fire Service Brigade (Shire of Mundaring): ph 9572 3016
- Ink Pen Road Volunteer Fire Service Brigade (Shire of Northam): Brigade Captain ph 9573 1093

Each year both of the above Brigades are to receive an updated plan of the existing quarry and proposed Voyager Relocated Quarry Operations Area indicating:

- Access roads, bushland access gate(s), and fire breaks within adjacent bushland
- High-volume water stand pipes
- Location of keys, if access gates are kept locked
5. Fire Fighting Resources

The following resources are to be maintained as serviceable on site at all times:

- An adequate number of appropriately trained staff to use the resources should be located on the site at all times when operations are in progress.
- High-volume stand pipes and associated feed pumps and protective bollards.
- Water truck with 45 kL capacity, pump and water cannon.
- Plant equipment, as may be required, shall be made available if a fire occurs in uncleared areas of Lots 11 and 14 which are owned by BGC (Australia) Pty Ltd.
- The Quarry Manager shall nominate persons responsible for verifying all of the fire fighting resources and safe practices as required above are in accordance with this plan.
- The staff crib-room notice board shall display a copy of the plan required by Paragraph 4 above and a copy of this Fire Management Plan.

6. Fuel Management Activities

Subject to the covenanting requirements of Schedule 1 of Ministerial Statement 706, fuel reduction strategies may be undertaken for land within Lots 11 and 14 remaining in BGC ownership. This may take the form of proscribed burning subject to advice from local Volunteer Fire Service Brigades. For further information see Planning for Bush Fire Protection which is available on the WA Planning Commission website:


Dr P Runham of Biota Environmental Sciences has recommended a methodology for further scientific work to be conducted such that the requirements of Condition 706:M9.2 may be satisfied. The proposal below should be reviewed and prioritised according to the information provided in Section 4.1 of this management plan.

The recommendations for further work (URS correspondence January 2006) includes the following:

Methodology

Brookton Highway Population Size Investigations of the size of the Brookton Highway *Gaius* population will involve two personnel conducting manual searches for spider burrows in the vicinity of the known individuals. The location of all burrows found will be recorded on differential GPS units, allowing the information to be downloaded and mapped in MapInfo GIS. The size of the population and spatial distribution of individuals within it will permit comparisons with existing data for the Voyager quarry site.

*Trapping for Male Gaius at Brookton Highway.*

Pit-fall traps will be installed during the search period so as to allow their placement throughout the full extent of the population. Traps containing ethyl glycol will be placed near clusters of burrows identified on the basis of door size of adult females. Although the final number of pit-fall traps installed is dependent upon the size of the spider population, we envisage that up to thirty traps will be used. Traps will be cleared and replenished with ethyl glycol once per fortnight, until male spiders are captured. The total duration of the trapping period is dependent upon the amount of rainfall during late summer and early autumn, but is expected to continue for no more than three months.

*Anatomical Characterisation of Male Gaius from Brookton and Comparison with Voyager Specimen.*

Male spiders captured at the Brookton Highway site will be characterised anatomically by Professor York Main for comparison with the Voyager population.

Translocation Trials at Voyager Relocation trials within Lots 11 and 14 near Voyager Quarry will first require an extensive literature search, and discussion with CALM and Professor York Main, to provide fundamental information for such work. The literature search is expected to provide information on methods used to construct artificial burrows, timing of translocations (primarily seasonal), numbers and ages of individuals translocated and methods for determining survivorship of individuals.

Once translocation methodology has been finalised, selected spiders will be removed from their burrows within the proposed disturbance area at the Voyager quarry site. These animals will then be placed in artificial burrows, constructed according to established protocols, within Lots 11 and 14 but outside the proposed disturbance area. The coordinates for each burrow will be recorded using differential GPS units. Each artificial burrow and spider will then be monitored once per month for an initial period of 12 months.
Attachment 2

to determine the short-term success of the translocation. A decision could then be made as to the frequency and requirement for longer-term monitoring of translocated individuals.

During daylight hours, spiders typically remain at depth in their burrow and it will not therefore be possible to visually confirm whether relocated spiders are alive. Hence, confirmation of individual survivorship will be based on indirect methods (e.g. burrow integrity, door construction) established on the basis of previous experience of the personnel and evidence obtained during the literature search and discussions. Photographic records of all burrows will be made at each monitoring interval.

Identification of areas with the potential to support *Gaius* populations.

The significant habitat parameters identified at Voyager include:

- a sandy substrate with limited pisolitic gravel;
- an intact vegetation assemblage dominated by a *Eucalyptus marginata* (Jarrah) overstorey and *Hibbertia hypericoides* understorey;
- an area removed from drainage lines and wetland inundation; and
- elevation and incline.

The desk-top survey would also include the values for these parameters from the Brookton Hwy site, thereby utilising the significant characteristics of both sites at which the spiders have been recorded.

Available spatial datasets providing information on each of the parameters would be plotted as spatial layers, using GIS mapping techniques, within a ten kilometre radius of the Voyager and Brookton Hwy populations as well as between the two areas. Overlaying these layers on a map of the area would permit visual identification of areas in which the optimal parameters from each layer intersect. Ground-truthing of these points would form the basis for subsequent searches for further *Gaius* populations and/or potential recipient sites for spiders translocated from the Voyager quarry site.

*Ground-truthing of sites identified as potential Gaius habitat.*

Each of the sites identified above would be located using maps, digital imagery and a Differential GPS, searched for *Gaius* populations and assessed for habitat suitability for possible translocation trials.
Other recommendations for further work by Dr P Runham include the following (URS correspondence September 2005).

While the work completed (Taxonomy of the Voyager TD Spider genus, Gaius) has added to the knowledge base, the data available at present do not yet allow definitive conclusions to be reached regarding taxonomic relationships – specifically; whether individuals from the two sites (Brookton Hwy and Voyager) represent the same Gaius species.

Based on the work to date, two potential scenarios exist.

1). Individuals from the two sites are conspecific, representing isolated populations of the same species and that each population comprises 50% of the known genetic diversity within this currently undescribed species. This scenario however, fails to recognise:

- a greater level of genetic diversity at the Voyager site;
- the Voyager site, known to contain in excess of 120 individuals (Biota 2004; Main and Trent 2004), is by far the larger of the two “populations”; and
- there is a lack of male specimens to allow a definitive alpha taxonomy assessment (and the intermediate genetic divergence levels).

Given the above, we are of the opinion that there is insufficient information to confirm that the two sites support populations of the same species. The second scenario is that the two sites support individuals representing distinct sibling species, each comprising 100% of the known within-species genetic diversity. In the absence of clear morphological distinctions, and with the border-line genetic divergence levels, there is also insufficient evidence to unequivocally support this scenario.

These data however, do suggest that the Voyager and Brookton Highway Gaius are reproductively isolated, a requisite for speciation to occur (Ridley, 1996). Given that speciation is a continual process it is not surprising to find populations at intermediate stages of separation that do not fall conveniently into our definitions of a species. In the context of evolutionary biology, a population is defined as a group of interbreeding individuals (Ridley 1996) and this in the context of (and probably the intent of) Condition 8.1 would suggest that the Brookton Highway site does not constitute a “…similar size population of the same species of spider….” irrespective of the actual taxonomic status.

The key conclusions of this report are as follows:

1) The taxonomic status of the Voyager and Brookton Highway Gaius populations in relation to one another remains uncertain (i.e. whether the isolated populations represent the same or distinct species).

2) The Voyager and Brookton Highway Gaius populations clearly and definitively represent one, or possibly two, previously undescribed species distinct from other known species in this genus occurring in other localities.
3) That Brookton Highway does not constitute a “….similar size population of the same species of spider….” where a population is defined as a group of interbreeding individuals.

4) On the basis of available taxonomic and ecological (population size and demography) data, the Voyager and Brookton Highway Gaius populations should be considered of equivalent conservation value.

Recommendations

The recommendations we present here are provided in the context of the requirements set out in the relevant (Draft) Ministerial Condition (8-1 to 8-4) [these have been replaced by 706:M9.2 which is essentially the same] and centre primarily on the still unresolved issue of clarifying the taxonomic status of the Voyager and Brookton Highway populations and locating another population of the Voyager Gaius species of comparable size.

1) A systematic search should be conducted for further Gaius Trap-door populations in the Darling Scarp.

Physical searches to date have been conducted on an ad hoc basis across a relatively small area adjacent to, and between, the known populations at Voyager and Brookton Highway. We suggest that a desktop analysis (using knowledge of Professor York-Main and GIS) to assess potential habitat on the Darling scarp may highlight other regions of suitable topography, soil types and habitats similar to those in which Gaius is known to occur. This would provide for more efficient targeting of additional searches of these areas to increase the likelihood of locating further conspecific populations. This work would also provide a basis for preparation of a translocation programme should that eventuate.

2) Locate and taxonomically characterise the undescribed congeneric species previously collected in the Collie region.

The Collie region represents an area having similar climatic and geological parameters to those present at the Voyager and Brookton Highway sites. The genetic comparisons in this study demonstrated that the Voyager and Brookton Highway Gaius populations are genetically divergent from the G. villosus and G. jonesae found at Tenterden and Grass Patch respectively. The animals from the Collie region provide a point of comparison that, due to a smaller geographic separation, may potentially also be genetically less divergent.

3) Continue genetic analyses of comparable congeneric species for which material is currently available and being collected.

The current genetic work, and the taxonomic relationship of the Voyager and Brookton Highway populations, may be further clarified by comparisons with additional genetic analyses of other congeneric species that are separated by similar geographic distances as the Voyager and Brookton Highway populations. Such material may currently be available in the collection of the South Australian Museum (M. Adams pers. comm. 2005) and is also being collected by Biota where available from other project areas as reference material.
4) Conduct additional trapping for males at Brookton Highway and other locations. The morphological analyses to date have been hampered by the lack of male specimens available from localities other than the Voyager site, despite initial trapping efforts over the past autumn. Further trapping at both known sites (and at others that may be located through the work outlined in Recommendation 1 above), would undoubtedly contribute to resolving the taxonomic status of the two populations.

5) More accurately assess the size and spatial distribution of the Voyager and Brookton Highway Gaius populations.

While the taxonomic relationship of the Voyager and Brookton Highway populations remains unresolved, the latter is the only known site that may be conspecific with the Voyager species. Ministerial Condition 8-1 clearly stipulates that any alternative population to the Voyager site should be of similar size. Currently, the number of individuals known from the Brookton Highway site totals 25, while the Voyager population is considerably larger, comprising in excess of 100 individuals. More comprehensive counts of individuals at each site should be completed and GPS coordinates recorded for all individuals.

We trust this report meets your current requirements. Please contact us should you wish to discuss the findings detailed above or to commence development of the scope outlined in the recommendations provided.

References


