AUDIT OF 1990's EXPLORATION ACTIVITIES WITHIN TWO GOLDFIELDS NATURE RESERVES

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ABSTRACT

Jilbadji and Dundas are large, relatively remote reserves vested in the National Parks and Nature Conservation Authority (NPNCA) and managed by the Department of Conservation and Land Management (CALM). Both reserves are within Western Australia's Goldfields, and have experienced substantial exploration activity within the last decade. Conditions designed to allow environmentally acceptable exploration on conservation land were imposed on tenements.

At the request of the NPNCA, field inspections were undertaken to audit the environmental impacts of exploration on the two nature reserves. This in turn gives an indication as to the effectiveness of conditions imposed for exploration on conservation land. Detailed reports on exploration in Jilbadji and Dundas Nature Reserves have been provided to the NPNCA.

This paper examines the hypothesis that as exploration techniques have developed over time, environmental disturbance from individual exploration programs has been minimised.

INTRODUCTION

Access to Western Australian conservation reserves for exploration depends on government policy and the policy of the NPNCA in which the reserves are vested. The concurrence (for A class) or recommendations of the Minister for the Environment, on advice from the NPNCA and CALM, are required for exploration in the conservation estate. The current government policy is to allow exploration except in instances where this is considered environmentally unacceptable. The NPNCA is opposed in principle to mining in conservation reserves, but has undertaken to examine each proposal and to recommend suitable conditions for exploration, or to recommend refusal of access. For example, exploration programs have been approved for Rudall River and D'Entrecasteaux National Parks, but an exploration application over the wilderness zone of Fitzgerald River National Park was refused by the Minister for Mines in agreement with the Minister for the Environment. The Department of Minerals and Energy (DME) has a Memorandum of Understanding with the Environmental Protection Authority (EPA), under which any significant environmental disturbance proposals are also referred to the EPA.

CALM policies which have direct relevance to exploration are Policy Statement N° 10 (Rehabilitation of Disturbed Land), N° 31 (Management of Reserves for the Conservation of Nature) and N° 34 (Visual Resources Management on Lands and Waters Managed by CALM). CALM Management Plans, where in place, also provide guidance for managing exploration on particular reserves. CALM's Environmental Protection Branch makes

recommendations to the NPNCA and the Minister for the Environment regarding tenement applications, assesses proposals for environmental disturbance exploration and makes recommendations to the NPNCA, and assists in management of exploration activities in conjunction with CALM District staff and DME Environmental Officers.

Although CALM deals with many applications for exploration tenements over land vested in the NPNCA (64 in the 1998-9 financial year) there are relatively few active exploration programs carried out on conservation land, and even fewer notices of intent for active mining (NOI). Only 4 environmental disturbance programs, and one NOI, were assessed for all NPNCA land in 1998-9.

Potential impacts of exploration activity include reduction in visual amenity, loss of "wilderness" character, rubbish, increased vectors for dieback and weeds, improved access for feral animals, disturbance to threatened flora and fauna, fire, erosion, threat to fauna from open drill holes, death of vegetation due to discharge of saline ground water, soil and water pollution due to fuel spills or toxic drilling muds, soil compaction, damage to management access, increased third party access with associated long term impacts, interruption to natural drainage, and damage to heritage sites.

The NPNCA asked CALM to report on the impacts of exploration in Rudall River National Park, and Jilbadji and Dundas Nature Reserves. Some of the more significant exploration programs on conservation reserves in recent times have occurred within these reserves. For example, CRAE's Rudall River exploration programme lasted eight years, with an expenditure of $35 million. CALM's Rudall River report (P. Kendrick, 1998) indicated that while the visual effects of exploration are still apparent, other environmental values do not appear to be seriously threatened due to the broad nature of the exploration carried out to date in the park. The report also indicated that the impacts of recent exploration should, in general, be shorter lived than earlier work, due to improvements in exploration and rehabilitation techniques.

JILBADJI AND DUNDAS NATURE RESERVES

Tenure History and Natural Attributes

Jilbadji and Dundas NRs are both semi-arid, receiving an average of less than 300 mm rainfall per year, and experiencing periodic drought. This is a crucial factor with respect to rehabilitation timing and success.

Jilbadji Nature Reserve

Jilbadji NR was initially reserved in 1954 as an unvested reserve for flora and fauna (then known as Lake Barker, or Barker Lake Wildlife Sanctuary). In 1977 the reserve was vested in the former Western Australian Wildlife Authority (WAWA), with the purpose of "Conservation of flora and fauna". Jilbadji NR is approximately 40 km south of the gold mining town of Marvel Loch, in CALM's Merredin District, and has an area of 208, 866 hectares.

A survey commissioned by Aztec Mining Co (Martinick, 1990) noted four principal landform types (undulating greenstone plain, sandplain, salt lake and granite hills) present in a 50,000 hectare section on the western side of the reserve, and supporting twenty vegetation types.

Eucalypt woodlands, mallee and kwongan heath are the main broad vegetation types, but vegetation types associated with granite rocks and salt lakes are also present.

Dundas Nature Reserve
Dundas NR is within CALM's Esperance District, has an area of 780, 883 hectares, and is south-east of Norseman. The Eyre Highway forms much of the northern boundary of the reserve. Dundas NR was vested in the former WAWA in 1981, for "Conservation of flora and fauna". An old telegraph line, which ran from Norseman to the South Australian border, bisects the reserve.

Dundas falls within the Mallee Region of the South West Province and the South West Interzone (Beard, 1990). Low eucalypt woodlands and mallee are present, as well as vegetation associated with salt lakes and granite rocks.

History of exploration

Jilbadji Nature Reserve
Two small gold deposits have been mined in the Cheritons section of Jilbadji in the 1990's. Nickel and gold exploration have been undertaken for a century. In the 1960's and 70's, extensive exploration for nickel and other base metals was carried out within Jilbadji NR. Many cleared lines are visible on aerial photographs. Little exploration was undertaken in the 1980's, while negotiations regarding access to the conservation estate for exploration and mining were occurring. Both environmental disturbance exploration and active mining have occurred at Jilbadji Nature Reserve in the 1990's.

Over thirty exploration or prospecting applications, and four mining lease applications, have been processed by CALM since 1991. Processing of another four mining lease applications is awaiting further information from the applicants which will provide a summary of proposed work and environmental values which may be impacted. Approximately nine separate environmental disturbance exploration programs have been undertaken in the 1990's, and considerable low impact exploration has occurred. DME, CALM and EPA have an agreed definition of low impact exploration:
"Types of activities that usually create little or no environmental disturbance, if carried out in accordance with standard environmental conditions, include:

- airborne surveys;
- satellite imaging;
- reconnaissance in light vehicles, including off-road access where approved;
- geophysical work (for example, magnetometer surveys), especially if carried out on foot, by helicopter or where approved with limited off-road access;
- geochemical work including collection of small samples (<20kg) especially if collected on foot or with limited off-road access;
- scout drilling on existing roads, tracks and approved management access routes.

Depending on location, vegetation type, time of year and degree of current road access and vehicle/tyre configuration, the following additional activities may be approved by the management authority which is responsible for management of the land in question:

- scout drilling off-road using drills mounted on low impact vehicles such as a bobcat, four wheel drive off-road tractor or other similar low ground-pressure off-road unit. Off-road low impact environmental disturbance activity should be such that, with the passage of a

short period of time the disturbance could not be seen, or following a wildfire event the access routes would be very difficult to distinguish from the surrounding landscape;
- Due to the large area covered by some conservation reserves, camping for field parties will be permitted on a limited basis in areas approved by the management authority, or by DME when the land involved is unvested." (Department of Minerals and Energy, 1998).

Dundas Nature Reserve
Unlike Jilbadji or the adjacent Brockway Timber Reserve, Dundas NR has little surface expression of basement rock, and is much less visibly affected by previous exploration activity than are Jilbadji or Brockway. However geologists have recently determined that the Yilgarn Craton underlies this area, suggesting prospectivity for gold and nickel. There is also potential for diamond prospectivity.

More than 50 applications for exploration licences have been approved by the Minister for the Environment for access for mining (exploration) within Dundas NR since 1991. No applications for Mining Leases have been received in that time. Five proposals for environmental disturbance exploration, involving ten exploration tenements, have been approved by CALM and the NPNCA These proposals together totalled over 400 kilometres of cleared access tracks and gridlines, and included over 150 RAB or RC drill holes and thousands of auger samples.

FIELD INSPECTIONS

Field inspections were undertaken by CALM staff (including relevant District Managers and Environmental Protection Branch), the Department of Minerals and Energy (DME) and in the case of Dundas NR, NPNCA representatives. Mining company representatives were available in most instances to assist with inspections. Due to the large size of the reserves, extent of exploration activities and access difficulties, inspections were representative rather than all-inclusive.

Prior to inspection, aerial photographs, DME's Tengraph system and exploration maps were used to select appropriate sites and plan routes. In the field, audit sheets were completed by CALM and DME, in consultation with mining company representatives, for a limited number of individual exploration sites. Choice of sites was based on stratified random sampling. Both objective and subjective methods were used to measure compliance issues. Time constraints precluded the use of statistically valid monitoring.

The audit sheets were based on existing CALM and DME sheets, and have similarities with a system developed for auditing petroleum operations in South Australia (Dobrzinski and Stone, 1998). They included a general list of audit items, provision for noting special conditions on a particular tenement, and administrative details such as company contact numbers. At each audit site, the items relevant to that site were inspected, and a score between zero and four assigned. An acceptable performance was given a score of two, an unacceptable performance zero, and excellence achieved a score of four. Averaging the item scores for each site would have little real meaning with respect to environmental disturbance, the potential impact of each item being extremely varied. However an average for each site can give an indication of the attention to "best practise" procedures at that particular site. Audit scores and items requiring attention were discussed with company representatives on site.

RESULTS OF INSPECTION

Jilbadji Nature Reserve

Forrestania Gold (Bounty Gold Mines) is currently operating south of Jilbadji, but also has interests in the southern part of Jilbadji and has recently undertaken low impact (foot traverse) soil sampling along old grid lines. Site markers were virtually the only visible indication of this program.

Previous exploration work at the Turkish Delight and Leeuwin prospects were audited. Some of the grid lines were cleared earlier for Aztec, some for Normandy, and most were drilled in 1996. While the lines were generally of acceptable width (approximately 3m), some windrows and heaps of vegetation were present, compaction in wheel ruts was evident, and entrance to lines had not been disguised.

Sons of Gwalia have begun operating in Jilbadji recently, and have carried out low impact bobcat mounted drilling, mainly in heath vegetation. Very little evidence of this program is visible. Further exploration is planned.

Inspection of a 1993 exploration program by another company near West Cheritons, which had caused concerns to CALM and DME at the time, showed that gridlines had not rehabilitated successfully and compaction, rutting, too much soil disturbance, windrows, and vegetation heaps were still present. Disturbance at this particular site is still highly visible, and this is an example of an area where a bond would have been desirable and where remedial work and closure of old lines by new tenement holders would be beneficial.

Dundas Nature Reserve

Exploration work undertaken by Pan Australian Exploration was inspected. This exploration has concentrated on the area between the Eyre Highway in the north and south of the Old Telegraph Line. A bobcat mounted auger drill rig was utilised for the majority of the exploration. Widely spaced grid lines were cleared using a rubber front end loader (blade above ground), and the bobcat operated within this grid. Approximately 25,000 auger samples were taken.

There was one area of deeper drilling at T4 which necessitated closer spaced cleared drill lines. Fifty five rotary air blast and over 100 reverse circulation holes were drilled at this site.

It was intended to inspect exploration work by Mt Burgess Gold Mining Company south of the Old Telegraph Track, but access to the site was precluded by wet, boggy tracks.

SIGNIFICANT ISSUES

Low Impact Exploration

Most of the bobcat work inspected in both reserves had almost no visual impact. In dense post-fire mallee stands, the passage of the machine could be discerned, but in most cases the direct impact was limited to some crushing of vegetation. As long as it is done with clean

machinery, off track bobcat auger drilling has little potential for long term impacts in Jilbadji and Dundas Nature Reserves.

Grid Lines

Cleared grid lines are necessary to allow safe access by four wheel drives and bobcat, and for drill rigs in areas of intensive drilling. However, excessively cut gridlines can take twenty or thirty years to revegetate (Jones, 1989).

There are many old gridlines in Jilbadji which have not rehabilitated to an acceptable degree. CALM will review management access requirements, and then discuss with current exploration companies which tracks may be needed for further exploration access. The companies have indicated they may be willing to close off unnecessary tracks when they have machinery working in the vicinity for future exploration programs, to prevent access by third parties while the lines are rehabilitating. As well as blocking track entrances, this may entail ripping the 100m closest to public access roads to encourage regeneration. For example, the access road to the Turkish Delight prospect has some severe erosion, and needs repair, or rehabilitation and closure.

While the standard of much of the work in Dundas was found to be acceptable, discussion were held with the company representative regarding some less than satisfactory aspects of the program, especially in parts of the intensively drilled area. An on-site meeting was held at the end of the field inspection, and Pan Australian agreed to undertake reparation work, in consultation with CALM and DME. This has been done to an acceptable standard (see *Program Close-Out for Dundas NR* below).

In general, gridlines appear to be fairly slow to revegetate. This may be due to competition from mature vegetation adjacent to lines, loss of rootstock due to excessive clearing, limited rainfall and/or compaction of tracks. Minimising area of disturbance (for example by using bobcat mounted rig in preference to line clearing) is first priority. Ripping of compacted areas (eg drill pads, wheel ruts) may be necessary to improve conditions for regeneration, although its use may not be appropriate for all soil conditions.

Drill holes

If left open, drill holes become pit traps for fauna and can exacerbate erosion. Both DME and the mining industry in general are committed to ensuring that, no matter the tenure of the land, drill holes are sealed. Standard conditions require all exploration drill holes to be filled and capped.

A group of open drill holes was found on cleared grid lines in the Cheritons area of Jilbadji NR. It is difficult to be sure which company left the drill holes open, but appears likely to have been "piratę" drilling. Sons of Gwalia have undertaken to cap and fill the holes when working in the vicinity. A very few open holes were noted in both reserves, presumably accidentally missed during recent exploration programs. Potentially more important is the fact that in both reserves some drill holes which had been inadequately capped and filled had subsequently subsided. This points to the need to cut off the drill collar cleanly, and make sure cap seals well. A DME Environmental Officer from Kalgoorlie has developed a tool for

efficient collar cutting. A similar device has also been developed by Hamersley Iron. Placing the cones deep enough so they are not dug up by rehabilitation ripping, or by vehicles using drill lines for access, is also critical.

Operations Guidelines

Sons of Gwalia and Forrestania Gold have both provided maps of their areas of interest within Jilbadji, and copies of their operating procedures manuals for exploration. The manuals are of great benefit, ensuring that field operators are fully aware of potential sources of environmental impact, and procedures designed to minimise these impacts.

Program close out for Dundas NR

Rehabilitation work was completed in July 1999 and included burying of sample bag collection close to Old Telegraph Track, ripping of compacted drill pads and wheel ruts, and closing turn offs from access tracks to exploration lines. This work has been satisfactorily completed, and inspected by a DME Environmental Officer. Success of rehabilitation will depend to a great extent on favourable seasons in the subsequent few years

This work also included pulling backs heaps of vegetation which had resulted from over clearing of some grid lines. The heaps had been in place for about two years and hibernating snakes and carnivorous marsupials were discovered in some. Although there is extensive undisturbed vegetation surrounding the lines, the heaps had been chosen as preferred habitat by these fauna. This emphasises the fact that rehabilitation should be completed as soon as possible after exploration. If for any reason rehabilitation is held up, careful consideration is needed to prevent adverse effects of some aspects of later rehabilitation.

DISCUSSION

Aeromagnetic exploration can be used to assess likely prospectivity, and on-ground exploration using a bobcat mounted drill rig can be accomplished with very little impact. While some clearing for gridlines is unavoidable, disturbance can be minimised if cleared or rolled drill lines are targeted to more prospective sections of the project area. This contrasts with older work in Jilbadji where close spaced, heavily cleared gridlines are still visible.

Draft guidelines have been developed by CALM for Rudall River National Park, and these include a requirement to rehabilitate and close all tracks at the end of each exploration season. Tracks can then begin regenerating, and be opened again if warranted by results of the previous season's exploration. Such a system may well be appropriate for future exploration programs in Jilbadji and Dundas Nature Reserves. There may be some exploration tracks in Jilbadji which could be left open to aid CALM's fire management, and this will be determined in consultation with the District Manager. At present there is no need for any exploration tracks to remain open to aid CALM management in Dundas NR.

Given the prospectivity of the reserves, and ongoing interest as indicated by tenement applications, CALM will liaise with DME and the relevant exploration companies, to develop individual exploration guidelines for Jilbadji and Dundas Nature Reserves. These guidelines will be of use for current operations, and also future proposals.

Audit sheets appear to be a useful method of assessing the impact of exploration programs, allowing some consistency over time, locations, programs, sites and assessors. The sheets are also a convenient historical record of activities for each nature reserve. Two days at each reserve was not enough time to develop a quantitative evaluation of cumulative impacts of exploration and mining on Jilbadji and Dundas Nature Reserves, due to the extensive sampling that would have been necessary.

It is particularly important that rehabilitation bonds are in place prior to start up of environmental disturbance projects. In the unusual circumstance that the company is unable or unwilling to carry out reparation (as has occurred with one program in Jilbadji NR) funds for this can then be obtained via DME.

The purpose of commercial mineral exploration is to discover ore bodies. While active mining of an ore body generally causes intensive disturbance to a small area, the preliminary exploration stage has the potential for extensive disturbance. Ongoing improvements in exploration techniques and procedures are moving towards minimisation of the environmental impacts of exploration on the conservation estate.

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