Metals X Limited

Wingellina Nickel Project

Level 1 Flora and Vegetation

Assessment of the Wingellina Borefield

April 2012

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Executive Summary

Metals X Limited has been granted a clearing permit to conduct groundwater exploration and associated works within Miscellaneous License L69/12 to provide water for its Wingellina Nickel Project. The proposed boreholes and access tracks are located 90 kilometres southwest of the Surveyor Generals' Corner which is the junction between Western Australia, the Northern Territory (NT) and South Australia (SA).

Condition 4 of the Clearing Permit granted to Metals X by the Department of Mines and Petroleum (DMP) on the 6 October 2011 (Clearing Permit 4523/1) specifies that the permit holder must not clear more than 20 hectares of native vegetation and that the area proposed to be cleared must be surveyed to ensure that no clearing occurs within 50 metres of any Delcared Rare Flora and 10 metres of any Priority Flora.

Outback Ecology was commissioned by Metals X Limited to conduct a survey for Declared Rare and Priority Flora species within three areas within the miscellaneous licence, the 'Study area', that are proposed to be used for groundwater exploration:

(a) an access track;
(b) a drill line track; and
(c) 11 drill pads along the drill line track, each of size 20 m by 10 m.

The key objectives of the assessment were to establish the locations of any conservation significant vascular flora in the Study area to ensure that no clearing took place within 50 m of any Declared Rare Flora and 10 metres of any Priority Flora.

Other objectives were to:

- Develop an inventory of the terrestrial vascular flora occurring in the vicinity of the Study area;
- Describe and map vegetation associations across the Study area using data collected from quadrats and assess their condition and conservation significance;
- Identify and specify locations of any introduced species including any Declared weeds and any weeds of environmental significance; and
- Identify potential impacts of the proposed clearing program.

The objectives and methods adopted for this survey and assessment were in accordance with:

- EPA Position Statement No. 3, Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002); and
- EPA Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004).

Five vegetation communities were recorded in the Study area. These communities were previously described in detail in the adjacent Tjuntjuntjarra Track by Outback Ecology (2011). None of the vegetation communities are analogous to those listed as Threatened or Priority Ecological Communities in the Department of Environment and Conservation (DEC) databases.

A desktop study identified that no Declared Rare Flora listed under the WA *Wildlife Conservation Act (1950),* have been previously recorded within or adjacent to the Study area. Five Priority Flora species were identified as likely to occur in the Study area based on habitat information from database and literature searches: *Acacia calcicola, Eucalyptus sparsa, Neurachne lanigera*, *Stackhousia clementii* and *Vittadinia pustulata.* Only one individual of the Priority 3 species *Stackhousia clementii* was recorded in the Study area, within the original drill line alignment. This line was amended to ensure that clearing would be more than 10 metres from this species.

A search of Threatened Flora listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*, the South Australian *National Parks and Wildlife Act 1972* or the Northern Territory's *Territory Parks and Wildlife Conservation Act* 2000 was also undertaken to complete the agreed scope and this revealed an absence of Threatened Flora.

An undescribed species of *Goodenia* referred to as 'sp. affin. *quasilibera* (L. Ransom 868)' was first recorded by Outback Ecology (May 2011) within the Wingellina Project area. This species is not listed by the DEC as of conservation significance as its status has not yet been determined. However it is being treated as Priority Flora in the current report since it is only known from L69/12 and an area to the SE of Warburton. It is not treated as Declared Rare Flora since the vegetation and habitat (Vegetation Community 5 on calcrete) in which is has been recorded is largely intact outside of the Study area, indicating that it may be reasonably abundant outside of the Project area. No individuals of *Goodenia* sp. affin. *quasilibera* (L. Ransom 868) were found within 10 metres of any of the 11 proposed drill pads. Five populations (totalling 98 plants) of this species were found within 10 metres of the original route for drill pad access; however several minor modifications to the route were selected in the field to ensure that the proposed clearing would be further than 10 metres from these populations. Clearing of vegetation and the subsequent invasion of Buffel Grass in localised areas may present a significant threat to the *Goodenia* species unless managed appropriately.

While the Study area is presently weed-free, the introduction of weeds from adjacent areas is a significant threat to the native vegetation. Of particular concern is the potential introduction of Buffel Grass (**Cenchus ciliaris*) and Ruby Dock (**Acetosella vesicaria*) from along Tjuntjuntjarra Track and areas surrounding the Wingellina Community. These species are particularly prevalent along roadsides and thus are readily spread by earth moving equipment working on roads. Both species are listed by DEC as significant environmental weeds and could potentially pose a threat to the vegetation in the Study area, which is in pristine condition, unless carefully managed. Weed control measures are specified under the clearing permit conditions.

Table of Contents

TABLES

FIGURES

PLATES

APPENDICES

1. INTRODUCTION

1.1 Project Background and Location

Metals X Limited (Metals X) is developing the Wingellina Nickel Project (the Project) which is located in the vicinity of the Wingellina Hills in the Central Ranges near the Wingellina Community. The Project is situated on Aboriginal Reserve A17614 in Western Australia which abuts both the South Australian and Western Australian borders (**Figure 1**). The Project involves mining and mineral processing activities aimed primarily at the recovery of nickel and cobalt from large nickeliferous limonite deposits.

Water supply is a critical component of the Project. Approximately 12 GL/yr of water are required for construction and operations. The raw water requirement for the processing plant is approximately 1,200 cubic metres per hour. This necessitates the development of a water supply borefield for the Project. The water will be sourced as bore water from groundwater reserves in the surrounding sedimentary basins. Two sources are being investigated:

- The Northern Borefield located approximately 100 km to the north of the proposed processing plant, in the Cobb Depression aquifer which is a sedimentary sub-basin marginal to the Canning Basin; and
- The Southern Borefield located approximately 100 km south-west of the proposed processing plant, in the Officer Basin aquifer, which consists of Langkarta Sandstone. (**Figure 2**)

Previous drilling in both areas found indications of large quantities of water of a quality suitable for the Project requirements. However, current hydrogeological testing of the borefields indicates that the Southern borefield is more suitable as the Project's groundwater source. Consequently, Miscellaneous License L69/12 in the Officer Basin has been the main focus of ongoing groundwater investigations prior to the finalisation of the Public Environmental Review.

The borefield design is conceptual, with further drilling required to confirm the source and production capacity. The conceptual borefield design consists of approximately 30 production bores producing 20L/sec per bore to give a maximum capacity of 12.5 GL/a (34,000 m^3/d). It is proposed that borewater will be transported the approximate 100 km from these production bores to the mine site via a pipeline. The raw water will discharge into a raw water surge tank, which then will overflow into two HDPE lined raw water ponds, providing 2 days of storage. Raw water for the water treatment plant will be drawn directly from the raw water tank and pumped to the Reverse Osmosis (RO) plant.

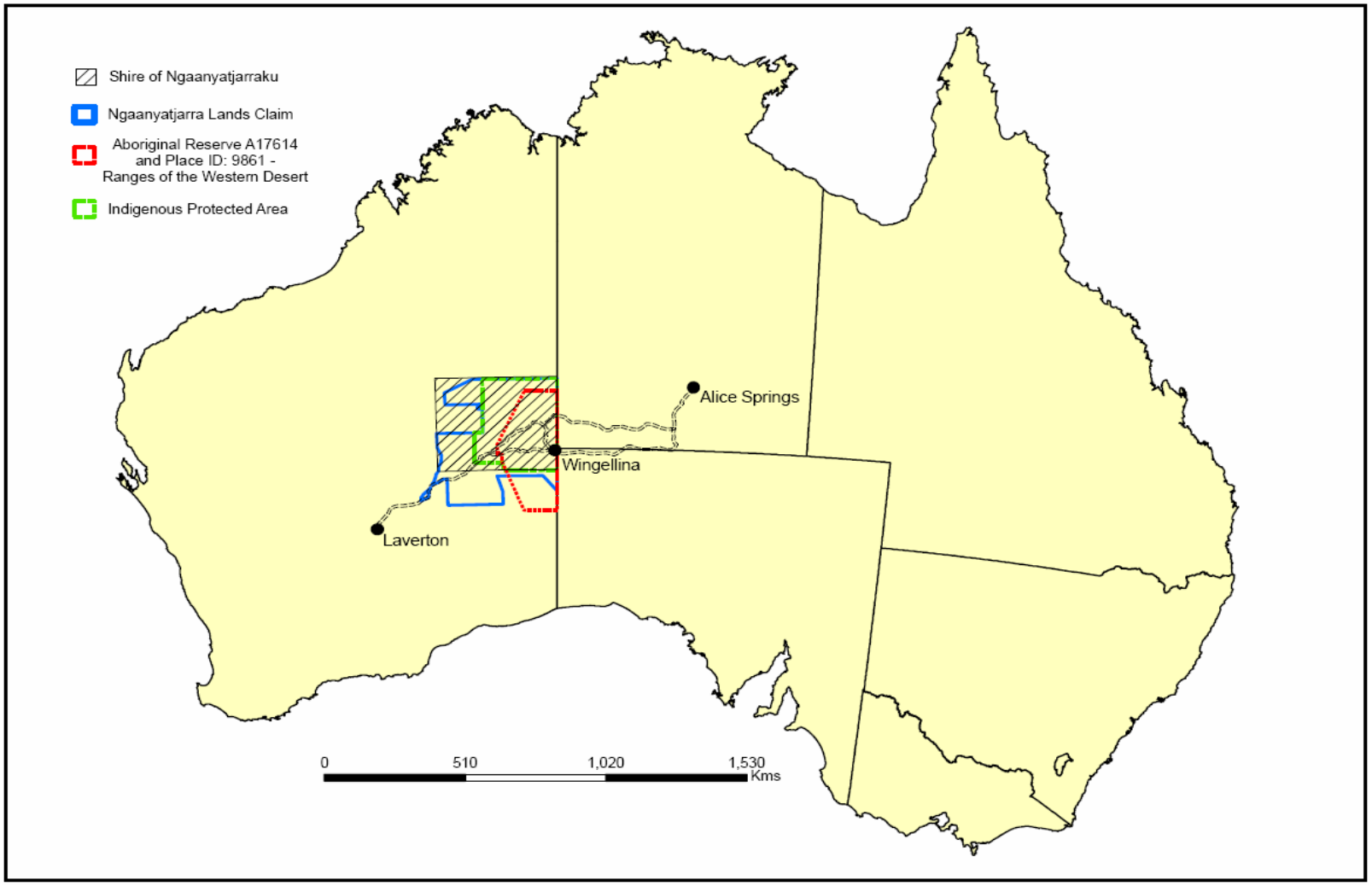


Figure 1: Regional location of the Wingellina Project

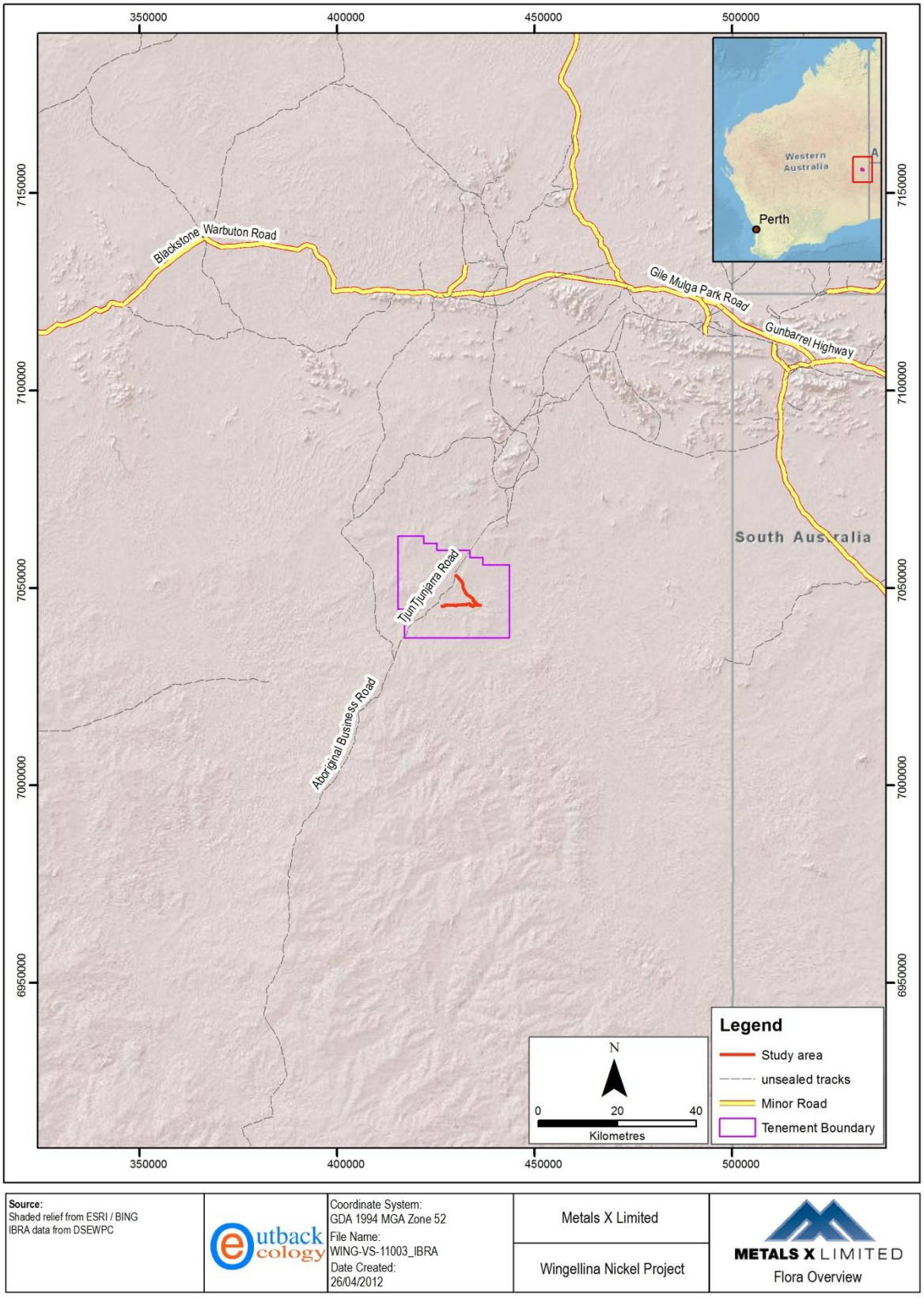


Figure 2: Map showing the regional location of the Study area and Miscellaneous License L69/12.

Metals X Limited (Metals X) commissioned Outback Ecology to undertake a Targeted Flora Assessment (the Survey) of proposed drill pads; associated drill line track and access track (the Study area) within the Wingellina borefield licence (**Figure 3**). More specifically, the Study area refers to:

(a) the 11 proposed drill pads, each of size 20 m by 10 m, and a buffer zone of 50 m radius surrounding each pad;
(b) the proposed drill line track linking the drill pads, with a 50 m buffer zone on each side; and
(c) the proposed access track to the drill line track, also with a 50 m buffer zone on each side (**Figure 3**).

The survey was specially aimed at satisfying Section 4 of Metal X's Special Purpose Clearing Permit 4523/1 (**Appendix A**).

1.2 Objectives

The main objective of the current Survey was to establish the presence or absence of Declared Rare Flora (DRF) and Priority Flora (PF) within 50 m and 10m respectively of the proposed drill pads, drill line track and access track in accordance with Condition 4 of a Clearing Permit granted to Metals X by the Department of Mines and Petroleum (DMP) on 6 October 2011 (Clearing Permit 4523/1). Condition 4 of this permit states that:

(a) Prior to undertaking any clearing authorised under this Permit, the Permit Holder shall engage a botanist, in accordance with Guidance Statement No. 51 to inspect that area for the presence of rare flora listed in the Wildlife Conservation (Rare Flora) Notice 2010(2) and priority flora.

(b) Where rare flora or priority flora are identified in relation to Condition 4(a) of this Permit, the Permit Holder shall ensure that:

(i) no clearing occurs within 50 metres of identified rare flora, unless approved by the CEO; and

(ii) no clearing of identified priority flora occurs and no clearing occurs within 10 metres of identified priority flora, unless approved by the CEO.

In particular, the survey targeted the Priority 1 species *Neurachne lanigera* (**Figure 4**) and a new undescribed species *Goodenia* sp. affin. *quasilibera* (**Figure 5**) both previously found along Tjuntjuntjarra Track within Miscellaneous Lease L69/12 (**Figure 6**), during a Flora and Vegetation Survey by Outback Ecology in May 2011 (Outback Ecology 2011b).

Other objectives agreed with Metals X were to:

- Develop an inventory of the terrestrial vascular flora occurring in the vicinity of the Study area;
- Describe and map vegetation associations across the Study area using data collected from quadrats or relevés and assess their condition and conservation significance;
- Identify and specify locations of any introduced species including any Declared weeds and weeds of environmental significance; and
- Identify potential impacts of the proposed clearing program.

The objectives and methods adopted for this survey and assessment are in accordance with:

- EPA Position Statement No. 3, *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA, 2002); and
- EPA Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004).

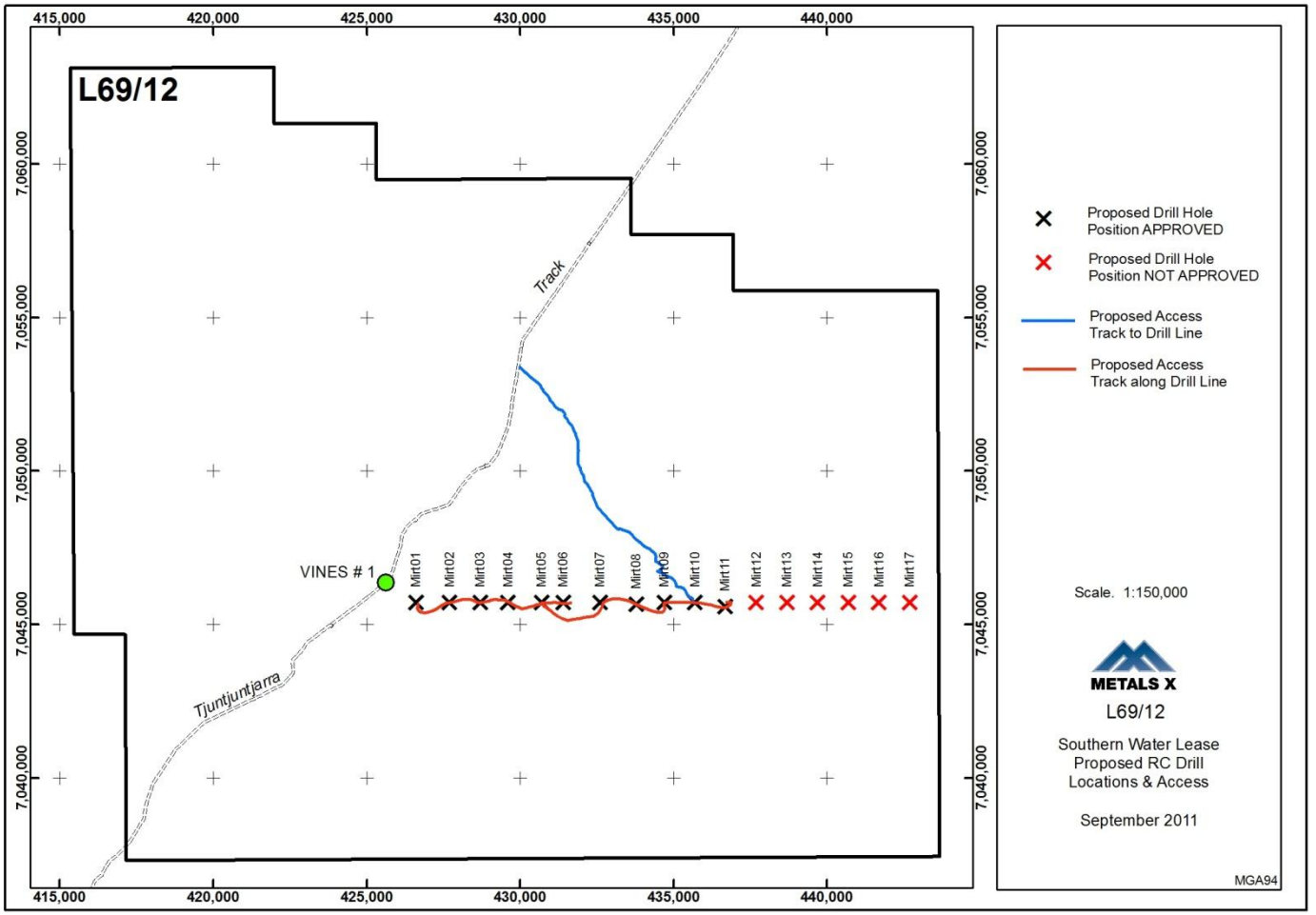


Figure 3: Proposed drill pads, drill line track and associated access track

2. BACKGROUND INFORMATION

2.1 Biogeographic Region

Thackway and Cresswell (1995) described a system of 85 biogeographical regions (bioregions) covering the whole of Australia; the result of collaboration between state conservation agencies and the Australian Government Department of Environment and Heritage (now the Department of Environment and Water Resources). Bioregions are defined on the basis of climate, geology, landforms, vegetation and fauna.

The Study area is located within the Great Victoria Desert Bioregion of the Interim Biogeographic Regionalisation for Australia (or IBRA) (Thackway and Cresswell 1995). The Great Victoria Desert includes six major components, or sub-regions; Shield (GVD1), Central (GVD2), Eastern/Maralinga (GVD3), Kintore (GVD4), Tallaringa (GVD5) and Yellabinna GVD6. The Study area is located in GVD3 which is referred to as the Eastern Subregion in Western Australia and the Maralinga Subregion in South Australia. In South Australia the subregion extends east to near Maralinga while in Western Australia it extends west of the border by approximately 200 km (**Figure 4**).

The Eastern Subregion of the Great Victoria Desert Bioregion is underlain by Devonian sediments of the Gunbarrel Basin, with extensive sandplains of deep Quaternary aeolian sands (Barton and Cowan 2001). Landforms consist of salt lakes and major valley floors with lake derived dunes. Sandplains with extensive seif dunes run east west, and occasional outcropping (breakaways) and quartzite hills provide minor relief.

Thackway and Cresswell (1995) describe the vegetation as primarily a tree steppe of *Eucalyptus gongylocarpa*, Mulga and *E. youngiana* over hummock grassland dominated by *Triodia basedowii* on aeolian sands. *Acacia* dominates the colluvial soils with *Eremophila* and *Santalum* spp., while halophytes occur on the edges of salt lakes and saline drainage systems. The climate is arid, with summer and winter rain averaging 150 to 180 mm. This subregion covers an area of 5,051,155 ha in Western Australia (Graham and Cowan 2001).

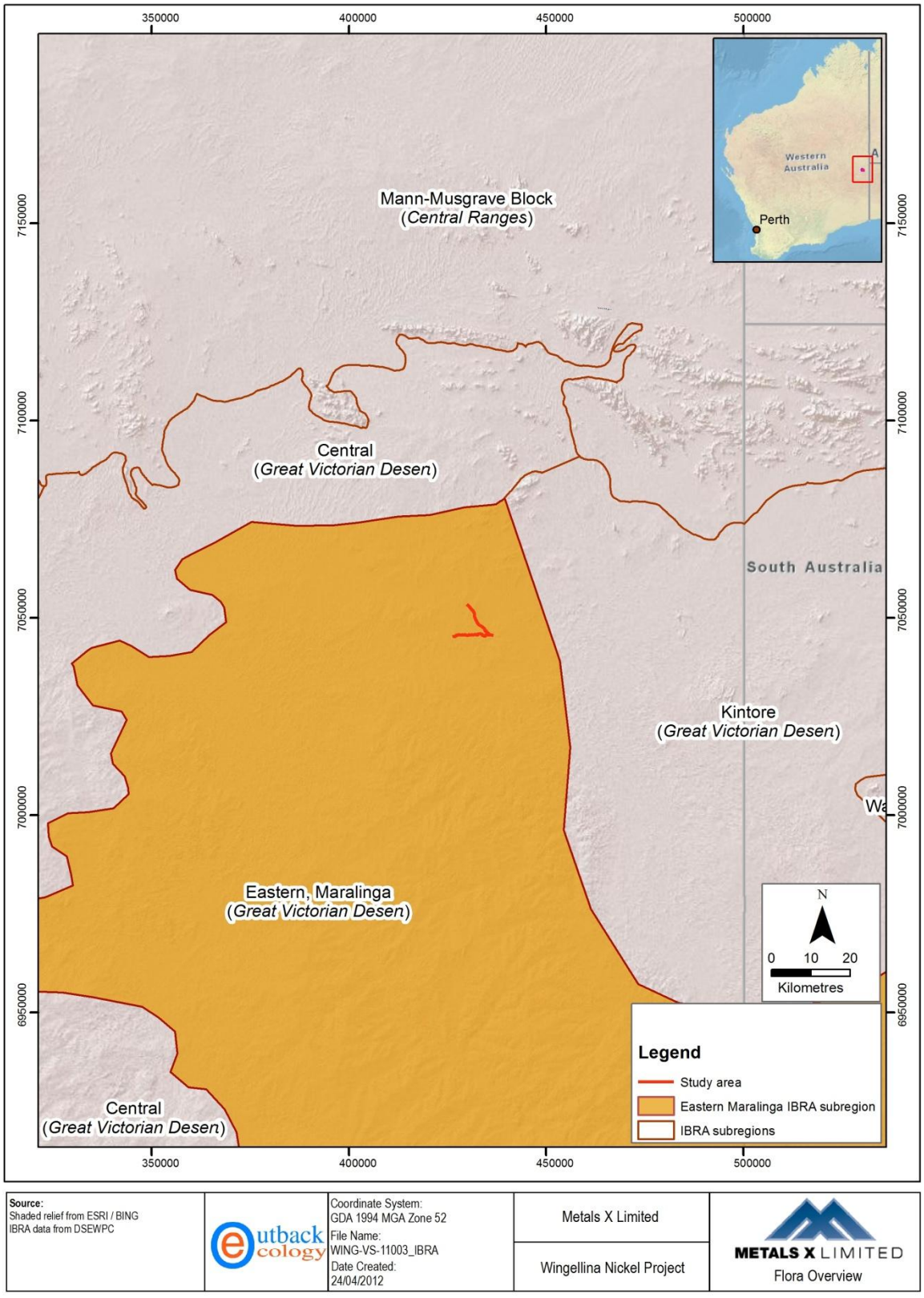


Figure 4: Location of the Study area in relation to the IBRA subregions of the Great Victoria Desert Bioregion of Western Australia

2.2 Climate

The climate of the Great Victoria Desert is characterised by hot summers and winters with mild days but cold nights. The region is influenced by a northern tropical/summer climatic pattern with easterly or south easterly prevailing winds. Rainfall is highly variable, however the majority is received during summer, largely due to the movement of low pressure troughs and tropical lows associated with monsoon troughs moving south in the region. In winter, days are mild and nights cold under the influence of predominant high pressure subtropical ridges (BOM 2011).

The closest meteorological station to the Study Area is the Giles station which lies approximately 170 km to the north of the Study area. Mean annual rainfall recorded at Giles is 282 millimetres (mm), with the majority received between November and March **(Figure 5)**. On average, the highest mean monthly maximum temperature (37.3°C) is recorded during January, and the lowest minimum mean temperature (6.9 °C) is recorded during July (BOM 2011).

2.3 Landscape Zones

Tille (2006) provides descriptions of all the Soil-Landscape zones of the rangelands and interior of Western Australia. The Study area falls within Zone 124, the Southern Great Victoria Desert Zone. This zone covers an area of 87,550 km^2 and is located in the southern arid interior between Lake Minigwal and the South Australian border. Tille (2006) describes this zone as consisting of sandplains and dunes (with some gravelly plains and calcrete plains) on sedimentary rocks of the Gunbarrel (and Officer) Basin. Associated soils are red deep sands and red sandy earths with some red loamy earths. Vegetation is described as being typically spinifex grasslands with mallee scrub and some mulga and eucalypt woodlands.

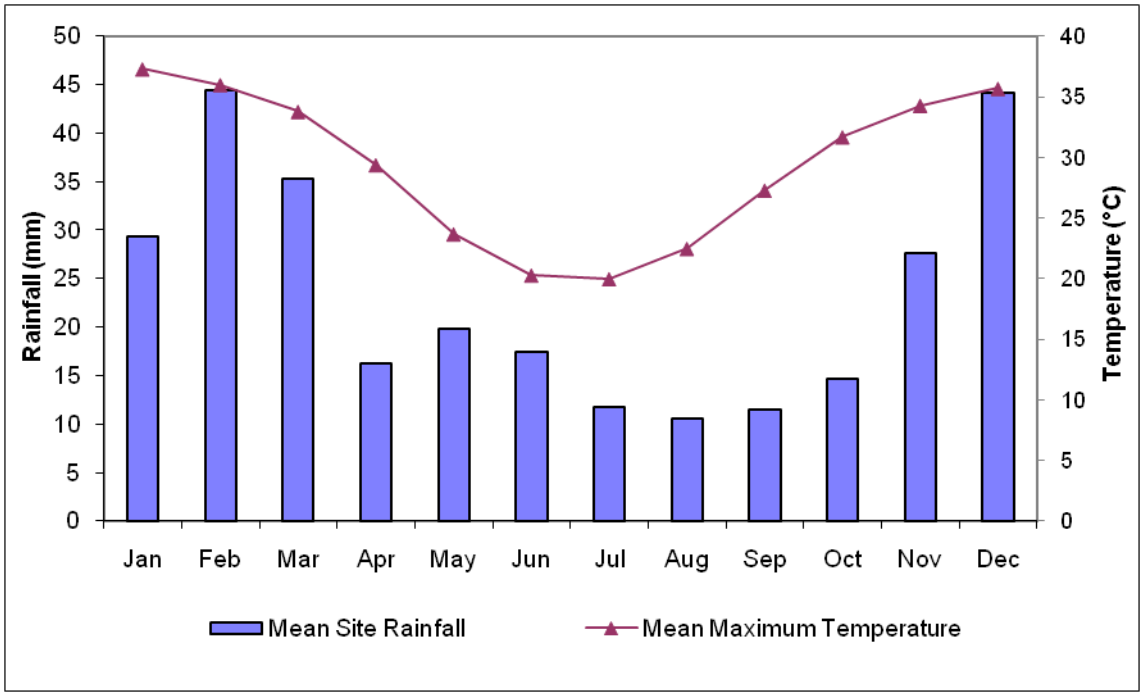


Figure 5: Mean climate data for the Giles (013017) Weather Station (BOM 2010)

2.4 Beard Vegetation Mapping within the Study Area

Beard (1974) undertook broad-scale vegetation mapping in the region based on interpretation of aerial photographs and ground-truthing. The Study area is located in the Giles Botanical District as defined by Beard (1974). The Giles Botanical District is approximately equivalent to the Central Ranges 1 (Mann-Musgrave Block Subregion) IBRA region. Beard (1974) broadly describes the vegetation of this region in relation to the underlying topography as being very varied, from low rounded quartzite ranges, sandy plains, confused dune systems, to salt lakes and kopi dunes.

Beard (1974) describes the plains in the Giles Botanical District as having both “loam flats with tall mulga” as well as very sandy plains with dunes of confused direction. He describes the sandhills as vegetated by desert bloodwoods *Grevillea stenobotrya, Acacia* sp., *Gyrostemon ramulosus, Crotalaria cunninghamii* and *Triodia melvillei.* Interdunal vegetation were described as typically a shrub steppe featuring *Hakea lorea* subsp. *suberea* (syn. *Hakea lorea* subsp. *lorea*), *Acacia pruinocarpa, A. aneura, A. cuthbertsonii, A. coriacea, Eucalyptus gamophylla, E. oxymitra, Eremophila forrestii* and *Triodia basedowii.* Beard (1974) also observed groves of *Allocasuarina decaisneana* throughout the region with no apparent pattern in their distribution or density.

The Study area is mapped entirely within Beard vegetation association 236 (a1eSi t2Hi) which is described as Hummock grasslands, shrub steppe; mulga and mallee (marble gum) over hard spinifex (Beard 1974) (**Figure 6**).

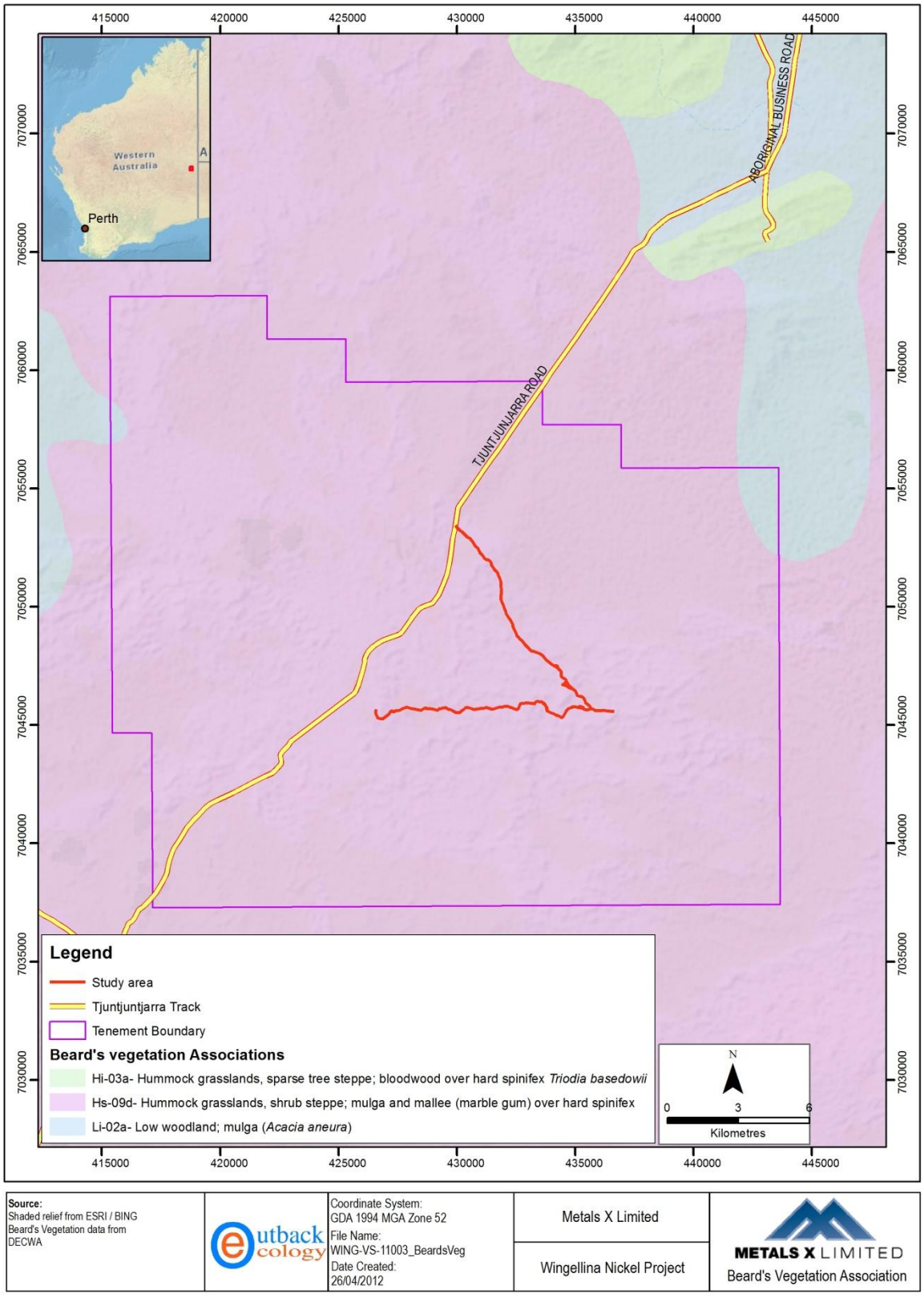


Figure 6: Beard vegetation units within and adjacent to the Study area

2.5 Land Use

2.5.1 Study Area

The Study area is entirely within Aboriginal Reserve A17614, leased for 99 years to the Ngaanyatjarra Land Council (NLC), and on granted Native Title Land which is managed for and on behalf of the Traditional Owners by the Ngaanyatjarra Council. Metals X Limited has signed a mining agreement with the Traditional Owners and the granted Native Title holders of the Project area, providing consent for the granting of a Mining Lease and subsequent development of mining operations, subject to State regulatory approvals.

2.5.2 Study Area Surrounds

The Study area lies within the Great Victoria Desert Eastern sub-bioregion. The dominant land use for this subregion is Aboriginal Reserve (57.37%). The remaining area is Unallocated Crown Land and Crown Reserves (32.87%) and Conservation Reserve (9.76%) (Graham and Cowan 2001).

3. METHODS

3.1 Regulatory Requirements

A Purpose Permit for clearing (4523/1) under section 51E of the *Environmental Protection Act 1986* has been issued to Metals X Limited for the purpose of clearing for groundwater exploration and associated works. A copy of this permit and the conditions under which clearing may take place is included **(Appendix A).**

The conditions of the clearing permit (paraphrased) are:

1. no more than 20 ha of native vegetation may be cleared;
2. clearing of native vegetation, particularly that of conservation value must be minimised and avoided;
3. the risk of introduction and spread of weeds must be minimised; and
4. the area proposed to be cleared must be surveyed for conservation significant flora and if found, no clearing must take place within 50 m of Declared Rare Flora and 10 m of Priority Flora.

3.2 Desktop Review

A review of databases and publicly available information was conducted prior to the field survey to determine flora species and vegetation types of conservation significance known, or likely to occur, within the Study area and surrounds. Databases searched included the:

- DEC TECs and Priority Ecological Communities (PEC) database (DEC 2011a);
- Department of Environment and Conservation (DEC) DRF database (DEC 2011b);
- DRF and PF List (DEC 2011c);
- Western Australian Herbarium (WAH) Specimen database for Declared Rare and Priority species (WAH 2011);
- NatureMap database for all flora species records occurring within the Study Area (DEC 2011d); and
- Protected Matters Database Search Tool for Threatened Species and Threatened Ecological Communities (TEC) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (DSEWPC 2011)

Searches of the databases were undertaken for a 100 km radius surrounding the co-ordinate 26°41'12''S, 128°17'35''E (GDA94). The only exception was for the Naturemap database which only allows a search for a distance of 40 km surrounding a point.

Also consulted were the following sources:

- Declared weeds listed under the *Agriculture and Related Resources Protection Act, 1976*;
- International Union for Conservation of Nature (IUCN) Red Listed Species;
- Environment Reporting Tool of the Australian Government Department of Environment,

Water, Heritage and Arts (DEWHA); and

- Australian Natural Resources Atlas of the National Land and Water Resources Audit (NLWRA).

A review was also made of previous flora surveys completed in the broader Wingellina area in particular:

- Halpern Glick Maunsell. (2002) *Acclaim Exploration NL Wingellina Baseline Biological Survey*;
- Robinson, A.C., Copley, P.B., Canty, P.D., Baker, L.M., and Nesbitt, B.J. (2003) A *Biological survey of the Anangu Pitjantjatjara Lands, South Australia 1991-2001*. DEH, SA; and
- Outback Ecology (2011a) *Level 2 Flora and Vegetation Assessment of the Wingellina Mine Site*. Report prepared for Metal X Limited.
- Outback Ecology (2011b) *Level 1 Flora and Vegetation Assessment of the Wingellina Borefield*. Report prepared for Metal X Limited.

More general literature which includes the Study area was also reviewed as a component of this assessment:

- Graham, D. and Cowan, M. (2001) *A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions. Great Victoria Desert 3* (*GVD3 – Great Victoria Desert Eastern subregion*). Department of Environment and Conservation, Western Australia.

3.3 Field Based Study

Desktop information derived from the assessment of the Wingellina Borefield (Outback Ecology 2011b) was used to provide a list of conservation significant flora species and descriptions of the vegetation types to target during surveys of the proposed drill line, access track and 11 drill pads.

The field survey focussed on targeted searches for conservation significant flora species, weeds and included broad descriptions and mapping of the vegetation.

3.3.1 Vegetation Descriptions and Mapping

Preliminary mapping of vegetation communities was undertaken using information from the desktop study described above (**Section 3.2**) and remote sensing imagery. This was fine-tuned by groundtruthing the complete length of the Study area on foot.

Vegetation associations recorded within the proposed borefield exploration Study area was analogous to those described in the Tjuntjuntjarra Track (Outback Ecology 2011b). Therefore no further quadrats were sampled. This allowed more time to search for DRF and PF species, the primary aim of the survey.

The relevant quadrat data from the borefield survey (OES 2011b) is provided in the current report including photopoint photographs of the vegetation taken from the NW corner for each of these quadrats (**Appendix G**). This includes data on:

- Percentage cover and height for each recorded species
- GPS location (recorded in GDA94 UTM 50K);
- Vegetation condition, based on the Keighery scale (Keighery 1994) (**Appendix C**);
- Overall percentage weed cover and individual cover of perennial weeds;
- Vegetation description, based on the vegetation structural classification by Keighery (1994) (**Appendix D**);
- Descriptions of factors causing vegetation degradation and the relative importance of these factors;
- Habitat data including landform type; topography and aspect; soil texture and colour;
- Average size and rock-type of outcropping or exposed rock; and
- Estimated time since fire.

Remote sensing imagery and ground truthing were used to map all plant communities in the Study area. Extrapolation using remote sensing imagery was used to extend mapping 50 metres out from the proposed drill pads, drill line and associated access tracks. The vegetation communities observed were compared with descriptions of those listed as TECs and PECs on the DEC *Threatened Ecological Communities and Priority Ecological Community database* (DEC 2011a).

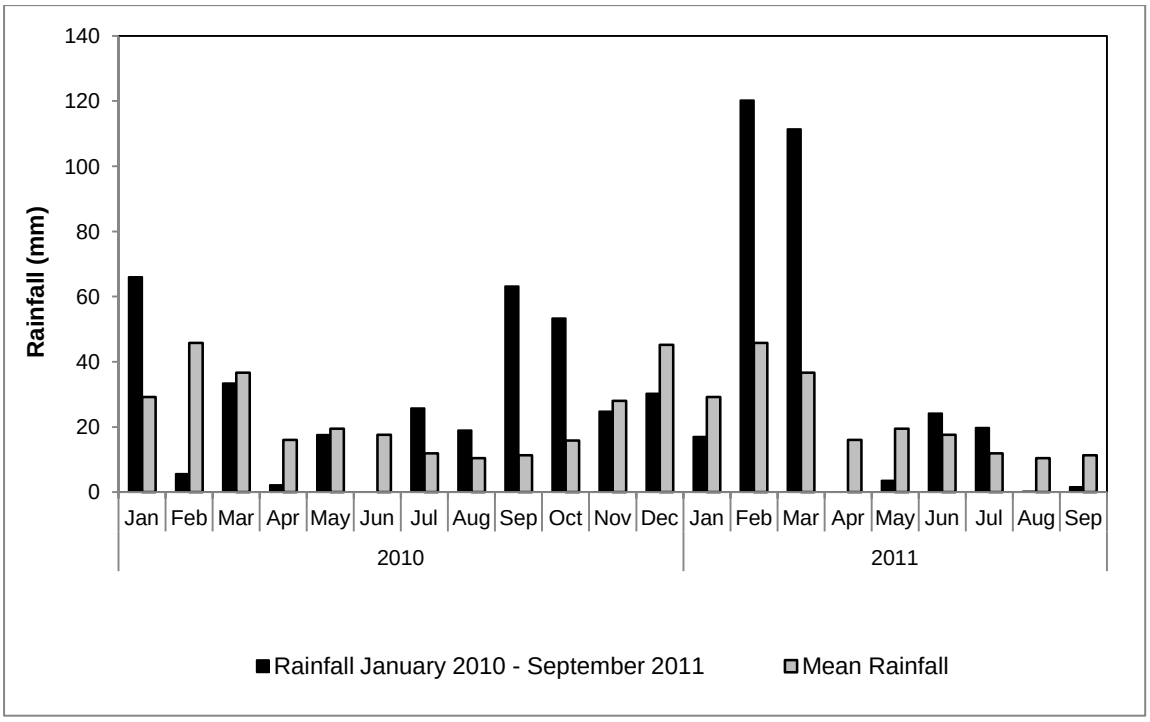
In Western Australia, the DEC recognizes four categories of TECs, as developed by English and Blyth (1997). These include – 'Presumed Totally Destroyed', 'Critically Endangered', 'Endangered' and 'Vulnerable' (**Appendix B**). Other ecological communities that are possibly under threat but do not meet the survey criteria associated with TECs, are listed as PECs. These are categorised as Priority 1, Priority 2 or Priority 3 according to criteria listed in **Appendix B**. Priority 4 PECs are those that are considered to be adequately known, and are rare but not threatened, or which have been recently removed from the TEC list and require regular monitoring. Conservation-dependent PECs are placed in Priority 5 (**Appendix B**).

3.3.2 Significant Flora Searches

Seaches for DRF and PF, as defined in **Appendix C** and as listed in Flora Base (DEC 2011e), were made throughout the Study area, in particular for species identified in the Desktop Study as occurring within 100 km of the Study area and in habitats represented in the Study area (**Section 4.1.3**). Each of the 11 proposed drill pads was surveyed by walking a spiral transect of radius 65 m extending from the centre of the proposed pad. The associated proposed access tracks were surveyed by walking parallel linear transects on both sides of each track, searching for any significant species occurring up to 10 metres from the proposed tracks. Searches were also made using a vehicle driven at slow-speed along the proposed track alignments themselves.

Where populations of DRF and PF were located, these were photographed and described. This included the recording of exact coordinates using a GPS, counts of population size and descriptions of potential direct and indirect threats from the project and other factors.

At the client's request, this survey was undertaken in October following two months of below average rainfall (**Figure 7**). However, the rainfall in the two months preceding this had been above average. Rainfall for the twelve months leading up to the survey (407mm) was well above average (282mm) due to a particularly wet summer.



NB: Survey 19-22 October 2011

Figure 7: Monthly rainfall between January 2010 and September 2011, and mean long-term monthly averages, for Giles Weather Station (BOM 2011).

3.3.3 Identification of Flora Specimens

Voucher specimens of significant species were collected and pressed for verification and identification. Specimens were identified and verified with reference to taxonomic guides, with help from experts in the Western Australian and Adelaide Herbaria. The undescribed species of *Goodenia* (*Goodenia* sp. affin. *quasilibera* (L.Ransom 868) observed and collected during both surveys was examined closely by Michael Hislop (WA Herbarium) and Dr Peter Lang (Adelaide Herbarium).

Specimen identifications for the May 2011 survey were undertaken by Dr Rick Davies (Outback Ecology) and Dr David Symon (Adelaide Herbarium) with assistance from Helen Vonow, Martin Oleary, Robyn Barker and Dr Peter Lang (Adelaide Herbarium) and Michael Hislop (WA Herbarium) for more difficult specimens.

3.3.4 Survey Personnel

The October 2011 targeted species search was undertaken by Dr Rick Davies and Ms Ashleigh Chapman (Outback Ecology).

3.3.5 Constraints and Limitations

The EPA (2004) lists a number of possible limitations and constraints that can impinge on the adequacy of flora surveys. These are listed in **Table 1** with an assessment relating to the May and October 2011 surveys. All factors identified by the EPA (2004) were considered in the design of this survey, and only one possible limitation was identified, the fact that the Drill Line survey was undertaken after two months of below average rainfall.

Table 1: Summary of potential flora survey constraints

Aspect	Constraint	Comment regarding the flora and vegetation survey
Competency/experience of consultants	No	Members of the survey team were flora specialists employed by Outback Ecology, and who together had 30 years experience undertaking flora surveys of this kind within central Australia.
Scope	No	The scope was clearly defined and realistically achievable within the designated timeframe.
Proportion of flora identified	No	Of the 163 taxa collected furing the May 2011 survey only five taxa could not be positively identified to species level. Unidentifiable taxa were compared to conservation significant species in order to remove the possibility of missing a significant species.
Information sources (e.g. historic or recent)	No	A number of local and regional studies have been carried out. Available data was reviewed within a few months prior to commencement of the survey.
Proportion of task achieved, and further work which might	No	The entire Study area was covered on foot to search for Priority Flora species and the undescribed *Goodenia* species. Several

Aspect	Constraint	Comment regarding the flora and vegetation survey
be needed		populations of the *Goodenia* were located and alternative routes that did not support this species were identified and demarcated. The vegetation associations were described utilising analogous descriptions from previous OES surveys.
Timing / weather / season / cycle	No	The October 2011 survey of the drill pads, drill line and access track followed winter rains and was considered adequate to locate the target conservation significant species.
Disturbances	No	The whole Study area has been little disturbed and is rated as being in “Pristine” condition.
Intensity	No	Survey intensity was in accordance with Guidance Statement 51.
Completeness	Possibly	The October 2011 survey of the drill line and access track followed two months of below average rain.
Resources	No	WAH specimens; taxonomic guides; DEC database searches and the FloraBase database were all used to prepare for the field surveys and used for the identification of unknown species and the confirmation of known species. Resources were adequate to carry out the survey.
Remoteness / access problems	No	The whole Study area was traversed on foot and by car.
Availability of contextual information	No	Information was available from the Interim Biogeographic Regionalisation for Australia (IBRA) Eastern Great Victoria Desert subregion, FloraBase, DEC lists, the Bureau of Meteorology and previously OES reports.

4. RESULTS AND DISCUSSION

4.1 Desktop Review

4.1.1 EPBC Protected Matters Database Search

No conservation significant flora species or TECs as defined under the *EPBC Act 1999* were recorded within the Study area (DSEWPC 2011).

4.1.2 DEC Database Search – Threatened and Priority Ecological Communities

A search of the DEC TEC-PEC database for an area bound by a radius of 100 km from the co-ordinates 26°41'12''S, 128°17'35''E (GDA94) was undertaken (DEC 2011a). This search identified no TECs or PECs. However, the IBRA Eastern Great Victoria Desert Subregion contains the Mirramiratjarra Dunefield which is listed by Graham and Cowan (2001) to be an "Ecosystem at Risk". Graham and Cowan (2001) and CALM (2003) describes this dune field as a unique dune formation with a vegetation and drainage system threatened by grazing pressures and feral animals, in particular camels and rabbits. The specific location of these dune fields is poorly defined in these documents.

4.1.3 Database and Literature Searches – Declared Rare and Priority Flora

A total of ten vascular flora taxa currently ascribed a conservation rating in Western Australia have been recorded or collected from an area 100 km radius of the Study Area (26°41'12''S, 128°17'35''E (GDA94) according to databases and literature searched. While not yet ascribed a conservation rating, the previously unknown and undescribed species (*Goodenia* sp. affin*. quasilibera* (L. Ransom 868)) discovered during the Wingellina Borefield survey (OES 2011b) is also considered likely to be of conservation significance. Details of these records are given in **Table 2**. None of these taxa are listed as DRF, as defined under the Western Australian *Wildlife Conservation Act 1950*. Based upon the habitat preferences of these species as described on herbarium records (WAH 2011; DEC2011e) and observed in the May 2011 borefield survey (OES 2011b), it was considered likely that habitat for four of these species (*Goodenia* sp. affin*. quasilibera* (L. Ransom 868), *Neurachne lanigera*, *Vittadinia pustulata* and *Eucalyptus sparsa*), may be present in the Study area. It was considered possible that the Study area may contain suitable habitat for a further two species: *Stackhousia clementii* and *Acacia calcicola* (**Table 2)**. Herbarium records and information from other surveys suggest that the remaining six species are confined to heavy soil, rocky hills and drainage lines; habitats that are absent from the Study area (**Table 2)**. The whole of the Study area consists of dunes and plains of sand and sandy loams with localised area of calcrete.

Table 2: Results of database and literature searches for flora of conservation significance collected or recorded within a 100 km radius of the Study area.

The table summarises the results of DEC database searches of an area of 100 km radius centred on 26°41'12''S, 128°17'35''E (GDA94).

Definitions of conservation codes (CC) are given in **Appendix A**; P=Priority Flora

Information sources: D=DEC (2011b); O11a=OES (2011a); O11b=OES (2011b); W11=WAH (2011); W&S92=Whibley and Symon (1992)

Family	Taxa	CC	Nearest record	Info source	Habitat	Habitat in Study area?
ASTERACEAE	*Calotis latiuscula*	P3	58km N	W11, D11a	Low rocky hills of large of large granite boulders (W11a); near creek bed on rocky hillside (W11a); clay plain with calcrete floaters (W11a); hardpan plain (W11a); stony ridge (W11a); Mitchell Grass plain (O11a)	No
ASTERACEAE	*Vittadinia pustulata*	P2	74km N	W11a	Sand flat adjacent to sand dune on one side (W11a)	Yes
BRASSICACEAE	*Menkea lutea*	P1	69km NNW	W11a, O11	Red loam (W11a); Mitchell grass plain (O11a)	No
CELASTRACEAE	*Stackhousia clementii*	P1	84km NW	W11a	Shallow skeletal sand on calcrete platform (W11a); soft, silty saline soil over limestone (W11a); drainage tract woodland (W11a); Saline playa in red-brown soil with gypsum (W11a); Kopi dune (W11a); watercourse (W11a).	Yes?
EUPHORBIACEAE	*Euphorbia parvicaruncula*	P1	65km NNW	W11a	On rocks (W11a); in or near range (W11a)	No
EUPHORBIACEAE	*Euphorbia inappendiculata*	P3	100km NNE	O11a	Red loam depressions interspersed with quartzite in a plain (W11a); clay soil in broken rocky scree (W11a); syone red cracking clay (W11a); open plain in heavy soil (W11a); Mitchell grass plain (O11a)	No
FABACEAE	*Acacia calcicola*	P4	100km NNE	W11a	On plains (W11a); calcareous soils, mainly crusty alkaline and neutral red duplex, brown calcareous or neural red earths (W&S92)	Yes?
GOODENIACEAE	*Goodenia* sp. affin. *quasilibera* (L. Ransom 868)		3 km W	O11b	Undulating calcrete plain (O11b)	Yes
GOODENIACEAE	*Goodenia lunata*	P1	82km NE	O11a	Salt lake margin (W11); Mitchell grass plain (O11a)	No
LAMIACEAE	*Teucrium grandiusculum* subsp. *grandiusculum*	P2	56km NE	W11a	Rocky slope in red sand	No
MYRTACEAE	*Eucalyptus sparsa*	P3	54km N	W11a	Flat plain with deep red sandy earth (W11); Near base of red sand-dune (W11)	Yes
POACEAE	*Neurachne lanigera*	P1	2km NE	O11b	Broad sandy ridges and undulating sandy loam plains (O11b)	Yes

4.1.4 Review of Existing Reports

HGM Maunsell (2002): Wingellina Baseline Biological Survey.

This report included an inventory of all the flora and fauna recorded during a Level 1 survey of the surrounds of the Wingellina community in April 2002 (an area of approx. 100km^2). This survey was undertaken in the Central Ranges (CR1 – Mann-Musgrave Block IBRA subregion) Central Ranges Bioregion (Graham and Cowan 2001) 100km to the north of the Study area. This study consisted predominantly of a desktop assessment with limited ground truthing.

A total of 188 plants were recorded during this survey, 75 of which had not been previously recorded for the area. No DRF were identified in this survey. One Priority 3 Flora species *Stackhousia clementii* was recorded in the Study area. Six introduced taxa were recorded, five of which were new records for the Central Ranges bioregion. HGM Maunsell concluded that a high level of human activity in the vicinity of the Wingellina community had exacerbated the spread of weed species.

Seven vegetation communities were identified during the survey, none of which were restricted to the survey area. None of the plant communities recorded in the survey was nationally listed as TECs under the *EPBC Act* or TECs or PECs as listed by DEC (2011a).

Three communities were considered to be regionally significant due to their apparent isolation and underlying geomorphology:

- Grassland of *Poaceae* spp. with occasional *Senna glutinosa* subsp. *glutinosa* and *Sida fibulifera* in patches of cracking clay;
- Low Scrub over *Triodia* spp. in sand over sand dunes; and
- Low Open Woodland of *Eucalyptus gamophylla* and *Eucalyptus socialis* subsp. *eucentrica* over *Acacia validinervia* over mixed shrubs over *Triodia scariosa* in clay loam on upper slopes of mafic ridges.

A. C. Robinson, P. B. Copley, P. D. Canty, L. M. Baker and B. J. Nesbitt (Eds) (2003): A biological survey of the Anangu Pitjantjatjara Lands, South Australia. Department for Environment and Heritage, South Australia.

This report includes an inventory of all the flora and fauna recorded during a survey of the Anangu-Pitjantjatjara (AP) lands of South Australia. It forms part of a comprehensive biological survey of South Australia spanning 10 years. A total of 719 plant species were recorded in the Anangu-Pitjantjatjara lands with 18% recorded only once and 16 taxa discovered for the first time in South Australia, indicating the general paucity of knowledge of the regions flora. Forty-four species had not been previously recorded from the North-western Herbarium Region of South Australia including a new undescribed species of *Calostemma*.

Species data was collected from 253 quadrats. This data was subject to a Cluster Analysis using the program PATN, resulting in the grouping of 30 qualitatively defined plant communities into eleven

Floristic Groups or "Clusters". The report describes each of the plant communities in terms of species composition, structure, distribution and habitat. Quantitative data is provided for each of the dominant species indicating their importance as indicator species for the communities in which they occur.

Graham, D. and Cowan, M. (2001): A biodiversity audit of Western Australia's 53 biogeographic subregions in 2002. Great Victoria Desert 3 (GVD3 – Great Victoria Desert Eastern subregion). Department of Environment and Conservation, Western Australia.

Graham and Cowan (2001) did not identify any TECs or any Wetlands of National or subregional significance in the GVD3 bioregion. However, the Mirramiratjarra dune field is described as an "at risk" ecosystem in this bioregion due to its "unique dune formation, vegetation and drainage systems". Threats to this ecosystem were described as grazing and feral animals (camels and rabbits). No DRF were identified as occurring in the GVD3 bioregion in this report.

Over the bioregion as a whole, the authors identified changed fire regimes, feral herbivores, mining interests and inadequate knowledge as the main threatening processes. They describe 8.4% of the GVD3 bioregion as being reserved within IUCN I-IV reservations.

Outback Ecology (2011a): Level 2 Flora and Vegetation assessment of the Wingellina Mine. Report prepared for Metals X Limited.

Outback Ecology was commissioned by Metals X Limited to conduct a Level 2 Flora and Vegetation Assessment of the Wingellina mine site. This report documented the results of the flora and vegetation survey conducted across that survey area in April 2008 and in October 2010. The survey gathered flora data from 33 quadrats and 44 relevés. The initial survey identified a total of 154 taxa. The later survey identified a total of 358 taxa, recorded from 46 families and 131 genera.

No DRF listed under the WA *Wildlife Conservation Act (1950)*, or TF species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*, the South Australian *National Parks and Wildlife Act 1972* or the Northern Territories *Territory Parks and Wildlife Conservation Act* 2000 were recorded within the Study area. An evaluation of field survey results and habitats in the Study area indicated that none of the conservation significant flora species were expected to occur there.

Four PF species were recorded during the October 2010 survey: *Menkea lutea* (Priority 1), *Goodenia lunata* (Priority 1), *Euphorbia inappendiculata* (Priority 3) and *Calotis latiuscula* (Priority 3). Large numbers of *Menkea lutea* were recorded in the Mitchell Grass dominated southern sections of the Study area.

One individual *Euphorbia inappendiculata* was recorded adjacent to the western boundary and one individual of both *Goodenia lunata* and *Calotis latiuscula* were recorded in the southern sections of the Study area. The report stated that it was unlikely that any of these PF species would be impacted

by the proposed mining activities, as they were not found within or adjacent to the proposed disturbance footprint.

Fourteen vegetation communities from eleven broad floristic formations were mapped and described within the area surveyed. None of the vegetation communities mapped and described were listed as TECs or PECs in Western Australia. Vegetation across the majority of the surveyed area was rated as being generally in excellent condition.

Eight introduced species, **Cenchrus ciliaris* (Buffel Grass), **Cenchrus pennisetiformis* (Cloncurry Buffel Grass), **Acetosa vesicaria* (Ruby Dock), **Capsella bursa-pastoris* (Shepherd's Purse), **Malvastrum americanum* (Spiked Malvastrum), **Tribulus terrestris* (Caltrop), **Citrullus colocynthis* (Camel Melon) and **Citrullus lanatus* (Pie Melon) were listed as occurring within the area surveyed. None of these nine species were Declared Plants under the *Agriculture and Related Resources Protection Act, 1976.* Eight were however, classified as 'Environmental Weeds' by the *Environmental Weed Strategy for Western Australia* (WA Department of Environment and Conservation [DEC] 1999). **Cenchus ciliaris* (Buffel Grass) was recorded in 15 quadrats and 12 relevé sites in the north eastern sections of the Study area. Low density scattered occurrences of the other weed species were detected in the survey area. All other weed species were recorded in low densities in scattered locations throughout the Study area. **Cenchrus pennisetiformis* (Cloncurry Buffel Grass) was described as being not previously been recorded from Western Australia.

The report describes the Project as resulting in the removal of approximately 2,543 hectares of vegetation. It was calculated that the majority of the clearance would occur in areas vegetated by sparse tall shrublands of *Acacia aneura*.

Outback Ecology (2011b): Level 1 flora and vegetation assessment of the Wingellina Borefield. Report prepared for Metals X Ltd.

Outback Ecology was commissioned by Metals X Limited to conduct a Level 1 Flora and Vegetation Assessment of the roadsides along the Tjuntjuntjarra Track within the Southern Wingellina Borefield (Miscellaneous License L69/12). This report documented the results of a flora and vegetation survey undertaken in May 2011. The survey gathered flora data from 12 quadrats and identified a total of 163 taxa from 32 families and 87 genera.

No DRF listed under the WA *Wildlife Conservation Act (1950)*, or TF species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*, the South Australian *National Parks and Wildlife Act 1972* or the Northern Territory's *Territory Parks and Wildlife Conservation Act 2000*, were recorded within the area surveyed. Based upon the field survey undertaken, together with a habitat assessment of the likely occurrence of these species, this report predicted that none were expected to occur in the borefield area.

Three populations of a PF species (*Neurachne lanigera*, P1) was recorded along the Tjuntjuntjarra Track, along with two species (*Acacia acanthoclada* and *Thrptomene longifolia*) occurring as highly disjunct populations outside their main known distribution. Of note, was the discovery of a probable new undescribed species plant: *Goodenia* sp. affin*. quasilibera* (L. Ransom 868). Two populations of this species were found, both confined to calcrete areas.

Six vegetation communities were mapped and described within the Tjuntjuntjarra Track and none of these were analogous to any TECs or PECs in Western Australia. Vegetation condition across the majority of the Study area was rated as being generally in excellent to pristine condition.

Only one weed of significance was recorded during the survey: **Cenchus ciliaris* (Buffel Grass). This species is classified as a significant 'Environmental Weed' by the *Environmental Weed Strategy for Western Australia* (WA Department of Environment and Conservation [DEC] 1999) due to its ability to invade and out-compete native species and its high flammability resulting in increased fire frequency and intensity (Robertson 2008). That study found only one population of Buffel Grass in the area surveyed, near to an existing drill hole. The report described Buffel Grass as being widespread around the Wingellina Community and cautioned that its potential spread on earth moving equipment was a significant threat to the vegetation in the area studied.

4.2 Field Survey Results

4.2.1 Flora

While no quadrats or relevés were sampled during the current survey, twelve quadrats were sampled during the May 2011 survey of the adjacent Tjuntjuntjarra Road within Miscellaneous License L69/12. Ten of the quadrats sampled during that survey were in the same vegetation communities found during the current survey. The remaining two quadrats were in Marblegum (*Eucalyptus gongylocarpa*) Low Open Woodland, a vegetation community not found along the proposed route for the drill line and access road. All vegetation communities occurring in the current Study area were considered to be adequately sampled during that previous survey.

The full list of species found during that previous survey is given in **Appendix H.**

4.2.2 Introduced Species

No introduced species were observed during the current survey. Of note was the absence along the proposed route for the drill line and access road, of the serious environmental weed **Cenchrus ciliaris* (Buffel Grass) which was observed during the May 2011 survey along the Tjuntjuntjarra Road.

4.2.3 Declared Rare and Priority Flora

The whole length of the proposed drill line and access track was searched on foot and by car as described in the methodology.

No DRF listed under the WA *Wildlife Conservation Act (1950)*, or TF species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*, the South Australian *National Parks and Wildlife Act 1972* or the Northern Territories *Territory Parks and Wildlife Conservation Act* 2000 were recorded within the Study area. Based upon the field survey undertaken, together with a habitat assessment of the likely occurrence of these species, none are expected to occur there.

Searches were also made for the five PF species identified during the desktop study as most likely to occur in the Study area (**Table 2**). Although the Priority 1 species *Neurachne lanigera* was previously found along the Tjuntjuntjarra Track within 2km of the northern end of the Study area during the May 2011 survey (OES 2011b), this species was not found on or within 10 metres of the proposed drill pads, drill line or access road. One individual of the Priority 3 Flora species *Stackhousia clementii* was located within the original drill line route. No other PF previously recorded within 100km of the Survey area (**Table 2**) were found.

Five populations of *Goodenia* sp. affin. *quasilibera* (L. Ransom 868) (**Plate 1**) comprising 98 individuals were found within 10 metres of the original proposed access road (as defined by Waypoints 001 to 336) (**Appendix G**; **Figures 8, 13-16**). This species has been tentatively named *Goodenia* sp. affin. *quasilibera* (OES 2011b) based on descriptions, particularly of the dense glandular hairs on the corollas, in the Flora of Australia Volume 35 and as recommended by Michael Hislop at the Western Australian Herbarium. However, it differs from that *G. quasilibera* in that it does not have dense glandular pubescence on its leaves and has paler seeds with broader wings. It has a similar shaped indusium to *Goodenia heteromera* but lacks stolons and has significantly larger seeds with wider wings than the size range given for that species in the Flora of Australia. Similarly, its seeds differ from those of *G. concinna*. It also has similarities with *G. fascicularis* but that species does not have dense glandular hairs on the corolla.

This probable new species is not listed by DEC as DRF or as PF since it was only first discovered in May 2011 (OES 2011b). However, it is being treated as a PF in the current report since it is only known from the Metals X Limited miscellaneous tenement L69/12 and an area to the SE of Warburton (M. Hislop, pers. com., 2012). It is not treated as DRF since its conservation status is poorly known; no systematic searches for the species have been made in the general region, a region where the majority of vegetation remains uncleared and is in pristine or near pristine condition. As summised during the May 2011 survey, the present survey only found this species on calcrete in Vegetation Community 5. Locations where this species was observed in the Study area are given in **Appendix**

G. Without further surveys it is difficult to ascertain how widespread this species in the local region since these calcrete areas are locally moderately common and extend into the the Anangu Pitjantjatjara Lands of adjacent South Australia. If highly localised, vegetation clearance and any associated Buffel Grass weed invasion may present a significant threat to the species unless managed appropriately. No individuals of *Goodenia* sp. affin. *quasilibera* (L. Ransom 868) were found within 10 metres of any of the proposed drill pads.

Plate 1: *Goodenia* sp. affin. quasilibera (L. Ransom 868) recorded along the proposed drill line and access track route

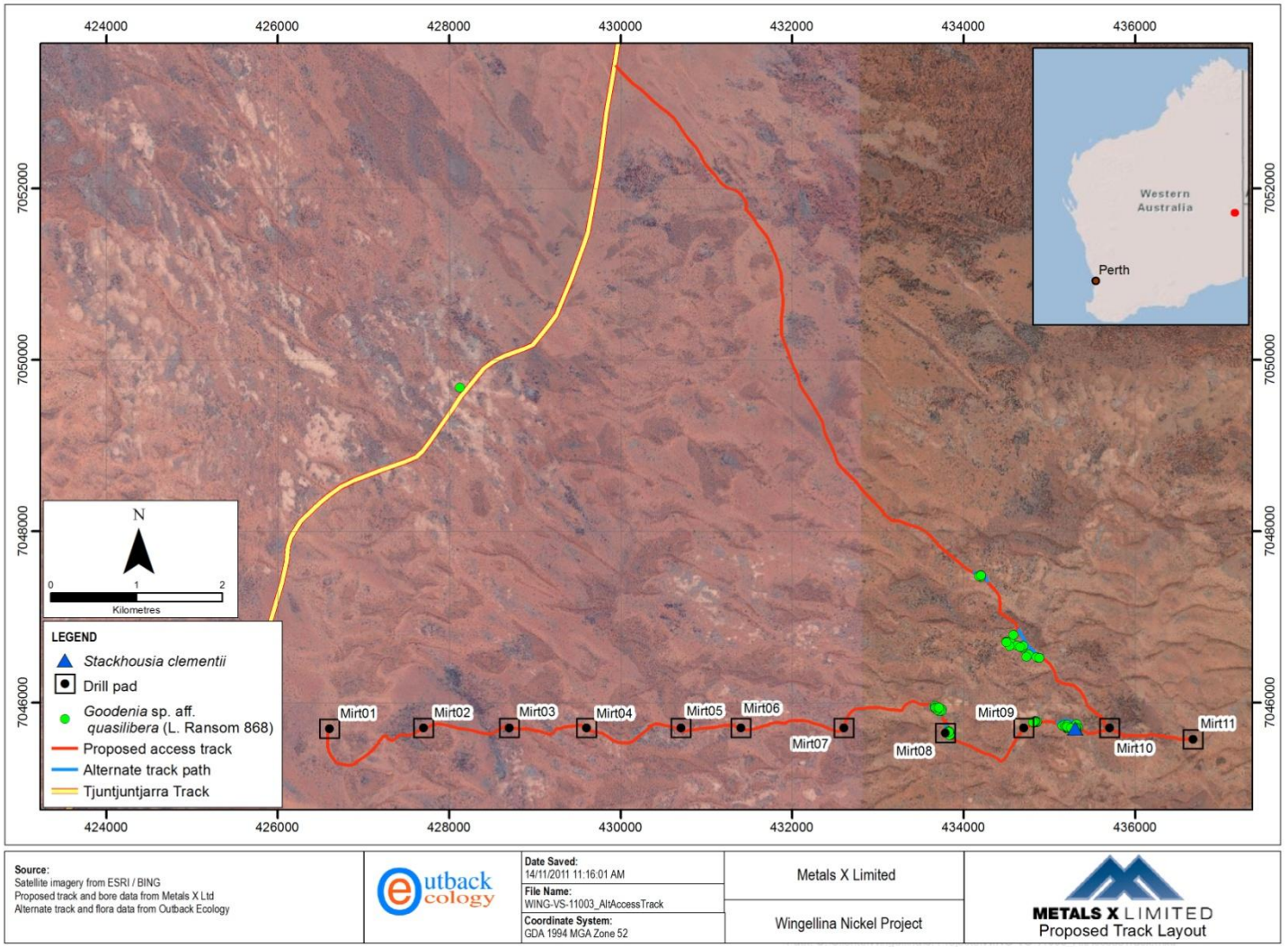


Figure 8: *Goodenia* sp. affin. *quasilibera* (L. Ransom 868) and *Stackhousia clementii* found during the current survey of the proposed route of the drill line and access road.

4.2.4 Vegetation Communities

Remote sensing imagery and ground truthing were used to identify all vegetation communities in the Study area. Five vegetation communities, previously described in the adjacent Tjuntjuntjarra Road (OES 2011b) were recorded in the drill line, access road and 11 drill pads. These five vegetation communities VC1, VC2, VC3, VC4a, VC4b and VC5; their habitat and the proportion of each within the Study area are described (**Table 3**)**.** The distribution of each vegetation community in the Study area is shown in **Figures 9 to 16**.

Table 3: Vegetation communities within the Study area

Vegetation Community, Habitat and Extent in the Study area	Images from quadrats recorded in the Tjuntjuntjarra Road Study area
VC2: *Eucalyptus oxymitra* ± Ooldea Mallee *(E. youngiana)* Very Open Shrub Mallee over *Aluta maisonneuvei* and *Thryptomene longifolia* Open Shrubland over *Triodia basedowii* (Very) Open Grassland Recorded on the crest and slopes of high dunes 24 ha (11% of Study area)	
VC3: *Eucalyptus glomerosa* and/or *E. gamophylla* ± *E. youngiana* (Very) Open Shrub Mallee over *Acacia ligulata* & *Acacia melleodora* or *Eremophila forrestii* (Low) Open Shrubland over *Triodia basedowii* Grassland. This community grades into *Triodia basedowii* Grassland with emergent mallee and mulga. Recorded on flat sand plains. 100 ha (445 of Study area)	

Vegetation Community, Habitat and Extent in the Study area	Images from quadrats recorded in the Tjuntjuntjarra Road Study area
VC4a: Mulga (*Acacia aneura*) Tall (Open) Shrubland with a Tussock Grass Understorey of *Triodia basedowii* Recorded on undulating sandy loam plains VC4a and VC4b comprise 91 ha (40% of Study area)	
VC4b: *Acacia aneura* Tall Shrubland over *Eremophila latrobei* Low Open Shrubland over *Eragrostis eriopoda*, *Aristida holathera,* ± *Eriachne mucronata* (Very Open) Grassland Recorded on undulating sandy loam plains VC4a and VC4b comprise 91 ha (40% of Study area)	
VC5: Inland Red Mallee (*Eucalyptis socialis* subsp. *eucentrica*) Very Open Shrub Mallee with Tussock Grass Understorey of *Triodia scariosa* Recorded on Undulating calcrete plains. 12 ha (5% of Study area)	

4.2.5 Threatened and Priority Ecological Communities

None of the vegetation communities recorded in the Study area is listed as TECs or PECs in Western Australia.

4.2.6 Local and Regional Conservation Significance

Vegetation community VC2 is closely related to vegetation community Group 26 (Umbrella Bush Dune Shrubland) that is described in Robinson *et al.* (2003) as widespread in the Anangu Pitjantjatjara Lands of North Western South Australia.

Vegetation community VC3 is also similar to a community described in Robinson *et al.* (2003), namely Group 27 (Hard Spinifex Communities on Sand Plains and Dunes) which is considered widespread in the Anangu Pitjantjatjara Lands of North Western South Australia.

Vegetation community VC4a was considered widespread in the Great Victoria Desert of Western Australia by Beard (1974).

Vegetation community VC4b is is conserved in the Unnamed Conservation Park in South Australia (Davies 1982; Davies *et al.* 1986; Neagle 1995). Robinson *et al.* (2003) indicate that a closely related vegetation community Group 29 (Mulga Woodland) is widespread in the Anangu Pitjantjatjara Lands of north-western South Australia.

Vegetation community VC5 appears to be closely related to community Group 22 (Spinifex Hummock Grassland on Limestone Plains), described in Robinson *et al.* (2003) and is moderately widespread in the Anangu Pitjantjatjara Lands of North Western South Australia. This community is also the habitat of the undescribed *Goodenia* sp. affin. Quasilibera (L. Ransom 868).

4.2.7 Vegetation Condition

Vegetation condition across the Study area was found to be in Pristine condition (**Appendix C)**. There was also no evidence of recent fires, camel browsing or weed invasion along the proposed drill line, access track or drill pads.

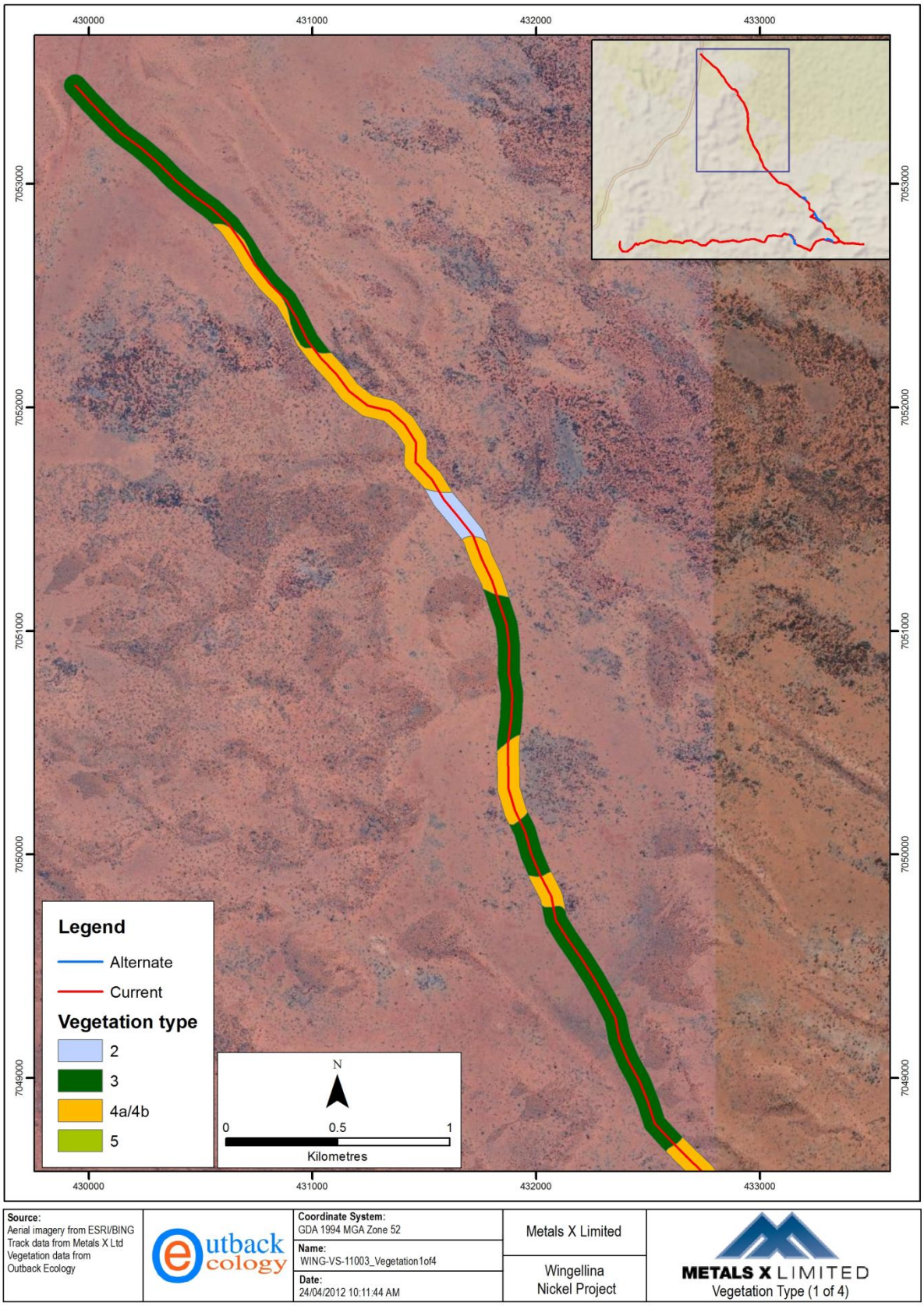


Figure 9 Vegetation Communities in the north-west end of the proposed access track

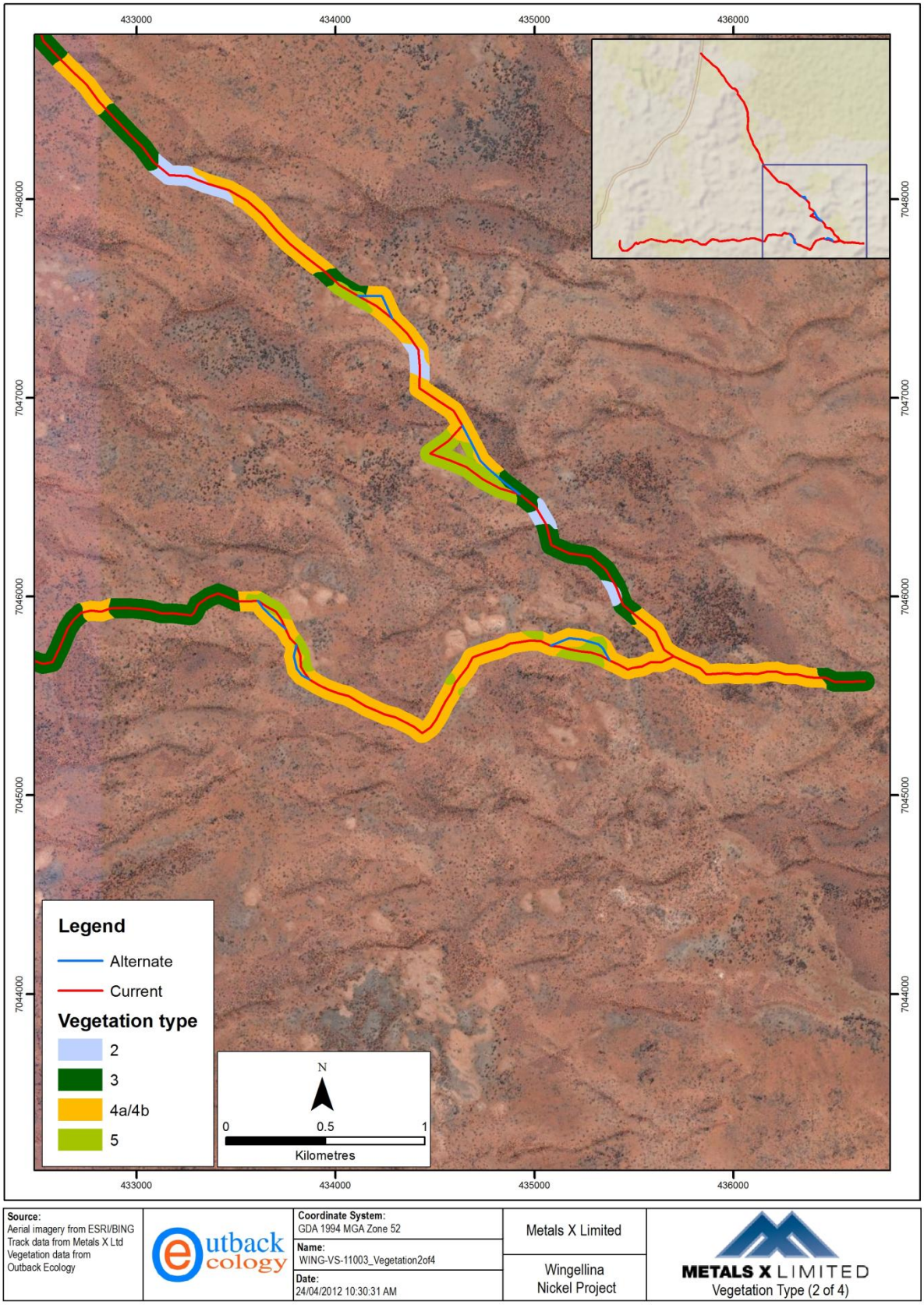


Figure 10: Vegetation communities within the southern end of the proposed access track and east end of the drill line

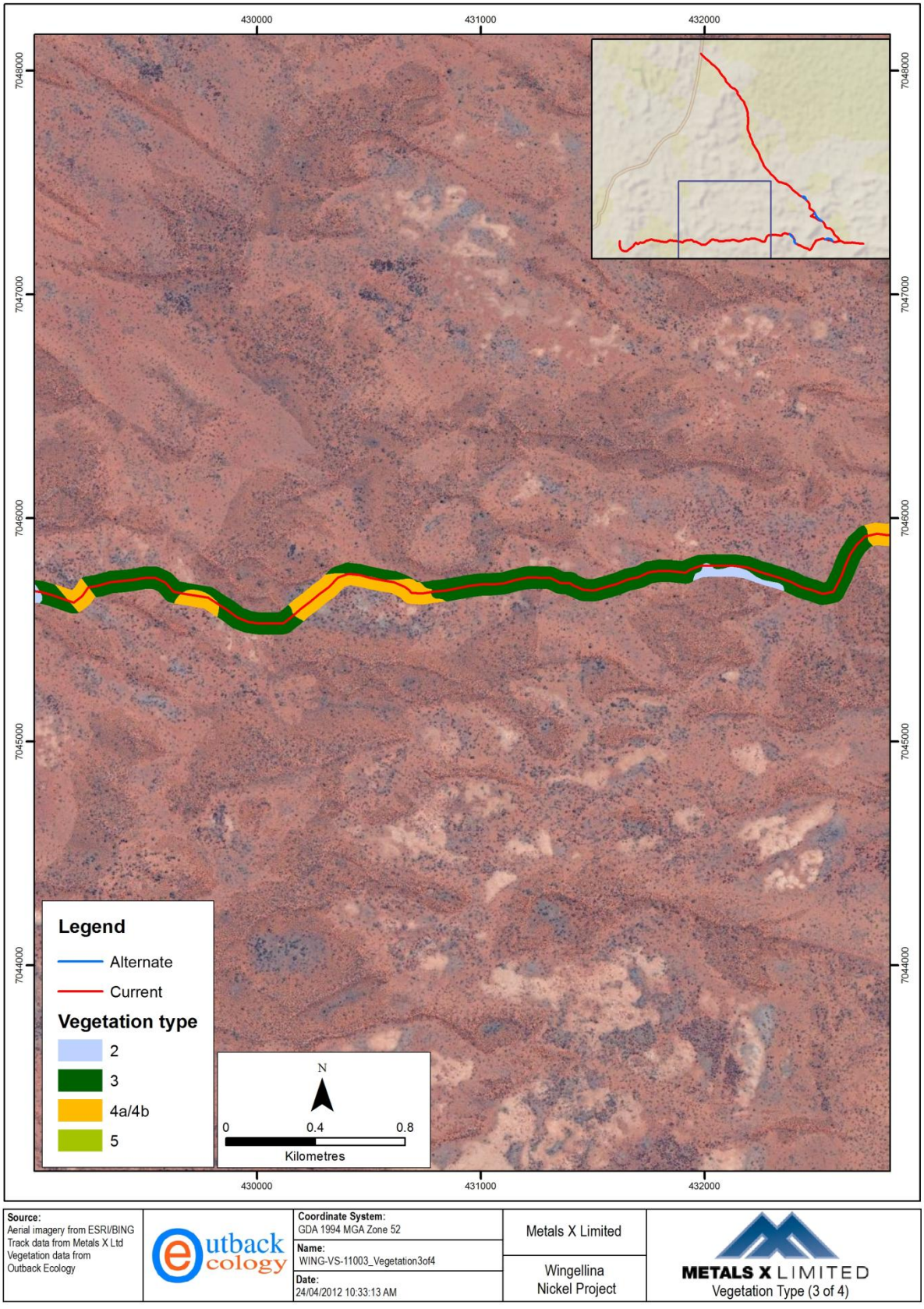


Figure 11: Vegetation communities within the centre of the drill line

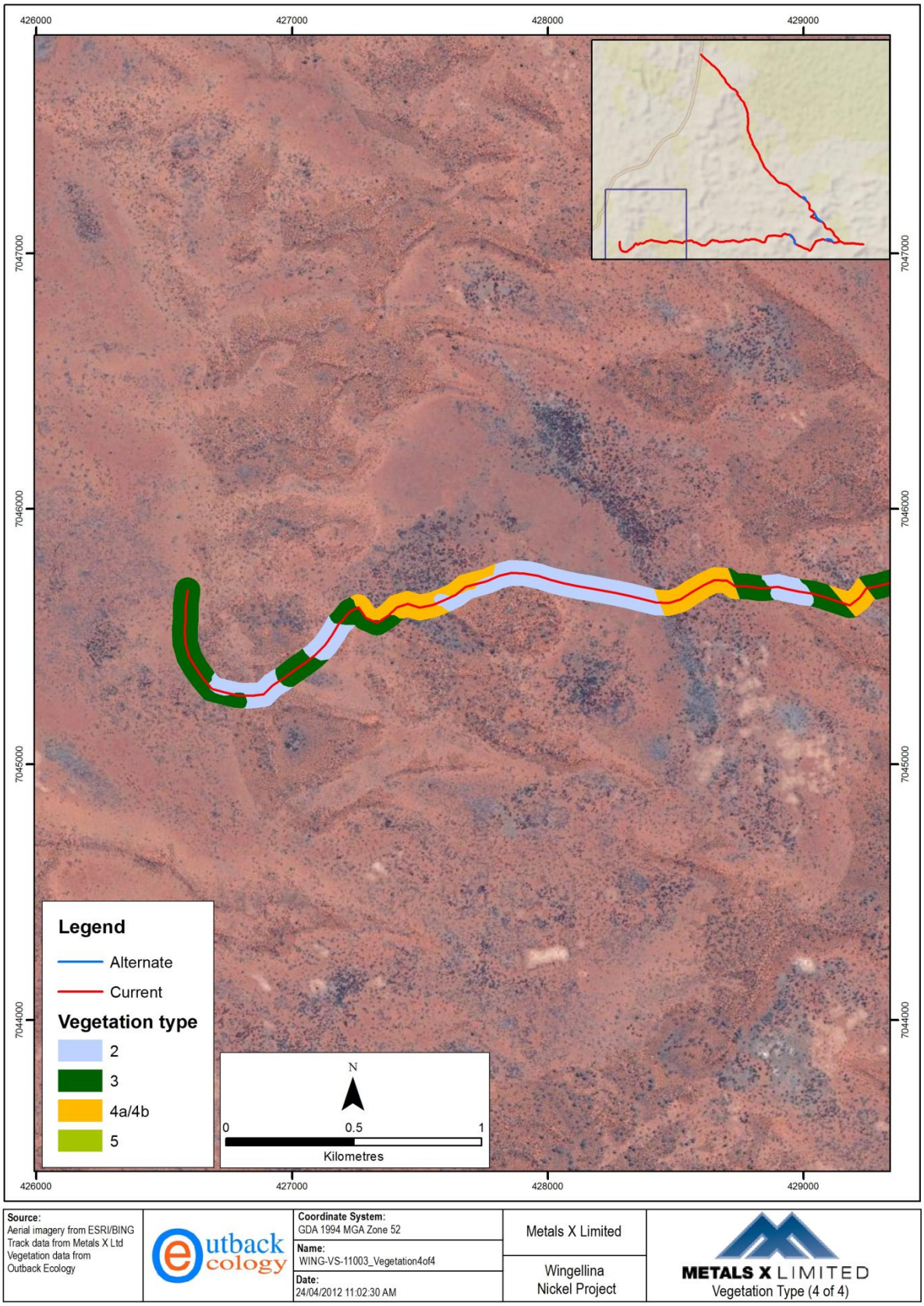


Figure 12 Vegetation communities in the western end of the proposed drill line

5. RECOMMENDATIONS

Only one PF species and one individual of the Priority 3 species *Stackhousia clementii* was recorded in the Study area, at the eastern end of the drill line just before it joins the access track. Ninety-eight individuals of the undescribed *Goodenia* sp. affin. *quasilibera* (L. Ransom 868) were recorded at five locations within 10 m of the original proposed drill line and access track alignment. Given the lack of knowledge of the conservation status of this undescribed species, it was treated as PF and thus alternative tracks were demarcated where it occurred within 10 m of the drill line (**Table 4**; **Figures 13-16**). It is recommended that the proposed access track and drill line be realigned according to these proposed route variations to ensure compliance with Clearance Permit 4523/1. The undescribed *Goodenia* was not recorded within 10 metres of any of the proposed drill pads.

While the Study area is currently weed-free, the introduction of weeds from adjacent areas is a significant threat. Of particular concern is the potential introduction of Buffel Grass (**Cenchus ciliaris*) and Ruby Dock (**Acetosella vesicaria*) from along Tjuntjuntjarra Track and areas surrounding the Wingellina Community. These species are particularly prevalent along roadsides and thus are readily spread by earth moving equipment working on roads. Both species are listed as significant environmental weeds in the *Environmental Weed Strategy for Western Australia* (WA Department of Environment and Conservation [DEC] 1999).

Buffel Grass readily invades intact native vegetation and out-competes native species (Robertson 2008). While native grass understoreys once burnt are unlikely to burn again for several years due to significant decreases in biomass, Buffel Grass infested understoreys are able to burn at a much higher frequency and intensity due to the high regenerative ability of the species following fire (Robertson 2008). This species is widespread around the Wingellina Community and its potential spread as seed in soil on earth moving equipment is a significant threat to the vegetation in the Study area including populations of *Goodenia* sp. affin. *quasilibera* (L. Ransom 868).

Increased fire frequency is also possible with increased human visitation and potentially increased fuel loads resulting from introduced Buffel Grass. This also has the potential to detrimentally impact native vegetation within the Study area. While mallee communities (and to a lesser extent Mulga communities) are adapted to regenerate from fire, of concern is the potential for increased fire frequency and intensity. Fire sensitive perennial species (e.g. *Hakeas*) which rely on seedling regeneration after fire ("Obligate Seed Regenerators") are particularly vulnerable to increased fire frequency and intensity. Loss of Obligate Seed Regenerators can occur if fire frequency increases to the extent that seedlings of such species are unable to reach maturity and set seed. Therefore it is recommended that management measures following the Clearing Permit conditions be implemented during construction of the borefield.

Table 4: Recommended changes to the proposed route for the drill line and access track, to provide a 10 m buffer area for populations of *Goodenia* sp. affin. *quasilibera* (L. Ransom 868) and an individual of *Stackhousia clementii*

Goodenia sp. affin. *quasilibera* (L. Ransom 868)							
Original proposed route				**Recommended variation to route**			
Waypoint	**Zone**	**Easting**	**Northing**	**Waypoint**	**Zone**	**Easting**	**Northing**
247	52 J	434826	7046545	Alt247	52 J	434846	7046575
248	52 J	434740	7046591	Alt248	52 J	434772	7046640
249	52 J	434657	7046651	Alt249	52 J	434727	7046687
250	52 J	434575	7046686	Alt250&251&252	52 J	434684	7046770
251	52 J	434475	7046721				
252	52 J	434566	7046784				
261	52 J	434204	7047464	ALT261	52 J	434234	7047512
28	52 J	435333	7045703	ALT28	52 J	435342	7045744
29	52 J	435285	7045719	ALT29	52 J	435321	7045760
30	52 J	435232	7045724	ALT30	52 J	435241	7045785
31	52 J	435179	7045734	ALT31	52 J	435174	7045792
63	52 J	433840	7045619	ALT63	52 J	433830	7045604
64	52 J	433826	7045646	ALT64	52 J	433804	7045636
65	52 J	433822	7045703	ALT65	52 J	433790	7045700
69	52 J	433727	7045884	ALT69	52 J	433719	7045863
70	52 J	433700	7045925	ALT70	52 J	433680	7045897
71	52 J	433655	7045950	ALT71	52 J	433638	7045939

Stackhousia clementii							
Original proposed route				**Recommended variation to route**			
Waypoint	**Zone**	**Easting**	**Northing**	**Waypoint**	**Zone**	**Easting**	**Northing**
346	52 J	435300	7045695	Alt247	52 J	434846	7046575

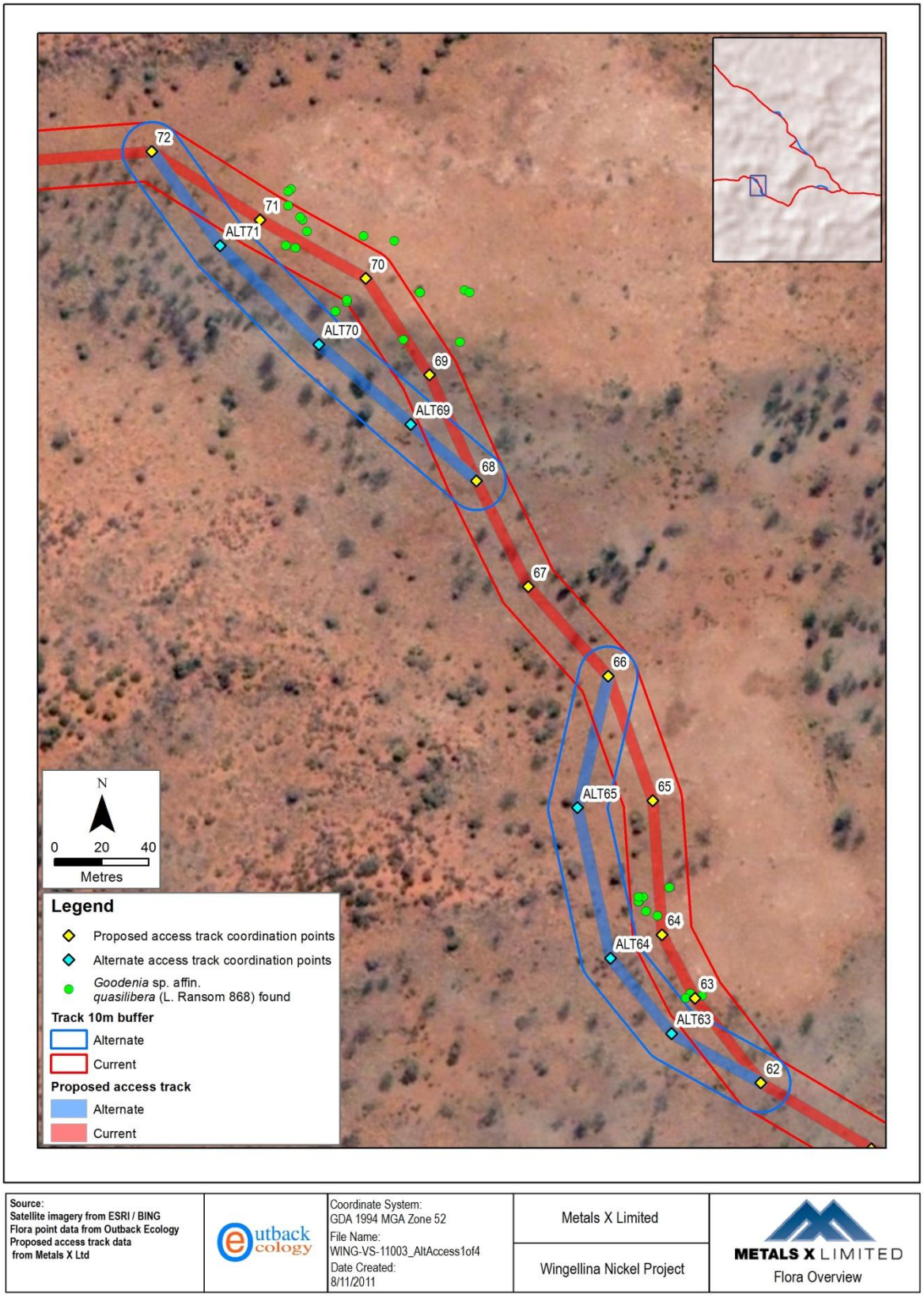


Figure 13: Recommended changes to proposed route of drill line and access track, to avoid *Goodenia* sp. affin. *quasilibera* (L. Ransom 868)

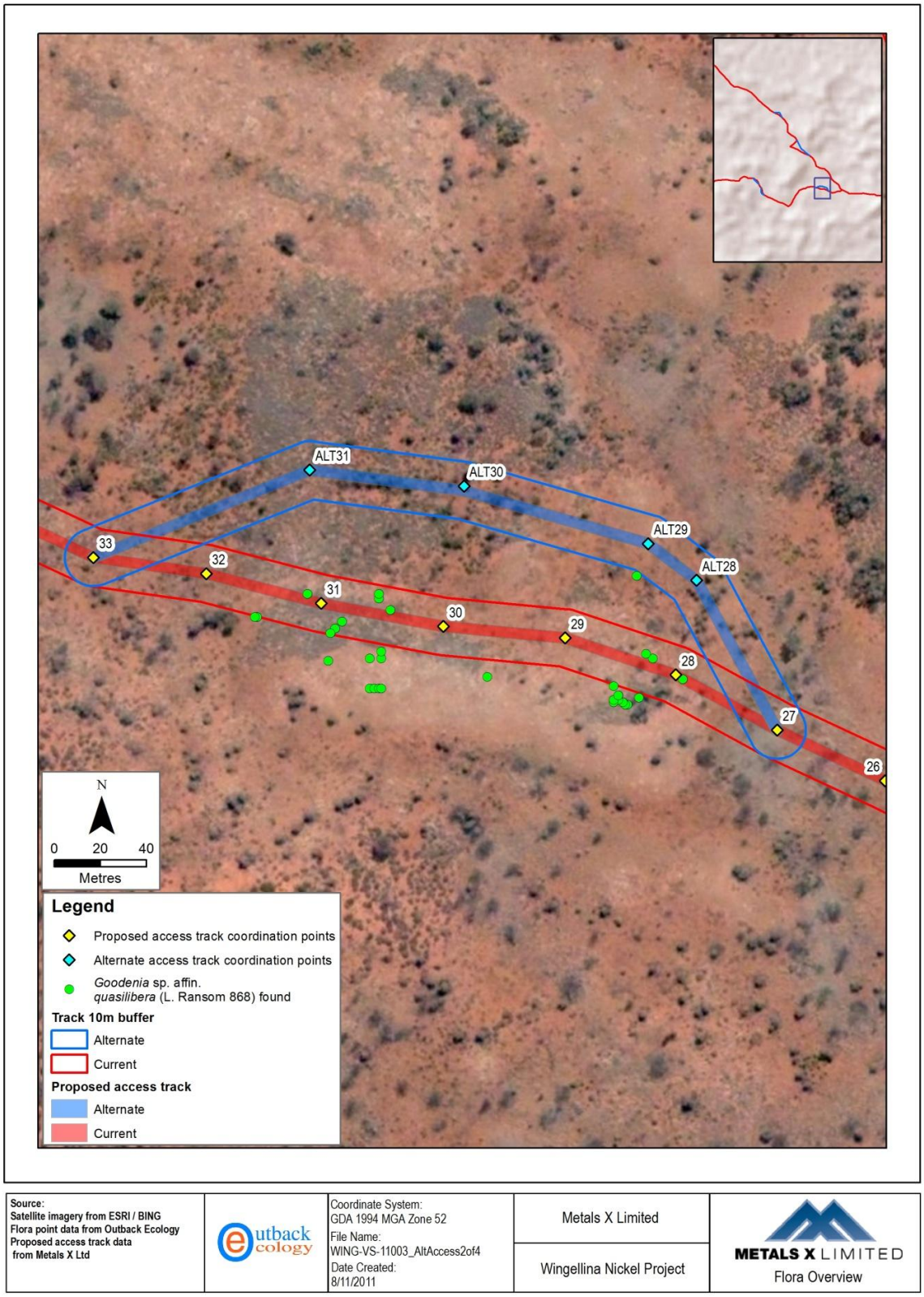


Figure 14: Recommended changes to proposed route of drill line and access track, to avoid *Goodenia* sp. affin. *quasilibera* (L. Ransom 868)

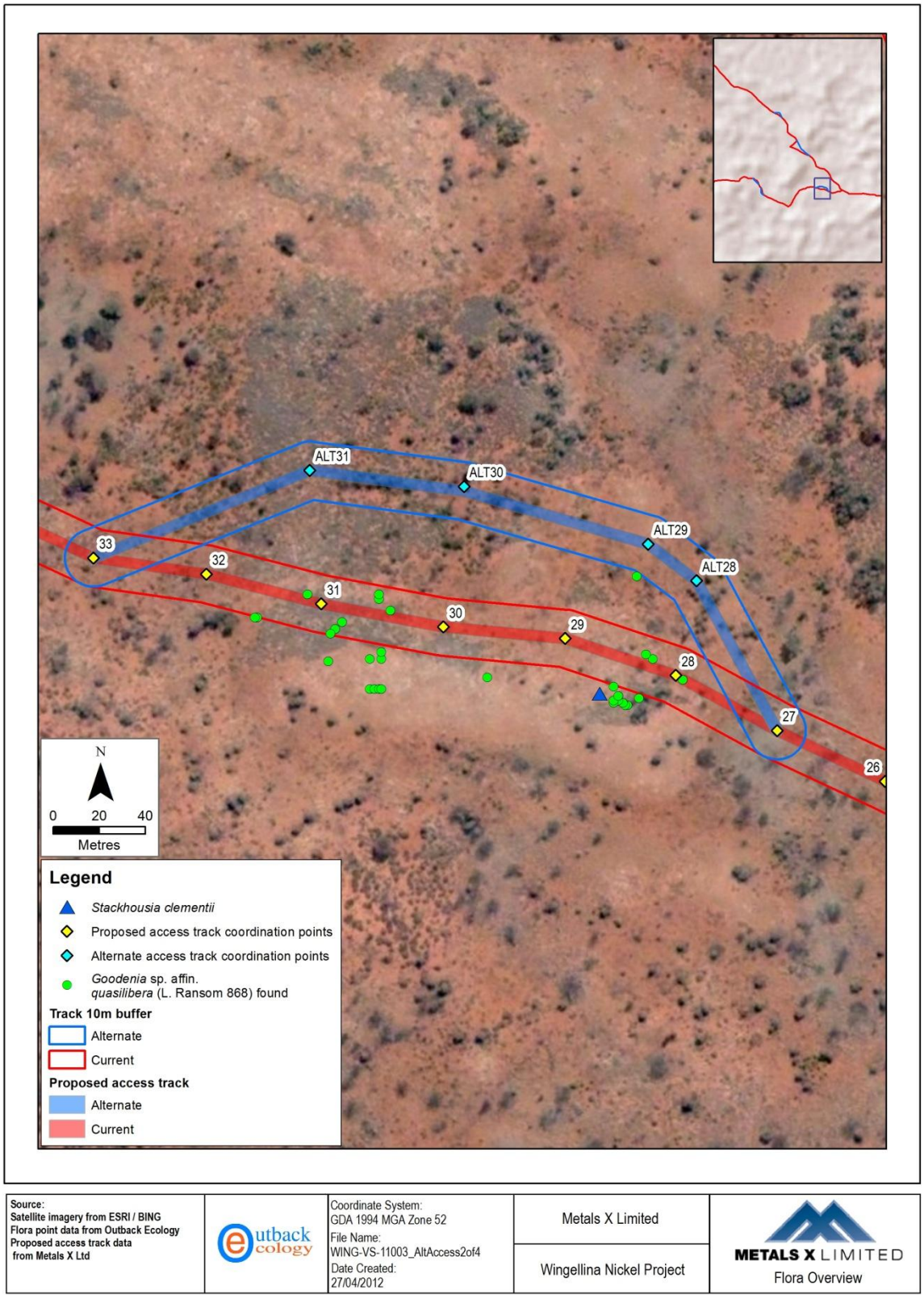


Figure 15: Recommended changes to proposed route of drill line and access track, to avoid *Goodenia* sp. affin. *quasilibera* (L. Ransom 868)

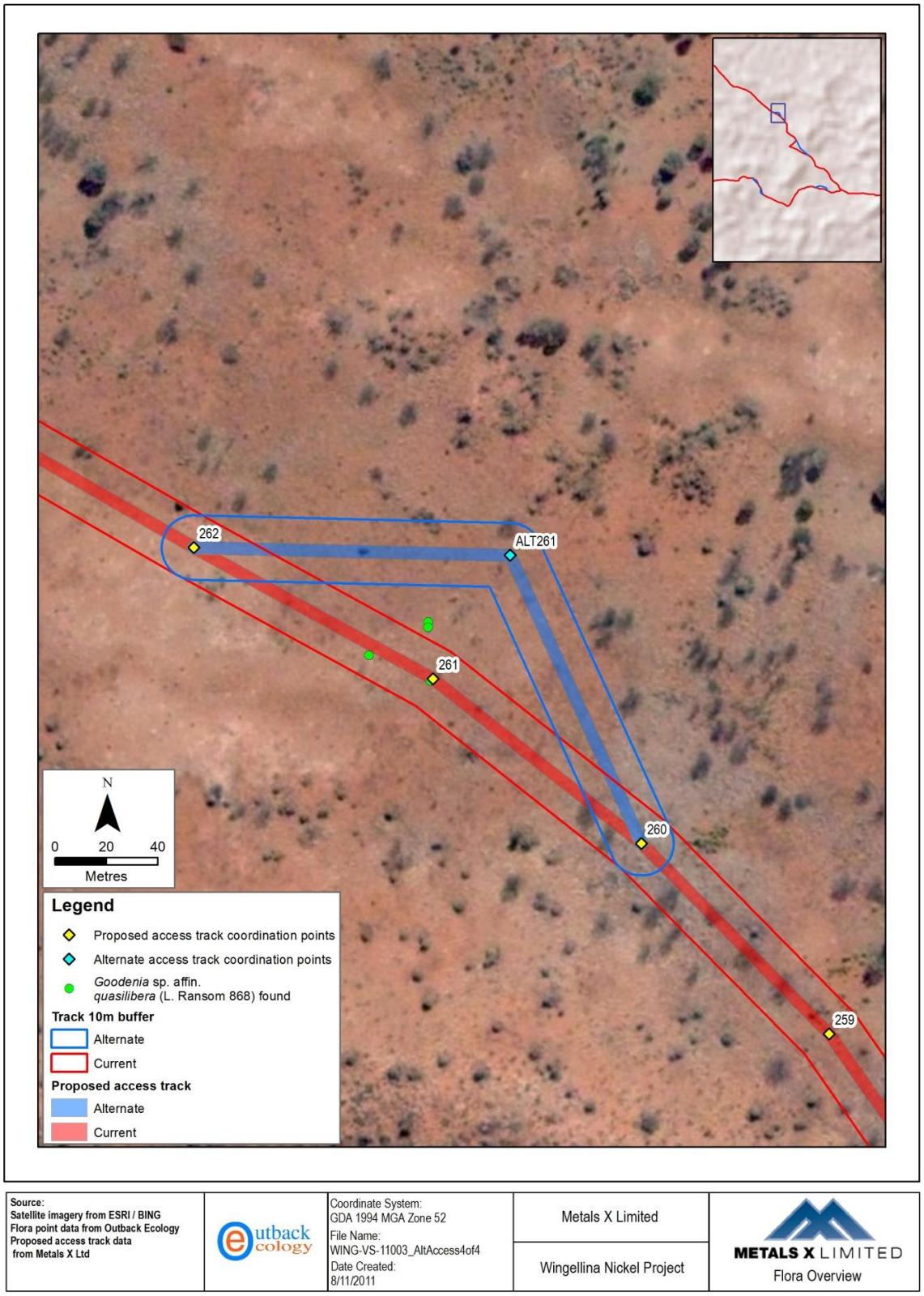


Figure 16: Recommended changes to proposed route of drill line and access track, to avoid *Goodenia* sp. affin. *quasilibera* (L. Ransom 868)

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Appendix A
Special Purpose Clearing Permit 4523/1

GOVERNMENT OF WESTERN AUSTRALIA

CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

PERMIT DETAILS
Purpose Permit Number: 4523/1
File Number: A1336/201101
Duration of Permit: From 29 October 2011 to 29 October 2016

PERMIT HOLDER
Metals X Limited

LAND ON WHICH CLEARING IS TO BE DONE
Miscellaneous Licence 69/12

PURPOSE FOR WHICH THE CLEARING MAY BE DONE
1. Clearing for the purpose of groundwater exploration and associated works.

CONDITIONS

Type of clearing authorised
1. The Permit Holder must not clear more than 20 hectares of native vegetation. All clearing must be within the areas cross-hatched yellow on attached Plan 4523/1.

Avoid, minimise etc clearing
2. In determining the amount of native vegetation to be cleared authorised under this Permit, the Permit Holder must have regard to the following principles, set out in order of preference:

   (i) avoid the clearing of native vegetation;
   (ii) minimise the amount of native vegetation to be cleared; and
   (iii) reduce the impact of clearing on any environmental value.

Weed control
3. When undertaking any clearing or other activity authorised under this Permit, the Permit Holder must take the following steps to minimise the risk of the introduction and spread of *weeds*:

   (i) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;
   (ii) ensure that no *weed*-affected soil, *mulch, fill* or other material is brought into the area to be cleared; and
   (iii) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

Flora management
4. (a) Prior to undertaking any clearing authorised under this Permit, the Permit Holder shall engage a *botanist*, in accordance with *Guidance Statement No. 51* to inspect that area for the presence of rare flora listed in the *Wildlife Conservation (Rare Flora) Notice 2010(2)* and *priority flora*.

   (b) Where rare flora or *priority flora* are identified in relation to Condition 4(a) of this Permit, the Permit Holder shall ensure that:

   (i) no clearing occurs within 50 metres of identified rare flora, unless approved by the *CEO*; and
   (ii) no clearing of identified *priority flora* occurs and no clearing occurs within 10 metres of identified *priority flora*, unless approved by the *CEO*.

Appendix B
Threatened and Priority Ecological Communities Definitions

Definitions for Threatened Ecological Communities (TEC) (DEC 2010)

Presumed Totally Destroyed (PD)

An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):

A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or

B) All occurrences recorded within the last 50 years have since been destroyed

Critically Endangered (CR)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):
   i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);
   ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):
   i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);
   ii) 0there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An

ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definitions for Priority Ecological Communities (PEC) (DEC 2010)

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly-known ecological communities

Ecological communities that are known from very few occurrences with a very restricted distribution (generally =5 occurrences or a total area of = 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities

Communities that are known from few occurrences with a restricted distribution (generally =10 occurrences or a total area of =200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four:

i) ***Rare*****.** Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

(ii) ***Near Threatened****.* Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

(iii) ***Ecological communities that have been removed from the list of threatened communities during the past five years***.

These communities require regular monitoring.

Priority Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix C
Threatened and Priority Flora Definitions

Definitions for Declared Rare Flora (DRF) and Priority Flora (PF) (DEC 2011)

Under the Wildlife Conservation Act, the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection.

T: Threatened Flora (Declared Rare Flora — Extant)

Taxa[1] which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the Wildlife Conservation Act 1950).

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria:

- CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild
- EN: Endangered – considered to be facing a very high risk of extinction in the wild
- VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
-

1: Priority One: Poorly-known taxa

Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

2: Priority Two: Poorly-known taxa

Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.

3: Priority Three: Poorly-known taxa

Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.

4: Priority Four: Rare, Near Threatened and other taxa in need of monitoring

1. Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special

2. protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.
3. Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
4. Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

5: Priority Five: Conservation Dependent taxa

Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

Appendix D
Vegetation Condition Scale

Vegetation Condition Scale (Keighery 1994)

Code	Description
Pristine	Pristine or nearly so. No obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as ‘parkland cleared’ with the flora comprising weed or crop species with isolated native trees or shrubs.

Appendix E
Classification of Vegetation Structural Formation and Height Classes

Vegetation Structure Classification (Keighery 1994)

Lifeform / Height Class	Canopy Cover			
	100% - 70%	**70% - 30%**	**30% - 10%**	**10% - 2%**
Trees > 30m Trees 10-30m Trees < 10m	Tall Closed Forest Closed Forest Low Closed Forest	Tall Open Forest Open Forest Low Open Forest	Tall Woodland Woodland Low Woodland	Tall Open Woodland Open Woodland Low Open Woodland
Tree Mallee	Closed Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Shrub Mallee	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2m Shrubs 1-2m Shrubs <1m	Closed Tall Scrub Closed Heath Closed Low Heath	Tall Open Scrub Open Heath Open Low Heath	Tall Shrubland Shrubland Low Shrubland	Tall Open Shrubland Open Shrubland Low Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

Appendix F

Flora Species Recorded at Wingellina Borefields during May 2011 Flora and Vegetation Surveys and their Conservation Status[1]

[1]DEC (2011d); Barker et al. (2005)

Family	Species	Conservation significance[1]
Adiantaceae		
	Cheilanthes sieberi	Not threatened (WA)
Amaranthaceae		
	Ptilotus chippendalei	Not threatened (WA)
	Ptilotus exaltatus	Not threatened (WA)
	Ptilotus helipteroides	Not threatened (WA)
	Ptilotus macrocephalus	Not threatened (WA)
	Ptilotus obovatus	Not threatened (WA)
	Ptilotus polystachyus	Not threatened (WA)
	Ptilotus schwartzii	Not threatened (WA)
	Ptilotus sessilifolius	Not threatened (WA)
Araliaceae		
	Trachymene glaucifolia	Not threatened (WA)
Asteraceae		
	Lawrencella davenportii	Not threatened (WA)
	Minuria leptophylla	Not threatened (WA)
	Rutidosis helichrysoides	Not threatened (WA)
	Schoenia cassiniana	Not threatened (WA)
	Vittadinia eremaea	Not threatened (WA)
Boraginaceae		
	Halgania cyanea	Not threatened (WA)
	Halgania erecta	Not threatened (WA)
Brassicaceae		
	Lepidium phlebopetalum	Not threatened (WA)
	Menkea sphaerocarpa	Not threatened (WA)
Campanulaceae		
	Wahlenbergia tumidifructa	Not threatened (WA)
Capparaceae		
	Cleome viscosa	Not threatened (WA)
Chenopodiaceae		
	Dysphania glomulifera	Not threatened (WA)
	Dysphania kalpari	Not threatened (WA)
	Dysphania melanocarpa	Not threatened (WA)
	Einadia nutans	Not threatened (WA)
	Enchylaena tomentosa	Not threatened (WA)
	Eremophea spinosa	Not threatened (WA)
	Maireana planifolia	Not threatened (WA)
	Maireana villosa	Not threatened (WA)

Family	Species	Conservation significance
Chenopodiaceae		
	Rhagodia eremaea	Not threatened (WA)
	Salsola sp.	Not threatened (WA)
	Sclerolaena clelandii	Not threatened (WA)
	Sclerolaena deserticola	Not threatened (WA)
	Sclerolaena diacantha	Not threatened (WA)
	Sclerolaena parviflora	Not threatened (WA)
	Sclerolaena patenticuspis	Not threatened (WA)
Chloanthaceae		
	Dicrastylis exsuccosa	Not threatened (WA)
	Dicrastylis gilesii	Not threatened (WA)
Convolvulaceae		
	Bonamia rosea	Not threatened (WA)
	Convolvulus clementii	Not threatened (WA)
Cyperaceae		
	Bulbostylis barbata	Not threatened (WA)
Euphorbiaceae		
	Euphorbia australis	Not threatened (WA)
	Euphorbia drummondii	Not threatened (WA)
	Euphorbia tannensis	Not threatened (WA)
Fabaceae		
	Acacia acanthoclada	**Not threatened (WA); disjunct outlying population**
	Acacia aneura var. *aneura*	Not threatened (WA)
	Acacia aneura var. *major*	Not threatened (WA)
	Acacia ayersiana	Not threatened (WA)
	Acacia kempeana	Not threatened (WA)
	Acacia ligulata	Not threatened (WA)
	Acacia maitlandii	Not threatened (WA)
	Acacia melleodora	Not threatened (WA)
	Acacia minyura	Not threatened (WA)
	Acacia pachyacra	Not threatened (WA)
	Acacia prainii	Not threatened (WA)
	Acacia pruinocarpa	Not threatened (WA)
	Acacia tetragonophylla	Not threatened (WA)
	Leptosema chambersii	Not threatened (WA)
	Muelleranthus stipularis	Not threatened (WA)
	Petalostylis cassioides	Not threatened (WA)

Family	Species	Conservation significance
Fabaceae		
	Senna artemisioides subsp. *filifolia*	Not threatened (WA)
	Senna artemisioides subsp. *petiolaris*	Not threatened (WA)
	Senna artemisioides subsp. x *artemisioides*	Not threatened (WA)
	Senna artemisioides subsp. x *coriacea*	Not threatened (WA)
	Senna pleurocarpa	Not threatened (WA)
	Swainsona acuticarinata	Not threatened (WA)
Geraniaceae		
	Erodium sp.	Not threatened (WA)
Goodeniaceae		
	Brunonia australis	Not threatened (WA)
	Goodenia centralis	Not threatened (WA)
	Goodenia sp. affin. *quasilibera* (L. Ransom 868)	**New undescribed species**
	Goodenia triodiophila	Not threatened (WA)
	Scaevola amblyanthera var. *centralis*	Not threatened (WA)
	Scaevola basedowii	Not threatened (WA)
	Scaevola spinescens	Not threatened (WA)
	Velleia glabrata	Not threatened (WA)
Haloragaceae		
	Haloragis gossei	Not threatened (WA)
	Haloragis odontocarpa forma *rugosa*	Not threatened (WA)
Lamiaceae		
	Microcorys macrediana	Not threatened (WA)
	Prostanthera sericea	Not threatened (WA)
	Prostanthera wilkieana	Not threatened (WA)
	Spartothamnella teucriiflora	Not threatened (WA)
Malvaceae		
	Abutilon cryptopetalum	Not threatened (WA)
	Abutilon fraseri	Not threatened (WA)
	Abutilon otocarpum	Not threatened (WA)
	Alyogyne pinoniana	Not threatened (WA)
	Brachychiton gregorii	Not threatened (WA)
	Hannafordia bissillii	Not threatened (WA)
	Keraudrenia nephrosperma	Not threatened (WA)
	Rulingia loxophleba	Not threatened (WA)
	Sida fibulifera	Not threatened (WA)
	Sida sp. Golden calyces (G.J. Leach 966)	Not threatened (WA)
	Sida sp. Golden calyces glabrous (H.N. Foote 32)	Not threatened (WA)
	Sida sp. Golden calyces/sp. Pindan	Not threatened (WA)

Family	Species	Conservation significance
Malvaceae		
	Sida sp. Tiny glabrous fruit (A.A. Mitchell PRP 52)	Not threatened (WA)
Myrtaceae		
	Aluta maisonneuvei	Not threatened (WA)
	Eucalyptus gamophylla	Not threatened (WA)
	Eucalyptus glomerosa	Not threatened (WA)
	Eucalyptus gongylocarpa	Not threatened (WA)
	Eucalyptus intertexta	Not threatened (WA)
	Eucalyptus oxymitra	Not threatened (WA)
	Eucalyptus socialis subsp. *eucentrica*	Not threatened (WA)
	Eucalyptus youngiana	Not threatened (WA)
	Melaleuca ?uncinata	Not threatened (WA)
	Micromyrtus flaviflora	Not threatened (WA)
	Thryptomene longifolia	**New record for WA**
Nyctaginaceae		
	Boerhavia repleta	Not threatened (WA)
Pittosporaceae		
	Pittosporum angustifolium	Not threatened (WA)
Poaceae		
	Amphipogon caricinus	Not threatened (WA)
	Aristida contorta	Not threatened (WA)
	Aristida holathera	Not threatened (WA)
	Aristida obscura	Not threatened (WA)
	**Cenchrus ciliaris*	Serious environmental weed
	Cymbopogon obtectus	Not threatened (WA)
	Digitaria brownii	Not threatened (WA)
	Enneapogon avenaceus	Not threatened (WA)
	Enneapogon caerulescens	Not threatened (WA)
	Enneapogon cylindricus	Not threatened (WA)
	Enneapogon polyphyllus	Not threatened (WA)
	Eragrostis eriopoda	Not threatened (WA)
	Eriachne mucronata	Not threatened (WA)
	Eriachne pulchella	Not threatened (WA)
	Monachather paradoxus	Not threatened (WA)
	Neurachne lanigera	**Priority 1 Flora (WA); Rare (SA)**
	Paractaenum refractum	Not threatened (WA)
	Paraneurachne muelleri	Not threatened (WA)
	Paspalidium clementii	Not threatened (WA)

Family	Species	Conservation significance
Poaceae		
	Themeda triandra	Not threatened (WA)
	Thyridolepis multiculmis	Not threatened (WA)
	Tragus australianus	Not threatened (WA)
	Triodia basedowii	Not threatened (WA)
	Triodia melvillei	Not threatened (WA)
	Triodia scariosa	Not threatened (WA)
	Triodia schinzii	Not threatened (WA)
	Triraphis mollis	Not threatened (WA)
Portulacaceae		
	**Portulaca oleracea*	Not threatened (WA); native and exotic forms in WA (DEC 2011)
	Calandrinia remota	Not threatened (WA)
Proteaceae		
	Grevillea juncifolia	Not threatened (WA)
	Grevillea stenobotrya	Not threatened (WA)
	Hakea divaricata	Not threatened (WA)
Rubiaceae		
	Psydrax latifolia	Not threatened (WA)
	Psydrax suaveolens	Not threatened (WA)
Santalaceae		
	Exocarpos sparteus	Not threatened (WA)
	Santalum acuminatum	Not threatened (WA)
Sapindaceae		
	Dodonaea viscosa subsp. *angustissima*	Not threatened (WA)
Scrophulariaceae		
	Eremophila clarkei	Not threatened (WA)
	Eremophila forrestii subsp. *forrestii*	Not threatened (WA)
	Eremophila gilesii	Not threatened (WA)
	Eremophila glabra subsp. *glabra*	Not threatened (WA)
	Eremophila latrobei subsp. *glabra*	Not threatened (WA)
	Eremophila longifolia	Not threatened (WA)
	Eremophila platythamnos subsp. *exotrachys*	Not threatened (WA)
	Eremophila willsii	Not threatened (WA)
Solanaceae		
	Nicotiana occidentalis	Not threatened (WA)
	Nicotiana rosulata	Not threatened (WA)
	Solanum centrale	Not threatened (WA)
	Solanum ellipticum	Not threatened (WA)
	Solanum lasiophyllum	Not threatened (WA)

Family	Species	Conservation significance
Zygophyllaceae		
	**Tribulus terrestris*	Exotic species
	Tribulus astrocarpus	Not threatened (WA)
	Zygophyllum simile	Not threatened (WA)
	Zygophyllum tesquorum	Not threatened (WA)

Appendix G

Coordinates of *Goodenia* sp. affin. *quasilibera* (L. Ransom 868) located along the proposed drill line and access track

Waypoint	Zone	Easting	Northing	Waypoint	Zone	Easting	Northing
Good1	52 J	433667	7045956	Good51	52 J	434203	7047463
Good2	52 J	433673	7045950	Good52	52 J	434179	7047473
Good3	52 J	433672	7045951	Good53	52 J	434202	7047486
Good4	52 J	433668	7045963	Good54	52 J	434695	7046663
Good5	52 J	433667	7045962	Good55	52 J	435336	7045701
Good6	52 J	433675	7045945	Good56	52 J	433666	7045939
Good7	52 J	433670	7045938	Good57	52 J	434536	7046656
Good8	52 J	433699	7045943	Good58	52 J	434498	7046702
Good9	52 J	433712	7045941	Good59	52 J	428122	7049678
Good10	52 J	433742	7045920	Good60	52 J	424248	7045288
Good11	52 J	433744	7045919	Good61	52 J	434817	7045765
Good12	52 J	433723	7045919	Good62	52 J	433818	7045662
Good13	52 J	433723	7045919	Good63	52 J	434839	7045781
Good14	52 J	433740	7045898	Good64	52 J	434839	7045779
Good15	52 J	433716	7045899	Good65	52 J	434841	7045780
Good16	52 J	433692	7045915	Good66	52 J	434845	7045773
Good17	52 J	433692	7045916	Good67	52 J	434848	7045770
Good18	52 J	433687	7045911	Good68	52 J	434854	7045774
Good19	52 J	433843	7045620	Good69	52 J	435209	7045731
Good20	52 J	433838	7045621	Good70	52 J	435204	7045736
Good21	52 J	433819	7045656	Good71	52 J	435204	7045738
Good22	52 J	433816	7045660	Good72	52 J	435182	7045709
Good23	52 J	433816	7045660	Good73	52 J	435200	7045710
Good24	52 J	433816	7045660	Good74	52 J	435205	7045710
Good25	52 J	433836	7045619	Good75	52 J	435205	7045713
Good26	52 J	435188	7045726	Good76	52 J	435317	7045693
Good27	52 J	435185	7045723	Good77	52 J	435312	7045690
Good28	52 J	435183	7045721	Good78	52 J	435311	7045690
Good29	52 J	435151	7045728	Good79	52 J	435310	7045691
Good30	52 J	435150	7045728	Good80	52 J	435308	7045692
Good31	52 J	435173	7045738	Good81	52 J	435306	7045691
Good33	52 J	435200	7045697	Good82	52 J	435306	7045692
Good34	52 J	435202	7045697	Good83	52 J	435308	7045694
Good35	52 J	435204	7045697	Good84	52 J	435308	7045694
Good36	52 J	435205	7045697	Good85	52 J	435306	7045698
Good37	52 J	435323	7045710	Good86	52 J	435251	7045702
Good38	52 J	435320	7045712	Good87	52 J	434579	7046790
Good39	52 J	435316	7045746	Good88	52 J	434202	7047484
Good40	52 J	434870	7046521	Good89	52 J	434817	7045767
Good41	52 J	434760	7046559	Good90	52 J	434827	7045770
Good42	52 J	434849	7046528	Good91	52 J	434837	7045783
Good43	52 J	434883	7046521	Good92	52 J	434837	7045781
Good44	52 J	434729	7046535	Good93	52 J	433816	7045662
Good45	52 J	434495	7046713	Good94	52 J	434658	7046649
Good46	52 J	434504	7046713	Good95	52 J	434826	7045774
Good47	52 J	434508	7046709	Good96	52 J	433829	7045666
Good48	52 J	434555	7046694	Good97	52 J	433824	7045654
Good49	52 J	434620	7046664	Good98	52 J	434809	7045769
Good50	52 J	434686	7046638				