

Section 7

Flora

7.1 Existing Conditions

7.1.1 Floristics

As part of the EIS study, URS commissioned Kristin Metcalfe and Julie Crawford to undertake flora surveys of the Maud Creek project area on behalf of Terra Gold (Crawford and Metcalfe 2007, see Appendix E for the full report).

The flora survey, carried out in March to April 2007, identified 153 plant species from 14 plant families. Nineteen species were introduced weeds. The plant families with the highest number of species were Fabaceae, Poaceae and Myrtaceae. A complete list of species identified within the area is presented in Appendix E.

Historical mining and the grazing of buffalo have resulted in relatively low species diversity and the spread of several introduced weeds species across the site.

7.1.2 Vegetation communities

The main vegetation communities within the project area may be broadly grouped as woodlands, low woodlands or low open woodlands (Table 7-1). Local variations in topography, substrate and drainage throughout the project area are reflected in distinct differences in species dominance, stratum height and canopy cover. The vegetation of the project area was classified according to these characteristics, using data on vegetation structure and composition collected from individual sites.

The various woodlands mentioned above are dominated by *Eucalyptus* species, *Corymbia* species, and *Erythrophleum chlorostachys*, in the upper stratum; *Hakea arborescens*, *Brachychiton megaphyllus*, *Petalostigma pubescens*, *Persoonia falcata*, *Cochlospermum fraseri*, *Carissa lanceolata* and *Terminalia platyphylla* in the mid stratum; and *Heteropogon contortus* (black speargrass), *Themeda triandra* (kangaroo grass), and *Brachyachne convergens* (native couch) are the dominant grass species.

7.1.3 Vegetation types to be disturbed

The total proposed areas required for mining and related site infrastructure is approximately 114 ha, excluding that required for the alternative access road (Table 2-2). Approximately 96 ha of savannah woodland vegetation has been cleared in the Maud Creek project area for pastoral development and to support exploration and historical mining activity. The plans documented in this EIS to develop an underground mine at the Maud Creek site will result in an estimated 18 ha of additional clearing (Table 2-2), mostly to upgrade access roads.

If the existing access road is used, it will need to be widened and upgraded for haulage of material to URGM; this would involve an estimated disturbance of 10 ha, compared with 15 ha for the preferred option, which is shorter and avoids crossing Gold Creek (Figure 1-3). The vegetation communities, species and their location are described below and presented in Table 7-2. Woodlands in upland areas were characterised by well-drained gravelly or sandy lateritic soils with various *Corymbia* species, *Eucalyptus tectifica* and *Erythrophleum chlorostachys* as dominant upper stratum species.

Mid-storey vegetation typically comprised species such as *Hakea arborescens*, *Brachychiton megaphyllus*, *Petalostigma pubescens*, *Persoonia falcata*, *Cochlospermum fraseri* and *Carissa lanceolata*, but the mid-stratum was typically very sparse at most survey sites.

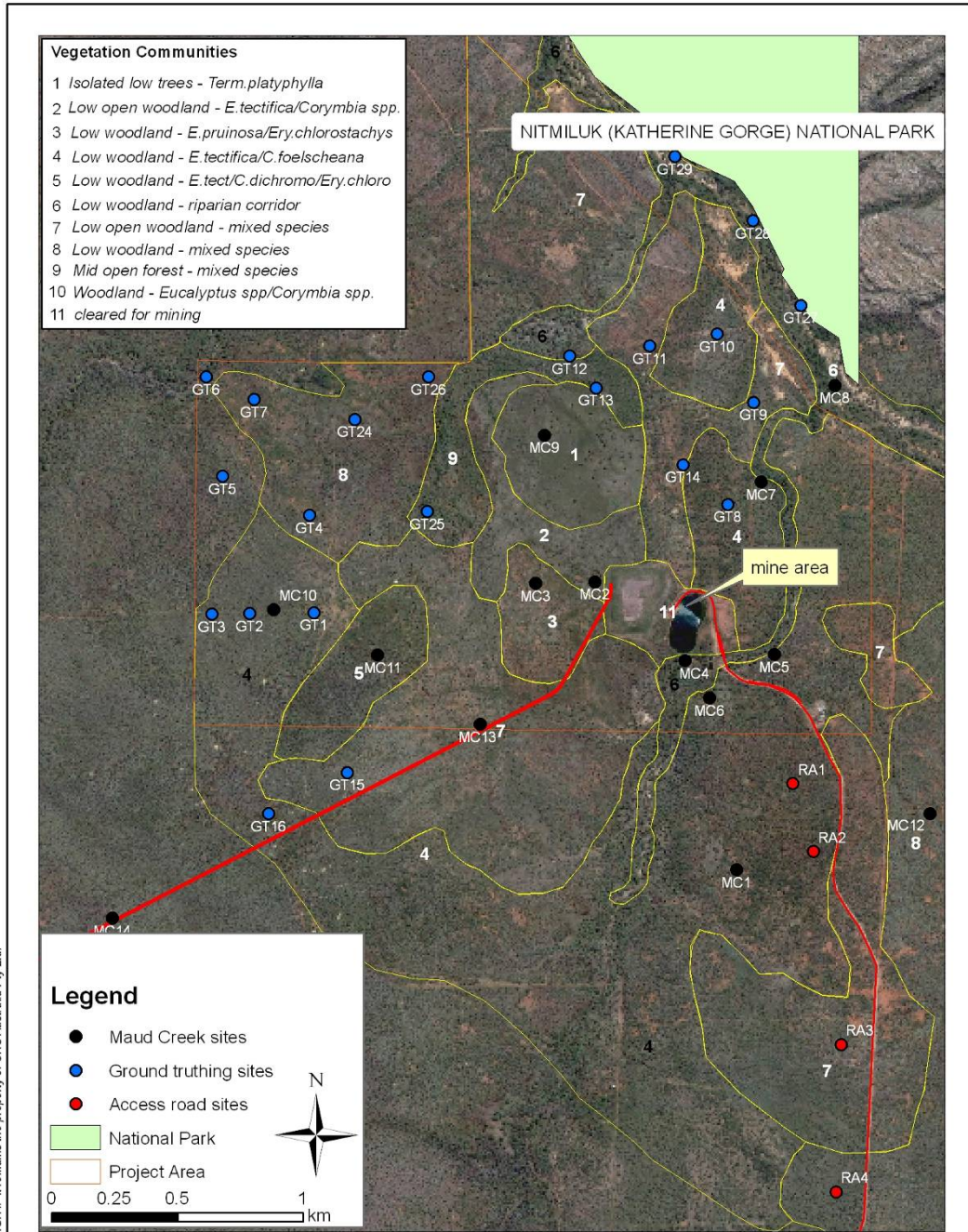
The lower stratum in woodland communities characteristically included *Heteropogon contortus* (Black speargrass) and *Themeda triandra* (Kangaroo grass) as the dominant grass species.



Section 7

Flora

Figure 7.1 Vegetation Classification of Maud Creek mining lease



This drawing is subject to COPYRIGHT. It remains the property of URS Australia Pty Ltd.

Client Terra Gold Mining Ltd	Project MAUD CREEK GOLD PROJECT	Title Vegetation Classification of Maud Creek mining lease
	Drawn: IH	Approved: VF
	Job No.: 42213775	Date: 30 AUG 2007
	File No.: 42213775-071.mxd	Figure:7-1
		Rev. A A4



Section 7

Flora

Table 7-1 Summary table of floristic communities within the survey area

Site ID	Easting	Northing	Mapping unit	Site description	C value
20m X 20m Quadrats					
MC1	225561	8400603	4	Low open woodland- <i>E. tectifical/ Corymbia</i> spp.	Low
MC2	224999	8401748	2	Low open woodland <i>E. tectifical /C. foelscheana</i>	Low
MC3	224764	8401742	3	Low open woodland- <i>E. pruinosa /E. chlorostachys</i>	Low
MC4	225357	8401434	6	Woodland -Riparian coridor	Low
MC5	225712	8401460	6	Low woodland-Riparian coridor	Low
MC6	225455	8401286	4	Low open woodland- <i>E. tectifical /C. foelscheana</i>	Low
MC7	225659	8402146	4	Low open woodland- <i>E. tectifical/ C. foelscheana</i>	Low
MC8	225952	8402530	6	Low woodland -Riparian coridor	Low
MC9	224798	8402332	1	Isolated low trees - <i>T. platyphylla</i>	Low
MC10	223722	8401638	4	Low open woodland- <i>E. tectifical, C. foelscheana</i>	Low
MC11	224135	8401456	5	Low woodland <i>E. tectifical/C.dichromophloial/ E.chlorostachys</i>	Low
MC12	226331	8400826	8	Low woodland- Mixed species	Low
MC13	224542	8401182	7	Low open woodland - Mixed species	Low
MC14	223080	8400410	8	Low woodland- Mixed species	Low
MC15	222265	8400058	2	Low open woodland <i>E. tectifical/ C. foelscheana</i>	Low
MC16	220525	8098648	8	Low open woodland- Mixed species	Low
Ground truthing					
GT1	223881	8401626	4	Low woodland- <i>E. tectifical/ C. foelscheana</i>	Low
GT2	223625	8401622	4	Low woodland- <i>E. tectifical /C. foelscheana</i>	Low
GT3	223475	8401620	4	Low woodland- <i>E. tectifical / C. foelscheana</i>	Low
GT4	223864	8402012	8	Low woodland- Mixed species	Low
GT5	223519	8402168	9	Low Open Forest - Mixed species	Low
GT6	223454	8402564	6	Low woodland -Riparian coridor	Low
GT7	223643	8402474	8	Low woodland- Mixed species	Low
GT8	225527	8402056	4	Low woodland- <i>E. tectifical / C. foelscheana</i>	Low
GT9	225630	8402462	7	Low open woodland - Mixed species	Low
GT10	225483	8402733	4	Low woodland- <i>E. tectifical / C. foelscheana</i>	Low
GT11	225215	8402686	7	Low open woodland - Mixed species	Low
GT12	224897	8402646	6	Low woodland -Riparian coridor	Low
GT13	225002	8402520	9	Low Open Forest - Mixed species	Low
GT14	225349	8402214	7	Low open woodland - Mixed species	Low
GT24	224044	8402394	8	Low woodland- Mixed species	Low
GT25	224331	8402028	9	Low Open Forest - Mixed species	Low
GT26	224338	8402564	8	Low woodland- Mixed species	Low
GT27	225818	8402848	6	Low woodland -Riparian coridor	Low
GT28	225627	8403184	6	Low woodland -Riparian coridor	Low
GT29	225316	8403440	6	Low woodland -Riparian coridor	Low
Proposed access road					
GT15	224015	8400990	7	Low open woodland - Mixed species	Low
GT16	223700	8400826	4	Low woodland- <i>E. tectifical / C. foelscheana</i>	Low
GT17	222580	8400180	7	Low open woodland - Mixed species	Low
GT18	222497	8400116	7	Low open woodland - Mixed species	Low
GT19	221875	8400092	4	Low woodland- <i>E. tectifical / C. foelscheana</i>	Low
GT20	220900	8399478	10	Woodland - <i>Corymbia</i> sp / <i>Eucalyptus</i> sp.	Low
GT21	220093	8397676	10	Woodland - <i>Corymbia</i> sp / <i>Eucalyptus</i> sp.	Low
GT22	220322	8397228	7	Low open woodland - Mixed species	Low
GT23	220251	8396990	8	Low woodland- Mixed species	Low
Existing access road					
RA1	225785	8400946	4	Low woodland- <i>E. tectifical / C. foelscheana</i>	Low
RA2	225867	8400676	4	Low woodland- <i>E. tectifical / C. foelscheana</i>	Low
RA3	225977	8399908	7	Low open woodland - Mixed species	Low
RA4	225957	8399322	8	Low woodland- Mixed species	Low
RA5	225217	8398076	8	Low woodland- Mixed species	Low
RA6	225027	8398556	8	Low woodland- Mixed species	Low
RA7	225478	8398054	8	Low woodland- Mixed species	Low
RA8	225728	8397664	8	Low woodland- Mixed species	Low
RA9	225770	8396554	8	Low woodland- Mixed species	Low
Other					
	225250	8401650	11	Disturbed area - Previous mining	



Section 7

Flora

Table 7-2 Summary table of vegetation communities and their location within the project area

Map Unit	Description	Mining lease area	South Road access	South West Road Access	Mine Water Dam
1	<i>Terminalia platyphylla</i> isolated low trees	•			
2	<i>Eucalyptus tectifica/ Corymbia</i> spp. Low open woodland	•			
3	<i>Eucalyptus pruinosa/ Erythrophleum chlorostachys</i> low woodland	•			
4	<i>Eucalyptus tectifica/ Corymbia foelscheana</i> low woodland	•	•	•	
5	<i>Eucalyptus tectifica/ Corymbia dichromophloia/ Erythrophleum chlorostachys</i> low woodland	•			•
6	Riparian corridor/ low woodland	•			
7	Mixed species low open woodland	•	•	•	
8	Mixed species low woodland	•	•	•	
9	Mixed species mid open forest	•			
10	<i>Eucalyptus</i> spp. / <i>Corymbia</i> spp. woodland			•	
11	Vegetation disturbed by mining	•			

NB : Description represents dominant upper stratum species and NVIS level 2 structural formation class.

Open woodland communities were typically located in shallow, poorly drained soils subject to water logging during the wet season. Open woodlands also occurred along rocky ridges with skeletal soils, which tend to support fewer upper stratum species. *Terminalia platyphylla* was sparsely distributed across the dark heavy soils located in the central area of the mining lease (Figure 7-1). *Eucalyptus pruinosa* formed stands of low open woodland, often co-dominant with *Erythrophleum chlorostachys* on the clayey flats and poorly drained depressions adjacent to the existing waste rock stockpile.

The upper stratum height in open woodland communities ranged from 5 to 7 m, with a very sparse mid stratum layer. Areas of dense grass cover dominated by *Brachyachne convergens*, annual herbs and legumes were characteristic of open woodlands in the project area. Patches of bare ground were common in highly disturbed locations.

Riparian vegetation formed a narrow corridor of woodland and low woodland along the network of seasonal drainage lines and Gold Creek, which flows into Maud Creek. The dominant tree species were *Lophostemon grandiflorus*, *Corymbia foelscheana*, *Terminalia platyphylla* and *Eucalyptus patellaris*. The width of the Maud Creek riparian corridor was greater than that along Gold Creek and supported a more diverse vegetation community including *Corymbia bella*, *Melaleuca leucadendra*, *Ficus racemosa* and *Timonius timon*.



Section 7

Flora

7.1.4 Significant flora species

A search of the Northern Territory Government database for records of plant species collected from the Maud Creek project area revealed no previous records. Expansion of the search to include an area of 0.1 degree latitude and 0.1 degree of longitude which encompassed the project area produced a total of 51 records of plant species (NRETA database, 2007). Of that total, all are classified as LC (Least Concern) in terms of conservation status.

None of the 153 plant species recorded during this survey are listed under Commonwealth legislation (*Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)) as vulnerable, threatened, rare or endangered (see IUCN categories and criteria at <http://www.redlist.org>). Species listed under Commonwealth legislation are considered to have the highest conservation significance, being of importance at a national level. Species listed under NT legislation are important for conservation of Northern Territory flora, but are of lesser significance than Commonwealth listed plants.

One species *Tephrosia humifusa*, recorded at 5 of the 16 study sites surveyed, is listed as NT (Near Threatened) on the Northern Territory database (NRETA 2007). Near Threatened taxa are not classified as threatened, and exist either as small fragmented populations, or occur in populations thought to be in decline (Appendix E). All other plant species recorded during the flora survey are listed as LC and are of lower conservation significance (Appendix E). Plant species classified as LC are considered to be widespread and abundant with healthy populations that are not in decline.

Although *T. humifusa* is classified as Near Threatened according to Northern Territory legislation under the *Territory Parks and Wildlife Commission Act* (TPWC Act), this species does not have conservation status on the Commonwealth EPBC register (EPBC Act). The conservation significance of Near-Threatened species is not as high as those with V (Vulnerable status) under Northern Territory listing, and is also potentially lower than many species listed as DD or Data Deficient (Appendix E).

T. humifusa appeared to be common locally, occurring at over one quarter of full floristic study sites and in a range of habitat types from low open woodland to low woodland and open forest along riparian corridors (Figure 2, Appendix E). The NT Herbarium contains records of *T. humifusa* from 5 different locations in the Top End of the Northern Territory. The current known distribution for this species appears to span an area from Maningrida to the southern end of Kakadu National Park. The Maud Creek population represents a sixth location for this species and an extension of the known range.

T. humifusa is an annual species, unlikely to be recorded during dry season surveys. The paucity of records and information for *T. humifusa* from elsewhere in the Northern Territory is not surprising given the poor wet season access to the low-lying habitats where it occurs, and its ephemeral life cycle. It typically occurs in habitats with heavy soils, which tend to be poorly drained but is also occasionally found on fine sediments on hillsides. Its likely distribution within the project area may be roughly correlated with communities in which *Eucalyptus tectifera* is dominant.

It is probable that future botanical surveys in suitable habitats in this region during the wet season are likely to reveal a wider distribution for this species (Appendix E). Crawford and Metcalfe (authors of Appendix E), on the advice of the NT Herbarium, recommended that clearing within the project area of vegetation communities and habitats that support this species, should be avoided as far as possible so as to conserve this species. No other special provisions for the conservation management of *T. humifusa* are suggested by the NT Herbarium (Appendix E).

7.1.5 Introduced Weed Species

A total of 19 exotic species were recorded during the 2007 vegetation assessment survey. Six species are declared as Class B under the Northern Territory *Weed Management Act 2001* indicating that the land owner must make a reasonable attempt to control and prevent the spread of these species. A further

Section 7

Flora

eleven environmental weeds, which do not have declared status under the *Weeds Management Act 2001*, were also recorded within the project area (Table 7-3).

Previous land use activities within the Maud Creek project area have contributed to the patchy distribution of weeds. Dense weed infestations have become established in highly disturbed areas. Elsewhere, weed density ranged from isolated plants to scattered clumps and localised dense infestations. The highest weed densities were observed at stock watering points, along drainage lines (particularly on highly disturbed creek banks), fringing vehicle access tracks and in areas of terrain disturbance from previous mining.

Three weed species (*Hyptis suaveolens*, *Calotropis procera* and *Crotalaria goreensis*) were recorded in a previous survey of a proposed access road (Appendix E) with *Hyptis* noted as the most widespread and abundant weed. Pastoral lease condition surveys by DPIFM officers also noted dense infestations of *Hyptis* within the mining lease and the presence of Devil’s claw (*Martynia annua*, undeclared) and Candle Bush (*Senna alata*, declared class B) as occurring within several kilometres of the project area.

H. suaveolens remains the most abundant and widespread weed throughout the mining lease area and along the existing access road. Infestations of *Hyptis* along the existing road range from sparse plants interspersed with native grasses to very dense monospecific infestations that clearly dominate the ground cover vegetation. Extremely dense populations of *Senna obtusifolia* were observed at the stock watering point along the existing road access and at the tanks and bore area in the north-west corner of the lease, where it forms blanket coverage.

Table 7-3: List of weed species recorded during survey of the Maud Creek project area in March-April 2007 indicating declared status under NT legislation.

Family	Genus & species	Common Name	Class	Location (Study site no.)		
				MC	GT	RA
DECLARED NOXIOUS WEEDS						
ASCLEPIADACEAE	<i>Calotropis procera</i>	Rubber bush	B South of 16° 30' latitude	4, 15		
CAESALPINIACEAE	<i>Senna obtusifolia</i>	Sicklepod	B	1, 3, 4, 8, 9, 10, 15	17,18, 21, 24, 25, 27	3, 4, 8, 9
LAMIACEAE	<i>Hyptis suaveolens</i>	Hyptis	B	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13.	1, 8, 9, 10, 12, 16, 17, 18, 19, 21, 24, 25, 27, 28, 29	1, 2, 3, 4, 5, 6, 7, 8, 9.
MALVACEAE	<i>Sida acuta</i>	Spinyhead sida	B	2, 3, 4, 6, 8,	1, 4, 10, 21	8, 9
POACEAE	<i>Themeda quadrivalvis</i>	Grader grass	B		21	
POACEAE	<i>Pennisetum polystachion</i>	Mission Grass	B		21	
UNDECLARED ENVIRONMENTAL WEEDS						
ASTERACEAE	<i>Bidens bipinnata</i>	Cobblers peg	-	5		
ASTERACEAE	<i>Tridax procumbens</i>	Tridax	-		17 ,23	



Section 7

Flora

Family	Genus & species	Common Name	Class	Location (Study site no.)		
				MC	GT	RA
FABACEAE	<i>Alysicarpus ovalifolius</i>	Buffalo clover	-	1, 5, 6, 12, 13, 15	17, 21	
FABACEAE	<i>Calopogonium mucunoides</i>	Calopo	-	4	21, 27, 28	
FABACEAE	<i>Crotalaria goreensis</i>	Gambia pea	-	15	27, 28	6
FABACEAE	<i>Macroptilium atropurpureum</i>	Siratro	-	4	21, 27, 28	
FABACEAE	<i>Macroptilium lathyroides</i>	Phasey Bean	-		21	
FABACEAE	<i>Stylosanthes hamata</i>	Carribbean stylo, Verano	-	3, 4, 5, 8, 10, 13, 15, 16	17, 18, 21	3, 4, 6, 7
PASSIFLORACEAE	<i>Passiflora foetida</i>	Wild passionfruit	-	1, 4, 5	21, 27, 28	
PEDALIACEAE	<i>Sesamum indicum</i>	Sesame	-	4, 8		
POACEAE	<i>Echinochloa colona</i>	Barnyard grass	-	4		

KEY TO WEED CLASSES:

- A To be eradicated** - Reasonable effort must be made to eradicate the plant within the NT
- B Growth and spread to be controlled** - Reasonable attempts must be made to contain the growth and prevent the movement of the plant
- C Not to be introduced to the Territory** - All Class A and Class B weeds are also considered to be Class C weeds
- **Weeds of environmental concern** - Weeds that may threaten natural ecosystems but are not declared in the *Weeds Management Act 2001*

The results of vegetation surveys of the proposed access road indicated that the majority of the route was currently relatively weed free (Appendix E). However, moderately dense infestations of *H. suaveolens* were located adjacent to sites GT17, GT18, & MC14. Along the proposed route and approximately 1.5 km from the Stuart Highway (at site GT21) another dense and diverse infestation of weeds was recorded. Two declared class B grass species, *Pennisetum polystachion* (Mission grass) and *Themeda quadrivalvis* (Grader grass) were found only at this location (Appendix E).

The Northern Territory *Weed Management Act 2001* places obligations on land owners and occupiers to manage the introduction and spread of declared weeds and to comply with approved weed management plans relating to declared weeds on their land.

A comprehensive Weed Management Plan is the recommended framework for landholders to identify, prioritise and to deal with both declared weeds and undeclared weed species reported to be of further concern to the environment. A Weed Management Plan for the project area will be prepared to adequately address weed management issues and to minimise the potential impacts of weeds on the environment.

7.2 Potential impacts of proposal

The proposed Maud Creek project is anticipated to have a number of potential impacts on the existing vegetation: clearing of vegetation, weeds, fire, dust and pit dewatering impacts.



Section 7

Flora

7.2.1 Clearing and other direct impacts

Despite the loss (in the short to medium term) of existing natural habitats, clearing for mining activities and associated infrastructure does not pose any known threats to the survival and viability of any individual native plant species or vegetation community (Appendix E).

Vegetation communities at the proposed operations site

The proposal has changed considerably since the flora survey was conducted by Crawford and Metcalfe. Originally there were greater areas of disturbance. These have been reduced and currently only three vegetation communities listed in Table 7-2 will be affected, and only to a minor extent - *Eucalyptus pruinosa* / *Erythrophleum chlorostachys* dominant in a low open woodland, low woodland with *Eucalyptus tectifica* / *Corymbia foelscheana* and woodland habitat with mixed *Eucalyptus* and *Corymbia* species. The majority of impacts will be in the mine area, shown as map unit 11 in Figure 7-1.

In general, the vegetation communities and plant species affected by construction are represented in other sections of the lease area and occur elsewhere the region generally. None of the communities likely to be impacted by construction and/or operations are habitats of high ecological significance.

Vegetation communities traversed by the proposed new access road

The proposed new access road (Option 1) will exit the south-west corner of the lease and represents an alternative route for the haul road to the Stuart Highway (Figure 1-3). This road alignment would replace the existing access road (i.e. that entering via Ross Road, see Appendix E) as the main access road for the mine. A major benefit of the proposed access road is that it avoids crossing any major drainage lines, including Gold Creek.

Just south-west of the main lease area, the proposed road alignment traverses *Eucalyptus tectifica* / *Corymbia dichromophloia* / *Erythrophleum chlorostachys* low woodland. Assessment of this area did not reveal any plant species of conservation significance, but this was the only location in which this particular community was mapped and described during the 2007 vegetation survey.

The road continues through low woodland and low open woodland before connecting with an existing vehicle track/fence line where significant disturbance to the vegetation from pastoral activity and weed invasion is already evident. Once diverting from the track, the proposed road will traverse woodlands dominated by *Eucalyptus* and *Corymbia* species where native grasses are abundant and weed infestation is low (Appendix E). Road construction activities could facilitate the introduction of weeds into these adjacent, relatively undisturbed areas (Appendix E).

Road construction generally also facilitates increased frequency of wildfires and controlled burns, lit for fire management purposes. Hence a potential indirect impact of road construction in fire-sensitive and fire-affected communities may be habitat degradation, due to increased frequency of fire.

Vegetation communities at the proposed mine water dam area

The original proposal detailed clearing for a mine water dam; this is no longer the case with the mine water dam now proposed to remain on the existing waste rock stockpile (from previous mining) within the bunded area (see Figure 2-3 or 6-4), corresponding to map unit 11 in Table 7-2, vegetation disturbed by mining.

7.2.2 Introduction and spread of weeds

Weeds are abundant and well established throughout the majority of vegetation communities within the lease area and the existing access road. Weed infestations are particularly dense along drainage lines and

Section 7

Flora

waterways, fence lines and vehicle tracks and at watering points for stock. The construction of infrastructure and the access road will increase the total area of terrain disturbance where weeds can proliferate and potentially exclude native vegetation.

Disturbance of the soil can also increase germination of weed seeds that were previously dormant in the soil seed bank. Furthermore, the introduction of earthmoving equipment to the area has the potential to introduce new and declared weeds listed in the *Weeds Management Act 2001* e.g. *Jatropha gossypifolia* (Bellyache bush).

The potential for mine construction and operation to encourage the spread of weeds, particularly the tall exotic grasses Mission Grass (*Pennisetum polystachion*) and Gamba Grass (*Andropogon gayanus*) represents perhaps the most significant threat to native vegetation and fauna from the proposed development. These species exclude native grasses and vegetation as well as supporting very intense fires, late in the dry season (Appendix E).

An invasion of any of these introduced grasses would pose a major threat to native flora and fauna (Appendix E). The growth, establishment and spread of these grasses can be exacerbated by disturbance, particularly vegetation clearing and soil disturbance associated with, mining activities. The rapid spread of weeds into new areas along linear corridors associated with roads and service corridors could occur, if adequate and on-going weed control were not maintained.

7.2.3 Fire management

Fire is inevitable in the woodland vegetation found within the project area. The Bushfires Council of the NT requires landholders to undertake a number of actions to manage fire, including managing the perimeters of the properties. This may require slashing and burning to prevent entry of wildfires or escape of fires from the property. Fire breaks coupled with adequate and appropriate prescribed burns will effectively manage fires on the lease, and reduce the risk of wildfires entering or emanating from the lease area.

7.2.4 Dust impacts

During the clearing, mining and transport of materials associated with this mining proposal, some dust will be generated within the lease area and along the transport corridors. Dust has the potential to coat the leaves and stems of exposed vegetation in the immediate vicinity, and if sufficiently thick can have a negative impact on plant growth and survival. It is unlikely, however, that the level of dust generated at the mine site or along the haul road will have a significant impact on survival, growth or vigour of affected vegetation (Appendix E).

7.2.5 Impacts on vegetation at pit dewatering and irrigation sites

The water table in areas surrounding the pit will be lowered due to dewatering operations, a process that may span 5 years (and up to a maximum of 10 years). The lowering of groundwater is likely to affect surrounding ecosystems for approximately 4 - 6 months during the dry season.

Those vegetation communities most dependent on groundwater (e.g. freshwater swamp, floodplain or riparian habitats) will be potentially the most affected by a reduction in groundwater. Other habitats better adapted to seasonal drought will be less affected by pit dewatering operations.

The lowering of groundwater is not expected to affect vegetation on Maud Creek or other riparian habitats downstream, as the catchment of Gold Creek is relatively small and a number of other (unaffected) tributary creeks also feed into Maud Creek.

Section 7

Flora

The water application rate to irrigation areas will need to be managed to prevent waterlogging impacts. In general, poorly drained and seasonally wet habitats characteristically have only sparse tree cover, and comprise relatively few tree species adapted to several months of boggy conditions and/or inundation. Ground layer vegetation generally comprises sedges and grasses adapted to swampy conditions.

The magnitude of the impact of irrigation from pit dewatering will depend on the native vegetation community affected (i.e. its natural tolerance of wet conditions). The duration and amount of water logging will also determine the impact of irrigation on existing vegetation.

7.3 Mitigation of impacts

Mitigation measures need to be implemented to minimise the impact of the project on the existing vegetation and ecological values of the area, particularly in relation to the bordering Nitmiluk National Park. The primary impacts on native flora relate to vegetation clearing and the potential for introducing and spreading weeds in vegetation communities surrounding the project lease area, access roads, and the irrigation areas. The potential impacts on the biodiversity values of native vegetation are considered below in terms of clearing, weed, fire, dust and irrigation management guidelines.

7.3.1 Vegetation clearance

Clearing of vegetation needs to be minimised for each section of the development. The boundaries of the areas to be cleared need to be clearly identified to contractors or mine operators prior to any clearing works taking place.

Additional areas required for plant turn-around areas, construction access tracks, storage areas and construction camps, will be kept to a minimum and immediately rehabilitated after construction.

Where practicable, vegetation removed from weed free areas needs to be used as mulch or sediment barriers in rehabilitation. Vegetation from weed infested areas needs to be burnt.

Topsoil (surface 0-10 cm) needs to be conserved as far as is practicable and respread immediately after works are completed, to facilitate rapid revegetation. Local provenance sources of native plant species need to be used where required in land rehabilitation. Rehabilitation and revegetation of disturbed areas needs to be commenced as soon as possible after they are no longer required for mining operations.

Revegetated areas need to be monitored to ensure satisfactory rehabilitation in terms of ground cover and weeds. Grazing animals should be excluded from newly revegetated areas.

7.3.2 Weed management

All six of the declared weeds discovered during the survey were class B/C (under NRETA's declared weed schedule), which requires that all reasonable attempts be made to contain further growth and spread of these species pursuant to the *Weed Management Act 2001*. The Terra Gold Weed Management Plan (Section 19.5) incorporates the following measures to ensure effective prevention of the spread of declared and other environmental weeds:

- regular (6 monthly) monitoring of weeds in construction areas during the construction phase;
- weed species identification and timely eradication in annual weed management actions in the project area;
- review and benchmarking of the weed management plan based on monitoring activity;

Section 7

Flora

- wash down and inspection of vehicles and earth moving equipment to ensure adhering soil and vegetation have been removed before moving on or off the mine site; and
- checking of planting material from outside the project lease area (seeds, seedlings) to ensure that it is weed-free prior to being taken on site.

7.3.3 Fire management

A Fire Management Program incorporating controlled burning actions will be implemented in the construction, operational and closure phases of the project to minimise the risk of wildfire, and to manage biodiversity values. Fire management will be coordinated with weed control activity and any rehabilitation works, to ensure effective land management.

Planting of pasture grasses that constitute an increased fire risk, namely Gamba Grass (*Andropogon gayanus*) and Mission Grass (*Pennisetum polystachion*), will be avoided. It is recognised that these grasses need to be controlled or eradicated to reduce the severe fire risk posed to infrastructure, rehabilitation and native habitats.

7.3.4 Dust management

Dust suppression on unsealed roads in the mine area needs will be undertaken as necessary during dry and windy weather, both during construction and operation. Dust monitoring will be carried out in areas considered to be problematic.

Revegetation of bare areas will be encouraged by respreading topsoil where this is practical.

7.3.5 Irrigation Areas

An appropriate irrigation rate and application system, to prevent soil waterlogging leading to land degradation and runoff to the receiving environment, is needed to ensure acceptable long term environmental performance.

7.4 Commitments

Terra Gold commits to minimising the area to be cleared during construction and mining operations.

Terra Gold commits to applying recognised best practice in its revegetation program.

Terra Gold commits to minimising dust impacts on native vegetation by regularly watering haul roads and run of mine areas to control dust.

Terra Gold commits to an active weed management and mitigation program for the project area.

Terra Gold commits to an active fire management program incorporating fuel reduction burns, fire break maintenance and control of high fire risk pasture grasses around the mine site to minimise the risk of hot wildfires, and to enhance biodiversity values where appropriate.

Terra Gold commits to managing the rate of water application to irrigated land so as to prevent land degradation, and potential off site environmental impacts.