

PANDANUS SOLUTIONS

GREENCOAST ENVIRONMENTAL REHABILITATION - CRESCENT HEAD STOCKPILE



SITE SURVEY REPORT - FEBRUARY 2018

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Project Title: Crescent Head stockpile site survey report

Prepared For: Greencoast Environmental Rehabilitation

Report History:

Draft 1: Prepared by Paul Smith, completed 7th March 2018

Final Report: Prepared by Paul Smith, finalised 18th March 2018

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1. Introduction

Pandanus Solutions was engaged by Greencoast Environmental Rehabilitation (GER) to conduct a field assessment of the flora, fauna and surface radiation levels on an abandoned Ilmenite waste stockpile, located on Lot 2281 DP1153793, approximately one kilometre from the township of Crescent Head, NSW.

The stockpile is located on a former mining lease, that was mined in the late 1950's and continued to the late 1970's. Since mining ceased, the stockpile appears to have been left to revegetate naturally.

GER is seeking approval under the NSW Mining Act (1992) to gain approvals required to remove the Ilmenite stockpile down to natural ground level, and rehabilitate the stockpile footprint. The stockpile covers an area of approximately two hectares.

This site survey forms part of GER's approval documentation to obtain a mining permit and development approval for the stockpile removal and revegetation. There are a series of specific requirements that need to be addressed as part of the site survey. GER has indicated that, in order to progress application as part of SEARS (Secretary's Environmental Assessment Requirements) Kempsey Council, Crownlands and the OEH requested the proponent to address the specific requirements outlined below.

In addition to the flora and fauna survey, surfaced radiation readings were also collected whilst on site on behalf of GER and provided to a specialist radiation consultant for assessment. Site inspection, sampling and observation occurred over a four day period, from the 3rd to the 6th of February 2018, with night, dawn and dusk surveys for Fauna also being undertaken during this period.

1.1. Kempsey Shire Council requirements

Kempsey shire council outlined their main areas of concern as follows:

- A Flora and Fauna assessment is required as the site is identified as comparisons a Potential Endangered Ecological Community, may contain Threatened Flora and is within a Wildlife Corridor
- Assessment against Council's Comprehensive Koala Plan of Management. The site is identified as Primary, Secondary Class A and unknown koala habitat

1.2. NSW Planning and Environment Department requirements

The NSW planning and environment department has set the following requirements of a biodiversity survey:

1. Undertake target surveys for the following threatened species, and their habitat listed under Schedule 1 of the Biodiversity Conservation Act 2016 and assess the impacts of the proposal on these species:
 - Koala *Phascolarctos cinereus*, due to site records, and the presence of mapped primary and secondary A koala habitat under the "Comprehensive Koala Plan of

Management for the Eastern Portion of the Kempsey Shire Local Government Area, dated May 2011,

- Sand Spurge *Chamaesyce psammogeton* and Silver bush *Sophia tomentosa*, as they are recorded within adjoining lands

2. Consider habitat for the following threatened species under Schedule 1 of the Biodiversity Conservation Act 2016, determine the need or otherwise for target survey of these species and assess the impacts of the proposal on these species:

- Austral toadflax *Thesium australe*, as it is recorded within adjoining lands
- Little Bentwing-bat *Miniopterus australis* and Glossy Black Cockatoo *Calyptorhynchus lathami* in assessing habitat resources present within the subject lands
- Osprey *Pandion cristatus* and the potential nesting sites within the vicinity of the subject lands

3. Undertake targeted survey to determine the presence or absence of the following threatened ecological communities (TEC) listed under Schedule 2 of the Biodiversity Conservation Act 2016, in accordance with the NSW Scientific Committee Determinations which can be found on the OEH website at: <http://www.environment.nsw.gov.au/determinations/>:

- Swamp Sclerophyll Forests on the Coastal floodplains of the NSW North Coast, Sydney Basin and South-east Corner Bioregions
- Subtropical Coastal Floodplain Forest of the NSW North Coast Bioregion

4. Assess the proposal's impacts on the:

- wildlife corridor function between the surrounding areas of Goolawah National Park, and as part of the greater regional coastal corridor, given the subject land is surrounded by OEH Estate Lands
- localised hydrology, especially as it relates to surface and subsurface water flow and likely effects on water dependant ecological communities within the adjoining Goolawah National Park and Crown Lands
- environmental health of the subject lands, resulting from the ilmenite pile disturbance, especially as it relates to threatened species, ecological communities, or their habitats on and adjoining the subject lands

1.3. Crown Lands

Crown lands has requested the following:

- Feral animal assessment and feral animal controls at the site - ensuring activities do not increase opportunities for feral animal presence or abundance at the site. Benchmark studies are to be undertaken to understand the baseline presence, distribution and abundance at the site prior to works being undertaken

- An assessment of likely significant impacts on threatened species, populations, ecological communities, or their habitats, additionally any Wildlife Corridors or Koala Habitats.

1.4.Site History

Sand mining in the area from the south of the Crescent Head township to Point Plomer commenced in 1957 by Mineral Deposits Ltd. The Crescent Head operation comprised three simple dredges in ponds and a separating plant using land based spiral units with the concentrates treated at a dry mill adjacent to the the existing stockpile.

The Crescent Head dry mill was one the company's two mills to produce approximately 75000 tonnes of rutile, zircon and monazite concentrates annually from its eight mines until the late 1960's and 1970's.. Between 1957 and 1960, Mineral Deposits Ltd is said to have produced 19,215 tonnes of rutile and 14,021 tonnes of Zircon from the Crescent Head operation, Morely (1981).

2. Site Survey Methodology

2.1. Vegetation assessment

Vegetation survey of the ilmenite stockpile and surrounds took place over four consecutive days. Survey methodology was tailored to the site with the primary pile area surveyed on a 25 metre grid as this will be the subject of the ilmenite removal and the surrounding area is not intended for disturbance.

Opportunistic surveys of the larger lot area also occurred during this period with the perimeter of the lot being traversed and points of interest (drainage trench) also being inspected. The grid, and perimeter walk locations are shown on Figure One.

The vegetation survey methodology consisted of all plants being identified along each transect, with any additional species within a five metre radius of the tape being added to the species list. Presence / Absence only was recorded with notes taken on relative abundance as required.

The entire survey area has been previously disturbed and no particular ecotype / vegetation community has yet been established. Some of the stockpile has evidence of previous tree plantings (such as random *B. integrifolia* plantings throughout the main body of the pile and the row of single age *E. tereticornis* planted along the roadside), however the majority of the pile shows only natural regeneration, mostly from weed species.

The stockpile is very heavily impacted by weed species, and suffers floristically from a lack of organic material as there is minimal visible topsoil of any kind over the majority of the pile. Despite the disturbed nature of the site, vegetation ecotypes have been described where applicable.

2.2. Fauna assessment

Ground searches for fauna occurred concurrently with the vegetation assessment over the 25 metre grid (Figure One). Dawn and dusk observations and call listening was undertaken on the 4th, 5th and 6th of February, with one nighttime spotlighting walk conducted on the night of the 5th.

Any trees encountered with the potential to be habitat trees were searched at the base for scats, the trunks for claw marks / scratches / sap bleeds and searches were made of the canopy for wildlife using binoculars.

2.3. Radiation survey

Surface radiation readings were taken one meter above ground level on the stockpile, from off-stockpile (background), as well as from the nearby township of Crescent Head. Readings on the stockpile were taken on roughly 20m distances, with locations dependent on thickness of vegetation overgrowth. The survey results were tabulated and provided to GER for subsequent assessment by an independent radiation consultancy.

3. Results

3.1. Vegetation assessment

As indicated, the ilmenite pile was surveyed intensively for vegetation, fauna and radiation levels. From the survey work conducted it is very clear that the entire stockpile is heavily impacted by weeds and influenced by the lack of a discernible topsoil layer. From the age of the vegetation that has established on the pile itself, and the surrounding vegetation on the entire lot, it is quite evident that the majority of the site is regrowth.

The regrowth present on the survey area can be loosely grouped into a series of vegetation types, mostly associated with access to water, soil and / or time since disturbance. The survey results have thus been classified into the following “vegetation communities” and a comparison made to the “typical” undisturbed vegetation communities that it may represent at some point in the future.

The vegetation survey transects are illustrated in Figure Two, with a full species list detailed in Table One.

3.1.1. Eastern fringing wetland vegetation

There is a shallow water filled trench or drainage channel that runs almost the entire length of the eastern side of the pile and this also wraps around the boundary of the Ilmenite pile to the north (all off stockpile).

The trench was presumably constructed to drain groundwater from the pile itself during mining operations and may also have served as a collection drain for the runoff from the pile (as the ilmenite would have been placed as a slurry originally).

The fringing bank of the trench has revegetated naturally to represent an establishing melaleuca woodland, with some other lowland coastal rainforest species establishing such as *Acmena smithii*, *Ficus spp.* and young *Melicoye elleryana*. All of this is off the main stockpile area.

Floristically this forest type is very simple, with only a few tree species and limited ground cover present in the area (mainly sedges such as *Juncus continuus*, Ferns including *Blechnum indicum* and grass species *Oplismenus hirtellus*). Weeds such as *Lantana camara* and *Chrysanthemoides monilifera rotundata* are also present, however the dense canopy of the Melaleuca has restricted their spread. Importantly, the entire trench is covered in a very thick layer of the weed *Salvinia molesta*.

Plate One: Off stockpile looking south



Plate Two: On stockpile looking off-stockpile to the south



3.1.2. Main stockpile vegetation

Plant establishment on the stockpile has been relatively limited and the tree species present on the pile are both sparse and relatively young. There are some a few tree species, such as *E. pilularis* and *B. integrifolia* that appear to have been planted as part of a previous unsuccessful revegetation program due to their relatively young age. There are some larger trees, that have either been present prior to the pile being placed (partially buried) or have established from seed (*Ficus spp.*). There are also a small number of *Pinus elliotii* present on the pile itself.

The mid and understory species characterise the pile vegetation type, notably due to their hardy nature (the pile is almost entirely devoid of topsoil) and their vegetative regrowth habitats. Native understory species are represented primarily by *Pteridium esculentum* and *Acacia sophorae*. Unfortunately the most dominate species present (dominant in both biomass and number) on the pile is *Lantana camara*. The second most dominant weed species present is *Chrysanthemoides monilifera rotundata* although this is not as dense as the Lantana.

Grass species were many and varied, but were mostly represented by the native *Imperata cylindrica* and introduced *Paspalum urvillei*.

Plate Three: On-stockpile looking east



3.1.3. Roadside vegetation

The roadside vegetation consists of a slashed grass edge, and a densely planted strip of *E. teriticornis*. These trees are growing on the edge of the pile and appear to have all been established as a single age class, possibly through roadside planting for koalas, or as a screening planting.

E. teriticornis is present elsewhere on the site, however, not in a single age stand such as the roadside. Koala use of these trees was evident with scats, scratches and scent markings present within these trees.

Plate Four: Roadside trees between the Point Plomer road and the stockpile looking south



3.1.4. Southern fringing wetland vegetation

The southern region of the block and off the edge of the stockpile is similar to the Eastern Fringing wetland vegetation detailed in section 3.1.1 and is characterised by a very thick *Melaleuca* forest all of a similar age class.

However this area has a large number of remnant trees present which improve the floristic diversity of the site, and improve its habitat values.

Of note is the larger number of *Ficus spp.* and larger individuals of *E. robusta*. This area is also quite dense, with a number of coastal rainforest tree species.

The ground and mid storey contained sparse Lantana plants, and vines (*Smilax spp.*)

Plate Six: Off-stockpile looking east



Table One: Flora Survey (* indicates found on stockpile)

Tree and Shrub species	Common Name	Notes
<i>Acmena smithii</i>	Lilly Pilly	one or two individuals
<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	young individuals present on trench margins
<i>Banksia serrata</i> *	Old Man Banksia	looks to be planted
<i>Banksia integrifolia</i> *	Coast Banksia	very few scattered across site
<i>Corymbia intermedia</i>	Pink Bloodwood	uncommon
<i>Corymbia gummifera</i>	Red Bloodwood	uncommon
<i>Cupaniopsis anacardioides</i> *	Tuckeroo	one or two individuals
<i>Eucalyptus grandis</i> *	Flooded Gum	two to five individuals
<i>Eucalyptus pilularis</i> *	Blackbutt	looks to be planted, younger tree
<i>Eucalyptus racemosa</i> *	Scribbly Gum	two to five individuals
<i>Eucalyptus robusta</i>	Swamp Mahogany	present along trench and southern boundary
<i>Eucalyptus tereticornis</i>	Forest Red Gum	common along the road (single age stand - possibly planted) and larger individuals on northern boundary
<i>Ficus coronata</i>	Sandpaper Fig	common on trench margins
<i>Ficus macrophylla</i> *	Moreton Bay Fig	common on site margins and present on dead tree in centre of pile
<i>Livistona australis</i>	Cabbage Palm	young individuals present on trench margins
<i>Melaleuca quinquenervia</i>	Broad Leaved Paperbark	very common around pile margins
<i>Persoonia linearis</i> *	Narrow Leaved Geebung	one or two individuals

Mid and Ground Cover		Notes
<i>Acacia sohorae</i> *	Coastal Wattle	spread through the site, mostly wrapped in together with Lantana, Bitou and Smilax spp.
<i>Asplenium australasicum</i>	Birds Nest Fern	juveniles around water trench, mostly on fallen trees, some epiphytes in large remnants
<i>Blechnum indicum</i>	Swamp water fern	sparsely establishing around drainage area
<i>Cassytha glabella</i> *	Dodder	uncommon
<i>Coleocarya gracilis</i>	Tuft Rush	sparsely establishing around drainage area
<i>Fimbristylis nutans</i>	Fringe Rush	uncommon
<i>Gompholobium virgatum</i>	Wallum Pea	uncommon
<i>Hibbertia linearis</i>	Guinea Flower	uncommon
<i>Juncus continuus</i>	Rush	sparse along watercourse
<i>Melicope elleryana</i>	Pink Eudia	young shrubs common around margins of pile
<i>Pteridium esculentum</i> *	Common Bracken	Extensive cover, almost all parts of the site, except for very shady areas
<i>Smilax australis</i> *	Barbed Wire vine	Common throughout site, quite dense amongst Lantana stands
<i>Smilax glycolphylla</i> *	Sarsaparilla Vine	Common throughout site, quite dense amongst Lantana stands
Grasses		Notes
<i>Digitaria parviflora</i> *	Smallflower Fingergrass	sparsely spread on exposed parts of the pile
<i>Eragrostis interrupta</i> *		on more exposed bare parts of the pile

<i>Eragrostis parviflora</i> *	Weepy Lovegrass	Common around carpark area
<i>Eriachne insularis</i> *		Common in dryer parts of the pile
<i>Imperata cylindrica</i> *	Blady Grass	very common in dryer parts of the pile especially northern end associated with little to no topsoil, in association with Bracken
<i>Panicum simile</i> *	Two Colour Panic	present in dryer parts of the pile, near roadside
<i>Oplismenus hirtellus</i>	Shade Grass	Common along edge of water course
<i>Themeda triandra</i> *	Kangaroo Grass	few individuals
Introduced Species		Notes
<i>Chrysanthemoides monilifera (rotundata)</i> *	Bitou Bush	Spread throughout site, mostly round plants, interspersed with Lantana
<i>Lantana camara</i> *	Lantana	extensive coverage over the entire site, thickets on the pile surface and heavily infested on forested margins
<i>Paspalum urvillei</i> *	Paspalum Grass	widespread
<i>Pinus spp. (possibly elliotii)</i> *	Pine Tree	individuals present on site range in sizes to established trees
<i>Salvinia molesta</i>	Duck Weed	complete coverage of drainage channel

3.2. Fauna assessment

Fauna assessment of the site was restricted to a three day period, and therefore was limited to observational recordings and ground searches. Unlike traditional fauna surveys, no pitfall / cage trapping, remote camera or call playback surveys were undertaken, due to the size and highly disturbed / degraded nature of the site.

As such, there are limits to the detail of the fauna survey results. However, despite the limitations, there were a number of species recorded for the site and these are listed in Table Two below.

3.2.1. Fauna observations

Table Two details the fauna species encountered on site. As anticipated, the site is relatively poor quality habitat, and the pile itself possesses very low habitat values. The pile area was almost completely devoid of wildlife and the few encounters in this area were from very mobile species that were most likely traversing the site, or using the dense stands of weeds as daytime shelter.

Of the species encountered, the following need to be considered in any future development plans for the site:

- The Koala (*Phascolarctos cinereus*): Koala scats were observed on site at three separate locations (Plate Seven) and scratch marks that could be attributable to a Koala were observed on a number of large remnant trees (Plate Eight). Whilst no Koala individuals were observed during the survey period, a strong musty odour, attributable to a male Koala scent marking was detected from a grove of *E. tereticornis* which contained the freshest scat recorded.
- The Echidna (*Tachyglossus aculeatus*): One Echidna was seen adjacent to the site and a scat, comprised of insect parts and giving of a strong formic acid smell was found within the roadside vegetation.
- Sugar Glider (*Petaurus breviceps*): No gliders were observed during the survey period however a number of potential sap feeding scars were observed on *E. robusta* trees (Plate Nine and Ten). The local area is known to provide habitat for both Sugar and Squirrel Gliders, although the Sugar Glider is expected to be the most common of the two.

All other species encountered during the survey were common species and, as such, do not warrant additional conservation consideration or management actions. Examples of the species encountered include:

- A Lace Monitor (*Varanus varius*) observed climbing a tree (Plate Eleven),
- Bandicoot diggings (*Isodon macrourus*) (Plate Twelve), and
- Yellow Tailed Black Cockatoos (*Calyptorhynchus funereus*) flying over the site

Plate Seven: Koala scat below roadside trees between stockpile and road



Plate Eight: Scratch marks (off-stockpile)



Plate Nine and Ten: Sap feeding scars (off-stockpile)



Plate Eleven: Lace Monitor climbing tree (off-stockpile)



Plate Twelve: Bandicoot diggings



3.2.2. Potential Habitat Trees

A number of habitat trees were identified along the fringes of the Ilmenite stockpile.

Importantly, there were no potential habitat trees of significance identified within the pile boundaries itself. One tree is recorded (a *Ficus*) in the middle of the pile, purely as it is a day time refuge area for *Wallabia bicolor*, within the most weed affected area.

Potential habitat trees were trees that contained the following signs of fauna utilisation (Table Three):

- Visible tree hollows, or epiphytes that may provide roosting or nesting potential (Plate Thirteen and Fourteen)
- Food trees for specific species through provision of leaves, fruit or sap, and
- Trees where animals were observed

Plate Thirteen: Habitat tree (Strangler fig and remnant Koala tree) off-stockpile



Plate Fourteen: Koala habitat trees between stockpile and road



Table Two: Fauna Survey (* indicates found on stockpile)

Terrestrial Vertebrate Species - Birds	Common Name	Notes
<i>Corvus orru</i>	Torresian Crow	seen flying overhead on numerous occasions
<i>Scythrops novaehollandiae</i>	Channel Billed Cuckoo	calling from eastern margin one morning
<i>Centropus phasianinus</i>	Pheasant Coucal	seen at southern edge of pile, hunting in undergrowth, calling frequently
<i>Dacelo novaeguineae</i> *	Laughing Kookaburra	calling every morning at site eastern margin, individual followed survey team
<i>Psophodes olivaceus</i>	Eastern Whipbird	calling from eastern margin and thickets of lantana in morning and evening, especially before rain
<i>Gymnorhina tibicen</i> *	Magpie	common across the site
<i>Acanthiza nana</i>	Yellow Thornbill	seen early one morning
<i>Philemon corniculatus</i>	Noisy Friarbird	common across the site
<i>Pardalotus striatus</i>	Striated Pardalote	heard leaving site one morning
<i>Entomyzon cyanotis</i>	Blue Faced Honeyeater	Seen feeding in Moreton Bay Fig
<i>Zosterops luteus</i>	Silver Eye	small flock found in thick margin of trench
<i>Gallirallus philippensis</i>	Buff-Banded Rail	one individual seen at edge of pile in thick lantata
<i>Sphecotheres viridis</i>	Figbird	seen feeding on sand paper figs

<i>Chalcophaps indica</i>	Emerald Dove	southern end of survey area, in thick <i>Melaleuca</i> forest
<i>Colluricincla harmonica</i>	Grey Shrike Thrush	common in thicker parts of the pile margin and northwestern margin
<i>Cracticus torquatus</i> *	Grey Butcherbird	seen at car park area over survey period
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	in trees outside of pile, but flew over regularly
<i>Calyptorhynchus funereus</i>	Yellow Tailed Black Cockatoo	See flying over site late one afternoon
Terrestrial Vertebrate Species	Common Name	Notes
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	One individual seen leaving pile area
<i>Wallabia bicolor</i> *	Swamp Wallaby	Individuals seen moving across middle of pile in <i>Lantana camara</i> thicket most days of survey
<i>Phascolarctos cinereus</i>	Koala	scats found, scent marking on tree evident, scratches on trees evident
<i>Isodon macrourus</i>	Northern Brown Bandicoot	not seen, profuse diggings found on edge of pile, eastern edge, complete margin
<i>Petaurus breviceps</i>	Sugar Glider	not see in survey, however sap feed trees appear evident on northern margin of pile, near drainage trench
<i>Tachyglossus aculeatus</i>	Short Beaked Ecidna	two individuals seen adjacent to site, scat found on southern margin of site (strong smelling, containing insect parts)
Reptiles		Notes

<i>Varanus varius</i>	Lace Monitor	One individual found climbing tree on edge of pile
<i>Amphibolurus muricatus</i>	Jacky Lizard	one individual seen on fallen tree
<i>Pogona barbata</i>	Eastern Bearded Dragon	one individual seen on log in water trench
<i>Ctenotus robustus</i> *	Eastern Striped Skink	individuals seen on pile, in leaf litter among <i>Pteridium esculentum</i> and <i>Lantana camara</i>
Pest Species		Notes
<i>Felis catus</i>	Feral Cat	two individuals seen leaving site in the evening, whilst spotlighting
<i>Vulpes vulpes</i>	Fox	scats seen at car park area, one seen leaving site at night
<i>Canis familiaris</i>	Dog	heard barking at rear of pile one evening

Table Three: Habitat Trees and Fauna Observations

GPS COORDINATE SOUTH	GPS COORDINATE EAST	PHOTOGRAPH	NOTES
31°11'57.8" S	152°58'03.8" E	N/A	Eastern grey kangaroo scat
31°12'01.2" S	152°58'03.8" E	P1010627.jpg	Fresh koala scat
31°12'02.2" S	152°58'04.1" E		Fig tree
31°12'02.3" S	152°58'04.1" E	N/A	Bird observation point - Whip Bird, Channel Bill Cuckoo, Grey Shrike Thrush, Friar Bird, Butcher Bird
31°12'02.1" S	152°58'05.3" E	P1010660.jpg	Bird observation point - Magpie, Lorikeets, Black Cockatoos,
31°12'01.0" S	152°58'07.9" E	P1010693.jpg	Potential sap feeding tree. Water present in trench. Covered with weed Salvinia.
31°11'58.9" S	152°58'07.1" E	N/A	Feral animal scat, most likely fox.
31°12'02.1" S	152°58'06.4" E	P1010666.jpg	Swamp Wallaby scat
31°12'03.5" S	152°58'07.7" E	P1010654.jpg	Very large old paperbark & fig trees. Bandicoot digs edge of swamp.
31°12'00.9" S	152°58'06.3" E	N/A	Swamp Wallaby scat.
31°12'01.6" S	152°58'07.8" E	N/A	Large cliff approximately 10m above swamp. Fig Birds. Goanna.
31°12'02.7" S	152°58'08.4" E	P1010697.jpg	Sandpaper Fig, Fantail Palm, Bangalow Palm, Swamp Mahogany
31°12'02.8" S	152°58'08.4" E	P1010686.jpg	Potential sap tree.
31°12'01.0" S	152°58'07.8" E	P1010672.jpg	Goanna climbing tree

31°12'00.1" S	152°58'05.4" E	N/A	Old buried tree with Strangler Fig. Old tree indicates depth of Ilmenite & no clearing prior to pile placement (potential buried topsoil) Strong odour of wallabies. Presence of wallaby tracks / scats
31°12'00.1" S	152°58'07.6" E	P1010628.jpg	Off grid. Large Ficus.
31°12'00.5" S	152°58'07.7" E	N/A	Off grid. Bloodwood with sap markings & hollows.
31°11'56.4" S	152°58'05.1" E	N/A	Off grid. Large habitat tree - large gum.
31°11'56.4" S	152°58'05.5" E	N/A	Off grid. Habitat tree - large gum.
31°11'57.7 S	152°58'06.8" E	P1010724.jpg	Off grid. Major habitat tree - Strangler Fig & Flooded Gum.
31°11'57.8" S	152°58'06.6" E	P1010725.jpg	Off grid. Edge of pile. Major koala habitat tree.
31°11'57.8" S	152°58'06.5" E	N/A	Off grid. Major habitat tree - Bloodwood.
Various (5m from roadside)	Various (5m from roadside)	P1010717.jpg & P1010718.jpg	Roadside Koala tree single age, possibly plantings

4. Recommendations

4.1. Vegetation

In general, the vegetation cover present on the ilmenite pile site is largely a mixture of natural regrowth (mostly weed species) with remnant tree species around the boundaries of the pile (see Figure One).

Common ecological theory indicates that all vegetation cover, regardless of the condition, provides an ecosystem service or has intrinsic value for habitat of some kind. In the case of the Ilmenite pile, the majority of the pile extents surveyed holds little value as fauna habitat or a source of ecosystem services.

The pile itself holds little floristic value due to:

- The simple species assemblage,
- The lack of habitats, shelter, roosting or nesting sites, and,
- The dominance of weed species across almost the entire surface of the pile.

Recommendations for management of the pile and surrounds can therefore be grouped into managing the remnant vegetation and addressing the weed issues during removal of the pile material itself.

4.1.1. Retention of key vegetation

Remnant vegetation on the site is restricted to the edges of the pile and present along most of its boundary. Thicker remnant vegetation areas are present to the north and south of the pile itself. The small amount of native vegetation present on the pile itself is of little ecological value, due to it being almost completely overtopped by weed species and therefore it is recommended that it could be sacrificed in the rehabilitation (removal of the Ilmenite) from the area.

The key habitat trees listed in Table Three should be retained to provide habitat for returning fauna once the project is completed and all care should be taken to retain as many of these as possible during the removal of the pile material. It is recommended that the one habitat tree in the centre of the pile (the Ficus) could be removed and replaced once pile works are completed.

Remnant vegetation found to the south west of the pile and along the roadside should be retained intact where possible, to provide a continuous corridor of Koala habitat trees and a pathway for arboreal fauna. Retention of the roadside trees is recommended, however it is noted that all the understory (mostly weed species) and some established trees could be removed to provide access if required.

The areas recommended for retention and preservation are detailed in Figure Two

4.1.2. Terrestrial weed control

Due to the extensive nature of the weed cover on the pile itself, it is recommended that physical removal, and follow up weed control be performed prior to removal of the ilmenite.

Bitou Bush has been listed as a Key Threatening Processes to Biodiversity in NSW and a Weed of National Significance and Lantana as a Weed of National Significance and therefore all attempts must be made to control both of these species on site.

A removal and rehabilitation strategy will be detailed further in the Site Remediation Plan, however at a minimum it is recommended that the entire vegetative cover on the pile be managed to ensure it doesn't re-sprout, germinate from the seed bank or have a chance to reestablish on the site post pile removal.

It is recommended that weed management actions also extend to the some of the retained vegetation buffers areas, with selective control of the lantana understory encouraged to promote natural colonisation of native under-storey species. This could be achieved cost effectively by mechanical pulling of the weeds and follow up painting of the stumps.

4.2. Fauna

Despite the reasonable numbers of species encountered on site, only three species of concern were noted for the survey area. These species, whilst relatively common in the region, require some additional precautions during the remediation of the stockpile and subsequent rehabilitation of the site. This is detailed below

4.2.1. Habitat retention and preservation

As recommended in the vegetation management section, the retention of the habitat trees outlined in Table Three and Figure Two, as well as restricting clearing activities to the stockpile footprint only should offset any temporary disruption to fauna that may occur during the life of the project.

It is recommended that prior to clearing, all habitat trees listed be flagged with appropriate flagging tape colours and all site personnel informed of the need to retain these trees.

4.2.2. Clearing precautions

The author recommends that prior and during all clearing activities, a qualified spotter / catcher be employed to reduce the risk of accidental harm to any fauna present on site. The spotter catcher must be present whilst the site is cleared of vegetation, but is, in the authors opinion, not required to be present once clearing activities around the habitat trees are complete.

4.3. Specific SEAR's Requirements

As part of the scope of works for the site a series of specific requirements need to be addressed as part of the recommendations of this report. The specific questions were posed in section 1 of this report and are addressed in Table Five below.

Table Five: Specific SEAR's requirements

Government body requirement	Response
Kempsey Shire Council	
A Flora and Fauna assessment is required as the site is identified as comparisons a Potential Endangered Ecological Community, may contain Threatened Flora and is within a Wildlife Corridor	<p>No threatened Ecological Community was identified on site and the site did not contain any threatened fauna.</p> <p>Site is small in nature and removal of the Ilmenite pile, whilst retaining habitat trees as identified in Table Four will not compromise the integrity of the the Wildlife Corridor</p>
Assessment against Council's Comprehensive Koala Plan of Management. The site is identified as Primary, Secondary Class A and unknown koala habitat	Koalas were found on the edges of the Ilmenite pile, no habitat was identified within the pile itself and the surrounding habitat is very degraded making it marginal habitat at best
NSW Planning and Environment Department	
Undertake target surveys for the following threatened species, and their habitat listed under Schedule 1 of the Biodiversity Conservation Act 2016 and assess the impacts of the proposal on these species:	
Koala <i>Phascolarctos cinereus</i> , due to site records, and the presence of mapped primary and secondary A koala habitat under the "Comprehensive Koala Plan of Management for the Eastern Portion of the Kempsey Shire Local Government Area", dated May 2011	Koalas were found on the edges of the Ilmenite pile, no habitat was identified within the pile itself and the surrounding habitat is very degraded making it marginal habitat at best
Sand Spurge <i>Chamaesyce psammogeton</i> and Silver bush <i>Sophia tomentosa</i> , as they are recorded within adjoining lands	No Sand Spurge or Silver Bush were identified on site due to the extensive weed infestations and the disturbed nature of the site
Consider habitat for the following threatened species under Schedule 1 of the Biodiversity Conservation Act 2016, determine the need or otherwise for target survey of these species and assess the impacts of the proposal on these species:	
Austral toadflax <i>Thesium australe</i> , as it is recorded within adjoining lands	No Austral toadflax was identified on site due to the extensive weed infestations and the disturbed nature of the site

Little Bentwing-bat <i>Miniopterus australis</i> and Glossy Black Cockatoo <i>Calyptorhynchus lathami</i> in assessing habitat resources present within the subject lands	No individual Little Bentwing Bats were identified on site and no roosting habitat (caves or pipes) occurs on site or surrounds. No Glossy Black Cockatoos were identified on site and no food trees (<i>Allocasuarina</i> spp.) were identified in the vegetation survey
Osprey <i>Pandion cristatus</i> and the potential nesting sites within the vicinity of the subject lands	No Ospreys were identified on site and no suitable old growth trees suitable for nesting or roosting sites were identified on site. Site is located some distance from the sea shore
Undertake targeted survey to determine the presence or absence of the following threatened ecological communities (TEC) listed under Schedule 2 of the Biodiversity Conservation Act 2016, in accordance with the NSW Scientific Committee Determinations which can be found on the OEH website at: http://www.environment.nsw.gov.au/determinations/ :	
Swamp Sclerophyll Forests on the Coastal floodplains of the NSW North Coast, Sydney Basin and South-east Corner Bioregions	No threatened Ecological Community was identified on site and the site did not contain any threatened fauna.
Subtropical Coastal Floodplain Forest of the NSW North Coast Bioregion	Site vegetation is highly disturbed and does not represent vegetation communities consistent with the bioregions identified
Assess the proposal's impacts on the:	
wildlife corridor function between the surrounding areas of Goolawah National Park, and as part of the greater regional coastal corridor, given the subject land is surrounded by OEH Estate Lands	Site is small in nature and removal of the Ilmenite pile, whilst retaining habitat trees as identified in Table Four will not compromise the integrity of the the Wildlife Corridor
localised hydrology, especially as it relates to surface and subsurface water flow and likely effects on water dependant ecological communities within the adjoining Goolawah National Park and Crown Lands	Not a subject of this survey
environmental health of the subject lands, resulting from the ilmenite pile disturbance, especially as it relates to threatened species, ecological communities, or their habitats on and adjoining the subject lands	Site is small in nature and removal of the Ilmenite pile, whilst retaining habitat trees as identified in Table Four will not compromise the integrity of the the Wildlife Corridor, or disturb the adjoining ecological communities
Crown lands has requested that:	

<p>Feral animal assessment and feral animal controls at the site - ensuring activities do not increase opportunities for feral animal presence or abundance at the site. Benchmark studies are to be undertaken to understand the baseline presence, distribution and abundance at the site prior to works being undertaken</p>	<p>Feral animals were encountered on site and it is unlikely that removal of the Ilmenite pile will impact either negatively or positively on their numbers or distributions.</p> <p>All personnel present on site will ensure they collect and dispose of rubbish and food stuff so as not to encourage feral animals on site</p>
<p>An assessment of likely significant impacts on threatened species, populations, ecological communities, or their habitats, additionally any Wildlife Corridors or Koala Habitats.</p>	<p>Site is small in nature and removal of the Ilmenite pile, whilst retaining habitat trees as identified in Table Four will not compromise the integrity of the the Wildlife Corridor, or disturb the adjoining ecological communities</p>

5. References

Brooker M. I. H and Kleinig D. A: Field Guide to Eucalypts - Volume 1, South Eastern Australia, Third Edition; Blooming Books Pty Ltd; 2006

Cronin L: Cronin's Key Guide - Australian Palms, Ferns, Cycads and Pandans; revised edition; Envirobook 38 Rose Street, Annadale, NSW 2038; 2000

Cronin L: Cronin's Key Guide - Australian Rainforest Plants; Jacana Books, Allen and Unwin, 83 Alexander street, Crows Nest, NSW 2065; 2009

Holliday I: Melaleucas - A field and garden guide; Second Edition; Reed New Holland Publishers; 2008.

Menkhorst P. W: A Field Guide to the Mammals of Australia; Oxford University Press Pty Ltd; 2001.

Morley, I.W: "Black Sands - A History of the Mineral Sand Industry in Eastern Australia: The University of Queensland Press, 1981

Pizzey G. M. & Knight F.: The Field Guide to Australian Birds; Seventh Edition; Menkhorst P. (ed); Harper Collins Publishers Pty Ltd; 2003.

Wilson S. K. and Swan G: A complete guide to Reptiles of Australia; Reed New Holland Publishers; 2003



