

Australian Ilmenite Resources

Aquatic Vertebrate Survey



Australian Ilmenite Resources Pty Ltd
SILL80 Project, Mining Lease Application 27422

DW090024

May 2011

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REVISION STATUS

Revision No.	Description of Revision	Date	Approved
1	Development and Review	July 2011	Ian Brown
2	Internal Review	July 2011	Casey Hawkey
3	Final Review	Nov 2011	Justine Shailes

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Executive Summary

As part of Australian Ilmenite Resources Pty Ltd (AIR) SILL80 project, it is proposed that water be drawn from the nearby Roper River for ore processing. An assessment of the environmental impacts of this proposed operation included evaluation of water resources in the region, aquatic flora and fauna potentially present and the risks to these environmental values, with particular attention on impacts to threatened species.

The Roper River is one of the largest in the Northern Territory, one of the most pristine and is largely undeveloped throughout its catchment. Its annual flow is variable, being dependent on annual rainfall and groundwater discharge. Water is proposed to be drawn from the Flying Fox station pump hole, a naturally occurring perennial pool situated in the main channel of the Roper River that is utilised to supply stock water to nearby stations.

A matters of National Environmental Significance Search was undertaken, which identified three aquatic species listed as threatened potentially present in the proposed water extraction area.

A field survey of the water hole was undertaken on 19 May 2011. Fauna survey effort comprised gill netting, seine netting, spotlighting, setting baited traps and angling within the river at the location of the proposed pumping. Flora investigations comprised aquatic and riparian flora surveys in and around Flying Fox station pump hole. Other incidental observations, including water birds present, were recorded.

Thirty three fauna species were identified during the survey, including 17 fish, two reptiles, seven amphibians, four crustaceans, one mollusc and two birds. These were all new biological records for the area, with all of the species not being previously recorded within 10km of the area. Riparian vegetation was defined and four aquatic plant species were recorded. No species of conservation significance were found in the area, although it is assumed that several species, in spite of no evidence of their presence, would still be considered likely to inhabit the area at some stage of the year.

It is considered likely that Flying Fox station pump hole acts as a significant refuge during the late dry season, particularly in years of lower rainfall.

The proposed water extraction will have three key impacts:

- Diversion of water flow downstream and diminished environmental flow, with particular consequence to migratory fish which may be prevented from travelling up stream;
- Drawdown of water levels at point of extraction, particularly during dry seasons, compromising the refuge value of the pool to aquatic fauna; and
- Increased noise and activity in the area and continued disturbance from pumping operations.

Provided the water extraction operation is limited during periods of low to no flow, appropriate thresholds in water level observed and ongoing monitoring for detection of fauna impact is undertaken, it is considered unlikely that the water extraction operation will significantly affect the aquatic fauna or flora of the area, or the environmental values of the Roper River.

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Acknowledgements

Special thanks to David Wilson for preparation of equipment, sampling method development, project execution and peer review of this report. Thanks are also extended to the Darwin Museum for the generous loan of their boat for sampling purposes. Thanks to Moira Lanzarin at Numul Numul Station for providing accommodation during the sampling period. Thanks are also extended to Jojo Huddleston and Mark Sullivan for their local information concerning the sampling site.

1 Introduction

Australian Ilmenite Resources Pty Ltd (AIR) plan to develop its SILL80 Ilmenite Project within Mineral Lease Application (MLA) 27422. This area is located in the Roper River region of the Northern Territory approximately 105 km east of Mataranka and 8 km south of the Roper Highway. The project involves strip mining dolerite sills and processing this material using an on-site gravity separation plant to extract the ilmenite (FeTiO_3). Water is required for the gravity separation (washing) process. It is proposed that the water required for the washing process be obtained from the Roper River at a point approximately 12 km north of the processing site and outside of MLA27422 (Figure 2-1).

The *Guidelines for the Preparation of a Public Environment Report* prepared specifically for the SILL80 Ilmenite Project by the NT Department of Natural Resources the Environment the Arts and Sport (NRETAS) has identified water management, including extraction from the Roper River, as a key risk citing concerns about downstream users including wildlife. This report aims to identify the aquatic biota of the Roper River and the pool from where water will be extracted and, with the terrestrial fauna and flora survey (see Appendix B of the PER) give a comprehensive description of the biota and vegetation communities that need to be considered in this development. Furthermore, they support the development of the Water Management Plan which has the stated objective of ensuring a sustainable off-take of water from the Roper River including considerations of the riverine biota (See Appendix G of the PER).

This report, combined with the PER, aims to provide the information required to guide the Northern Territory Minister for Natural Resources, Environment and Heritage (the Minister) and the NT Government in assessing the potential environmental and social impacts of the proposal in accordance with the *Environmental Assessment Act 1982*.

1.1 Scope and Objectives

This report outlines the aims, methods and results of the aquatic vertebrate survey conducted at the proposed water extraction point on the Roper River in May 2011. Such a survey is important as it develops baseline knowledge on species presence with particular attention on threatened species and communities. The aims of this survey are:

- To identify potential species and habitats of significance at the water extraction point;
- Assess the likelihood of threatened species occurring at the water extraction point; and
- Utilise the information gathered within this survey to develop management strategies to minimise potential impacts on species located at the water extraction point.

The focus of this report is aquatic species, terrestrial species of the surrounding area and any species identified as migratory (Under the EPBC Act) are discussed in the Fauna and Flora Report (Appendix B of the PER).

2 The Roper River

The Roper River is a large river with a catchment of over 80,000 km² (Faulks 2001). It is one of the largest rivers in the Katherine region and is the largest Northern Territory river flowing into the Gulf of Carpentaria. The river is perennial in its upper reaches with supply throughout the dry season by discharge from the Tindall Aquifer (Zaar 2009). Faulks (2001) describes the Roper River as being in high to very high physical and ecological condition with generally little disturbance or degradation. Land use and tenure are predominantly pastoral and traditional Aboriginal use, and the majority of land is held under pastoral lease or Aboriginal land trusts as private freehold. Pastoral activities in the region are of generally low productivity and grazing occurs largely on native pastures. Several small communities are located within the catchment and rely on surface and groundwater supplies.

Importantly the community of Ngukurr is a major population centre (population approximately 1600) along the Roper River and is situated near the tidal limit of the river. This community draws most of its water from groundwater sources. However, the community regularly supplements their requirements with water drawn directly from the river. Any significant loss of water from the Roper River will cause the saltwater/freshwater interface to migrate upstream and deny the community of Ngukurr an essential source of freshwater.

Baseflow in the river over the dry season is variable from year to year and is largely dependent on discharge from the Tindall Aquifer, which in turn is dependent on the magnitude of the preceding wet season. Variability of rainfall also impacts on the flow conditions in the river during the wet season.

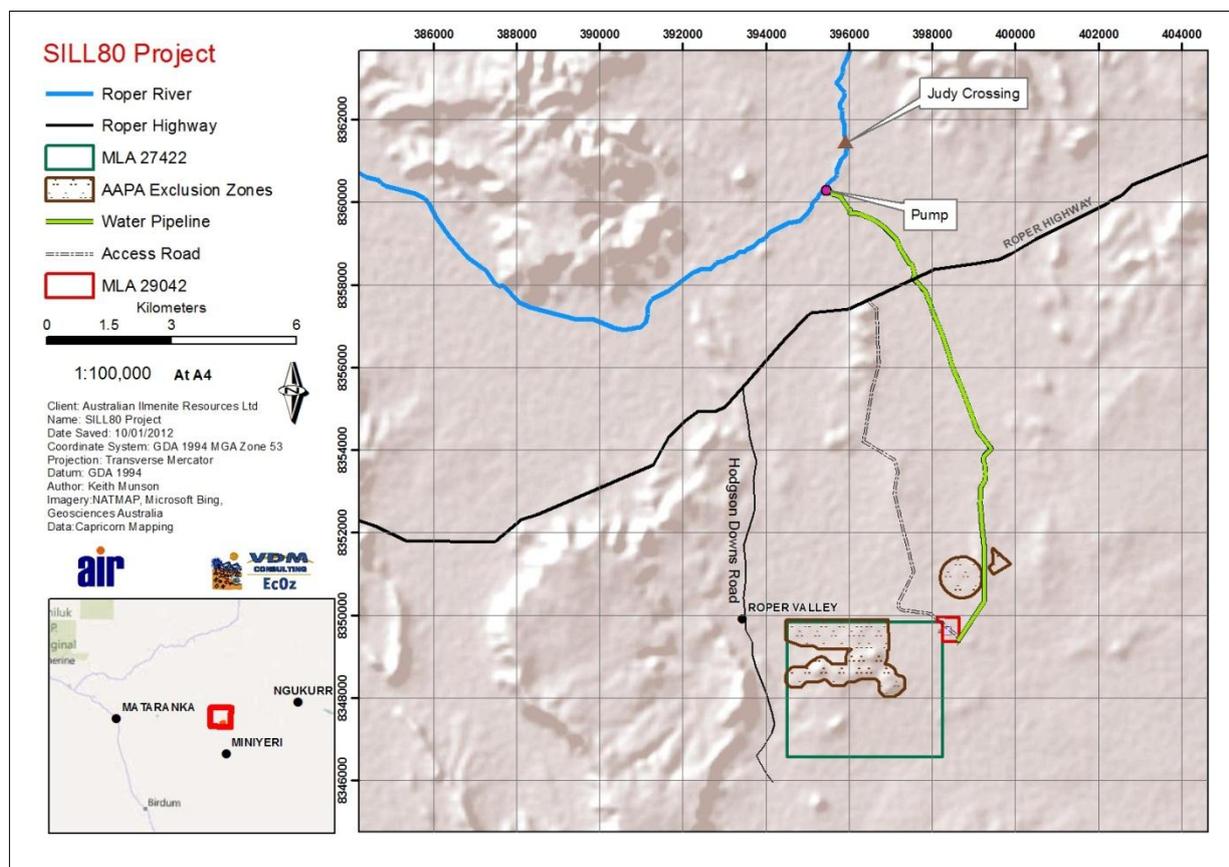


Figure 2-1: MLA27422, pipeline route and connection to the Roper River.

The Roper River along the stretch from which water extraction is planned is a losing stream (i.e. flow decreases with distance downstream). In dry years, when groundwater discharge is reduced from below average rainfall during the preceding wet season, it is expected that the river will cease to flow in the vicinity of the Flying Fox station pumping hole. Although records of flow at this point of the river are limited, cease to flow events have been recorded from the now closed gauging station at Judy Crossing. This gauging station was located approximately one kilometre downstream of the planned water extraction point. The records from the Judy Crossing gauging station allow other cease to flow events to be inferred from additional records for some years from gauging stations which have now been closed. The remaining operational gauging stations on the Roper River are located at Mataranka (G9030176) and Red Rock (G9030250) approximately 80 km upstream and 60 km downstream of the planned extraction point, respectively. Within this stretch there are limited permanent waterholes, so the pool proposed for water extraction may be a moderately important dry season refuge for aquatic flora and fauna.

Important wetlands on the Roper River have been identified at the headwaters and the mouth of the river. These are the *Mataranka Thermal Pools* and the *Limmen Bight (Port Roper) Tidal Wetlands System* respectively (Environment Australia 2001).

3 Desktop Review

3.1 Matters of National Environmental Significance within the Region

A search of matters protected under the EPBC Act for a 10 km radius (centring on Flying Fox stations pump hole - co-ordinates 14o49'46"S 134o01'42"E – Figure 3-1) indicated that matters of National Environmental Significance, namely Threatened and Migratory species (refer to Table 3-1) could be present within the region. Six nationally threatened, and fourteen nationally listed migratory species could potentially occur in the vicinity of the Flying Fox station pump hole according to EPBC Act protected matters report (refer to Table 3-2), however there are no nationally listed heritage places, marine areas, wetlands, or threatened ecological communities within close vicinity to the AIR proposed water extraction point.

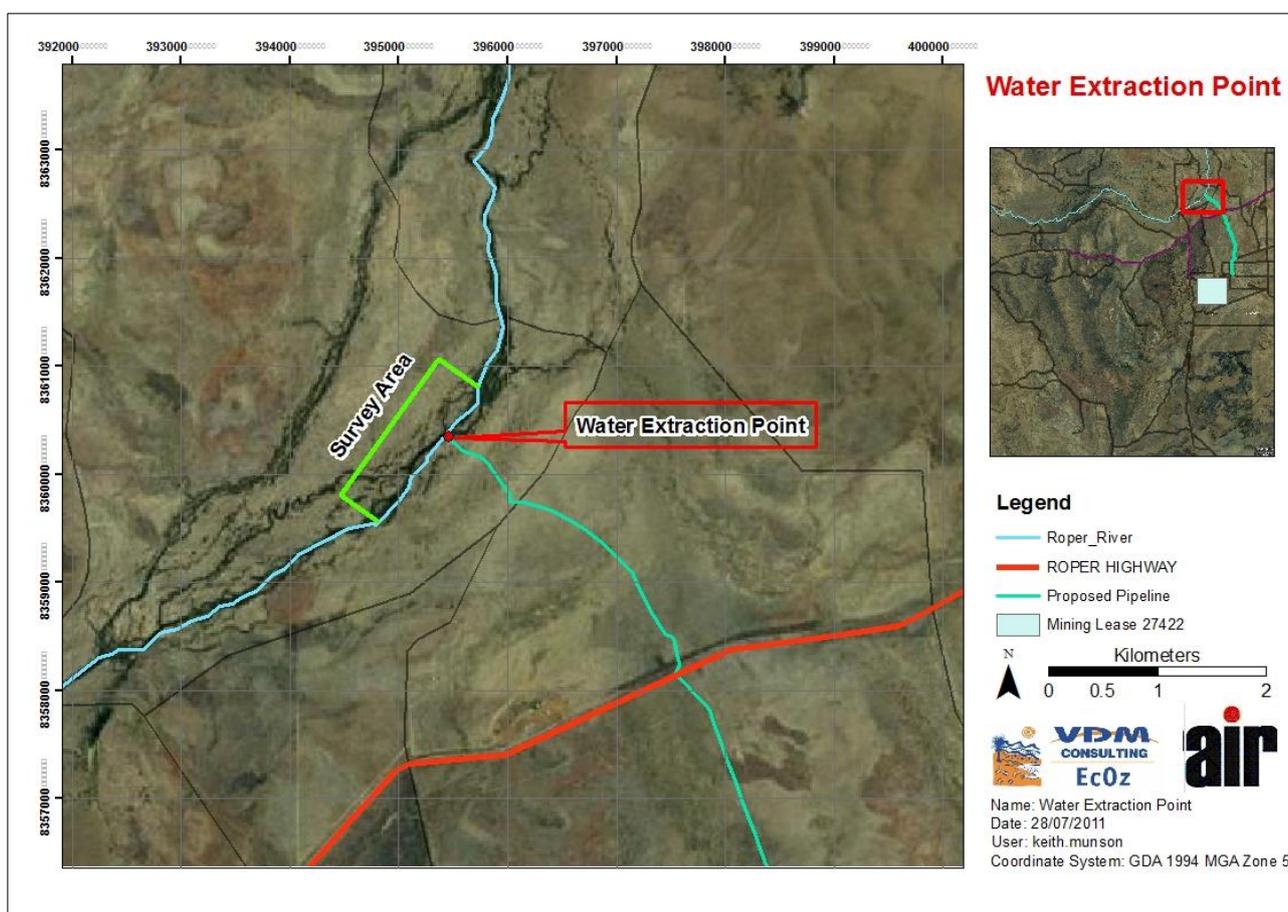


Figure 3-1: Flying Fox station pump hole and proposed pipeline.

Table 3-1: Matters of National Environmental Significance for AIR’s water extraction point (July 2011)

Matter of National Environmental Significance	
World Heritage Properties	None
National Heritage Places	None
Wetlands of International Significance (Ramsar Sites)	None
Commonwealth Marine Areas	None
Threatened Ecological Communities	None
Threatened Species	6
Migratory Species	11

3.2 Potential Threatened Species

Table 3-2 lists six threatened species (EPBC Act) that may occur near the Flying Fox station water hole, and includes information on preferred habitat and their likelihood of occurrence in the area. One species listed as vulnerable from the TPWC Act has been included in this table – due to its predicted presence at the Flying Fox station water hole. Three of the species included in Table 3-2 were considered as having a high chance of occurring at the site; these were the Freshwater Sawfish *Pristis microdon*, Gulf Snapping Turtle *Elseya lavarackorum* and Mertens Water Monitor *Varanus mertensi*. Birds and mammals listed in Table 3-2 are considered to potentially occur within the proximity of the proposed extraction site - however, this report solely investigates the potential impacts of increased water extraction on aquatic vertebrates. Therefore birds and terrestrial mammals of national significance are not covered in this survey, but are discussed in the flora and fauna report for MLA27422 (Appendix B of the PER).

The fish and reptiles listed in Table 3-2 are discussed further in Chapter 6. Management processes developed to minimise negative impact to these species during development/operations of AIR’s pump site are covered in the Water Management Plan (WMP) (Appendix G of the PER).

Table 3-2: Threatened species that could utilise the Flying Fox station water hole or immediate surrounds.

CR – Critically Endangered; EN – Endangered; VUL – Vulnerable; DD – Data Deficient; LC – Least Concern.

Common & Scientific Names	EPBC Act Status	Habitat and known distribution	Likelihood of occurrence
BIRDS			
Red Goshawk (<i>Erythrotriorchis radiates</i>)	VU	Coastal, sub-coastal forests, tropical woodlands.	Moderate. May well inhabit the region. Sparsely distributed across a range of habitats.
Gouldian Finch (<i>Erythrura gouldiae</i>)	EN	Open tropical woodland that has a grassy understorey, often in hilly areas.	Moderate. May well inhabit the region due to availability of habitat.
Australian Painted Snipe (<i>Rostratula australis</i>)	VU	Dense Swamp vegetation – extremely secretive. Emerges only in dawn and dusk periods	Moderate. May well inhabit the region due to availability of habitat.
FISH			
Freshwater Sawfish (<i>Pristis microdon</i>)	VU	Muddy bottoms of freshwater rivers and estuaries. Moves into marine waters after around 4 years.	Moderate. Populations of <i>P.microdon</i> have been recorded in the Roper River with reported sightings upstream at Elsey Station.
REPTILES			
Mertens` Water Monitor (<i>Varanus mertensi</i>)	Not listed in EPBC act but listed as vulnerable in TPWC act	Coastal and inland waters of far northern Australia, from far north-western Australia to central Qld and the western side of Cape York Peninsula.	Moderate. Species have wide distribution across Northern Australia – however, have been greatly impacted by Cane Toad populations
Gulf Snapping Turtle (<i>Elseya lavarackorum</i>)	EN	Restricted to rivers draining to the Gulf of Carpentaria, mainly herbivorous, feeding upon leaves, flowers, bark and <i>Pandanus</i> roots.	Moderate. May well inhabit the region due to availability of habitat.
MAMMALS			
Northern Quoll (<i>Dasyurus hallucatus</i>)	EN	Rocky escarpment, open forest and open woodland.	Unlikely. Lack of suitable habitat and presence of Cane Toads in these areas reduces likelihood of quoll populations.

* Species listed as Migratory under the EPBC Act are discussed in the Flora and Fauna Report (PER Appendix B).

4 Methodology

4.1 Survey Site

An aquatic flora and fauna survey was conducted at AIR's proposed water extraction point; a permanent water pool on the main channel of the Roper River (14°49'46"S 134°01'42"E). Water is currently extracted from this site by Flying Fox station for domestic and stock supply. Historically, water has also been extracted from this site to supply Numul Numul station during particularly dry years.

The pool was surveyed on 19 May 2011 (Figure 4-1) after the end of the wet season whilst flow was moderate. The timing of the survey increased the probability of detecting migratory species which move whilst water levels and flow rates are dropping, and allowed for the identification of ground cover species prior to desiccation. Photographs of the site and a brief description of surrounding country were recorded. The river was surveyed for a total length of one kilometre.



Figure 4-1: Photo of the Roper River at the survey site.

4.2 Water Quality

Electrical Conductivity, pH and temperature were measured in the field using handheld instruments calibrated by an external ISO9001 accredited agent on the 4th August 2010 and by EcOz internally the day before sampling. An Aquasonics reagent test kit was used to determine carbonate hardness for Alkalinity, and a hardness test for Total Hardness.

4.3 Aquatic Vertebrate Survey

A variety of techniques were employed to survey aquatic vertebrates in the river. These were:

- Gill netting for a period of one hour in the afternoon. Multi-panel nets were used with a total length of 35 metres. The net consists of seven panels, each of five metres length and two metres drop. Each panel has a different mesh size of 26mm, 44mm, 58mm, 76mm, 100mm, 126mm and 150mm. These different panel sizes allow for a large range of fish to be caught. One of these nets was set parallel to the bank. The current in the pool prevented a net being set perpendicular to the bank. The net was watched to ensure that no air breathing animals were drowned.
- Seine netting of shallow waters was performed with a fifteen metre long net of 12mm mesh.
- Spot lighting was used to identify some species at night. When species are small and in shallow water, they will often sit motionless in the light's beam and can be collected using a dip net for positive identification.
- Baited traps were also set and checked at regular intervals.
- Angling provided another method of sampling fish that may be shy of nets or traps.

Other records of fauna were obtained by direct observation. Additional information concerning the surveyed pool was provided by Flying Fox station manager, Mark Sullivan.

4.4 Aquatic and Riparian Flora Survey

An aquatic and riparian flora survey was performed within a 50m x 50m quadrat at the water extraction point. Soil type, underlying geology, vegetation structure and species present were all recorded. General landform and disturbance were also noted.

5 Results

5.1 Site Observations

The Flying Fox station pump hole is a naturally occurring permanent pool in the main channel of the Roper River. The river at this point flows through low hills which are part of an area used for pastoral purposes. The river immediately above and below this pool is shallow and braided. The pump hole consists of brown clay loams overlying quaternary sand soil and alluvial deposits. The soil was bare, particularly on the steep river banks. The river bed was of a similar substrate. The riparian vegetation formed a medium to tall closed forest with no mid storey or ground cover, and numerous dead trees provide structure within the pool. The riparian forest was unburnt.

5.1.1 Water quality

Water quality parameters measured at the Flying Fox station pump hole on the 19th May 2011 are presented in Table 5-1.

Table 5-1 Water quality parameters

Parameter	
Water temp.	25°C
pH	8.6
Turbidity (Secchi depth)	1.2m
Total hardness	220ppm
Electrical conductivity	774µS/cm
Alkalinity	120ppm

Water velocity was measured at 0.25 m/s. At the point where water velocity was measured, the greatest depth of water was also measured at 6.4 metres and the channel width was estimated to be 32 metres.

The discharge of the Roper River at the pump site on the 19th May 2011 was estimated to be approximately 25.6 m³/s [Discharge (m³/s) = ½ {Width (m) x Depth (m)} x Velocity (m/s)]. Given the unusually large and prolonged 2010-2011 wet season, it is likely that the observed discharge does not represent the long term average for this site.

5.2 Fauna

Table 5-2 Fauna recorded at the proposed water extraction site.

COMMON NAME	SCIENTIFIC NAME
FISH	
Archer Fish	<i>Toxotes chatareus</i>
Chequered Rainbowfish	<i>Melanotaenia splendida inornata</i>
Berney's Catfish	<i>Neoarius berneyi</i>
Blue Catfish	<i>Arius graffei</i>
Shovelnose Catfish	<i>Neoarius paucus</i>
Longtom	<i>Strongylura krefftii</i>
Flathead Goby	<i>Glossogobius giurus</i>
Golden Goby	<i>Glossogobius aureus</i>
Barramundi	<i>Lates calcarifer</i>
Spangled Perch	<i>Leiopotherapon unicolor</i>
Black-striped Rainbowfish	<i>Melanotaenia nigrans</i>
Sail-fin Glassfish	<i>Ambassis agrammus</i>
Reticulated Glassfish	<i>Ambassis macleayi</i>
Flyspecked Hardyhead	<i>Craterocephalus stercusmuscarum</i>
Northern Trout Gudgeon	<i>Mogurnda mogurnda</i>
Bony Bream	<i>Nematalosa erebi</i>
Sleepy Cod	<i>Oxyeleotris lineolata</i>
CRUSTACEANS	
Red Claw Yabby	<i>Cherax quadricarinatus</i>
Cherabin or Giant River Prawn	<i>Macrobrachium rosenbergii</i>
Handschin's River Prawn	<i>Macrobrachium hanschini</i>
Freshwater Crab	<i>Austrothelphusa transversa</i>
Unknown River Prawn	<i>Macrobrachium</i> sp. (possibly juvenile <i>M.bullatum</i>)

COMMON NAME	SCIENTIFIC NAME
MOLLUSCS	
Freshwater mussel	<i>Velesunio angasi</i>
REPTILES	
Freshwater Crocodile	<i>Crocodylus johnstoni</i>
Brown Tree Snake	<i>Boiga irregularis</i>
AMPHIBIANS	
Green Tree Frog	<i>Litoria caerulea</i>
Wotjulum Frog	<i>Litoria wotjulumensis</i>
Rocket Frog	<i>Litoria nasuta</i>
Ornate Burrowing Frog	<i>Opisthodon ornatus</i>
Peter's Frog	<i>Litoria inermis</i>
Red Tree Frog	<i>Litoria rubella</i>
Roth's Tree Frog	<i>Litoria rothii</i>
BIRDS	
Whistling Duck	<i>Dendrocygna sp.</i>
Snake Bird	<i>Anhinga melanogaster</i>

5.2.1 New Fauna Records for the Survey Area

All 33 fauna species identified during the survey, including 17 fish, 2 reptiles, 7 amphibians, 4 crustaceans, 1 mollusc, and 2 birds (Table 5-2), have not been previously recorded within 10 km of the Flying Fox station pump hole according to the NT Fauna Atlas database. The large number of new records reflects the general paucity of biological surveys conducted within the area. Many bird species listed in the NT Fauna Atlas were not recorded during May 2011 because the survey only targeted aquatic vertebrates with opportunistic bird identification. All species records generated from this survey will be provided to the Northern Territory Parks and Wildlife Service such that new species records for the area can be included in the NT Fauna Atlas Database.

5.3 Flora

5.3.1 Riparian Flora

The Broad Floristic Formation of the riparian forest from Hnatiuk *et al.* (2009) can be described as Medium to Tall Closed *Excoecaria parvifolia*, *Cathormion umbellatum*, *Melaleuca leucadendra*, *Casuarina cunninghamiana*, *Antidesma ghesaembilla* Forest.

The upper storey and ground cover species surveyed at the site are listed in Table 5-3. There were no mid-storey species present. There was no ground cover under the closed canopy of the forest (Figure 5-1). Ground cover species were only recorded on the margin of the riparian forest at the edge of the quadrat where the canopy became more open.

Table 5-3 Flora recorded at the proposed water extraction point.

UPPER STOREY	GROUND COVER
<i>Excoecaria parvifolia</i> (Gutta Percha)	<i>Enteropogon minutus</i>
<i>Cathormion umbellatum</i>	<i>Paspalidium distans</i> (Spreading Panic-grass)
<i>Pandanus aquaticus</i> (River Pandanus)	<i>Chrysopogon fallax</i> (Golden Beard-grass)
<i>Melaleuca leucadendra</i> (Cajuput)	<i>Alternanthera nodiflora</i> (Common Joyweed)
<i>Casuarina cunninghamiana</i> (River She-oak)	<i>Hygrophila angustifolia</i> (Willow Hygro)
<i>Flagellaria indica</i> (Supplejack)	<i>Ammannia baccifera</i>
<i>Antidesma ghesaembilla</i> (Blackcurrant Bush)	<i>Indigofera linnaei</i> (Birdsville Indigo)
	<i>Sporobolus australasicus</i> (Fairy Grass)

The site was moderately damaged from cattle and vehicle access, including soil compaction. The site did not show any evidence of having been burnt, and no exotic species were recorded.



Figure 5-1: Riparian forest at the survey site

5.3.2 Aquatic Flora

Aquatic vegetation was not systematically surveyed but recorded as encountered during the aquatic fauna survey. In-stream vegetation was sparse due to the heavy shading from riparian vegetation. The only floating aquatic species recorded was the water lily *Nymphaea violacea*.

Emergent species recorded were:

- *Pseudoraphis spinescens* (Spiny Mud-grass)
- *Hygrophila angustifolia* (Willow Hygro)
- *Nelsonia campestris*
- *Fimbristylis* sp. (possibly *F.rara*)

6 Discussion

This report presents the results of the survey performed to investigate aquatic vertebrate presence at the Flying Fox station pump hole with regard to the proposed operation of a pump for the AIR mining operations. The survey was performed to address information requirements identified by NRETAS in the “Final Guidelines for the Preparation of a Public Environmental Report for the SILL80 project; April 2011”. As such, this report aims to address concerns specific to potential impacts to aquatic vertebrates as the result of water extraction, and therefore decreased flow, in the Roper River as part of AIR’s ilmenite processing.

The pool is currently equipped with Flying Fox station’s pump used to supply domestic and stock water to adjoining cattle stations. The results of this survey have been used to assist in the development of a Water Management Plan for the AIR mine site as well as assist in the development of sustainable extraction limits agreed with NRETAS. Issues concerning water usage for the mine are beyond the scope of this report and are addressed in the Water Management Plan (Appendix G of the PER) presented with the Public Environmental Report.

6.1 Observations

Archerfish were particularly abundant at the survey site. Interestingly only Spangled Perch and no other species of grunters (*Terapontidae*) were surveyed. However, Flying Fox station manager, Mark Sullivan, was interviewed about fish present at the pump water hole and he indicated that anglers caught Barramundi and Bream. “Bream” in the Gulf of Carpentaria rivers generally refers to three species: Black Bream, Silver Bream and Golden Bream. These are otherwise known as:

- Black Bream, (or Sooty Grunter) *Hephaestus fuliginosus*
- Silver Bream, (or Spangled Perch) *Leiopotherapon unicolor*
- Golden Bream, (or Gulf Grunter) *Scortum ogilbyi*

As Spangled Perch (Silver Bream) are generally too small to be caught by anglers, it is likely that other species of grunter are present in the waterhole but were not detected by this survey. No fishes identified in this survey, or for which there is anecdotal evidence, are listed as threatened under Northern Territory or Commonwealth legislation.

Many chironomids were observed to be flying at the waterhole on dusk. Dropping water levels at the end of the wet season act as a trigger for many aquatic macroinvertebrates to emerge as winged adults. Large numbers of flying insects with aquatic life stages (such as chironomids) are a feature of all Top End waterways at this time of year.

Although not within the study area, a Merten’s Water Monitor was observed at a roadside culvert approximately 10.5 km south-south-west of the water extraction point and one kilometre west-north-west of MLA27422. This species is listed as Vulnerable under the *Territory Parks and Wildlife Conservation Act* (TPWC).

6.2 Potentially Present Threatened Species

Three threatened species are believed likely to occur at AIR’s proposed water extraction point but were not identified in the May 2011 surveys. General descriptions of the species are discussed below – along with the primary threats to their existence.

6.2.1 Freshwater Sawfish (*Pristis microdon*)

Freshwater Sawfish are listed as Vulnerable both nationally (*EPBC Act*) and within the Northern Territory (*TPWC Act*). NT Fauna Atlas records indicate that this species has not been recorded within 10 km of MLA27422. Freshwater Sawfish are a large ray-like fish, with an easily recognisable elongated rostrum – present as a long flat blade equipped with rows of teeth on either side. The saw is presumed to be used to dig out crustaceans and molluscs from the substrate as well as being used to stun and injure fish. Freshwater specimens range between 76-250cm and are olive to brown dorsally with a white under body (Allen *et al* 2002).

This species is noted as being relatively uncommon but potentially widespread in coastal drainages of northern Australia, from Northern Queensland to Northern Western Australia. *P.microdon* are a bottom dweller of estuaries and lower reaches of large river systems – but have been known to penetrate considerable distances upstream. Thorburn *et al* (2004) encountered *P.microdon* in the Roper River at Eley station, upstream from this surveys sampling site.

6.2.2 Mertens Water Monitor (*Varanus mertensi*)

Merten's Water Monitors are listed as Vulnerable within the Northern Territory (*TPWC Act*), although they are not nationally listed (*EPBC Act*). NT Fauna Atlas records indicate that this species has not been recorded within 10 km of MLA27422. Merten's Water Monitor is a medium-large sized semi-aquatic monitor. It is dark olive grey to olive brown with numerous small, dark-edged cream or yellow spots. It is typically found near rivers, large creeks, lagoons, reservoirs and billabongs in northern Australia (Woinarski *et al.* 2007). The Monitor is an excellent swimmer, able to hold its breath for minutes at a time and swim underwater with the aid of special valves in its nostrils that shut tightly when they are underwater (Woinarski *et al.* 2007). Merten's Water Monitors have a strong sense of smell and feed mostly on fish, frogs, and carrion, but also insects and small terrestrial invertebrates (Woinarski *et al.* 2007). Merten's Water Monitor has a broad geographic range and has been recorded in coastal and inland waters across most of the top end and gulf region (Woinarski *et al.* 2007). The cane toad is a major threat to the Merten's Water Monitor as amphibians are part of the Monitor's diet and it will often eat them and die from the ingested poisons. Tests have shown that this species is highly susceptible to cane toad toxins, and several reports (Burnett 1997, Van Dam *et al.* 2002, Griffiths & McKay 2005 and Smith & Phillips 2006) have identified the cane toad as being a major threat to populations. The Merten's Water Monitor is listed as Vulnerable due to a reduction of more than 30% of its population projected to be met within the next 10 years or within three generations, primarily due to Cane Toads (Woinarski *et al.* 2007).

6.2.3 Gulf Snapping Turtle (*Elseya lavarackorum*)

The Gulf Snapping Turtle *Elseya lavarackorum* is listed as Endangered nationally (*EPBC Act*), but is not regarded to be of conservation concern (Least Concern) in the Northern Territory (*TPWC Act*). This is a large, short-necked turtle that can grow up to 35 cm in length. It is similar in appearance to the more common Northern Snapping Turtle (*E. dentata*) but possesses an undulating structure between the humeral and pectoral shields of its plastron (Wilson and Swan 2008). The species is mainly herbivorous, feeding upon leaves, flowers, bark and *Pandanus* roots. Juveniles have been known to feed on insect larvae. The Gulf Snapping Turtle is restricted to rivers draining into the Gulf of Carpentaria including the Calvert and Nicholson River systems of the Northern Territory (Woinarski *et al.* 2007). Little information is available concerning the likelihood of *E. lavarackorum* occurring in the Roper River. The major threat to this species appears to be trampling of its nesting sites by stock and feral animals, such as pigs, though a lack of information on this species limits identification of significant threats (Woinarski *et al.* 2007). Lack of previous records within the region does not confirm that the species does not inhabit the area. Management measures by AIR will focus on maintenance of flow requirements for the Roper River, based on a conservative

approach of assuming that threatened species such as this are either present at the extraction site or further downstream. Additional detail on proposed management measures can be found in the WMP.

6.3 Species and habitats of significance

This survey did not encounter any threatened species at the water extraction point. Two threatened species (Red Goshawk, *Erythrotriorchis radiata* and Merten's Water Monitor, *Varanus mertensi*) were identified in the Notice of Intent as having some likelihood of being encountered because of suitable habitat at the water extraction point. One of these species (Merten's Water Monitor, *Varanus mertensi*) was recorded in the general area and it would be reasonable to assume that this species would utilise the section of river proposed for water extraction. No detailed survey of terrestrial birds was conducted at the water extraction point, so it remains possible that Red Goshawks (*Erythrotriorchis radiata*) may be present in this area.

Freshwater Sawfish (*Pristis microdon*) and Freshwater Whiprays (*Himantura chaophyra*) have both been recorded in the Roper River in a previous study (Thorburn *et al* 2004). That study recorded one Freshwater Whipray downstream of Roper Bar in the tidal zone, but recorded Freshwater Sawfish (*P. microdon*) well upstream of the proposed extraction site (Thorburn *et al* 2004). However a subsequent survey by the Museum and Art Gallery of the Northern Territory (Dally and Larson 2008) failed to record any Freshwater Sawfish in the same area. Subsequent to this survey a local man, Jojo Huddleston, told of a small, probably juvenile, sawfish that had been caught in a waterhole approximately 35 kilometres upstream of the proposed water extraction point from Strangways Creek in early June 2011. This was probably a Freshwater Sawfish (*P. microdon*). These results may indicate that Freshwater Sawfish are either uncommon in the river or perhaps are only present at certain times of year (Thorburn *et al* 2004).

Although neither Freshwater Sawfish nor Whipray were identified during this survey it is probable that Freshwater Sawfish navigate through the area. Thorburn *et al* (2004) have collected this species from both tidal and non-tidal areas which indicate that this species utilises the entire length of the river. Similarly Freshwater Whiprays have been recorded throughout the lower and middle reaches of other river systems, particularly the Daly River (Thorburn *et al* 2004). Their recorded presence in the lower Roper River means it may be possible that Freshwater whiprays may utilise the Roper River in the vicinity of Flying Fox station pumping hole.

Pig-nosed turtles (*Carettochelys insculpta*) have been recorded in the Roper River near Roper Bar (Department of Lands and Housing 1991 cited in Faulks 2001). This species is not considered as threatened under either Northern Territory or Commonwealth legislation, but is listed on the International Union for the Conservation of Nature (IUCN) Red List (Asian Turtle Trade Working Group 2000). No turtles were observed in the survey of Flying Fox station pumping hole and surrounds, but this pool is likely to provide suitable habitat for this species and other freshwater turtles.

Given the shallow, braided nature of the Roper River in the vicinity of the proposed extraction site, it is likely that this pool acts as a significant refuge during the late dry season. This will be particularly important in years of low rainfall when the river ceases to flow in these reaches.

6.4 Potential impacts

Extracting water from the Roper River at the proposed site has three main potential impacts. Firstly, drawing water from the river will affect environmental flows downstream. Diminished flow downstream of the extraction point will expose barriers to fish migration earlier in the dry season, or delay them being passable early in the wet season (e.g. Roper Bar). Any delay in flow at the start of the wet season is likely to be more significant for migratory species. It is likely that all migratory species would have completed their movements by the time the river ceases to flow during the dry season, even considering proposed extractions. The second potential impact is on the volume of water and water level in the pool after cessation of flow. The Flying Fox station pumping hole is not a large pool, and continued extraction of water after the river ceases

to flow at this point is likely to be highly significant. The Roper River in the vicinity of the pool is shallow and braided and it is likely that this pool provides a moderately important dry season refuge for many aquatic species. Significant draw down of water from this pool after cessation of inflow will reduce the volume of this refuge and impact on the species therein. Finally, the installation of a pump at the proposed location will increase noise and activity at the site. A pump to provide water to adjacent cattle stations already operates at the site and it is likely that any fauna in the area is already accustomed to some disturbance. However the extraction of water by AIR will require a greater level of activity and noise because the pump will be visited regularly for maintenance purposes and run for longer periods.

6.5 Limitations of this study

This survey was of short duration (one day) and only conducted on the actual extraction point area. Hence it may not have identified all fauna species that are resident or migrate through the area. Safety limitations concerning crocodiles prevented the use of mask and snorkel as a survey technique.

This survey only collected limited information on bird species around the proposed water extraction point. Riparian habitats are known to be important for birds. However, only water birds were recorded in this survey. Permanent freshwater pools are also known to be important to terrestrial birds, especially later in the dry season.

Other water extractions and developments along the length of the Roper River, both present and planned, are likely to have an influence on the aquatic flora and fauna in the future. This will mean that this baseline survey and on-going monitoring at this site only will be of limited value. Many changes in the condition of the river will only be attributable if surveys are viewed in conjunction with other monitoring conducted along the length of the river.

7 Conclusion

The Flying Fox station pump hole is a perennial waterhole in the main channel of the Roper River. It is most likely of moderate importance as a dry season refuge for a number of aquatic species, particularly when freshwater inflows cease along this stretch. Although this survey did not detect any, it is likely that some threatened species utilise this pool including Merten's water monitor (*Varanus mertensi*) and Freshwater sawfish (*Pristis microdon*).

Properly managed water extraction from this point of the Roper River is unlikely to significantly affect the flora and fauna of the Roper River. Levels of extraction will be limited during periods of low flow and there will be no extraction of water during periods of very low or no flow. These thresholds and levels are detailed in the Water Management Plan (Appendix G to the PER), and can only be properly adhered to if there is some method of determining water flow at the site. Any volume of extraction by AIR for the processing of ilmenite must also take into account the amount of water extracted by the pastoral industry from this pool.

Monitoring of impacts of water extraction at this point can only be meaningful if assessed against results of monitoring of other development and water extraction activities along the entire Roper River.

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