Coordinator-General's report

Gladstone Nickel Project

Appendices

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Queensland the Smart State

Queensland Government
Department of Infrastructure and Planning

Contents

Appendices

Appendix A

Gladstone Pacific Nickel Refinery – Summary Project Description

1. EIS scope

The Gladstone Pacific Nickel Refinery will initially be developed in two stages – 1 and 2. It is anticipated that Stage 1 will produce up to 63,000 t/y of nickel metal and 6,000 t/y of cobalt metal. Stage 2 will produce up to 126,000 t/y of nickel metal and 12,000 t/y of cobalt metal. This EIS addresses both stages.

The project components covered in the EIS comprise:

- the refinery
- an ore slurry pipeline (freshwater) between the Marlborough mine and the refinery
- an alternative rail supply option for ore delivery from Marlborough to the refinery
- ahe Residue Storage Facility (RSF)
- residue slurry and return treated liquor pipelines between the refinery and the RSF
- treated water discharge pipeline from refinery to a dilution pit on the Calliope River and then onto the discharge via diffusers in a seabed pipeline off the RG Tanna coal terminal
- material handling facilities at the Gladstone port
- associated infrastructure (including acid pipeline, pre-assembled module transport corridor and seawater intake).

Project components located in the Marlborough mine project area have already received a separate environmental approval (MIM 800078102) and do not form part of the scope of this EIS.

2. Proposed Project

GPNL's vision is to build a major long-life nickel/cobalt refinery at Gladstone within the Gladstone State Development Area (GSDA). The refinery will produce metal products for export to the global nickel market, which is expanding primarily due to growth in demand for stainless steel. Stainless steel has a number of properties, including corrosion resistance, high temperature stability, strength, ductility and recyclability that support its sustainable use and generally result in high service life and reduced life cycle impacts compared to other alternative materials. The GNP is aimed at assisting in filling the widening gap between existing global nickel metal production and worldwide demand.

The refinery will treat high grade nickel laterite ores from around the south-west Pacific, underpinned by beneficiated ores from its own Marlborough deposits, and will produce valuable nickel and cobalt metal products, resulting in a positive effect on Australia's balance of trade. At the completion of Stages 1 and 2, the refinery will have the capacity to produce 8-10% of global nickel demand. Refer to Table 1 below for details of the Stage 2 operating parameters.

The project will comprise a modern nickel/cobalt laterite mine at Marlborough, with either ore being railed or beneficiated ore being pumped as a slurry through a 180 km pipeline to a fourth generation High Pressure Acid Leach (HPAL) refinery sited in the Yarwun Precinct of the GSDA. The refinery incorporates a leach plant to produce an intermediate product, a metals plant for the production of pure nickel and cobalt metal products, and associated infrastructure and services. In addition to railed or slurried ore from Marlborough, nickel ore

(and sulfur) will be imported through the Wiggins Island Wharfs (WIW) to be developed at Wiggins Island, Gladstone by the Gladstone Ports Corporation (GPC) as part of its proposed Wiggins Island Coal Terminal (WICT) project.

The refinery will utilise the HPAL process, which treats nickel laterite ores by contact with sulfuric acid at high temperatures and pressures, resulting in the leaching of nickel and cobalt into solution. This process is successful in extracting high levels of nickel and cobalt whilst minimising the extraction of iron and aluminium (contaminants of metal products). The HPAL process has low greenhouse gas emissions per unit of product compared to other process alternatives because of the non-carbon derived energy that is produced and harnessed from the manufacture of sulfuric acid. The nickel/cobalt leach liquor is recovered and processed to produce high purity nickel and cobalt metal.

The refinery's products, refined nickel and cobalt metal, will be containerised and transported by rail to a container shipping terminal in Brisbane and then exported. Ammonium sulphate (amsul), produced as a by-product, will be exported through the port facilities at Barney Point.

Residue from the refinery will be piped (via a corridor within the GSDA) to the RSF to be constructed in the Aldoga Precinct of the GSDA.

Table 1: Stage 2 Operating Parameters

Process Input/Output	Stage 2
Products	
Nickel product (t/y)	126,000
Cobalt product (t/y)	12,000
Ammonium sulfate by-product (t/y)	360,000
Process Inputs	
Imported ore (Mdt/y)	8-10
Marlborough ore (Mdt/y)	1-4
Sulfur (Mt/y)	3.2
Limestone (Mt/y)	5.2
Raw water (GL/y)	**30**
Seawater (GL/y)	**16**
Wastes	
Residue (Mdt/y)	**14.1**
Treated Water Discharge (m^3/h)	**3,420**

Freshwater will be used as cooling water. Seawater extracted from Port Curtis (or possibly piped from NRG effluent) will be used in the initial slurry mixing in the process instead of fresh water. Treated barren liquor from the process will be mixed with cooling water bleed and discharged to Port Curtis via diffusers near the Clinton Wharf at the RG Tanna Coal Terminal.

3. Treated water discharge

The discharge will be via diffuser which will consist of a perforated pipe laid on the seabed. There will be one diffuser for each of the proposed two stages of the refinery.

The treated water will be piped from the refinery to a dilution pump pit. Seawater will be mixed with this water in the pit at a dilution ratio of 10:1 seawater to treated water and then discharged to Port Curtis (see map below). During periods when the ambient tidal velocity is

low (half an hour either side of tide change over, or “slack water”) the dilution ratio will be increased to 20:1.

4. Acid pipeline

The volume of acid produced by the acid plants for use in the leaching process will be approximately 4.5 Mt/y during Stage 2. Not all of this acid will be consumed in the process and excess acid will be exported from the site. An export pipeline with a capacity of approximately 4,000 t/d is proposed. The pipeline will transfer the sulfuric acid to/from a storage area located at the southern end of the Fisherman's Landing Wharf Area, approximately five kilometres from the refinery site. The storage area consists of two, 10,000 tonne storage tanks. The storage area will allow for the export for sale of excess acid and also provide a storage reservoir in the event that one of the acid plants is offline, and additional acid is required for processing. It will also allow for the import of acid in the event sulphur supply is disrupted. The acid pipeline alignment will generally follow Orica's ammonia pipeline alignment.

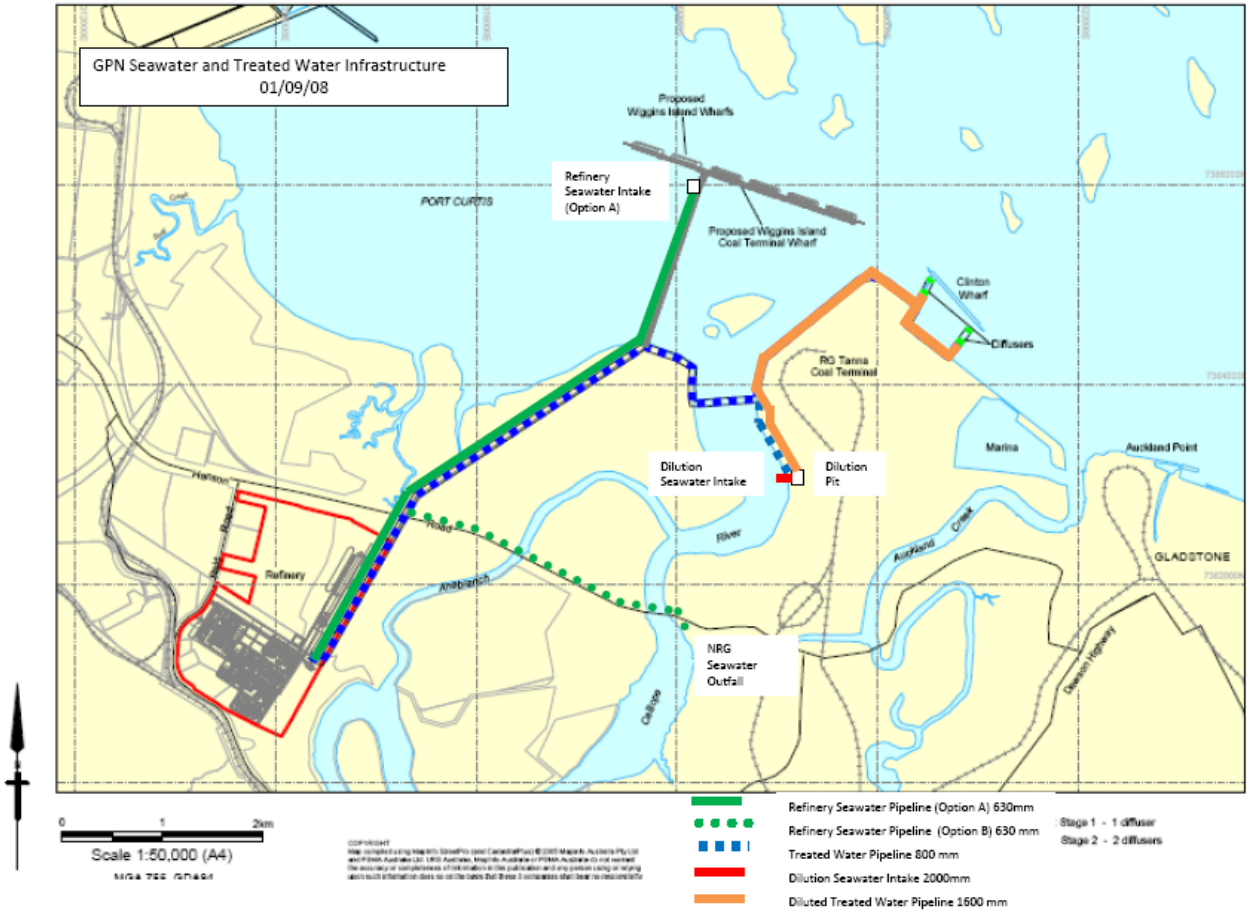
5. Pre-assembled Modules (PAMs)

The strategy for construction of the GNP is to maximise modularisation by the offsite fabrication of pre-assembled modules (PAMs). This includes modularisation of key vendor packages such as the power plant and sulfuric acid plants.

These process modules and tanks will be fabricated complete with structural steel platforms, walkways, handrails, piping, electrical, instrumentation and equipment. Once complete, they will be loaded onto a vessel using hydraulic trailers for shipment from the fabrication site to Gladstone directly by sea transport. The PAMs will then be offloaded with hydraulic trailers and installed directly onto prepared foundations. Pre-commissioning activities will also be maximised prior to delivery.

The PAM strategy is based on utilising S.E. Asian fabrication facilities. These facilities include large well-equipped and established contractors with low cost labour capable of achieving high output at a competitive price and fit for purpose quality.

The size of the PAMs proposed would be less than 1,000 tonnes and can be offloaded at existing berth facilities on Fisherman’s Landing. A route has been proposed between Fisherman’s Landing and the refinery site.


GPN Seawater and Treated Water Infrastructure
01/09/08
Proposed
Wiggins Island Wharfs
Refinery
Seawater Intake
(Option A)
PORT CURTIS
Proposed Wiggins Island
Coal Terminal Wharf
Clinton
Wharf
Diffusers
RG Tanna
Coal Terminal
Marina
Auckland Point
Dilution
Seawater Intake
Dilution
Pit
Harbour
River
Auckland
Creek
GLADSTONE
Refinery
Anabranch
NRG
Seawater
Outfall
Calliope
Dawson Highway
0
1
2km
Scale 1:50,000 (A4)
Refinery Seawater Pipeline (Option A) 630mm
Refinery Seawater Pipeline (Option B) 630 mm
Treated Water Pipeline 800 mm
Dilution Seawater Intake 2000mm
Diluted Treated Water Pipeline 1600 mm
Stage 1 - 1 diffuser
Stage 2 - 2 diffusers

Appendix B

Summary of sulphuric acid mist control information provided by Gladstone Pacific Nickel Ltd (GPNL) to EPA post-SEIS

The following are the key points provided by GPNL to EPA after the finalisation of the SEIS in relation to acid mist generation during upset conditions and GPNL's commitments to manage and mitigate this matter. This information has been supported by advice from a sulphuric acid plant expert. It's presentation here is in the interest of disclosure. While the Coordinator-General has considered this information in his assessment of the potential environmental impacts of this Gladstone Nickel Project (GNP), its inclusion as an Appendix to this Report does not imply endorsement by the Coordinator-General of the information it contains.

- Acid mist emissions during normal acid plant operation will be invisible, or barely visible, in the range 25–40 milligrams per normalised cubic metre mg/Nm^3 (GPNL's steady emission concentration is predicted to be 22 mg/Nm^3). At above 50–60 mg/Nm^3 the plume soon becomes apparent against a clear sky.
- Visible emissions of acid mist should not occur. To avoid or minimize a mist plume requires operation of the acid plant absorption tower within a narrow window of inlet acid strength (98.5% +/- 0.1–0.2 %) and a temperature (around 80^oC). The optimum absorber concentration is when the combined acid vapour pressure and unabsorbed SO_3 are at a minimum.
- Excursions to higher acid concentrations cause more trouble, since oleum (fuming acid, > 100% concentration) may be produced, which produces a particularly dense mist, saturating the fibre bed mist eliminators and taking a longer recovery time. The frequency, intensity and duration of any excursions will be minimized by having the correct systems in place, properly maintaining those systems, and employing experienced and vigilant operators. Controls to avoid serious upset conditions that will be used in the GNP include:
    - provision of the best control and monitoring mechanisms for plant operators, including two independent (redundant) acid concentration analysers with a control system programmed to alarm the deviation between the two readings and to alarm a reading which has been static for more than a few minutes.
    - closed circuit TV cameras to monitor the acid concentration analyser sampling flow, to provide a visual check that the control system is operable;
    - a separate portable analyser to validate the results of the control instrumentation in case there is any doubt when operation intervention is required;
    - experienced and vigilant operators are essential, imbued with a corporate commitment to comply with environmental standards; and
    - a maintenance program to ensure the integrity of the above systems.
- On-line measurement of mist emissions is not an established procedure available for acid plants, and periodic measurements required for compliance testing require the setup of complex sampling and measuring apparatus, and several specialist technicians.
- Mist emissions will become very obvious when exceeding the steady normal conditions by a factor of three, by which point operator intervention will be triggered.
- While upset conditions are not unrealistic scenarios, they are not inevitable. It is within the control of plant management and operators to avoid such occurrences. With implementation of the controls listed above, GPNL commits that major acid mist upset events will be:

- confined to a frequency no greater than once every 5 years;
- limited in intensity of emissions to no more than ten times the normal operating conditions; and
- controlled within one hour of the commencement of the event.

Appendix C

Summary of hydrogen sulphide (H_2S) plant information provided by Gladstone Pacific Nickel Ltd (GPNL) to EPA post-SEIS

1. General background on air quality in Gladstone

GPN submitted tables (provided in Appendix D of this Report, Summary of air emission characteristics) to EPA showing information for each emission point covering:

- expected emissions variability
- rates used in modelling
- source of estimated emission rates
- proposed control technologies.

2. The H_2S plant design and process

Most recently built H_2S production plants are based on the 50-year old Girdler process, where hydrogen is bubbled through molten sulphur at 450^{o}C and a pressure of approx 760 kPa. While the process is well understood, reliable, and predictable, experience obtained from refinements over recent years at other H_2S plants in the region would enable the GNP plants to adopt superior designs and operating systems.

All H_2S vent streams are collected and piped to a caustic H_2S scrubber, which will have a removal efficiency of 99%. The scrubbed effluent from that will flow to the thermal oxidiser (expected 99.9% removal efficiency). Both the scrubber and the thermal oxidiser will be rated to handle the largest emission scenario independently, therefore providing redundancy should either fail.

There is one caustic scrubber and one thermal oxidiser arranged in series. They are both capable of handling 100% of the emissions if either fails. The scrubber ensures H_2S levels emitted from the stack are safe at ground level, and the thermal oxidiser ensures that stack emissions are odour free at ground level.

As design progresses, detailed scenario and consequence modelling will be conducted to ensure that safe levels of H_2S are not exceeded at ground level under any release scenario. This would deal with accidental uncontrolled leaks.

During construction, each unit it will be hydro-tested at design pressure to ensure integrity of pipes, vessels etc.

As part of the commissioning process nitrogen pressure testing will be conducted on every flange, valve gland or other connection to verify gas tightness before commencing a start-up.

After heating up and filling with molten sulphur, gas flow will be established using inert nitrogen as part of the start-up procedure, providing a further opportunity to check for hot gas tightness. Consequently, by the time hydrogen is introduced to begin H_2S production, there would be no possibility of external H_2S leakage around the plant itself.

The reactor sulphur fill-up and heat-up phase will last about 24 hours depending on pump and heater capacities. During this phase a small nitrogen flow will pass through the reactor and into the vent system. When H_2S production commences, the plant will be operated at a minimum flow of around 30% design rate. If the sulphiding area is not ready to accept H_2S, it will be vented via the scrubber incinerator system. As the scrubber/incinerator system will be designed to cope with full plant flow, there would be no emission problems, as the process

will not be able to produce in excess of the emission control system capacity. This stage of commissioning would be under set hydrogen input flows, (rather than on demand by the sulphiding part of the plant) so it will not stress the emission control system from the refinery acid plants.

The H_2S capture system will be rigorously designed using fluid flow modelling software to ensure the system can handle all foreseeable emissions scenarios. The GPNL plant will also incorporate redundant electronic safety controls.

The GNP will not use a flare system located a great distance from the H_2S emissions sources to control emission, as some other plants have done.

The difference between a flare and thermal oxidiser should be noted. A flare is typically a tall gas discharge stack equipped with pilot burners, the function of which is to burn flammable hydrocarbon gas mixtures for atmospheric release. A flare is generally used for atmospheric disposal of large emergency flows of flammable gases such as that encountered in oil refineries and off-shore oil rigs. A thermal oxidiser is typically a gas fired furnace with an enclosed combustion chamber. These are used to destroy low concentrations of toxic species in a non-flammable effluent gas stream such as the H_2S containing emissions stream from the GPNL plant. A flare is not appropriate for this purpose because, unless the gas mixture is flammable, it will not provide enough heat to destroy the H_2S.

3. Possible upsets during normal operations

a. Reactor relief valve lifting

Each H_2S plant will be designed for a pressure approximately 50% higher than the required operating pressure, and the reactor relief valve will be set to lift at this level, giving a wide margin for error. Emergency relief via emergency pressure safety relief valves would be used as a last resort should all other automated controls fail. There would also a pressure relief valve on the inlet hydrogen line that is set to lift at just above normal operating pressure and well below the reactor pressure safety valve rating, so that the input feed cannot be overpressure. The controls and trip systems will also be set up to prevent overpressure, and even in full plant trips, the reactor should not experience a pressure surge of more than around 5% of normal operating pressure.

Emergency pressure relief is a rare event in H_2S plants (less than once per year and last for up to two minutes).

In the unlikely event that the emergency relief valve is lifted during normal operation, it will relieve into the vent/scrubber/incinerator system. The valve will have a set capacity and the vents system will be designed to accommodate it. The caustic scrubber and thermal oxidiser will be designed to cater for the potential vented gases from this type of event.

GPNL is also considering the alternative of a low pressure H_2S plant which would reduce the risk of emergency de-pressurisation.

b. Normal plant trip or power failure

In the event of a plant trip, the outlet H_2S valve will be shut, the inlet hydrogen valve will be shut, the sulphur makeup pump will stop, and the heater will be turned off. The plant will then sits safely until operations can either return it to service, or nitrogen purge it in a controlled manner through the vent /scrubber/ incinerator system.

c. Normal plant operations

Occasionally, with operation of valves there may be seepage of sulphur or H_2S. Routine operations such as daily gas cooler changeovers or monthly pump changeovers may generate this. The plant will be installed with H_2S monitors around the unit to identify traces of H_2S (1 or 2 ppm) so that corrective action can be taken. H_2S generation from such events are very small and localised.

Table D1. Emission characteristics and emission rates for point sources (for SO_2, NO_x, H_2SO_4 and H_2S)

Source name	No. Stacks		Stack height m	Stack diameter m	Velocity m/s	Temperature °C	Normal flowrate Nm³/s	Emission rate, g/s per stack				Source of emission data	Controls assumed	Failsafe/ emergency containment procedures	Design features
	Stage 1	Stage 2						SO_2	NO_x	H_2SO_4	H_2S				
Sulphuric Acid Plant	2	4	60	2.86	15	82	74.2	38		1.6		Manufacturers' specifications for SO_2 from sulphuric acid plant. sulphuric acid emissions based on acid mist production rate of 0.04 kg/tonne acid, 4.5 tonnes acid/yr.	Candle filter to remove fine liquid droplets and SO_3 with efficiency of 100% for droplets >1 um and 98% for droplets < 1um.		Double absorption plant design, Acid conversion efficiency of 99.85%.
Hydrogen Sulphide Thermal Oxidiser	1	2	25	0.8	15	795	1.7	0.0008	0.40			Engineering estimates and H_2S scrubber efficiency for SO_2 emissions.	Caustic scrubber before thermal oxidiser with removal efficiency of 99%. The thermal oxidiser has an expected >99.9% H_2S removal efficiency.	Gases from emergency de-pressurisation of the Hydrogen Sulphide plant, process plant vent gases and relief valve discharges are directed to the H_2S vent scrubber and then to the plant vent incinerator.	Thermal oxidiser is back-up control system for all potential sources of H2S.
Power Plant	1	2	40	2.7	15	130	59.3	0.27	8.89			NO_x emission limit below 74 ppmv at 15% excess O_2.			Operation on natural gas only.
Hydrogen Plant	1	2	40	1.5	15	300	12.8		3.23			NOx emission limit below 122 ppmv at 3% excess O_2.			
Neutralisation Vent	1	2	25	0.51	15	72	2.5				0.01	GPN commitment to scrubbing H_2S to less than 0.01 g/s.	Scrubber on hydrogen sulphide plant with removal efficiency of 99.9%.		H_2S limited to 0.01 g/s/stack.
Cobalt Dryer Vent Gas	1	2	15	0.03	15	110	0.01				0.003	H_2S emission concentration of 244 ppmv.			
Ni Powder Dryer Off-Gas	1	2	15	0.11	15	120	0.1				2.1 E-05	H_2S emission concentration of 0.1 ppmv.			
Total from site, Stage 2 g/s								**150.5**	**25.0**	**6.4**	**0.026**				

Table D2. Emission characteristics and emission rates for point sources (for metal particulates)

Source name	No. Stacks		Stack height m	Stack diameter m	Velocity m/s	Temperature °C	Normal flowrate Nm³/s	Metal particulate emission rate, g/s per stk						Source of emission data	Controls assumed
	Stage 1	Stage 2						Cobalt	Nickel	Nickel carbonyl	Other metals	Cadmium	Mercury		
Cobalt Sinter Furnace Stack	1	2	15	0.10	15	60	0.1	4.9 E-06			9.8 E-05	2.0 E-05	2.0 E-05	Maximum engineering design estimate of 0.05 mg/m³ for cobalt, NSW DECC limit of 0.2 mg/m³ for cadmium and mercury, NSW DECC limit of 1 mg/m³ for total metal particulates.	Bagfilter to capture fugitive dust from briquetting, sintering etc with efficiency of 99.9%.
Ni Sinter Furnace Vent Gas	2	4	15	0.23	15	80	0.5		4.6 E-04	2.3 E-04	4.6 E-04	9.2 E-05	9.2 E-05	World Bank limit of 1 mg/m³ for nickel, Victorian limit of 0.5 mg/m³ for nickel carbonyl, NSW DECC limit of 0.2 mg/m³ for cadmium and mercury, NSW DECC limit of 1 mg/m³ for total metal particulates.	Bagfilter to capture fugitive dust from briquetting, sintering etc with efficiency of 99.9%.
Total from site, Stage 2 g/s								**9.8E-06**	**1.8E-03**	**9.2E-04**	**2.0E-03**	**4.1E-04**	**4.1E-04**		

Table D3. In-stack emission concentration for point sources

Source name	Emission concentration (mg/Nm³)										Odour emission conc OU/Nm³
	SO_2	NO_x	H_2SO_4	H_2S	Cobalt	Nickel	Nickel Carbonyl	Other Metals	Cadmium	Mercury	
Sulphuric Acid Plant	505.6		21.6								1685
Hydrogen Sulphide Thermal Oxidiser	0.5	235.2									904
Power Plant	4.6	149.9									580
Hydrogen Plant		251.6									960
Neutralisation Vent				4.1							10713
Cobalt Dryer Vent Gas				370.7							976174
Cobalt Sinter Furnace Stack					0.05			1.0	0.2	0.2	
Ni Powder Dryer Off-Gas				0.2							1989416
Ni Sinter Furnace Vent Gas						1.0	0.5	1.0	0.2	0.2	

Table D4. Odour emission rates for point sources

Source name	Odour due to individual components, OU/s			Total odour from source, OU/s
	SO_2	NO_x	H_2S	
Odour threshold (mg/m³)	**1**	**2**	**0.00076**	**-**
Sulphuric Acid Plant	125,000	0	0	125,000
Hydrogen Sulphide Thermal Oxidiser	10	1,530	0	1,540
Power Plant	460	33,920	0	34,380
Hydrogen Plant	0	12,330	0	12,330
Neutralisation Vent	0	0	26,320	26,320
Cobalt Dryer Vent Gas	0	0	7,430	7,430
Ni Powder Dryer Off-Gas	0	0	60	60
Total odour from all sources, OU/s				**207,060**

Table D5. Emission rates for fugitive materials handling activities at refinery

Materials handling activity		Stage 1 emission rates, g/s		Stage 2 emission rates		Controls on materials handling operations	Assumed effectiveness of controls for modelling
	Material	TSP	PM_{10}	TSP	PM_{10}		
Ship unloader and conveyor	Sulphur	0.38	0.15	0.38	0.15	Chemical dust suppressant used, material is a imported as a break-resistent pastille. Conveyors to be covered, belt washing and spillage containment will be installed on each conveyor.	90% - Water spray with chemicals (to represent coated pastille material)
	Imported Ore	0.46	0.19	0.46	0.19	Ore received at 35% moisture content. Ore to be maintained at dust extinction moisture content by water sprays. Conveyors to be covered, belt washing and spillage containment will be installed on each conveyor.	90% - Covered conveyor, wet ore/ water sprays
Train unloader and conveying	Local Ore	0.18	0.07	0.18	0.07	Rotary dumper used within a semi-enclosed building and recovered from underground bin. Ore received at 18% moisture content. Ore to be maintained at dust extinction moisture content by water sprays. Conveyors to be covered, belt washing and spillage containment will be installed on each conveyor.	70% - Enclosure
Stockpile	Sulphur	1.11	0.45	1.11	0.45	Chemical dust suppressant used, material is a imported as a break-resistant pastille.	90% - Water spray with chemicals (to represent coated pastille material)
	Imported Ore	1.36	0.55	1.36	0.55	Ore to be maintained at dust extinction moisture content by water sprays	90% - Water spray with chemicals (for high MC ore)
	Local Ore	0.41	0.17	0.41	0.17	Ore to be maintained at dust extinction moisture content by water sprays.	50% - Water spray
Conveyor to site	Sulphur	0.01	0.01	0.03	0.01	Chemical dust suppressant used, material is a imported as a break-resistant pastille. Conveyors to be covered, belt washing and spillage containment will be installed on each conveyor.	90% - Water spray with chemicals (to represent coated pastille material)
	Imported Ore	0.06	0.02	0.16	0.06	Ore to be maintained at dust extinction moisture content by water sprays. Conveyors to be covered, belt washing and spillage containment will be installed on each conveyor.	90% - Covered conveyor, wet ore/ water sprays
	Local Ore	0.05	0.02	0.05	0.02	Ore to be maintained at dust extinction moisture content by water sprays. Conveyors	90% - Covered conveyor, wet ore/ water sprays

Materials handling activity		Stage 1 emission rates, g/s		Stage 2 emission rates		Controls on materials handling operations	Assumed effectiveness of controls for modelling
	Material	**TSP**	**PM_{10}**	**TSP**	**PM_{10}**		
						to be covered, belt washing and spillage containment will be installed on each conveyor.	
Amsul loading to truck (on site)	Ammonium sulphate	0.02	0.01	0.03	0.01	Ammonium sulphate crystals are stored in enclosed sheds. Trucks to use automatic tarping systems for dust control.	70% - Enclosure
Amsul conveyor and loading to ship (Fishermans Landing)	Ammonium sulphate	0.95	0.38	0.95	0.38	Truck tipping in covered dump station, stored in enclosed shed. Loaded onto conveyor inside shed, covered conveyor from stockpile to ship.	70% - Covered conveyor
Total Refinery emissions (g/s)		**4.62**	**1.86**	**4.74**	**1.91**		

Appendix E

Matters of National Environmental Significance

1. World Heritage values of the Great Barrier Reef

Port Curtis is located within the Great Barrier Reef World Heritage Area (GBRWHA), the boundary of which is mean low water. The GBRWHA is administered by the Great Barrier Reef Marine Park Authority (GBRMPA) in association with the EPA.

Port Curtis lies outside the boundaries of the Great Barrier Reef Marine Park (GBRMP). The GBRMP boundary is the eastern side of Facing Island and Curtis Island and extends offshore to the limit of Australian territorial waters.

The Great Barrier Reef Coast Marine Park (GBR Coast MP) is a state marine park under the *Marine Parks Act 2004* that runs the full length of the GBRMP, providing protection for Queensland tidal lands and tidal waters (EPA, 2006(c)). The Mackay/Capricorn Marine Park (a state marine park) is part of the GBR Coast MP. The southern boundary of the Mackay/Capricorn Marine Park begins to the north of the Fisherman's Landing Wharf between Friend Point on the mainland and Laird Point on Curtis Island.

At the northern end of Port Curtis is 'The Narrows', which is an area between Curtis Island National Park and the mainland and is part of the Mackay/Capricorn Marine Park. The Narrows is also listed in the National Estate Register.

The Great Barrier Reef was inscribed on the World Heritage List in 1981. Four different criteria were developed as the basis for its listing as a World Heritage property. These criteria are given in the following Table E1, together with an assessment of the potential impact from the Project and my conclusions about that impact.

Table E1. World Heritage criteria

Criterion	Project impact	Conclusions
Outstanding example representing a major stage of the earth's evolutionary history	• Examples given of the values of the Great Barrier Reef which relate to this criterion include: its coral reefs; coral cays; geological processes linking reefs, cays, islands, sand barriers and dunes; and its record of sea level changes and climatic history. • There are no coral reefs or cays in the vicinity of the refinery site. The nearest significant coral communities are between Curtis and Facing Islands, approximately 8 km to the east of the proposed discharge point. While parts of Port Curtis may exhibit geological processes linking the various elements of the coastal environment (e.g. estuaries, intertidal flats, mangroves and embayments) the Project will not result in any additional disturbance to any of these elements. The Project will be using land that will be filled and wharfs that will be constructed by the Gladstone Ports Corporation which has obtained or is seeking separate approvals for these activities. There will be no other Project components which will interfere with the listed examples of the earth's evolutionary history.	• The only credible source of potential impact of the Project on the GBRWHA is marine discharge of waste water. • As discussed in Section 4.2.6.1 of the CG Report, all water quality objectives are substantially met at a maximum of 5.9 m of the diffusers. • Far-field modelling indicates that the maximum discharge concentrations would approximate ambient seawater concentrations within approximately 200 m of the diffusers. • Conditions C31 to C40 as, detailed in Schedule A2 of this Report, provide a statutory basis for the monitoring of all environmental effects on the marine environment of Port Curtis. If trigger thresholds are exceeded, the EPA requires the Proponent to take necessary remedial action. • Therefore, I conclude that there is no likelihood of the marine discharge causing any impact to the World Heritage values of the GBRWHA.

Table E1. World Heritage criteria

Criterion	Project impact	Conclusions
An outstanding example representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment.	• Examples given of the values of the Great Barrier Reef which relate to this criterion include: its size and morphological diversity; the process of accretion and erosion of coral reefs; extensive Halimeda beds; dispersion and evolution of hard corals; diversity of flora and fauna; coral colonies and communities; floristic regions; and morphological and genetic changes in mangroves and seagrass. • The Project area is located in Port Curtis, which contains one of Queensland's busiest ports. In 2004/05 the Port of Gladstone had a throughput of over 60 million tonnes of cargo and in 2005/06 it was visited by over 1,100 commercial ships. The GNP will reinforce this existing commercial nature of Port Curtis. • As discussed above, the Project will not result in any further physical disturbance to the area's marine features beyond those which already exist or have been approved. While there are no coral reefs or cays in the Project vicinity, the diversity of marine flora and fauna has been described in the EIS and the only potential disturbance to this will be from the discharge of the refinery's treated waste water. Due to the significant potential effects a detailed assessment of the treated water discharge has been carried out. The assessment described in the technical supplement by URS, July 2008, and sections 4.2 and 6.2.2.1 of this Report addresses the likelihood and extent of possible impacts to water quality and marine flora and fauna in Port Curtis and the lower Calliope River as a result of the treated water discharge.	• The only credible source of potential impact of the Project on the GBRWHA is marine discharge of waste water. • As discussed in Section 4.2.6.1 of the CG Report, all water quality objectives are substantially met at a maximum of 5.9 m of the diffusers. • Far-field modelling indicates that the maximum discharge concentrations would approximate ambient seawater concentrations within approximately 200 m of the diffusers. • Conditions C31 to C40 as, detailed in Schedule A2 of this Report, provide a statutory basis for the monitoring of all environmental effects on the marine environment of Port Curtis. If trigger thresholds are exceeded, the EPA requires the Proponent to take necessary remedial action. • Therefore, I conclude that there is no likelihood of the marine discharge causing any impact to the World Heritage values of the GBRWHA.

Table E1. World Heritage criteria

Criterion	Project impact	Conclusions
Contains unique, rare and superlative natural phenomena, formations and features and areas of exceptional natural beauty.	• Examples given of the values of the Great Barrier Reef which relate to this criterion include: its vast extent and variety of reefs and islands; coastal mangrove systems of exceptional beauty; rich variety of landscapes and seascapes; spectacular breeding colonies of seabirds and butterflies; and migrating mammals. • The Project does not interfere with any reefs or islands. While there is a coastal mangrove system in the vicinity of the refinery, there will be no disturbance to these mangroves. The Project is located in a port and industrial landscape and will add further to this landscape character. • There will be no disturbance to breeding colonies of seabirds nor to migrating mammals as a result of this Project.	• The only credible source of potential impact of the Project on the GBRWHA is marine discharge of waste water. • As discussed in Section 4.2.6.1 of the CG Report, all water quality objectives are substantially met at a maximum of 5.9 m of the diffusers. • Far-field modelling indicates that the maximum discharge concentrations would approximate ambient seawater concentrations within approximately 200 m of the diffusers. • Conditions C31 to C40 as, detailed in Schedule A2 of this Report, provide a statutory basis for the monitoring of all environmental effects on the marine environment of Port Curtis. If trigger thresholds are exceeded, the EPA requires the Proponent to take necessary remedial action. • Therefore, I conclude that there is no likelihood of the marine discharge causing any impact to the World Heritage values of the GBRWHA.

Table E1. World Heritage criteria

Criterion	Project impact	Conclusions
Provides habitats where populations of rare and endangered plants and animals still survive	• Examples given of the values of the Great Barrier Reef which relate to this criterion include: structurally and ecologically complex coral reefs; large number of islands providing extensive habitats; mangroves and seagrass beds; inter-reefal and lagoonal benthos; and plants and animals of conservation significance. • As discussed, in the Project vicinity there are no reefs or islands that will be affected by the Project. Nor are there any inter-reefal or lagoonal areas within Port Curtis. While there are mangrove and seagrass areas in the vicinity of the refinery, these are not predicted to be significantly disturbed by the Project. There are no threatened or significant species that have key or important habitats in Port Curtis that will be lost or damaged due to the GNP.	• The only credible source of potential impact of the Project on the GBRWHA is marine discharge of waste water. • As discussed in Section 4.2.6.1 of the CG Report, all water quality objectives are substantially met at a maximum of 5.9 m of the diffusers. • Far-field modelling indicates that the maximum discharge concentrations would approximate ambient seawater concentrations within approximately 200 m of the diffusers. • Conditions C31 to C40 as, detailed in Schedule A2 of this Report, provide a statutory basis for the monitoring of all environmental effects on the marine environment of Port Curtis. If trigger thresholds are exceeded, the EPA requires the Proponent to take necessary remedial action. • Therefore, I conclude that there is no likelihood of the marine discharge causing any impact to the World Heritage values of the GBRWHA.

1.1 Port Curtis Wetland

Port Curtis is listed in the Directory of Important Wetlands in Australia (DEH, 2006(a)). The Port Curtis Wetland (Qld 019) is defined as nationally important and occupies an area of approximately 31,264 ha. The Port Curtis Wetland includes all the tidal areas in the vicinity of Gladstone, from Laird Point and Friend Point at the southern end of The Narrows, to Gatcome Head and Canoe Point at the southern end of Boyne Island, including Facing Island, and Curtis Island and the Calliope and Boyne Rivers and tributaries of these (DEH, 2006(a)).

There are extensive mangrove forests and shrubland (3,300 ha), seagrass beds (2,430 ha) and mudflats and saltflats (2,800 ha) within the Port Curtis Wetland (DEH, 2006(a)). The seagrass beds provide vital habitat for commercially fished crustaceans (tiger, endeavour and king prawns) as well as being the preferred feeding grounds of several Japan Australia Migratory Bird Agreement (JAMBA) and China Australia Migratory Bird Agreement (CAMBA) migratory waders. Dugongs and marine turtles are known to utilise the Port Curtis Wetland for feeding, breeding and as a major nesting site (DEH, 2006(a)).

Conclusion

The only credible source of potential impact of the Project on the Port Curtis Wetlands is due to marine discharge. Dispersion within Port Curtis should cause the key constituents of the

discharge waters to dilute to near ambient concentrations. I conclude that the Conditions C31 to C40 set by EPA for the operation and monitoring of the discharge, as detailed in Schedule A2 of this Report, should be adequate to prevent environmental harm in Port Curtis and the Port Curtis Wetland.

1.2 Habitat Protection Zones

There are a number of marine park Habitat Protection Zones (HPZ) located in Port Curtis. These comprise the HPZ at Seal Rocks on the southern boundary of the Port Curtis shipping channel, the HPZ on the eastern side of Facing Island and the HPZ through The Narrows. This HPZ has been identified for its extensive range of marine wetlands encompassing seagrass beds, mangrove forest and intertidal mudflats that provide habitat for a range of terrestrial and aquatic flora and fauna.

There are no declared Fish Habitat Areas (FHAs) under the *Fisheries Act 1994* in the vicinity of the refinery and RSF sites. The nearest FHAs are located at Corio Bay at Yeppoon (north of Rockhampton) and Cawarral Creek near Emu Park (south-east of Rockhampton) (DPI&F, 2006(a)).

Conclusion

The only credible source of potential impact of the Project on the Habitat Protection Zones is due to marine discharge. Dispersion within Port Curtis should cause the key constituents of the discharge waters to dilute to near ambient concentrations. I conclude that the Conditions C31 to C40, as proposed by the EPA for the operation and monitoring of the discharge, as detailed in Schedule A2 of this Report, should be adequate to prevent environmental harm in Port Curtis and the Habitat Protection Zones.

1.3 Dugong Protection Zone

The waters of Port Curtis also comprise the north-western part of the Rodds Bay and Peninsula to the south-east of the region. The Rodds Bay Dugong Sanctuary is a Zone B Dugong Protection Area (DPA) which stipulates and regulates legal netting practices to ensure the protection of Dugongs (GBRMPA, 2006(a)). The DPA extends from Rodds Peninsula in the south to beyond Graham Creek on Curtis Island National Park.

Conclusion

The only credible source of potential impact of the Project on the Dugong Protection Zones is due to marine discharge. As discussed in Section 4.2.6.1 of the CG Report, all water quality objectives are substantially met at a maximum of 5.9 m of the diffusers. The likelihood of dugongs encroaching this immediate mixing zone is negligible. Dispersion within Port Curtis should cause the key constituents of the discharge waters to dilute to near ambient concentrations. I conclude that the Conditions C31 to C40 set by EPA for the operation and monitoring of the discharge, as detailed in Schedule A2 of this Report, should be adequate to prevent environmental harm in Port Curtis and the Dugong Protection Zones.

1.4 Threatened and migratory species including Matters of National Environmental Significance

The following Table E2 shows the results of a database search for threatened and migratory species:

Table E2. Threatened and migratory species

Common name	Scientific name	Conservation status
		Cwlth EPBC Act[1]
Threatened species		
Mammals		
Humpback whale	*Megaptera novaeangliae*	V and M
Reptiles		
Loggerhead turtle	*Caretta caretta*	E and M
Green turtle	*Chelonia mydas*	V and M
Leatherback turtle	*Dermochelys coriacea*	V and M
Hawksbill turtle	*Eretmochelys imbricate*	V and M
Pacific/olive ridley turtle	*Lepidochelys olivacea*	E and M
Flatback turtle	*Natator depressus*	V and M
Sharks		
Whale shark	*Rhincodon typus*	V and M
Migratory species		
Marine birds		
Southern giant petrel	*Macronectes giganteus*	M
Marine mammals		
Bryde's whale	*Balaenoptera edeni*	M
Irrawaddy dolphin	*Orcaella brevirostros*	M
Killer whale, orca	*Orcinus orca*	M
Indo-Pacific humpback dolphin	*Sousa chinensis*	M
Reptiles		
Estuarine crocodile	*Crocodylus porosus*	M

1 – Cwlth EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth); Endangered (E), Vulnerable (V), Migratory (M)

Due to the lack of visibility and high turbidity in Port Curtis, no species listed under the EPBC Act was observed during the field survey in February 2006.

Of the species listed in the above table, and as indicated by the literature review, it is likely that only the following species would be encountered within Port Curtis:

- Indo-pacific humpback dolphins (*Sousa chinensis*)
- Loggerhead turtles (*Caretta caretta*)
- Green turtles (*Chelonia mydas*)
- Dugong (*Dugong dugong*)
- Flatback turtles (*Natator depressus*).

The Indo-Pacific humpback dolphins (*Sousa chinensis*) and bottlenose dolphins (*Tursiops truncates*) are known to utilise habitats in the outer harbour and occasionally move northward through Port Curtis into The Narrows.

The loggerhead turtles (*Caretta caretta*), green turtles (*Chelonia mydas*), and flatback turtles (*Natator depressus*) are known to utilise habitats in the outer harbour and occasionally move northward through Port Curtis into The Narrows. However, there are no recognised nesting beaches inside Port Curtis, with the closest sites being used by flatback turtles at North Cliff Beach (Facing Island) and the main beach at Southend (Curtis Island), where annual numbers have been estimated at 25–50 nesting turtles per beach (DEH, 1994).

Conclusion

The only credible source of potential impact of the Project on the marine threatened and migratory species is due to marine discharge. As discussed in Section 4.2.6.1 of the CG Report, all water quality objectives are substantially met at a maximum of 5.9 m of the diffusers. The likelihood of marine threatened and migratory species encroaching this immediate mixing zone is negligible. Dispersion within Port Curtis should cause the key constituents of the discharge waters to dilute to near ambient concentrations. There are no other Project components that will impact upon migratory birds (i.e. southern giant petrel). Chronic long term impact on biota, including listed migratory species (birds, mammals and reptiles), is not likely. I conclude that the Conditions C31 to C40 as proposed by EPA for the operation and monitoring of the discharge, as detailed in Schedule A2 of this Report, should be adequate to prevent environmental harm in Port Curtis and to threatened and migratory species.

2. Listed threatened species and communities (flora)

2.1 Refinery site

The EIS identified seven flora species listed under the EPBC Act of conservation significance as potentially occurring in the region.

None of the species identified in the survey area are listed as threatened species under the EPBC Act.

None of the species identified in the flora survey that are present within vegetation potentially impacted by the Project have significance from a commercial or recreational standpoint.

Species of cultural significance that might potentially be present within the broader study area include species traditionally utilised for food or medicinal purposes, tree species utilised for its bark for painting, and wildflower species traditionally collected for decoration or adornment.

2.2 Residue Storage Facility site

In order to identify the range of species and communities that may be present, reviews of existing data from the (then) Commonwealth Department of Environment and Heritage (DEH – now DEWHA) databases were conducted.

Existing data on flora of the RSF site were compiled through acquisition of the following key references:

- EPA Herbarium flora database (HERBRECS)
- EPA Wildnet Database
- EPA 1:100 000 regional ecosystems mapping
- EPA Ecomap environmentally sensitive areas database
- Commonwealth DEWHA “Matters of National Environmental Significance” Environment Protection and Biodiversity Conservation Act (EPBC) database.

Threatened, significant or otherwise noteworthy flora potentially occurring in the locality were identified from previous studies and the above databases. From this list, an assessment of potential presence was made based on suitable habitat present on site. Species identified as being potentially present in the Project area were targeted for identification during the field assessment.

The flora survey employed an assessment of floral taxa and vegetation communities in keeping with the methodology employed by the Queensland Herbarium for the survey of regional ecosystems and vegetation communities (Nelder et al., 2004). Preliminary identification of the vegetation communities of the Project areas was conducted prior to the commencement of fieldwork. It included vegetation community definition from stereo image 1:25,000 colour aerial photography (DNR, 1999) and interpretation of 1:100,000 regional ecosystems coverage Version 5.0 for the region (EPA, 2005(a)). The results were used to identify locations for representative field survey sample plots to obtain floristic and structural data and ground-truth the vegetation communities.

The RSF site is situated within the Brigalow Belt Bioregion. The bioregions of Queensland are based on landscape patterns that reflect changes in geology and climate, as well as major changes in floral and faunal assemblages at a broad scale and are used as the fundamental framework for the planning and conservation of biodiversity.

Nature conservation of the Brigalow Belt Bioregion has received increasing attention due to the rapid and extensive loss of habitat that has occurred. Major impacts upon vegetation of the Brigalow Belt include tree clearing, high grazing pressure and the proliferation of exotic species such as the prickly pear (*Opuntia stricta*) (Young et al., 1999).

The Brigalow Belt Bioregion contains 36 sub-regions or provinces that delineate significant differences in geology and geomorphology (Young et al., 1999). The RSF site is situated within the Mount Morgan Ranges sub-region.

The desktop literature review identified eight flora species listed under the EPBC Act of conservation significance as potentially occurring in the region.

None of the species identified in the survey area are listed as threatened species under the EPBC Act.

None of the species identified in the flora survey that are present within vegetation potentially impacted by the Project have significance from a commercial or recreational standpoint.

2.3 Pipelines

The desktop assessment was based on existing Commonwealth and state databases, botanical texts, the state bioregional planning assessment, satellite imagery and existing Queensland Herbarium mapping. The desktop assessment was followed by an 11-day field investigation during which 42 flora survey sites were assessed. Floral characteristics of each site were recorded.

Approximately 155 km of the 191.5 km proposed pipelines alignment is previously cleared land. Remnant vegetation that is transected by the proposed alignment consists of an estimated 25 km of eucalypt woodlands, 700 m of brigalow woodlands and 300 m of mangroves and other marine plants.

There are no Commonwealth protected communities transected by the proposed alignment. One vegetation community *Acacia harpophylla* and/or *Casuarina cristata* (RE 11.3.1 – brigalow woodland), which is listed as Endangered under the EPBC Act, was originally intersected by the proposed alignment. However, the alignment was subsequently moved to avoid this community.

A review of the Queensland Herbarium (HERBRECS) for areas within a 55 km search area centred on the proposed alignment identified 47 EVR species that are known to have ranges that overlap the study area. Of these 47 species, 23 were identified as having a preferred habitat within the proposed alignment. These species and the preferred habitats were specifically targeted during the field survey work. Only one of these species listed by commonwealth DEH were actually located during field studies, see Table E8 below. Species identification was confirmed by the Queensland Herbarium.

Table E8. Protected flora species recorded along the proposed ore slurry pipeline alignment

Family	*Scientific name* (Common name)	Conservation status *	Preferred habitat	Number of locations	Numbers in vicinity of alignment
Myrtaceae	*Eucalyptus raveretiana* (black ironbox)	Vulnerable (EPBC Act & NC Act)	Always along creek beds and riverbanks in coastal and subcoastal areas from Ayr and Charters Towers south to Duaringa in central Queensland (Brooker and Kleinig, 1994).	5	100+

* NC Act = *Nature Conservation Act 1992* (Qld)
EPBC Act = *Environment Protection and Biodiversity Conservation Act 1998*

Black ironbox (*Eucalyptus raveretiana*) is listed as vulnerable under the EPBC Act. Between KP 38 and KP 80.5 the alignment crosses five ephemeral watercourses which are lined by dozens of black ironbox trees, which include a mix of both mature and juvenile trees.

The watercourses where the black ironbox was located are:

- Two Mile Creek (KP 38)
- Limestone Creek (KP 60.5)
- Deep Creek (KP 62.5)
- Lion Creek (KP 72)
- Neerkol Creek (KP 80.5).

Subsequent to the field investigations, the pipeline alignment has been revised at the crossing locations to minimise impacts to this species at the watercourse crossings, although due to the numbers present, total avoidance is not possible.

Whilst the occurrence of additional EVR flora species cannot be completely ruled out as not all parts of the alignment were inspected, ecologists that undertook the field survey consider it unlikely that any other species would occur within the proposed alignment and that even if present, the numbers would be very low.

Based on the mitigation measures proposed (including narrowing the area of clearing at these crossings and avoidance of large individual black ironbox trees as far as possible), the maximum numbers of trees and juvenile black ironbox plants that would be required to be removed has been estimated and is outlined in the following Table E9:

Table E9. Black ironbox plants to be removed

Location	Trees to be removed	Juvenile plants to be removed
Two Mile Creek	0	<10
Limestone Creek	0–5	<5
Deep Creek	0	<15
Lion Creek	0–10	0
Neerkol Creek	0	<10

In each of these cases, black ironbox is the dominant canopy tree along the creek banks and in excess of 100 trees occur immediately upstream and downstream of the proposed crossing points. Also, given the efficient regeneration capacity of the species, it is expected that over the longer term the potential impacts on this species will be reversible through natural regeneration. As such, the impact of clearing on this species is considered to be low.

Conclusion

With the small number of black ironbox plants to be removed, I consider that the impact of the proposed clearing on this species is low. As discussed in Section 7 of the EIS, to minimise impacts at all waterway crossings, the Proponent has committed to the use of boring and/or horizontal directional drilling wherever appropriate. Therefore I conclude that the impact to the black ironbox plants will be very low.

Aquatic vegetation

A search of the Commonwealth Government's Database and the Directory of Important Wetlands (Blackman et al., 1999) identified that there are no Ramsar wetlands transected by the proposed alignment but that there are three nationally important wetlands downstream of the proposed alignment (Table E10). These are:

- Fitzroy River Delta
- Fitzroy River Floodplain
- Great Barrier Reef Marine Park.

Table E10. Nationally Important Wetlands

Wetland	Proximity to pipeline alignment	Description
Fitzroy River Delta	Majority downstream of alignment – small swamp mapped as part of the Fitzroy River Delta Nationally Important Wetland crossed at KP 103.	Fitzroy River Delta covers 70,254 ha. The wetland meets four criteria of importance (biogeographical representativeness, functional importance, value as an ecological refuge, and human social importance). The system includes eight wetland types ranging from subtidal aquatic beds to freshwater lagoons and marshes (Blackman et al., 1999).
Fitzroy River Floodplain	Located downstream of the alignment (closest approach is approximately 3 km at KP 79).	The ephemeral floodplain covers 19,485 ha. The wetland meets four criteria of importance (biogeographical representativeness, functional importance, value as an ecological refuge, and value as a population refuge). The floodplain includes five wetland types ranging from permanent rivers and streams to seasonal lakes and freshwater swamp forest.
Great Barrier Reef Marine Park (GBRMP)	Located downstream of the pipeline route,	The GBRMP system covers 34,108,876 ha and meets all six criteria of importance. The system includes eight marine and coastal wetland types ranging from coral reefs to rock marine shores, mud, sand or salt flats and intertidal forested wetlands (Blackman et al., 1999).

The proposed alignment has been selected to minimise direct impacts to wetlands through increased erosion, siltation, removal of vegetation and changes in drainage patterns. Wetland areas downstream of the alignment also have the potential to be impacted through changes to hydrogeology and influx of sediment.

A number of wetlands within the vicinity of the proposed alignment support a variety of wildlife (including endangered, vulnerable and/or rare (EVR) fauna species as discussed in sections 3.3.2 and 3.3.5 and the maintenance of existing water flow patterns is essential to ensure the vegetation structure and ecological values of the wetland areas are maintained.

A number of control measures will be put in place to minimise the potential impacts to wetlands from changes to drainage patterns and are included in the EMP presented in the EIS. These include:

- scheduling the construction of the pipelines for the dry season (between April and October) where possible
- placement of all stockpiles of topsoil or subsoil outside of drainage channels
- removal of all barriers and berms (where these will impede drainage flows) post construction
- reinstatement of pre-existing drainage lines and contours post construction.

The downstream release of sediment also has the potential to adversely impact the values of the wetlands. The key risk factor associated with the downstream release of sediment would be associated with a major rainfall event during construction if appropriate erosion control measures are not in place.

A number of control measures will be put in place to minimise the potential impacts to wetlands by sedimentation and are detailed in the EMP. These include:

- alignment of the pipeline route to avoid direct disturbance of wetlands as far as possible
- scheduling the construction of the pipeline for the dry season (April to October) where possible
- installation of and regular monitoring of sediment control devices around all topsoil and subsoil stockpiles
- scheduling activities to minimise the duration of construction through the wetland areas;
- prioritising restoration of the disturbed areas, to achieve a stabilised surface prior to commencement of the wet season
- development of a site specific revegetation plan for the wetland area utilising native macrophytes species sourced from topsoil of disturbed wetland or seed sources from adjacent undisturbed wetland areas where possible.

Mitigation measures

The pipeline route has been selected to avoid or minimise (where avoidance has not been possible due to other constraints) impacts to protected vegetation and significant ecological communities.

Mitigation measures will follow the procedures outlined below.

General

- Work in consultation with the EPA, NRW and DPI&F to obtain the necessary approvals for vegetation clearing.
- Restrict disturbance to the 35 m (max.) ‘right-of-way’ corridor (ROW) and designated work areas.
- Install physical barriers around significant vegetation areas in order to restrict access and avoid disturbance.

- Clearly indicate the location of vegetation to be retained on construction drawings and alignment sheets.
- Mark clearing boundaries through areas of significant vegetation during preconstruction pegging for the pipeline alignment.
- Undertake regular monitoring of clearing and clearing boundaries during construction.
- Allow vegetation to re-establish to within 3 m of the centreline of each outer pipeline following construction.

Protected vegetation

- Minimise clearing widths and disturbance in riparian areas that contain black ironbox; (Two Mile Creek (KP 38); Limestone Creek (KP 60.5); Deep Creek (KP 62.5); Lion Creek (KP 72) and Neerkol Creek (KP 80.5).
- Conduct pre-construction vegetation survey of the final alignment and clearly identify any individual black ironbox plants that are located within the construction easement and that may be avoided during construction.

Restoration

- Develop a reseeding plan based on soil types, existing local vegetation characteristics and landholder preferences.
- Reseed ecologically sensitive areas with local provenance bluegrass (*Dicanthium sericeum*) seed if available, or purchased bluegrass seed from other parts of Central Queensland (subject to landholder preferences).
- Re-spread vegetative wastes, stick raking timber into piles to provide animal habitat and to assist in revegetation and erosion control (subject to landholder agreement).
- Avoid large scale burning of vegetative wastes (subject to landholder preferences).
- Allow trees and shrubs to naturally regenerate on cleared areas not required to be kept tree free for pipeline protection and maintenance (subject to landholder preferences).
- Monitor vegetation reestablishment post-construction and undertake appropriate corrective action where necessary, e.g. vegetation fails to re-establish, excess weed species.

Conclusion

Given the number of control measures that GPNL will implement to minimise the impacts to wetlands, such as aligning the pipeline route to avoid direct disturbance of wetlands as far as possible, and scheduling construction of the pipeline in the dry season, I am satisfied that the impacts of pipelines on aquatic vegetation will be minimal.

3. Listed threatened species and communities (fauna)

3.1 Refinery site

3.1.1 Terrestrial fauna

Existing fauna data were reviewed from a number of sources. These included:

- EPA Wildnet database (EPA, 2006(d))
- terrestrial vertebrate records from the Queensland Museum (Queensland Museum, 2006)
- DEH online EPBC database (EPBC Protected Matters Report, 1 May 2006).

- existing fauna studies from the Yarwun precinct of the GSDA, including: Barden & Martin (1997), Dames & Moore (1998), Connell Wagner (2002), Connell Wagner (2005), Connell Hatch (2005 and 2005(a)), and Enviros ciences (1993).

Following a review of the above existing data, target species potentially occurring in the study site, including endangered, vulnerable, rare/threatened fauna, were identified.

A survey of fauna at the refinery site was undertaken in May and June 2006. A total of 93 native and 5 introduced vertebrate species were recorded during field survey. Native species included 3 amphibian, 12 reptile, 61 bird and 17 mammal species.

3.1.2 Aquatic fauna

The refinery study area is located adjacent to the Calliope River and a number of small, unnamed ephemeral gullies that drain the site directly into the adjacent estuarine system. During the survey period, the refinery study area did not support any non-estuarine surface water. The lower reaches of the local stream systems supported brackish estuarine water. During the survey a single freshwater dam within the refinery study area had recently dried, and a number of dead long-finned eels (*Anguilla rheinhardtii*) were observed at this site.

3.1.3 Endangered, vulnerable and rare (EVR) and/or threatened species

The majority of the species recorded or expected within the study area are widespread in eastern Australia, while a small number of species are restricted or regionally uncommon. Fauna species occurring within the study area are assigned a threatened status of either endangered, vulnerable or rare according to Commonwealth legislation and are described in the:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

In addition to the threatened species, the EPBC Act also includes a list of migratory species. These species are those that are listed under the following international agreements to which Australia is a signatory nation:

- Japan Australia Migratory Bird Agreement (JAMBA)
- China Australia Migratory Bird Agreement (CAMBA)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Under the EPBC Act, Australia has an international obligation to protect significant populations and significant sites for these species.

Significant species other than EVR species have also been identified. A number of action plans concerning fauna species were also reviewed for this study, and fauna species listed as Near Threatened are identified in this report. Relevant action plans include the Action Plan for Australian Birds (Garnett & Crowley, 2000), the Action Plan for Australian Bats (Duncan et al., 1999), the Action Plan for Australian Marsupials and Monotremes (Maxwell et al., 1996) and the Action Plan for Australian Reptiles (Cogger et al., 1993).

No Endangered or Critically Endangered species are known or expected to occur in the study area. No species listed in the EPBC Act were recorded.

3.1.4 Migratory species

Two species listed as migratory birds under the EPBC Act (DEH, 2006) were recorded within the refinery study area. One migratory shorebird, the lesser sand plover (*Charadrius mongolus*), was recorded at the north-eastern end of the site in March 2006. A terrestrial bird species, the rainbow bee-eater (*Merops ornatus*), was also observed in a number of habitats across the survey area. This species is common and does not require specific habitat management measures.

In comparison to the terrestrial sites surveyed, mangrove and salt marsh habitats on marine clay-pans on the margins of the refinery site supported the lowest diversity of native fauna species and a relatively moderate diversity of birds.

Mangrove, salt-marsh and marine claypan habitats supported a number of bird species that were restricted to or more common in this habitat type, including one species listed as a migratory species under the EPBC Act (lesser sand plover). Open salt-marsh with standing water and mudflats on the Calliope River anabranch also supported a number of wetland and marine birds. Additional migratory wading species may utilise these habitats during the southern hemisphere summer.

This mangrove/salt marsh habitat provides potential habitat for the Rare rusty monitor (*Varanus semiremex*) and support habitat for migratory shorebirds and waders.

3.1.5 Other significant species

Two fauna species listed as Near Threatened (Commonwealth DEH) under relevant action plans were present within the survey area. These are listed in the following Table E11 and are largely associated in open forest habitats in the refinery area.

Table E11. Significant fauna species

Common name	Scientific name	Site no.	Action Plan status
Bush stone-curlew	*Burhinus grallarius*	Across study area	Near Threatened (Garnett & Crowley, 2000)
Barking owl	*Ninox connivens*	S2, S3, S4, S5	Near Threatened (Garnett & Crowley, 2000)

The clearing associated with the refinery's construction will remove most of the fauna habitat presently on the site. The extent of clearing proposed and the area of each vegetation community/habitat type to be affected is discussed in section 8.5.9.

The terrestrial habitats within the refinery site have been impacted by past land clearing and land use. Areas of the remaining forest and woodland appear to be at a relatively young successional stage, with low availability of hollows suitable for wildlife habitat. In addition there are currently a number of anthropogenic impacts affecting the study area including lighting, noise from adjacent industrial developments and road and rail easements, unmanaged fires, access for fishing and recreational four-wheel-drive, camping and rubbish dumping.

The south-eastern section of the surveyed area adjacent to the Calliope River (Figure 8.1.2) supported a relatively high diversity of native species compared to the balance of the area. Less disturbed and structurally mature forests are located in this area (Vegetation Units 2c and 2f.) and this open forest supported the highest diversity of native species, particularly birds and mammals (transect 2) and the highest diversity of reptile species (transect 5). However, this area is outside of the refinery site and will not be disturbed by the GNP.

The mudflats and mangrove areas in the Calliope/Port Curtis area are identified as significant habitats for migratory wading birds. The marine clay pan area in the north-eastern section of the refinery site is used by a number of wading and shore bird species. However, this area will be filled by the GPCL as part of the WICT project. The environmental impacts of this filling operation are addressed in the EIS for that project. The component of the GNP to be built in this area (stockpiles) will be built on land which, once filled, will have negligible habitat value.

The fauna species recorded within the terrestrial habitats of the refinery area are generally common and widespread in the region. Only one EVR species, the vulnerable powerful owl, was recorded during the survey and all observations of this species were within the open

forest area in the south-east of the survey area adjacent to the Calliope River. This area is outside of the refinery site and will not be affected by the GNP.

EVR species were not detected within the refinery site, and in general the forests present in this area recorded overall lower diversity of fauna species, lower number of arboreal mammals, and few old growth trees with hollows.

Mitigation measures

Clearing of the site will be undertaken in a way that is sensitive to the site's habitat values and the presence of native fauna. Strategies to be employed will include the following:

- Areas to be cleared will be limited to only those required for construction activities.
- Access of construction and operational workers to areas outside of the cleared areas will be permitted only with the prior approval of the Environmental Representative.
- Where possible, dead trees, stags and hollow branches will be salvaged from the cleared area and relocated to the surrounding areas to create compensatory shelter.
- The timing of clearing operations will be selected, where possible, to minimise impacts on breeding species.
- A pre-clearing survey for potential habitats or nesting trees for the powerful owl (e.g. large senescent trees with suitable hollows) will be undertaken. Where such trees are present, these will be inspected for breeding pairs or chicks (breeding is in winter). If present, the clearing of such tress will be avoided, where possible, until the chicks have left the nest.
- A comprehensive search of other vegetation to be felled will be performed prior to clearing to determine the presence of birds, reptiles, microchropteran bats, and arboreal mammals. Species will be recovered and released in areas unaffected by the construction activities.
- Any hollow bearing trees identified will be felled in a manner which reduces potential for fauna mortality. Felled trees will be inspected after felling and fauna (if identified and readily accessible) will be removed and relocated or rendered assistance if injured. After felling, trees will remain unmoved for at least 24 hours to allow animals to move of their own volition.
- Plans will be developed to monitor and control populations of vertebrate feral pests (e.g. red fox (*Vulpes vulpes*) and feral cat (*Felis catus*), as well as mosquitoes.

Conclusion

Due the high degree of previous disturbance to the refinery site, the overall ecological integrity of the site has been strongly compromised. Also, given the low incidence of listed fauna sightings on the refinery site, I conclude that the likely impact to listed threatened fauna species and communities is negligable.

In addition, the EPBC Act listed threatened and migratory species, and the diversity of marine and estuarine ecosystems and feeding and breeding habitats for seabirds, marine reptiles and marine mammals that contribute to the World Heritage values of the GBRWHA will also be unaffected by the refinery discherge.

3.2 Residue Storage Facility site

3.2.1 Terrestrial fauna

Existing fauna data were reviewed from a number of sources. These included:

- EPA Wildnet database (EPA, 2006(d))
- terrestrial vertebrate records from the Queensland Museum (Queensland Museum, 2006)
- Environment Australia online EPBC database (EPBC Protected Matters Report, 1 May 2006)

- existing fauna studies from the Aldoga and Yarwun precincts of the GSDA, including Barden & Martin (1997), Dames & Moore (1998), Connell Wagner (2002), Connell Wagner (2005 and 2005(a)), Connell Hatch (2005) and Enviros ciences (1993).

The fauna survey of the RSF study area was undertaken in May and June 2006. General observations were made across the study area as well as more detailed assessment at four transect sites. Standard biological survey techniques were used during field surveys, including a number of live capture/release trapping techniques, standard and general observational and habitat searches, as well as methods to indirectly detect the presence of terrestrial fauna. The survey focussed on terrestrial vertebrate taxa.

A total of 106 native and 5 introduced terrestrial vertebrate species were recorded during field surveys in the RSF study area. Native species included 7 amphibian, 17 reptile, 63 bird and 19 mammal species.

3.2.2 Species of conservation value and Matters of National Environmental Significance

3.2.2.1 Overview

The majority of the species recorded or expected within the study area are widespread in eastern Australia, while a small number of species are restricted or regionally uncommon. Fauna species occurring within the study area are assigned a threatened status of either endangered, vulnerable or rare according to Commonwealth legislation and are described in the:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

In addition to the threatened species, the EPBC Act also considers migratory species. These species are those that are listed under the following international agreements to which Australia is a signatory nation:

- Japan Australia Migratory Bird Agreement (JAMBA)
- China Australia Migratory Bird Agreement (CAMBA)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Under the EPBC Act, Australia has an international obligation to protect significant populations and significant habitats for these species.

Significant species other than EVR species have also been identified. A number of action plans concerning fauna species were also reviewed for this study, and fauna species listed as Near Threatened are identified in this report. Relevant action plans include the Action Plan for Australian Birds (Garnett & Crowley, 2000), the Action Plan for Australian Bats (Duncan et al., 1999), the Action Plan for Australian Marsupials and Monotremes (Maxwell et al., 1996) and the Action Plan for Australian Reptiles (Cogger et al., 1993).

3.2.2.2 Endangered, vulnerable and rare (EVR) and/or threatened species

Threatened species, under the EPBC Act, known to occur within the study area are listed in the following table. No endangered or critically endangered species are known or expected to occur in the study area. One species is classified as vulnerable under the EPBC Act.

Table E12. Threatened fauna species

Common Name	Scientific Name	Transect	EPBC Act	NC Act
Squatter pigeon	*Geophaps scripta*	7, 8, 11	V	V

Squatter pigeon (*Geophaps scripta*)

The southern sub-species of the squatter pigeon (*Geophaps scripta scripta*) is distributed through inland areas from northern NSW to the Burdekin region of Queensland. It occurs patchily, mainly in grassy eucalypt woodland and gravel ridge habitats, and is a seed eater (Garnett & Crowley, 2000). The species has declined significantly in the southern parts of its range (NSW), but appears to be stable in central Queensland. The southern sub-species is listed as vulnerable under state and Commonwealth legislation. In the northern part of its range cattle grazing is thought to have had a lesser impact on this species than land clearing and subsequent fragmentation of populations (Garnett & Crowley, 2000). Predation by foxes, changes in availability of food plants and other impacts combined with drought have been identified as potential threats (Garnett & Crowley, 2000).

Squatter pigeons were regularly observed in grassy woodlands and adjacent pasture areas throughout the RSF study area. A number of sightings were associated with cattle watering points and artificial dams. Most sightings were of small groups, between two and six individuals, usually foraging on the ground or gathered near open water. This species has also been observed in adjacent areas (Barden & Martin, 1997).

3.2.2.3 Migratory species

No significant migratory species were recorded within the RSF study area. A single bird species was identified, the rainbow bee-eater (*Merops ornatus*). This is listed as a migratory species under the EPBC Act (DEH, 2006). This species is common and does not require specific habitat management measures. None of the habitats present within the RSF study area are suitable for migratory wetland or shorebirds.

3.2.2.4 Other significant species

A number of fauna species present within the RSF study area are listed as Near Threatened and protected under specific action plans produced by the Commonwealth DEH. These species are largely associated with open forest and woodland habitats in the RSF study area, particularly in alluvial areas. The following Table E13 lists these species.

Table E13. Other significant species

Common name	Scientific name	Transect	Action Plan status
Australian bustard	*Ardeotis australis*		Near Threatened (Garnett & Crowley 2000)
Speckled warbler	*Chthonicola sagittata*	8	Near Threatened (Garnett & Crowley 2000)
Grey-crowned babbler	*Pomatostomus temporalis*	8	Near Threatened (Garnett & Crowley 2000)
Barking owl	*Ninox connivens*	8	Near Threatened (Garnett & Crowley 2000)
Squirrel glider	*Petaurus norfolcensis*	6	Near Threatened (Maxwell et al. 1996)
Yellow-bellied glider	*Petaurus australis*	South of 11	Near Threatened (Maxwell et al. 1996)

Mitigation measures

Specific management strategies relating to EVR/threatened species and habitats within the RSF area include:

- Squatter pigeon:

- Preservation and rehabilitation of known or likely habitats in Project areas adjacent to the RSF footprint area.
- Contribution to any regional monitoring and assessment program for the squatter pigeon within the GSDA, in conjunction with Government and other land users.

- Maintenance and management of habitat:
  - During construction of the RSF, already established access tracks will be utilised where possible and laydown areas will be positioned to avoid disturbance to potential roost or nesting trees within Project areas adjacent to the RSF footprint area.
  - Protection and management of terrestrial habitats in Project areas adjacent to the RSF footprint area.
  - Monitoring and control of declared pest animals and non-declared animals in Project areas adjacent to the RSF footprint area.

Conclusion

Due the high degree of previous disturbance to the residue storage facility site, the overall ecological integrity of the site has been strongly compromised. The southern sub-species of the squatter pigeon (*Geophaps scripta scripta*), which listed as vulnerable under the EPBC Act, has been recorded from the residue storage facility site. However the squatter pigeon has been observed widely within the Gladstone region, including adjacent pasture areas throughout the RSF study area, and its population appears to be stable in central Queensland.

Given the mitigation measures committed to be undertaken by the Proponent, as listed above and in the EIS and SEIS, I conclude that the likely impact to listed threatened fauna species and communities on the residue storage facility site is negligible.

3.3 Pipeline

3.3.1 Terrestrial fauna

The fauna assessment consisted of two stages; a desktop study, followed by a field assessment of the proposed pipeline alignment. The desktop study involved a review of published material and searches of relevant databases and archives. This assessment was used to document known records for the study area, identify the potential presence of significant fauna species, and assist in targeting areas for field assessment.

Field assessment of the proposed alignment was conducted over ten days from 9–18 February 2006. No fauna trapping was employed during this assessment. The field surveys targeted habitat assessments and involved walk-through assessments of 63 selected sites which were representative of the habitats along the alignment.

Assessments of the above attributes were supplemented by opportunistic and dedicated searches for fauna and fauna signs at each site including spotlighting and recording of bat calls.

The desktop fauna assessment identified 674 fauna species that may potentially utilise habitat within the wider area. These comprised 3 butterflies, 41 fish, 32 amphibians, 125 reptiles, 377 birds (over 50% of total Australian bird species) and 96 mammals. Of these fauna species, 72 are EVR species. During the field assessment 145 fauna species were recorded, comprising 10 amphibians, 21 reptiles, 88 birds and 26 mammals.

Listed EVR species are defined as those taxa listed in the EPBC Act[1] or the NC Act as critically endangered, endangered, vulnerable, rare or migratory.

[1] Cwlth EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) classifications: Presumed Extinct (PE); Critically Endangered (CE); Endangered (E); Vulnerable (V); Conservation Dependent (CD); Migratory (M)

Regionally significant fauna were also identified from species identified by the Brigalow Belt South Fauna Expert Panel (EPA, 2003 (a)) as non-EVR priority taxa for the Brigalow Belt Bioregion and/or had been listed in a relevant action plan for the specific taxonomic groups including butterflies, freshwater fishes, frogs, reptiles, birds, monotremes and marsupials, bats and rodents.

Based on field habitat assessments and RE mapping, 13 broad habitat types were identified as present within the proposed corridors and these are described in the following Table E14.

Table E14. Fauna habitat descriptions

Fauna habitat	Description
Brigalow woodland	Woodland dominated by brigalow (*Acacia harpophylla*) and/or belah (*Casuarina cristata*) on plains and undulating slopes. Some with emergent eucalypts. Corresponds to RE 11.3.1 and 11.11.16.
Ironbark woodland	Ironbark (*Eucalyptus crebra*) dominated woodland on hills and plains. Corresponds to RE 11.11.1, 11.11.4, 11.11.15, 11.12.1 and 12.11.14 identified as present by the flora survey.
Mixed eucalypt woodland	Woodland dominated by mixed eucalypt species over a grassy understorey and variable shrub layer. Corresponds to RE 11.11.7 and 11.11.10.
Fringing riparian woodland	Fringing woodland along creeks and rivers, dominated by Queensland blue gum (*Eucalyptus teretecornis*) and/or river red gum (*E. camaldulensis*) and casuarinas. Corresponds to RE 11.3.25.
Riparian forest	Queensland blue gum (*Eucalyptus teretecornis*) and/or river red gum (*E. camaldulensis*) tall woodland to open forest, over a grassy understorey, on alluvial plains. Corresponds to RE 11.3.4.
Poplar box woodland	Woodland dominated by poplar box (*Eucalyptus populnea*) on alluvial plains. Corresponds to RE 11.3.2.
Mixed open forest	Open forest dominated by a mixture of *Eucalyptus* and *Corymbia* species on hills and plains. Understorey grassy or shrubby, often with a tall shrub to low tree layer. Corresponds to RE 11.3.26, 11.11.3 and 12.11.6.
Wetlands	Freshwater or brackish seasonal or perennial swamps and lagoons, often with fringing rank vegetation of rushes, sedges and grasses. Includes artificial water bodies formed by dams and levees.
Watercourse	Creeks and rivers, both perennial and seasonal. Range from small ephemeral or seasonal drainage lines, through larger creeks often including waterholes, to large rivers.
Mangrove forest / woodland	Low woodland to closed forest of mangrove species on intertidal flats of saline marine clays. Corresponds to RE 11.1.4.
Samphire	Samphire forbland on marine clay plains. Saltpans and mudflats with clumps of saltbush on supratidal flats with deep saline clay soils. Corresponds to RE 11.1.2.
Rocky outcrops	Rock outcrops, often with loose rocks lying on the rock or the ground, or aggregations of loose surface rock. May include overhangs, small cliffs, crevices etc.
Cleared land	Land cleared or mostly cleared of trees and other woody vegetation, for agriculture such as grazing or crops. Often includes occasional scattered ‘paddock’ trees, remaining as individuals or small stands.

Based in the results of the fauna assessment, it is concluded that potentially significant impacts to terrestrial fauna due to pipeline construction and operation are not likely.

3.3.2 Endangered, vulnerable and rare (EVR) and/or threatened species

Desktop searches identified 72 EVR fauna species listed under the EPBC Act and/or NC Act as having the potential to occur in the vicinity of the proposed pipelines. These species comprised 1 invertebrate, 1 fish, 1 amphibian, 20 reptiles, 33 birds and 16 mammals.

Of these species, 35 are listed under both the EPBC Act. Based solely on the desktop review of habitat preference, 17 species listed under the EPBC Act may potentially utilise habitats within the pipeline corridor. A full listing of EVR fauna species, together with the preferred habitat and an indication as to whether the habitat is present within the proposed alignment is contained within Appendix D3 of the EIS.

One EVR fauna species under the EPBC Act was positively recorded along the proposed alignment during the field assessment, while an additional species was potentially recorded/sighted, refer the following Table E15.

Table E15. EVR species sightings

Common name (*Scientific name*)	Status*	Preferred habitat	No. sightings	Approx. KP
Squatter pigeon (*Geophaps scripta scripta*)	V	Open grasslands often in eucalypt woodland. Preference for areas on sandy soil with low gravel ridges and nearby water.	6	9 (1 km off alignment), 65, 158, 166, 167, 167.5
Capricorn yellow chat (*Epthianura crocea macgregori*)	CE	Freshwater or saline drainage channels on coastal marine plains, connected to tidally influenced wetlands. Breeding habitat is rank vegetation (rushes, sedges, grasses) flanking wetlands, adjacent to muddy substrates used for foraging.	Possible sighting	132.5

Status*: Cwlth EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) classifications: Presumed Extinct (PE); Critically Endangered (CE); Endangered (E); Vulnerable (V); Conservation Dependent (CD); Migratory (M)

While the Capricorn yellow chat was not positively recorded, the species has previously been observed at 12 Mile Creek (KP 130) and Raglan Creek (KP 136) and may utilise suitable habitat in other areas of the coastal plain (Houston et al., 2004).

3.3.3 Other fauna species of conservation significance

An additional 112 bird species listed under the EPBC Act as migratory and/or marine protected species were identified as previously recorded from the wider study area, or with geographic ranges that overlap the wider study area. These include species listed under the Japan Australia Migratory Bird Agreement (JAMBA), China Australia Migratory Bird Agreement (CAMBA) and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Forty-seven of these were listed as both migratory and marine protected species and 65 as marine only. Whilst these are not EVR fauna, these are EPBC Act protected species that may utilise local habitats on a seasonal basis, or marine species that may fly over or otherwise utilise the wider area.

3.3.5 Aquatic fauna

Aquatic EVR species identified as occurring within the wider area include the Fitzroy River turtle (*Rheodytes leukops*) listed as mulnerable under the EPBC Act and the saltwater crocodile (*Crocodylus porosus*) listed as migratory and marine under the EPBC Act . The pipeline crossing locations on Marlborough Creek (KP 9) and the Fitzroy River (KP 10) provide potential habitat for these species.

No EVR fish species were identified as occurring in the region; however, five fish species identified as regionally significant may occur in watercourses intersected by the pipeline including:

- Agassiz's glassfish (*Ambassis agassizii*)
- Southern purple-spotted gudgeon (*Mogurnda adspersa*)
- Freshwater catfish (*Tandanus tandanus*)
- Southern saratoga (*Scleropages leichardti*)
- Leathery grunter (*Scortum hillii*).

The southern saratoga and leathery grunter are endemic to the Fitzroy Catchment.

The platypus (*Ornithorhynchus anatinus*) was also identified as a regionally significant species and may occur within the Project area. Platypus use freshwater creeks, slow-moving rivers, lakes joined by rivers and built water storages such as farm dams and are still relatively widespread in eastern Australia, but may be locally threatened by degradation of waterways.

3.3.6 Matters of National Environmental Significance

A number of EVR fauna species identified as potentially occurring within the proposed alignment are species that are nomadic, highly mobile or occupy very large home ranges. These include red goshawk, squatter pigeon, glossy black-cockatoo, powerful owl, square-tailed kite, freckled duck, large-eared pied bat and eastern bent-wing bat. Given the small amount of remnant vegetation to be cleared by construction of the proposed pipeline compared to the area over which individuals of these species range, no significant impact is likely upon these species.

Several other EVR fauna species have the potential to be directly impacted if these are present within the pipeline corridor in forest and woodland habitats, but also have preferred habitat types that are similarly well represented in the immediate vicinity of the proposed alignment. These include brigalow scaly-foot and yakka skink.. Although there is potential for some direct impact on these species, the small amount of habitat to be cleared combined with the implementation of appropriate mitigation recommendations would result in minimal potential for the proposed pipeline construction to significantly impact these EVR fauna species.

The detailed distributions of several of the other EVR fauna species identified are poorly known, as these are particularly secretive or cryptic in habits. These include short-necked worm-skink, Dunmall's snake, yellow-naped snake, ornamental snake and grey snake. A conservative approach has been taken to assume that these are present in remnant woodland and brigalow habitats and on cracking clay soils and mitigation measures have been developed on this basis.

Of the EVR species listed under the EPBC Act and identified as potentially utilising preferred habitat within the proposed pipeline corridor, 9 are considered to have the potential to be impacted by the proposed pipeline due to potential effects on preferred habitat, while one species, the Capricorn yellow chat, has the potential to be significantly impacted.

Table E16. EPBC Act-listed Species Potentially Impacted by the Pipelines

Common name (*Scientific Name*)	Status *	Ecology and distribution notes	Potential Impacts
Reptiles			
Fitzroy river turtle (*Rheodytes leukops*)	VU	Recorded in Fitzroy River and in Marlborough Creek near the alignment.	Habitat loss (riffle zones in Fitzroy R and tributaries)
Brigalow scaly-foot (*Paradelma orientalis*)	VU	Reliant on logs and ground debris for shelter. Recorded from the Stanwell and Marlborough areas close to the alignment, and potentially present in Brigalow remnants and Eucalypt Woodland along the entire route.	Habitat loss (Brigalow, logs), trench fall.
Yakka skink (*Egernia rugosa*)	VU	Ground-dwelling reliant on logs and ground deris for shelter. Widespread but rare, potentially present in Eucalypt Woodland along the entire route.	Habitat loss (logs), trench fall.
Collared delma (*Delma torquate*)	VU	Ground-dwelling, reliant on rocks, logs and ground debris for shelter. Potentially present in Eucalypt Woodland and Brigalow remnants along the entire route.	Trench fall
Dunmall's snake (*Furina dunmalli*)	VU	Ground-dwelling, reliant on logs and ground debris for shelter. Potentially present in Eucalypt Woodland and Brigalow remnants along the entire route.	Trench fall
Ornamental snake (*Denisonia maculate*)	VU	Poorly known, ground-dwelling, reliant on logs and ground debris for shelter. Recorded in Rockhampton area, and potentially present in Eucalypt Woodland and Riparian Woodland along the entire route.	Trench fall
Birds			
Capricorn yellow chat *(Epthianura crocea macgregori*)	CE	Recently recorded on Raglan Creek and 12 Mile Creek near proposed alignment, and potentially present in freshwater and tidally-influenced wetlands and lagoons with rank vegetation between Bobs Creek (KP105) and Raglan Creek (KP137).	Habitat loss (wetlands, altered hydrology)
Australian painted snipe (*Rostratula australis (benghalensis)*)	VU	Cryptic nomadic bird of shallow wetlands, nests on the ground in reeds close to water. Potentially present in wetlands habitats along entire route, and especially between Bruce Hwy and Raglan Creek (KP101-137).	Habitat loss (wetlands)
Bats			
Eastern long-eared bat (*Nyctophilus timoriensis*)	VU	Dependent on tree hollows for roosting. Potentially present in Eucalypt Woodland, Open Forest and Riparian Woodland with hollow-bearing trees along the entire route.	Loss of roost sites (tree hollows)

Commonwealth-listed (EPBC Act): PE = Presumed Extinct; CE = Critically Endangered; EN = Endangered; VU = Vulnerable, CD = Conservation Dependen.

3.3.7 Potential impacts on the EPBC Act listed yellow chat

The Capricorn yellow chat (*Epthianura crocea macgregori*) was the only EPBC Act-listed species that was considered to have the potential to be significantly impacted from construction of the pipeline through the impacts to preferred habitat – rank vegetation surrounding lagoons and creeks. The Capricorn subspecies of the yellow chat was believed to occur only on Curtis Island near Gladstone, until two additional small populations were discovered in 2003/04 on the mainland in the 12 Mile Creek – Raglan Creek area of the Fitzroy River delta, and at Toorilla Plain north of Rockhampton. The habitat of the yellow chat is shallow saline and freshwater drainage lines connected to tidally influenced wetlands, including samphire and inundated sedgelands. Rank vegetation (thick sedges, rushes and grasses) surrounding freshwater lagoons provide shelter, while foraging takes place on adjacent exposed muddy substrates. Breeding has been recorded between October and February (Houston et al., 2004, 2006).

Pipeline construction has the potential to impact on the yellow chat through direct disturbance causing birds to leave the site or reduce breeding activity (e.g. noise, dust or lights associated with construction activities) and physical disturbance of habitat (e.g. clearing of wetland vegetation upon which chats may be dependent) (Houston, 2006). Indirect impacts may also occur if control measures are inadequate during crossings of creeks due to erosion and sedimentation of downstream habitat or through loss of emergent vegetation upon which chats depend for food and shelter

The hydrology of the area also appears to be an important factor to the chats' breeding cycle and loss or reduction of downstream flows due to pipeline construction could seriously impact on yellow chat habitat through changes in productivity (providing the basis of food chains for breeding chats) or changes to vegetation structure and floristics upon which chats depend for shelter and nesting. Where sites are dependent on overland flows for inundation, there is potential for disturbance by small alterations in surface topography associated with pipeline infrastructure construction (trenches and access roads) and on-going pipeline maintenance requiring road access (Houston, 2006).

Upon completion of the field investigation, the pipeline route was revised to reduce the potential for impacts to the yellow chat. An additional field inspection of the proposed alignment corresponding to the potential habitat of the yellow chat was completed on the 3 August 2006, and involved Wayne Houston who has previously completed a number of surveys in this area (Houston et al., 2004, 2006). As part of this investigation, confirmed and potential habitat associated with the pipeline alignment was identified. These habitats were categorised as:

- High priority – defined as sites where breeding has been confirmed
- Medium priority – defined as sites where yellow chats have been observed but at which the breeding status is uncertain and few numbers were present
- Low priority – defines sites at which chats have not been found but have appropriate vegetation structure such as emergent sedges or grasses (e.g. key species supporting breeding listed above plus *Typha*, *Carex* and *Eleocharis*).

As a result, an alternate alignment between KP 126 and KP 137 has been proposed, which moves the proposed route west which reduces the potential impacts on rank vegetation surrounding the lagoons and creeks and potential habitat for the yellow chat. This alignment is upstream of all these high and medium priority sites but will disturb some low priority sites.

Mitigation measures

The pipeline route has been selected to avoid or minimise (where avoidance has not been possible due to other constraints) impacts to protected vegetation and significant ecological communities. Detailed mitigation measures are presented in Section 7.5.9 and the EMPs in Section 14.8 of the EIS.

Conclusion

The Capricorn yellow chat (*Epthianura crocea macgregori*) was the only EPBC Act-listed species (critically endangered) that was considered to have the potential to be significantly impacted from construction of the pipeline through the impacts to preferred habitat – rank vegetation surrounding lagoons and creeks.

Given the number of control measures that GPNL will implement to minimise the impacts to yellow chat habitat as far as possible, such as aligning the pipeline route to avoid direct disturbance of wetlands, to minimise disturbances at watercourse crossings including Raglan Creek and 12 Mile Creek, and scheduling construction of the pipeline in the dry season, I am satisfied that the impacts of pipelines on EPBC Act-listed species will be minimal.