ANNUAL ENVIRONMENTAL COMPLIANCE REPORT FEBRUARY 2014 - FEBRUARY 2015

REVISION CONTROL PAGE

MAIN DOCUMENT

REV.	DATE	DESCRIPTION	COMMENTS
00	30-APRIL-2014	Issue for Construction	Preparation initiated in March.

ATTACHMENTS

DOCUMENT CODE	DESCRIPTION	REV.
2-250-329-REP-TRE-8083-att01	Heritage Monitoring of 6 sites within 2 km of the Yara Pilbara Nitrates Pty Ltd plant site (Western Australia) 2015	00

Doc. Category: 3

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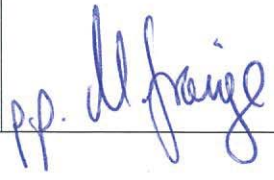
		

INDEX

Table Index

Figure Index

ABBREVIATIONS

ADS:	Ambient Dust Sampler.
ALARP:	As Low As Reasonably Practicable.
AN:	Ammonium Nitrate.
BIE:	Burrup Industrial Estate.
BMP:	Biosecurity Management Plan.
BRM:	Biosecurity Risk material.
CAQMP:	Construction Air Quality Management Plan.
CWQMP:	Construction Water Quality Management Plan.
CAP:	Compliance Assessment Plan.
CAR:	Compliance Assessment Report.
CEMP:	Construction Environmental Management Plan.
CNMP:	Construction Noise Management Plan.
CEO:	Chief Executive Officer.
CESMP:	Erosion Control and Stormwater Management Plan.
CTFMP:	Construction Terrestrial Fauna management plan.
CTFVMP:	Construction Terrestrial Flora and Vegetation Management Plan.
CSIRO:	Commonwealth Scientific and Industrial Research Organisation.
CWMP:	Construction Weed Management Plan.
CWTH:	Commonwealth.
DEC:	Department of Environment and Conservation.
DoE:	Department of Environmental Protection.
DRF:	Declared Rare Flora.
EO:	Environmental officer.
EPA:	Environmental Protection Authority
EPBC:	Environment Protection and Biodiversity Conservation Act 1999.
EPC:	Engineering, Procurement and Construction.
ERMP:	Emergency Response Management Plan.
GME:	Groundwater monitoring events.
Ha:	Hectare.

HMMP:	Hazardous Material Management Plan.
HO:	Head Office.
HSE:	Health, Safety and Environment.
IPMP:	Integrated Pest Management plan.
JHA:	Job Hazard Analysis.
Km:	Kilometer.
LNG:	Liquified Natural Gas.
MOM:	Minute of meeting.
MSDS:	Material Safety Data Sheet.
MTPD:	Metric Tons Per Day.
NA:	Nitric Acid.
NDT:	No destructive test.
NEPM:	National Environmental Protection Measure.
NSW:	New South Wales.
OEMP:	Operational Environmental Management Plan.
OEPA:	Office of the Environmental Protection Authority.
PER:	Public Environmental Review.
PPE:	Personnel Protective Equipment.
PM_{10}:	Particulate Matter up to 10 micrometers in size.
PVC:	Poly vinyl chloride.
TAN:	Technical Ammonium Nitrate.
TANPF:	Technical Ammonium Nitrate Production Facility.
TDS:	Total dissolved solids.
TEOM:	Tapered element oscillating microbalance analyser.
TPA:	Tonnes Per Annum.
TRSA:	Tecnicas Reunidas S.A.
TSP:	Total Suspended Particulates.
TSS:	Total suspended solids.
SEWPaC:	Commonwealth Department of Sustainability, Environment, Water, Population and Communities.
VOCs:	Volatile Organic Compounds.
WA:	Western Australia.
YPFPL:	Yara Pilbara Fertilisers Pty Ltd.
YPNPL:	Yara Pilbara Nitrates Pty Ltd.

1. INTRODUCTION

Yara Pilbara Nitrates Pty Ltd (YPNPL) is constructing a Technical Ammonium Nitrate Production Facility (TANPF) with a production capacity of (circa) 350,000 TPA or 915 MTPD of Technical Ammonium Nitrate (TAN).

YPNPL was granted environmental approval for the TANPF as follow:

- Sections 130 (1) and 133 of the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999 (License Reference No. EPBC Act referral 2008/4546, 14th September 2011)
- Part IV of the State of WA Environmental Protection (EP) Act 1986, (License Reference: Ministerial Statement No. 870, 7th July 2011
- Part V of the State of WA Environmental Protection (EP) Act 1986 (License Reference: Works approval no. W4701/20101, 25th July 2013)

Conditions received from EPBC Act referral 2008/4546 are managed though the Construction Environmental Management Plan (CEMP) developed for the TANPF. The CEMP was approved by SEWPaC on 22nd November 2012 (Letter reference: 2012/08279).

Conditions received from Works approval no. W4701/20101 and the State of WA (OEPA Ministerial Statement 870 [4]), are managed by YPNPL throughout all the phases of the TANPF thus from Conception until the De-commissioning phase of the TANPF

- Compliance Assessment Plan (CAP), 2-250-329-REP-TRE-8001, approved on 23rd August 2012.
- Environmental Commissioning Plan (emissions and discharges of significance), 2-250-329-PRO-TRE-0142.

2. PURPOSE AND SCOPE

The Construction Environmental Management Plan (CEMP) for the TANPF has also been developed to comply with EPBC 2008/4546 conditions. Condition 3 requires annual demonstration of compliance as follows:

> *"Within three months of every 12 month anniversary of the commencement of the action, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of any management plans and monitoring programs as specified in the conditions. Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be provided to the Department at the same time as the compliance report is published".*

The purpose of this second Annual Construction Environmental Compliance Report is to provide evidence of compliance from the 17th of February, 2014 to the 17th of February, 2015

to comply with condition condition 3 of EPBC Act referral 2008/4546 and section 4.4.2 of CEMP.

The scope of the second Annual Compliance Report includes the following covering:

- An overview of the progress of the project during construction;
- Current status of compliance with Conditions and commitments of the EPBC Act referral 2008/4546, Ministerial Statement No. 870 and CEMP monitoring actions and activities, relevant to the current phase of the project;
- Summary report for each of the environmental issues part of the CEMP; Air Quality, Water, Erosion Control and Stormwater, Waste, Traffic, Blasting, Noise, Terrestrial Fauna, Terrestrial Vegetation and Flora, Weeds and Integrated Pest Management Plan.
- The existing environmental management plans and environmental management systems;
- Overall outcomes of environmental audits carried out on 2013/2014;
- Environmental incidents recorded during this period;

The first Annual Compliance Report, 2-250-329-REP-TRE-8055 was submitted in March, 2014.

3. TANPF PROJECT DESCRIPTION

3.1 TAN Burrup plant facilities

The project comprises a turnkey delivery of the TAN Burrup plant facilities, which will contain three major process units, each producing a separate product in the manufacturing process:

- A Nitric Acid (NA) plant to convert ammonia and atmospheric air into Nitric Acid (NA). The NA unit with capacity of 760 metric ton per day (MTPD) as 100% weight (wt).
- An Ammonium Nitrate (AN) Solution plant to convert ammonia and NA into AN solution. This Ammonium Nitrate wet section with capacity of 965 MTPD in balance with nitric acid production capacity level.
- A TAN plant to convert AN solution into TAN prills (final product). This is a dry section for production of Technical Ammonium Nitrate prills (0.7 and 0.8 kg/l density) with a capacity of 915 MTPD. Surplus ammonium nitrate solution shall be sold as hot liquid.

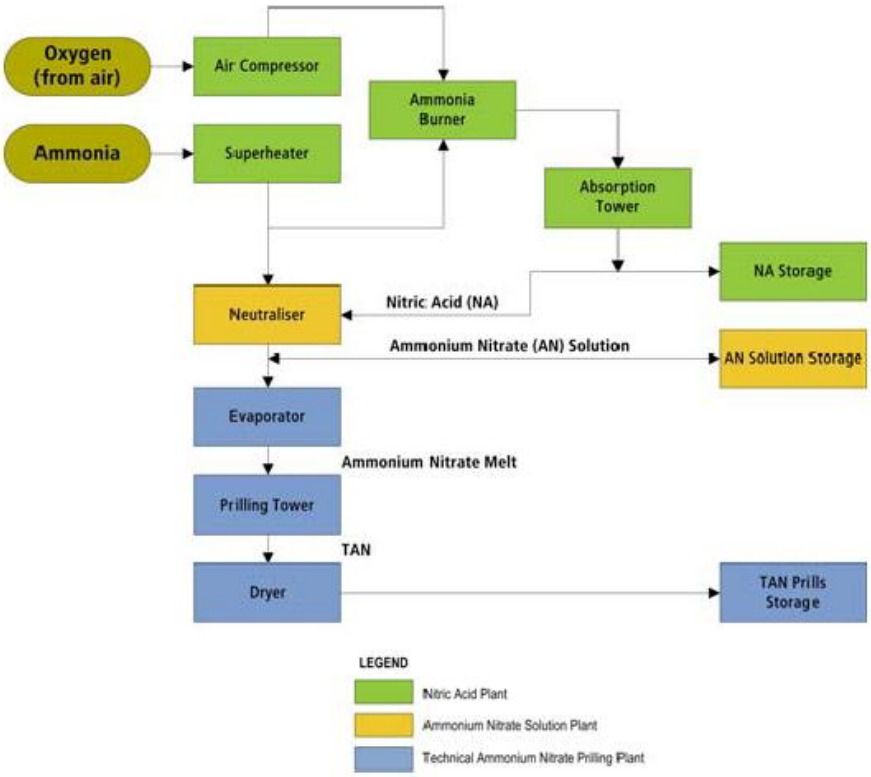
In addition to these three plants, other facilities are required as part of the project and include:

- Storage, loading and transport facilities:
  - Liquid Ammonia pipeline between TANPF and YPNPL plants.
  - Bulk and Bagged TAN storage buildings.
  - Bulk loading system, bagging unit, truck loading.
  - Storage for intermediate product (nitric acid) and finished products: 12000 tons bulk storage, 1800 tons storage for big bags, 500 tons storage for ammonium nitrate solution.
- Required off-sites.
- Necessary infrastructure.

The main feedstock, ammonia, shall be delivered from the adjacent ammonia plant.

Refer to Figure 3-1 for further information about the TAN prill process.

Figure 3-1 Process Flow Diagram



3.2 TANPF Location and Site Description

The TANPF development site is located approximately 13 km northwest of Karratha and 1300 km north of Perth, on the Burrup Peninsula, Western Australia, within the Shire of Roeburne. The site for the TANPF is a 79 Ha area of land within the Burrup Industrial Estate (BIE), which is referred to as Site D. Site D is located adjacent to the existing Yara Pilbara Fertilisers Pty Ltd (YPFPL) Ammonia plant, which will provide the main feedstock, ammonia, for the TANPF. The TANPF requires about 35 Ha (which includes all permanent and temporary construction laydown areas) of the 79 Ha Site and will be accessed from Village Road.

Refer to Figure 3-2 and Figure 3-3 for information about TANP location and Site Location.

Figure 3-2 TANPF Location

Figure 3-3 Site location

3.3 Adjacent Land Uses

Table 3-1 details the surrounding land uses. These include both industrial facilities and environmental / public areas. To the south and west of the facility are industrial facilities including the Woodside Supply base, Kings Bay Industrial Estate and the Schlumberger workshops.

YPFPL's ammonia plant is located adjacent to the facility in the east. This facility is connected to the Dampier Bulk Liquid Berth (BLB) Jetty by a 500mm liquid ammonia transfer pipeline and a 100mm recirculation pipeline. The YPFPL ammonia pipeline is contained within a dedicated pipeline corridor administered by WA Land Corporation (LandCorp).

WaterCorp also operates a Desalination Plant within the lease boundary and is situated to the south of TANPF. The North West Shelf Venture LNG plant is located to the north of the facility and consists of two LNG gas processing plants (KGP and Pluto) operated by Woodside Energy Limited.

The Burrup Peninsula Conservation Reserve and Murujuga National Park are located to the north and south of the facility. Hearson Cove, a popular recreational area, is located to the southeast.

Table 3-1 Burrup Peninsula Land Uses and Distances from TANPF

Name	Occupier	Description	Distance (m)
YPFPL Ammonia Plant	YPFPL/Yara	Fertiliser production facility	100
North West Shelf Joint Venture	Woodside	Onshore gas plant and jetty	3,200
Pluto Development	Pluto	LNG and Port Facilities	2,200
Dampier Port	Dampier Port Authority	Port Operations	4,000
Dampier Supply Base	Mermaid Marine	Port and Infrastructure facilities	4,000
Desalination Plant	WaterCorp	Desalination Plants and associated infrastructure	Adjacent
Hearson Cove			900 to 1,300

There are two sensititive areas nearby to the TANPF site; Deep Gorge and Hearson Cove Beach. Deep Gorge is located approximately 1.4 km to south of the TANPF Project. It is a popular petroglyhs or rock art valley. Rock art in this area is well documented and is visited by tourists. Hearson Cove is at the east of the site, about 0.9 to 1.2 km. Hearson Cove is well known to tourists and locals to view the Stairway to Moon and to use the beach and barbeque facilities. Access to Deep Gorge and Hearson Cove is via Hearson Cove Road (gravel road), which runs to the south of the TANPF Project site and the existing YPFPL ammonia plant.

3.4 Meteorological Conditions

The Burrup Peninsula lies at the western edge of the semi-desert tropical Pilbara region, with the climate commonly described as having two seasons:

- April to November - Fine, warm and dry winters; and
- December to March - Hot, summers with periodic, heavy rains.

The annual average rainfall is 261mm, with an average of 31 rain days, over two peak periods per year:

- January to March due to tropical thunderstorms and cyclonic activity; and
- May to June due to the passage of low pressure systems through the south of WA.

The mean annual maximum and minimum temperature are 32.2°C and 20.5°C respectively with relative humidity for Karratha ranging from 47.0% at 9am to 40.05 at 3 pm.

Strong easterly winds prevail in winter due to anticyclones over southern WA or South Australia. East to south easterly winds are dominant in the morning shifting to north easterly in the afternoon. Wind speeds range from 11-20 km/hr.

During summer, winds are predominantly from west shifting to north westerly in the afternoon. Average wind speeds range from 11-20 km/h in the morning to 21-30 km/h in the afternoon. On average, two cyclones cross the Pilbara coast per year in summer. During cyclones, wind speeds of up to 250 km/h, heavy swells and torrential rain can be experienced.

3.5 Topography, Soils and Hydrogeology

The Site is located in a tidal salt flat that forms an east-west trending valley at approximately 5.5 metres (m) Australian Height Datum (AHD) and divides the Burrup Peninsula into two separate units from King Bay in the west to Hearson Cove in the east. The invert of this valley is comprised of marine sediment. The TANPF is located on colluvium of sand, silt, and gravel in outwash fans of the supra-tidal flats between Kings Bay and Hearson Cove. This tidal flat runs through the middle of the Site and indicates a soil profile associated with a low energy marine depositional environment.

Depth to groundwater ranges from over 3 metres below ground level in the northern, more elevated part of the site to approximately 0.5 m below ground level in the southern part of the site near the supratidal flat area. Groundwater flows to the south-east.

4. SUMMARY OF CONSTRUCTION ACTIVITIES, FEBRUARY, 2014 - FEBRUARY 2015

Highlights achieved and relevant activities related to the site preparation, civil works, mechanical erection, heavy lifting and module erection have been carried out between 17th February 2014 and 17th February 2015. Refer to Table 4-1and Table 4-2 below.

Table 4-1 Project Development Highlights

Activities Description	Status
Highlights	Project overall progress: 94.22%: • 100 %: Engineering. • 99.96 % Manufacturing, • 100 %: Module construction at yard (Indonesia) • 80.08 % to construction at site. Total manpower incorporated to the Project at close-out date report, including construction subcontractors manpower is 506. Main achievements during June have been: • Modules already arrived to the Site (100%). • Modules already installed in final position (99%). • Production of pedestals, tank rings, slabs, concrete channels and underground works (poured (99%) • 8% completed of channels and 95% completed of underground works. • Aboveground plastic piping (68 % completed. • Electrical cable pulled (54% completed). • Instrument cable pulled (36% completed). • Main Compressor Alignment works. • Compressor Shelter finishing works. • Conveyor system package and solid handling is progressing on track. • Buildings already installed on site. • Preliminary works prior to energisation.

Further information is shown in the February Monthly report, 2-250-329-PRO-TRE-8233-tmp33.

Table 4-2 Project Development Activities Status

Main Activity	Activities Description	Status
Site Preparation	- Mobilization of machinery. - Fencing. - Excavations and blasting. - Backfilling (material from excavation and borrowed material). - Slope Protection. - Anti-flooding barrier. - Drainage perimeter channel. - Demobilization of machinery.	Completed
Civil Works	- Excavations, backfilling works. - Foundations of structures, permanent buildings, equipment and modules. - Concrete structures (insitu and precast). - Pipe racks foundations. - Roads, pavements. - Underground piping. - Underground grounding. - Electrical trenches civil works. - Civil completion.	Ongoing
Mechanical Erection	- Dismantling of Module sea-fastening on vessel (shipment). - Equipment and storage tanks erection. - Final anchoring and hook-up of modules (PAR /PAU /PAS). - Piping prefabrication and erection. - Non Destructive Test (NDT) activities. - Steel structure supply and erection (when required). - Painting of pipes and supports, and final touch up of modules and equipment. - Insulation works and final repair in the modules. - Hydrotest / Pressure test. - Reworks or works not finished in modules.	Ongoing
Heavy lifting	- Lifting activities and all operations involved. - Mobilization and demobilization of the major required equipment. - Design, mobilization, and demobilization of the supporting structures and systems. - Mobilization and demobilization of the auxiliary assembler equipment. -Testing, inspections, and certifications required to complete the scope.	Almost Completed Modules already installed in final position (99% of total amount).

Main Activity	Activities Description	Status
Pre-commissioning	- Examination and checkout of individual components, integrity of critical isolations, instrument and electrical items undergo end-to-end continuity. - Loop and no-load tests to confirm their fitness for functioning, - Control valves are stroked, - Protective devices are calibrated and installed. - Lubrication and hydraulics functioning. - Motors are run uncoupled. - Water flushing. - Air blowing system. - Reinstatement of piping.	Initiation of activities
Commissioning	- Making Piping Systems operational i.e. LIVE. - Running of Rotating equipment. - Nitrogen Purging. - Steam Blowing. - Chemical cleaning. - Oil flushing. - Catalyst and chemicals loading.	Non initiated
Start up and Operation	- Operation of the Plant. - Performance Test.	Non initiated

5. ASSESSMENT OF COMPLIANCE AGAINST EPBC ACT REFERRAL 2008/4546

TANPF is subjected to the conditions of Works approval under Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act referral 2008/4546) issued by Australian Government Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) on the 14th September 2011.

Table 5-1 Status of Conditions of EPBC Licence 2008/4546

Item Nº	Condition	Phase	Verification February 2015	Status (Note 1)
1	Advise the department in writing of date of commencement.	Construction	Mail sent to SEWPaC on 17th February 2013.	CLD
2	Maintain records activities associated to conditions and make available to the Department. Records may be subject to audit and results may be publicised to the department.	Overall	Compliance Assessment Report (MS 870) Doc. No. 2-250-329-REP-TRE-8001 was submitted to the OEPA in October 2014. Records have also been included in Environment Compliance Reports (section 6.2) and are available to OPERA or SEWPac for auditing. OEPA has already carried out a desktop audit MS 870 on November 2014. OEPA Letter "Statement 870 – Desktop Audit report November 2014"	C
3	Within three months of every 12 month anniversary of the commencement of the action, a report addressing compliance must publish on website.	Overall	This report "Annual Environmental Compliance Report February 2013/February 2014 (-250-329-REP-TRE-8083" and the "Annual Environmental Compliance Report February 2012/February 2013 (2-250-329-REP-TRE-8055) full fills this requirement. In addition, Compliance Assessment Report (MS 870) Doc. No. 2-250-329-REP-TRE-8001 was submitted to the OEPA in October 2014.	C

Item Nº	Condition	Phase	Verification February 2015	Status (Note 1)
4	Wastewater from facility meets the requirements for discharges into the Multi User Brine Return	Engineering	There are several Wastewater Drainage Systems that will operate throughout the TANPF site including the following: Clean Effluents: Condensates from air chiller, boiler blowdown and Clean Condensate are discharge through Cooling Tower Blow down to Multi User Brine return line (MUBRL) in accordance with DER Works Approval requirements, Environmental Commissioning Plan (emissions and discharges of significance), 2-250-329-PRO-TRE-0142	C
5	Notify the Department of any proposal to apply larvicide or adulticide. Notification in writing at least six (6) months.	Overall	NR	NR
6	a) Employ structures to deter birds from entering ponds. b) Ensure are in place prior to commissioning.	Commissioning	Correspondence between YPNPL and OEPA and Department of Parks & Wildlife seeking recommendations and approval for suitable bird deterrents to be installed in the ponds (letter 17 Dec 72014 / email ref. Request to get approval of bird deterrents as per condition 7.1 of MS 870 of YARA PILBARA NITRATE Project and Bird Deterrent Feasibility Assessment).	C
7	a) CEMP must be submitted to the department at least two (2) months prior construction. b) OEMP at least two (2) months prior operation. c) Additional management plans, including those covering both construction and operation, must be submitted (2) months prior construction.	Overall	Construction Environmental Management Plan (CEMP), Hazardous Material Management Plan (HMMP) and Emergency Response Management Plan (ERMP) were sent to SEWPaC on 22nd September 2012 and approved on 22nd November 2012 (Letter reference: 2012/08279). YPNPL will develop OEMP and submit to	C

Item Nº	Condition	Phase	Verification February 2015	Status (Note 1)
	Construction and operation cannot begin until the management plans mentioned above have been approved by the minister. The contents of these plans must not contain management actions that are inconsistent with these approval conditions.		SEWPaC by 30th November 2014 for the approval.	
8	To protect the values of the Heritage place; a)install chain mesh fencing at least 2.5 m in height, b)signs of at least 1m^2 at 50 metres intervals, c)record if access needed to rock art sites, d) i)at least once annually, engage heritage monitor to survey rock art sites within a two (2) kilometer, ii)report to provide to Department one (1) month after being issued, e) any impact to be reported in writing within 72 hours.	Overall	Chain mesh fencing and signs are already installed. No personnel from TANPF have access to rock art sites. YPNPL engaged CSIRO to carry out rock art sites as per this condition. The monitoring will be held on 2nd and 3rd April, and first report will be submitted to SEWPaC by 30th June 2014.	C
9	a) Undertake air quality monitoring at three (3) sites, b)ensure readings are undertaken by suitably qualified person, c)ensure twenty four (24) months of baseline monitoring are taken at least four (4) times in every 12 months, d)baseline data to be submitted to the department 12 months after construction completion or following 24 months of baseline monitoring, e)continue monitoring for five years following baseline establishment and once operation has commencement, f)report the results of five years in writing, within two (2) months of monitoring have been	Overall	Air quality monitoring equipment has been installed at three CSIRO sites for monitoring impact on rock art. Each location has been provided with the following equipment: · One ADS Atmospheric Precipitation sampler. · One MIE ADR-1500 particulate matter monitor (PM_{10}). · One dust deposition gauge (total solids suspended). · NH_3, NO_x, SO_x diffusion tubes (duplicate collocated at each monitoring site).	C

Item Nº	Condition	Phase	Verification February 2015	Status (Note 1)
	completed.		· One tipping rain gauge. · Minivol TAS for PM_{10} at Water Tanks site, in order to compare readings between MIE ADR-1500 and Minivol TAS. All above equipment was commissioned in September 2013.	
10	a)Contribute a pro-rata amount annually for the DER-managed colour contrast and spectral mineralogy monitoring program (DER-managed monitoring program), b)continue agreed annual contribution for a period of five years or until DER-Program is concluded, c) i)engage a heritage monitor to survey rock art sites within a two (2) kilometer radio, ii) complementary to the DER-managed monitoring program, iii)provide department written endorsement on the suitability of rock art monitored, iv)undertake art monitoring at least once annually, beginning from time construction commences , v)the monitoring must continue for at least five years of the plant´s operations, vi) engage Murujuga Aboriginal corporation in the planning and reporting associated with the annual survey of rock art sites d)within two (2) months of the results of the DER-managed Monitoring program and annual survey are completed, report to Department and Murujuga Aboriginal corporation, and publish in website.	Overall	On 31st January 2014, YPNPL agreed with BRATWG for expanding the rock art monitoring program within two kilometres of the project site in order to comply with the variation condition received from Federal Government (Department of the Environment). YPNPL has already requested Murujuga Aboriginal Corporation for the approval of three additional petroglyph rocks. The Heritage Monitoring of 6 sites within 2 km of the YPNPL TANPF plant site (Western Australia) in the Burrup Peninsula have been measured 2013 and 2014. The engravings and background rocks were measured in situ. Measurement of the annual colour and mineralogical changes utilised two spectrophotometer techniques, the Analytical Spectral Device (ASD) and the BYK colour spectrophotometer. An examination of the colour measurements as a function of time, as well as a comparison of the two measurement techniques, has been conducted and no significant change was identified. The 3D pictures were acquired for both years and change was not detected.	C

Item Nº	Condition	Phase	Verification February 2015	Status (Note 1)
			Refer to attachment 1 in this report	
11	Upon being notified that changes in patination of monitored rock art, notify the Department within 72 hours, b)provide funds annually for a period further five years (maximum) from the event date, c)within two (2) months patination reported, provide management plan to Minister; i) summary of results DER-program, ii)description of the changes, iii) analysis causes, iv) appropriate mitigation, v) a detailed plan for the continuation of DER-program and air quality monitoring program.	Overall	NR	NR

Note 1: Compliant (C), Completed (CLD), Not Audited (NA), Non-compliant (NC), Not required at this stage (NR).

6. GENERAL ASSESSMENT OF COMPLIANCE AGAINST CEMP´S REQUIREMENTS

6.1 CEMP Specific Environmental Management Plans

The following plans have been issued for TANPF for the management of environmental issues during construction.

- Construction Environmental Management Plan (CEMP) comprising of:
  - Air Quality Management Plan;
  - Water Quality Management Plan;
  - Erosion Control and Storm water Management Plan;
  - Waste Management Plan;
  - Traffic Management Plan;
  - Blasting Management Plan;
  - Noise Management Plan;
  - Terrestrial Fauna Management Plan;
  - Terrestrial Flora and Vegetation Management Plan;
  - Weed Management Plan;
  - Integrated Pest Management Plan;
  - Construction HSE Management Plan;
- Hazardous Material Management Plan.
- Emergency Response Management Plan.
- Aboriginal Heritage Management Plan.

Section 4.3.1 of CEMP summarise the specific monitoring measures and commitments, which are explained in detail in each of the specific environmental management plans developed.

YPNPL is working on its Operational Environmental Management System, which will be submitted to SEWPaC prior to Operations.

6.2 Bi-annual Environmental Compliance Reports

The following reports have been issued for TANPF and submitted to SEWPaC in order to follow up and demonstrate compliance with all applicable requirements and commitments (section 4.4.2 of CEMP).

Table 6-1 Compliance Reports issued between February 2014 and February 2015

Environmental Plan	Environmental Compliance Report
Air Quality Management Plan	Compliance Report for Air Quality Management Jan-Jun 2014, 2-250-329-REP-TRE-8054 Rev 00 Compliance Report for Air Quality Management July-Dec 2014, 2-250-329-REP-TRE-8071 Rev 00
Water Quality Management Plan	Compliance Report for Water Quality Management Jan-Jun 2014, 2-250-329-REP-TRE-8063 Rev 00 Compliance Report for Water Quality Management July-Dec 2014, 2-250-329-REP-TRE-8072 Rev 00
Erosion Control and Stormwater Management Plan	Compliance Report for Erosion Control and Stormwater Jan-Jun 2014, 2-250-329-REP-TRE-8056 Rev 00 Compliance Report for Erosion Control and Stormwater July-Dec, 2-250-329-REP-TRE-8073 Rev 00
Waste Management Management Plan	Compliance Report for Waste Management Jan-Jun 2014, 2-250-329-REP-TRE-8062 Rev 00 Compliance Report for Waste Management July-Dec 2014, 2-250-329-REP-TRE-8074 Rev 00
Traffic Management Management Plan	Compliance Report for Traffic Management Jan-Jun 2014 2-250-329-REP-TRE-8065 Rev 00 Compliance Report for Traffic Management July-Dec 2014, 2-250-329-REP-TRE-8075 Rev 00
Noise Management Management Plan	Compliance Report for Noise Management Jan-Jun 2014, 2-250-329-REP-TRE-8059 Rev 00 Compliance Report for Noise Management July-Dec 2014, 2-250-329-REP-TRE-8076 Rev 00
Fauna management Management Plan	Compliance Report for Terrestrial Fauna Management Jan-Jun 2014, 2-250-329-REP-TRE-8061 Rev 00 Compliance Report for Terrestrial Fauna Management July-

Environmental Plan	Environmental Compliance Report
	Dec 2014, 2-250-329-REP-TRE-8077 Rev 00
Terrestrial Vegetation and Flora Magement Plan	Compliance Report for Terrestrial Vegetation and Flora management Jan-Jun 2014 2-250-329-REP-TRE-8057 Compliance Report for Terrestrial Vegetation and Flora management July-Dec 2014, 2-250-329-REP-TRE-8078 Rev 00
Weed management Management Plan	Compliance Report for Weed management Jan-Jun 2014, 2-250-329-REP-TRE-8064 Rev 00 Compliance Report for Weed management July-Dec 2014, 2-250-329-REP-TRE-8079 Rev 00
Integrated Pest management Management Plan	Compliance Report for Integrated Pest management Jan-Jun 2014, 2-250-329-REP-TRE-8058 Rev 00 Compliance Report for Integrated Pest management July-Dec 2014, 2-250-329-REP-TRE-8080 Rev 00
Air Quality Monitoring Report at CSIRO rock art sensitive receptors Management Management Plan	Compliance Report for Air Quality Monitoring at CSIRO Rock Art Sensitive Receptors Jan-Jun 2014, 2-250-329-REP-TRE-8066 Rev 00 Compliance Report for Air Quality Monitoring at CSIRO Rock Art Sensitive Receptors July-Dec 2014 , 2-250-329-REP-TRE-8081 Rev 00

Table 6-2 Status of CEMP´s monitoring activities and commitments

Monitoring Action Reference	Monitoring Action Description	Frequency	Verification February 2015	Status (Note 1)
AIR QUALITY MANAGEMENT	CAQMP-1: Set up exact location of monitoring equipment	Prior to construction	Air Quality Monitoring Equipment is already installed at the eastern and western site boundaries of Tan Burrup project and at three CSIRO rock art sensitive receptors. Final location was included in Compliance Assessment Report (MS 870) Doc. No. 2-250-329-REP-TRE-8001 and Compliance Report for Air Quality Management Compliance Reports for Air Quality Management (see Table 6-1).	C
	CAQMP-2: Monitoring of PM10 at 3 established locations (CSIRO rock art sensitive receptors)	Ongoing	Monitoring of PM10 at CSIRO rock art sensitive receptors started in September 2013. These sites being sites previously selected, designed, fenced off and used in the original Western Australian Department of Environment and Conservation (WA DEC)/ CSIRO air quality monitoring program. • Site 5 – Burrup Road site; • Site 6 – Water tanks site; and • Site 7 – Deep Gorge site. Monitoring data of PM10 at the three stablish locations included in Compliance Report for Air Quality Management Compliance Reports for Air Quality Management (see Table 6-1).	C
	CAQMP-3: Monitoring on dust deposition	Monthly	Dust deposition gauges are already installed at the eastern and western site boundaries, as well as CSIRO rock art sensitive receptors. Results of dust deposition analysis have already been included in the Air Quality Management Compliance Reports for Air Quality Management (see Table 6-1).	C
	CAQMP-4: Weather measurement (wind speed / direction, temperature and rainfall)	Ongoing	A weather station has been installed at the western site boundary. Daily weather measurements (wind speed, direction, temperature and rainfall) are carried out.	C

Monitoring Action Reference	Monitoring Action Description	Frequency	Verification February 2015	Status (Note 1)
	CAQMP-5: Internal TRSA Audit to performance on site (independent chapter for air quality monitoring program)	Quarterly	Refer to section information regarding environmental audits and site inspection in the Air Quality Management Compliance Reports for Air Quality Management (see Table 6-1).	C
WATER QUALITY MANAGEMENT	CWMP-1: Wastewater disposal tracking forms	Ongoing	Only sanitary wastewater is generated at this stage of TANPF. Inventory of sanitary wastewater, carrier, tank specifications, invoices and tracking forms have been included in Compliance reports for Water Quality Management (see Table 6-1).	C
	CWMP-2: Water level gauging and water quality monitoring at existing wells	Every six months	Groundwater monitoring events in October 2014 and March 2014 have been included in Compliance reports for Water Quality Management Doc. (see Table 6-1). Note: Baselines wells MW1 and MW4 were decommissioned, two bores were drilled to replace them on the 6th and 7th September 2013 by GHD. The results of the water quality monitoring event showed that reactive phosphorus in MW1, MW3 and MW5, selenium in MW4 and aluminium in MW3 were detected at concentrations slightly above trigger values. All other analytes were below current maximum acceptable values. The results continue to support the fact that the observed variability in the groundwater chemistry with no clear trends suggests the results depict a combination of natural variability in groundwater chemistry and off site contributions as opposed to increasing concentrations of analytes associated with site activities. None of the analytes observed exceeding the trigger levels are regarded as directly attributed to current on site activities.	C
	CWMP-3: Surface water sampling according to standard procedure	Ongoing	Surface water monitoring was performed for recording this event, and results were included in Compliance reports for Water Quality Management (see Table 6-1).	C
EROSION CONTROL AND	CECSMP-1: Storm water quality monitoring	Cyclone season	Refer to CWMP-3. Records were also included in Compliance reports for Erosion control and storm water management Compliance reports (see Table 6-1).	C

Monitoring Action Reference	Monitoring Action Description	Frequency	Verification February 2015	Status (Note 1)
STORMWATER	CECSMP-2: Internal TRSA audit to performance on site (compliance with requirements)	Quarterly	Refer to section 2.2.2 environmental audits and site inspection. Further details can be found in Compliance reports for Erosion control and storm water management (see Table 6-1).	C
WASTE MANAGEMENT	WMP-1Routine inspections to ensure appropriate waste segregation.	Ongoing	Daily inspections are carried out by HSE team. The HSE daily inspection checklist includes the following topics: Fuels/oils correctly signed and bunded. Waste being disposed of correctly. Rubbish cleaned up and placed in bins. Material Safety Data Sheets (MSDS) available for hazardous substances. Oils/Chemicals spillage equipment available.	c
	WMP-2: Internal TRSA audit to performance on site (compliance with requirements)	Quarterly	Refer to environmental audits and site inspection. Further details can be found in Compliance reports for Waste Management (see Table 6-1).	C
TRAFFIC MANAGEMENT	TMP-1: Routine inspections to ensure compliance with applicable requirements and mitigation measures	Ongoing	Daily inspections are carried out by HSE team. Traffic Management Plans (see Table 6-1) have been developed. Changes on traffic conditions are informed to workforce through Traffic Management Bulletins.	C
	TMP-2: Internal TRSA audit to performance on site (compliance with requirements)	Quarterly	Refer to information regarding environmental audits and site inspection. Further details can be found in Compliance reports for Traffic Management (see Table 6-1).	C

Monitoring Action Reference	Monitoring Action Description	Frequency	Verification February 2015	Status (Note 1)
BLASTING MANAGEMENT	BMP-1: Noise monitoring during explosive firing	When shot is fired	Airblast noise and ground vibration monitoring has been performed during Site preparation Phase of the TANPF (first year of construction). Refer to "Annual Environmental Compliance Report February 2012/February 2013 (2-250-329-REP-TRE-8055) full fills this requirement.	CLD
	BMP-2: Vibration monitoring during explosive firing	When shot is fired	Refer to BMP-1 above.	CLD
	BMP-3: Internal TRSA audit to performance on site (compliance with requirements)	Quarterly	Refer to BMP-1 above. Refer to section 2.2.2 environmental audits and site inspection. Details can be found in Compliance Reports for Blast Operation Doc. Nos. 2-250-329-REP-TRE-8035&8044, Noise and vibration monitoring results for blast operations Doc. No. 2-250-329-REP-TRE-8042.	CLD
NOISE MANAGEMENT	NMP-1: Sound level measurements at site boundary	Periodic depending on activities	Noise measurements at site fence have been performed and included in Compliance Reports for Noise Management (see Table 6-1).	C
	NMP-2: Airblast noise level while firing	During firing shot	Refer to BMP-1 above.	CLD
	NMP-3: Additional monitoring measurements should results exceed established levels	Punctual	No additional measures are required, based on the results of the noise surveys carried out to date.	CLD
	NMP-4: Internal TRSA audit to performance on site (compliance with requirements)	Quarterly	Refer to information regarding environmental audits and site inspection. Details can be found in Compliance Reports for Noise Management (see Table 6-1).	C

Monitoring Action Reference	Monitoring Action Description	Frequency	Verification February 2015	Status (Note 1)
TERRESTRIAL FAUNA MANAGEMENT	TFMP-1: Excavations and trenching inspections and monitoring for fauna protection	Ongoing	Site inspections are undertaken in accordance with what is outlined in the Construction Terrestrial Fauna management plan (CTFMP). For fauna this comprises the inspections of open excavations. Job Hazard Analysis (JHA) for earth works and excavations include statement related to inspect excavation, before commencing works and after breaks, and during backfilling. All JHAs include statement of inspect machine prior start-up for fauna presence, and in case of interaction with fauna, to contact with TR HSE team. All project staff shall report and monitor if any fauna is spotted. Refer to Compliance Reports for Fauna Management (see Table 6-1).	C
	TFMP-2: Internal TRSA audit to performance on site (compliance with requirements)	Quarterly	Refer to information regarding environmental audits and site inspection. Details can be found in Compliance Reports for Fauna Management (see Table 6-1).	C
TERRESTRIAL FLORA AND VEGETATION MANAGEMENT	TFVMP-1: Routine site inspections	Ongoing	Site inspections are undertaken in accordance with what is outlined in the Terrestrial Flora and Vegetation Management (CTFVMP). Records and findings of these inspections can be found in Site clearing report, Declare Rare flora and Priority Flora Survey for Unit 60 and main access road, as well as for Air Quality Monitoring equipment, Report for widening of King Bay Road, Weed mapping report. Reports are included as attachments in Compliance Reports for Terrestrial Flora and Vegetation Management (see Table 6-1) as well as Compliance Assessment Report (MS 870) Doc. No. 2-250-329-REP-TRE-8001.	C
	TFVMP-2: Internal TRSA audit to performance on site (compliance with requirements)	Quarterly	Refer to information regarding environmental audits and site inspection. Details can be found in Compliance Reports for Terrestrial Flora and Vegetation Management (see Table 6-1).	C

Monitoring Action Reference	Monitoring Action Description	Frequency	Verification February 2015	Status (Note 1)
WEED MANAGEMENT	WDMP-1: Routine site inspections	Ongoing	Site inspections are undertaken in accordance with what is outlined in the Terrestrial Flora and Vegetation Management plan as well as in the Weed Management Plan. A Biosecurity Management Plan and Site Plan for Department of agriculture actions for the modules shipments have been developed and implemented. Therefore, site and modules inspection also consider the recommendation and requirements within these documents. An updated Weed mapping report of Tan Burrup site was carried out in December 2014. All of above documents are included in the Compliance report for Weed Management. Details can be found in Compliance Reports for Weed Management (see Table 6-1).	C
	WDMP-2: Internal TRSA audit to performance on site (compliance with requirements)	Quarterly	Refer to information regarding environmental audits and site inspection. Details can be found in Compliance Reports for Weed Management (see Table 6-1).	C
INTEGRATED PEST MANAGEMENT	IPMP-1: Bunds and containers around site (visual inspection)	Weekly	During 2014, there were none records of mosquito nuisance and breeding grounds within TAN Burrup site. Site inspections are undertaken by HSE team in accordance with what is outlined in the Integrated Pest Management Plan. Preventive measures to avoid mosquito breeding were raised as result of these inspections. A Biosecurity Management Plan and Site Plan for Department of agriculture actions for the modules shipments have been developed and implemented. Therefore, site and modules inspection also consider the recommendation and requirements within these documents. Refer to Compliance Reports for Integrated Pest Management (see Table 6-1).	C
	IPMP-2: Ponds and basins (visual inspection and sampling of larvae)	Weekly and monthly (sampling)	Visual inspection is undertaken by HSE team. No records of mosquito nuisance and breeding grounds on TAN Burrup site. Therefore, sampling of larvae was not needed.	C

Monitoring Action Reference	Monitoring Action Description	Frequency	Verification February 2015	Status (Note 1)
	IPMP-3: Stormwater drainage systems (visual inspection and sampling of larvae)	Weekly and as required (sampling)	Refer to IPMP-2.	C
	IPMP-4: Low lying areas (visual inspection and sampling of larvae)	Weekly and as required (sampling)	Refer to IPMP-2.	C
	IPMP-5: Intertidal wetlands/saltmarshes (sampling of larvae)	As required following heavy rain	No intertidal wetlands/salt marshes habitats within our site boundary. Compliance Reports for Integrated Pest Management (see Table 6-1).	NR
	IPMP-6: Routine inspection for other pests (visual)	Weekly	Site inspections are undertaken by HSE team. Nuisance problems with bees and spiders (red backs) have been recorded in the Compliance Reports for Integrated Pest Management (see Table 6-1).	C

Note 1: Compliant (C), Completed (CLD), Not Audited (NA), Non-compliant (NC), Not required at this stage (NR).

6.3 Environmental Audits and Site Inspections

6.3.1 Corporate External Audits

The Works approval and CEMP requirements are audited on a periodic basis in order to assess site environmental management performance and immediately correct identified non-compliance situations. This section presents the findings of the Environmental Audits carried out for Technical Ammonium Nitrate Production Facility (TANPF).

A formal audit has been carried out by the HO HSE team between 15th and 19th of December 2014. Two sections were audited: HSE System and Documentation (91.53% of compliance) and Field execution (88.80% percentage of compliance). Refer to Report Health, Safety and Environmental Audit Closed-Out Meeting Report (IASM-2080-03).

- Refresh training to supervisors.
- Reinforce accountability and PTW purpose understanding.
- Toolbox talks to focus on JHA & PTW System.
- Promote campaigns on main concerns (posters, banners, activities).
- Reinforce supervision.
- Hazardous Material, shall be properly store according to the MSDS
- Ensure that all containers are clear for access and egress
- Hazardous Material, shall be properly store according to the MSDS and away from any flame
- Reinforce site housekeeping
- Provide dip tray for the refuelling system
- Remove the sand affected by the spill
- Provide environmental awareness campaigns to avoid mixture of different types of waste.
- Provide Signs to the waste containers to have the identified with the type of waste

6.3.2 Regulatory OPEA External Audits

OEPA's On Site Audit: as a result of the OEPA`s desktop audit referred in Section 4.1.7.2 above, MS 870 conditions were required by to be verified on site by OEPA´s Authorised Officers and Inspectors on the 22nd of October 2013. The on site audit scope included the verification of proper implementation of the following: Ambient Air Quality Monitoring Programme, Rehabilitation, Fauna Management, Dewatering measures, Groundwater monitoring and Acid Sulphate Soil management. Refer to OEPA´s Notification "Verification Site Inspection Scope - Ammonia Nitrate Facility- MS870 - 22 October 2013".

The OEPAS´s on site audit concluded under OEPA's Letter: "The Resolutions of non compliance report", dated on 15 January 2014 that the conditions which were not complied with (status "non compliance") are the following:

- Confirmation that at least two fauna-clearing appropriated licenced by Department of Parks and Wildlife to remove fauna from the trenches and other construction related voids as required by Condition 7-2.2.

- Details of the design, construction and location of the bores installed to replace groundwater monitoring bores MW1 and MW4 and reasons and rationale for replacing bores.

- A report that provides exceedances of groundwater triggers levels and details to support the report´s conclusions as required by Condition 8-5.2.

6.3.3 Internal Inspections

YPNPL submitted the required information to demonstrate OEPA a proper implementation of above conditions with status “non compliance” on 14 February 2014 YPNPL’s Letter Reference: YP250-500-LET-EPA-0005) and OEPA determined the issue resolved on 14 March 2014 (OEPA’s Letter Reference: 2014.0000631365).

HSE weekly / daily site inspections are performed by YPNPL or TRESA HSE. Environmental issues to be monitored during site inspections are:

- Vehicles and machinery condition.
- Adequate housekeeping.
- Air quality and dust management.
- Hazardous material storing and handling areas.
- Proper waste segregation and management.
- Waste storing area conditions.
- Erosion and storm water management.
- Noisy equipment and noisy activities.
- Rock art protection and impact monitoring being performed.
- Heritage and archaeological issues are being complied with.
- Deterioration, leaks or accumulation of materials in containment areas.
- Flora, fauna and vegetation disturbance.

6.3.4 Conclusions

Based on the findings of the different audits and site inspections carried out during period between 17th February 2014 and 17th February 2015, it is concluded that Environmental Management processes and practices at TANPF are adhering to the key requirements of CEMP, thus complaining with the legislative framework and specific conditions of Works’ approval.

6.4 Environmental Incident Reports

In case an environmental incident takes place, it shall be immediately reported by subcontractors to TRSA in order to start necessary action and so as to report it to YPNPL. A specific Incident

report is prepared and issued including, date/time, description, location, causes, corrective actions and measures to prevent recurrence.

Table 6-3 Major Environmental incidents

INMEDIATE REPORTABLE INCIDENT	DESCRIPTION
Incidents of environmental national significance	None incidents of environmental national significance had happened at TANPF

The environmental incidents reported to YPNPL in the period February 2014 to February are shown in Table 6-4.

Table 6-4 Environmental incidents

Ref.	Date	Time	Subcontractor	Environment Type	DEscription
46	7/01/2014	8:30	WBHO	Flora / Fauna	Kangaroo found deceased in Pond 1-3, Drowned
57	25/01/2014	9:00	WBHO	Flora / Fauna	Driving vehicle and notice death adder on floor of cab
62	5/02/2014	13:00	WBHO	Spill to Land	Hydraulic spill from Grader on the road widening project
73	25/02/2014		Forge	Spill to Land	Diesel spill in generator that runs air conditioning for chemical store containers
93	13/05/2014	6:00	Downer	Spill to Land	Sewerage water overflow from toilet block Crib/Stores Laydown 2 area
115	3/07/2014	10:00	WBHO	Spill to Land	Motor oil
117	1/07/2014	12:15	Ahrens	Spill (contained)	Hydraulic hose fractured spilling fluid onto the concrete floor.
201	17/12/2014	13:30	Wenco	Spill to Land	At approx 10.20am the lines commenced filling with water. At approximately 1.30pm the spotter noticed water coming from a joint from the eastern pipe at the north end of Unit 20 and contacted the operator at the start of the line (Yara), and the supervisor. The spotter was approximately 7m from the point of failure. The water pressure was at 1300kpa on the way to 1460kpa. The pipe join subsequently broke and forced the pipe approximately 1 metre in a southerly direction,

Ref.	Date	Time	Subcontractor	Environment Type	DEscription
					which caused a break at the south end of Unit 20 as well.
218	25/01/2015	13:50	Downer	Spill to Land	During the process of preparing to hydro-test a Pipeline in Area 35, a low pressure discharge of water occurred, wetting a nearby worker. The nearby worker was working inside the area preparing to weld base plates. The low pressure discharge was caused by a hose cam lock fitting that was missing its rubber seal.
249	4/04/2015	17:30	Wenco	Spill to Land	After works were suspended from previous incident, Wenco left blinds off the respective flanges and conducted works within TAN Burrup. The works allowed water within the sea water line to back flow into YPF and release to ground via the open flanges.

7. ASSESSMENT OF COMPLIANCE AGAINST AIR QUALITY MANAGEMENT REQUIREMENTS

7.1 General

The Construction Air Quality Management Plan (CAQMP) is included in the CEMP as attachment 01. The purpose of this CAQMP is to outline how air emissions will be managed and monitored for the construction phase of the TANPF. This CAQMP was prepared in line with the requirements of the SEWPaC and also taken into account local state requirements as per the expectations of the WA DEC discussed during a meeting held on 22nd May 2012.

Two Compliance Reports for Air Quality Management (Table 7-1) have already been issued to comply with SEWPaC requirement of a Compliance Monitoring Report every six months. Both reports outline the monitoring activities and commitments, thus providing discussion and evidences of how compliance with each requirement was met.

Table 7-1 Compliance Reports

Environmental Compliance Report
Compliance Report for Air Quality Management Jan-Jun 2014, 2-250-329-REP-TRE-8054 Rev 00 Compliance Report for Air Quality Management July-Dec 2014, 2-250-329-REP-TRE-8071 Rev 00
Compliance Report for Air Quality Monitoring at CSIRO Rock Art Sensitive Receptors Jan-Jun 2014, 2-250-329-REP-TRE-8066 Rev 00 Compliance Report for Air Quality Monitoring at CSIRO Rock Art Sensitive Receptors July-Dec 2014 , 2-250-329-REP-TRE-8081 Rev 00

7.2 Monitoring Objectives

The specific objectives for air quality monitoring are to:

- Identify triggers for implementation of construction management response measures;
- Assess the effectiveness of dust control measures during construction;
- Ensure the construction activities' contributions for dust concentrations and deposition remain below relevant air quality criteria at the receptors;
- Provide data suitable to demonstrate compliance with the SEWPaC/WA Environmental Protection Authority (EPA); and

- Provide baseline measurements at the sensitive rock art sites for species to be emitted during operation of the facility.

7.3 Ambient Air Quality Standards

Commonly used ambient air quality standards have been set under the National Environmental Protection Measure (NEPM) for the protection of human health rather than the protection of rock art or flora and fauna. Whilst there are no residential sensitive receptors located close to the project boundary, it is considered that use of the NEPM standards will provide adequate protection of the sensitive uses identified by the Commonwealth.

The trigger threshold for dust deposition at the site boundary monitoring locations has been set at no more than 2 mg/m^2/month above baseline levels, as per NSW regulations. The baseline levels of dust deposition will be defined by the baseline monitoring, which includes dust monitoring using dust deposition gauges and air pollutants monitoring in close proximity to the rock art sites (condition 9 of Works Approval EPBC 2008/4546).

Table 7-2 Adopted Ambient Air Quality Criteria for TANPF

Species	Averaging Period	Air Quality Criteria	Maximum Allowable Exceedences
PM_{10}	24 hours	50 µg/m^3	Nil
	1 year	30 µg/m^3	Nil
Dust deposition	1 year (total)	4 g/m^2/month	Nil
	1 year (increase)	No more than 2 g/m^2/month above baseline	Nil
1. Source: "Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales" (revised 2005).			

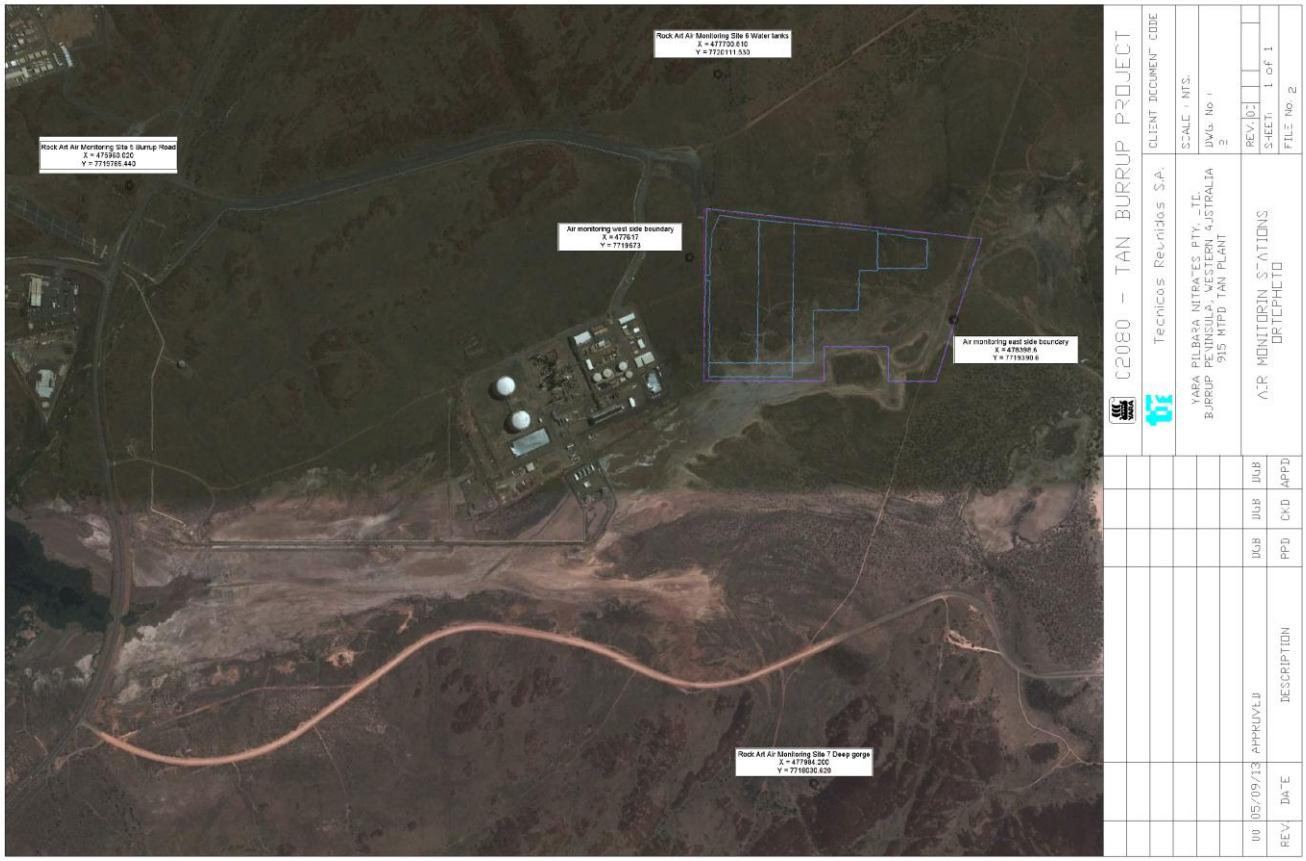
7.4 Monitoring equipment, location, frequency and duration

Management of dust impacts from construction activities will be undertaken through the use of on-site control measurements together with boundary control measurements.

On-site control measurements will form the basis for control and reduction of dust generation from site activities to ensure off-site impacts are minimized. Continuous control of dust generation at source will assist with compliance with the applicable standards at off-site locations and ensure, as far as possible, that construction activities may continue unimpeded.

Air quality monitoring equipment has already been installed at the eastern and western site boundaries of TANPF. Additional air quality monitoring equipment has been installed at three CSIRO rock art sensitive receptors (Figure 8-1) in order to comply with CAQMP.

Figure 7-1 Air Quality Monitoring location drawing



Two Thermoscientific Tapered element Oscillating Microbalance analyser (TEOM) 1405, two dust gauges and a weather station have been installed at TANPF´s boundaries. Equipment installed there is running since 7th March 2013. Information about type of monitoring, frequency, equipment and applicable Australia Standards for on-site equipment can be found in Table 7-3.

In order to monitor impact of TANPF activities on rock art, air monitoring equipment have been installed in three CSIRO monitoring location (site 5-Burrup road, site 6-Water tanks, site 7-Deep Gorge). Each location has been provided with the following equipment:

- One Atmospheric Dust Precipitation sampler (ADS).
- One MIE ADR-1500 Particulate Monitor (PM10).
- One dust deposition gauge (total solids suspended).
- NH_3, NO_x, SO_x diffusion tubes (duplicate collocated at each monitoring site).
- One tipping rain gauge.

- Minivol TAS for PM10 at site 6, in order to compare readings between MIE ADR-1500 and Minivol TAS.

Table 7-3 Air Quality Monitoring Equipment located at Site Boundary

Type of Monitoring	**Monitoring Location**	**Monitoring Frequency**	**Monitoring Equipment**	**Trigger Threshold for Additional Mitigation**
Construction Compliance Monitoring (During Construction for a Period of 31 months)				
PM_{10} ambient concentration	E1 - Eastern site boundary	Continuous	One TEOM (*AS 3580.9.8:2008)*	The trigger level is proposed to be set at three levels (Alert Level, Remedial Action Level and Extreme Action Level) to be protective of the overall 24-hour average PM_{10} criterion (50 $\mu g/m^3$).
	W1 – Western site boundary	Continuous	One TEOM (*AS 3580.9.8:2008)*	
Dust deposition	E1 - Eastern site boundary	Monthly	One Deposition gauge (*AS 3580.10.1: 2003*)	Total of 4 g/m^2/month, with no more than 2 g/m^2/month above baseline levels. Baseline levels are defined through baseline monitoring (detailed in OAQMP).
	W1 – Western site boundary	Monthly	One Deposition gauge (*AS 3580.10.1: 2003*)	
Weather Monitoring (Continuous During Construction Compliance Monitoring)				
Wind speed and direction	W1 – Western site boundary	Continuous	Anemometer	
Temperature		Continuous	Temperature sensor	
Rainfall rate		Monthly	Tipping rain gauge	

Offsite equipment was installed and commissioned in September 2013. Further information about air monitoring equipment installed at CSIRO locations can be found in Table 7-4.

Table 7-4 Air Quality Monitoring Equipment located at CSIRO rock art sensitive receptors

Type of Monitoring	Monitoring Location	Monitoring Frequency	Monitoring Equipment	Trigger Threshold for Additional Mitigation
Construction Compliance Monitoring: *During Construction for a Period of not less than 24 months beginning from the commencement of construction. Air quality readings during the twenty four (24) months of baseline monitoring are taken at least four (4) times in every 12 months.* *Air quality monitoring of the rock art monitoring sites (sites 5, 6 and 7) is continued for an additional period of five (5) years, following the establishment of baseline data and once operation has commenced.*				
PM_{10} ambient concentration	Site 5-Burrup road	Continuous	MIE ADR-1500 particulate monitor	The trigger level proposed is PM_{10} criterion (30 µg/m^3).
	Site 6-Water tanks	Continuous	MIE ADR-1500 particulate monitor	
	Site 7-Deep gorge	Continuous	MIE ADR-1500 particulate monitor	
PM_{10} ambient concentration	Site 6-Water tanks	Once every 6 days, 24 hours	Minivol TAS	
Dust deposition	Site 5-Burrup road	Monthly	One Deposition gauge (*AS 3580.10.1: 2003*)	Total of 4 g/m^2/month.
	Site 6-Water tanks	Monthly	One Deposition gauge (*AS 3580.10.1: 2003*)	
	Site 7-Deep gorge	Monthly	One Deposition gauge (*AS 3580.10.1: 2003*)	
Rainwater sampling	Site 5-Burrup road	Monthly	One ADS Atmospheric Precipitation sampler. One tipping rain gauge.	If there is more than 150 mm of rain expected during the month, the rainwater gauge and possibly the bucket will overflow. In that case the sites should be visited to record the amount of rain in the gauge.
	Site 6-Water tanks	Monthly	One ADS Atmospheric Precipitation sampler. One tipping rain gauge.	
	Site 7-Deep gorge	Monthly	One ADS Atmospheric Precipitation sampler. One tipping rain gauge.	
Passive Gas samplers: ammonia (NH_3), nitrogen oxides (NO_x) and sulphur oxides	Site 5-Burrup road	Monthly	Two passive gas samplers for ammonia (red dot), nitrogen oxides (black body) and sulphur oxides (grey body).	

Type of Monitoring	Monitoring Location	Monitoring Frequency	Monitoring Equipment	Trigger Threshold for Additional Mitigation
(SO_x)	Site 6-Water tanks	Monthly	Two passive gas samplers for ammonia (red dot), nitrogen oxides (black body) and sulphur oxides (grey body).	
	Site 7-Deep gorge	Monthly	Two passive gas samplers for ammonia (red dot), nitrogen oxides (black body) and sulphur oxides (grey body).	

7.5 Data reporting

A site record of the Air Quality monitoring shall be kept throughout the construction period thus detailing:

- Dust sources.
- Dust management measures applied.
- Date and time of dust management measures.
- Complaints of dust emissions/deposition.
- Any other visual observations of incidents likely to cause impacts to air quality, including weather conditions (dust storms) and non-YPNPL activities.
- Exceedances of monitoring trigger thresholds.

These records ensure that dust management is undertaken throughout the construction period, and assist in identification of sources not mitigated in the event of exceedance of a trigger threshold.

7.5.1.1 Site Boundary

7.5.1.1.1 Monthly Dust analysis

Two dust deposition gauges (are used for measuring dust deposition at eastern and western site boundaries. Position of the sampling inlet of the dust deposition gauge was selected according to the AS/ NZS 3580.1.1:2007. Samples are sent to ALS laboratory in Newcastle. This is a NATA accredited laboratory to ensure quality assurance. Table 7-5 includes a summary of the sampling results.

Figure 7-2: Dust gauges.

Figure 7-3 Dust deposition gauge at eastern boundary

Figure 7-4 Dust deposition gauge at western boundary

Table 7-5 Summary of Dust Gauges´ Analysis

Sample ID	Date in	Date out	Results					
			Total Soluble Matter		Total Insoluble Matter		Total Solids	
			g/m^2.month	mg	g/m^2.month	mg	g/m^2.month	mg
TBP-DG-E-0010	06/12/2013	04/02/2014	0.4	12	1.6	56	2	68
TBP-DG-W-0010	06/12/2013	04/02/2014	8.6	306	1.4	51	10	357
TBP-DG-E-0011	04/02/2014	10/03/2014	0.7	14	0.6	12	1.3	26
TBP-DG-W-0011	04/02/2014	10/03/2014	1.8	36	2.1	42	3.9	78
TBP-DG-E-0012	10/03/2014	10/04/2014	2.1	39	2.5	45	4.6	84
TBP-DG-W-0012	10/03/2014	10/04/2014	0.8	14	2.8	51	3.6	65
TBP-DG-E-0013	10/04/2014	12/05/2014	2.3	43	1.1	21	3.4	64
TBP-DG-W-0013	10/04/2014	12/05/2014	<0.1	<1	3.6	68	3.6	68
TBP-DG-E-0014	12/05/2014	13/06/2014	1.9	35	<0.1	<1	1.9	35
TBP-DG-W-0014	12/05/2014	13/06/2014	1.9	36	2.3	43	4.2	79

Sample ID	Date in/time	Date out/time	Results					
			Total Soluble Matter		Total Insoluble Matter		Total Solids	
			g/m^2.month	mg	g/m^2.month	mg	g/m^2.month	mg
TBP-DG-E-0016	16 July 2014	13 Ago 2014	1.4	24	0.7	11	2.1	35
TBP-DG-W-0016	16 July 2014	13 Ago 2014	0.4	6	**56.9**	930	57.3	945
TBP-DG-E-0017	13 Aug 2014	25 Sep 2014	2.1	54	0.9	22	3.0	76
TBP-DG-W-0017	13 Aug 2014	25 Sep 2014	1.4	35	4.2	107	5.6	142
TBP-DG-E-0018	25 Sep 2014	25 Oct 2014	3.8	67	1.2	22	5.0	89
TBP-DG-W-0018	25 Sep 2014	25 Oct 2014	0.1	1	0.8	14	0.9	15
TBP-DG-E-0019	25 Oct 2014	25 Nov 2014	1.2	21	0.3	5	1.5	26
TBP-DG-W-0019	25 Oct 2014	25 Nov 2014	0.7	13	0.7	13	1.4	26
TBP-DG-E-0020	25 Nov 2014	10 Jan 2015	0,32 (0.5 / moth and 15 day)	12	**5.1** (7.9 / moth and 15 day)	213	5.47 (8.4 / moth and 15 day)	225
TBP-DG-W-0020	25 Nov 2014	10 Jan 2015	0,26 (0.4 / moth and 15 day)	11	**5.1** (7.8 / moth and15 days)	210	5.34 (8.2 / moth and 15 day)	221

Exceedances were recorded in TBP-DG-W-0010, TBP-DG-E-0012, TBP-DG-W-0014 and TBP-DG-W-0016 (July 2014 - Aug 2014). Minor exceedances were recorded in TBP-DG-W-0020, TBP-DG-E-0020.

Causes of this exceedance are:

- Wind patterns, that were mainly East to West or South East to North West and speed (up to 40 km/h),
- re-mobilisation of vehicles and machinery on site after Christmas break
- Site conditioning after cyclone Christine
- Crushing on areas 1 and 2
- Trenching for installation of cable between weather station and YPFPL MMC.

7.5.1.1.2 Continuous PM10 monitoring

PM_{10} monitoring is carried out by Thermoscientific TEOM 1405 at the western and eastern sides of the site boundary in TANPF. The TEOM analyser offers continuous operation, providing near real-time measurements for assessment and study of the temporal changes in ambient suspended particulate matter. Refer to Figure 7-5 and Figure 7-6.

Australia Standard AS 3580.9.8 sets out the operational requirements for the continuous determination of suspended particulate matter in ambient air using the tapered element oscillating microbalance (TEOM) analyser. To minimize the contribution of liquid water to measured particle mass, the TEOM analyser conditions the incoming sample aerosol to 50°C prior to and during its measurement. This procedure provides constant sampling conditions, because it can provide a measure of mean particle concentration over periods from 10 minutes to 24 hours. Position of the sampling inlet of PM_{10} monitoring considers the AS/ NZS 3580.1.1:2007.

Readings of TEOMs and Weather station are continuously downloaded at site offices. A data acquisition and reporting software (Envitas Air Resources Manager) provides automatic reports and remote data download through an internet connection in a deskop.

Figure 7-5 Thermoscientific TEOM 1405 (TRA2) at eastern boundary

Figure 7-6 Thermoscientific TEOM 1405 (TRA 1) at western boundary.

- 

To identify if trigger limits are exceed (period of 24 hours) the following criteria is followed:

- TEOM gives value every 5 minutes (average). The contribution of this reading in the 24 hours monitoring was calculated.
- A column with the cumulative values of readings was developed.
- A graphic concentration vs. cumulative data was prepared. This graphic shows the average of readings every 24 hour. Therefore, it is possible to identify if trigger threshold of 50µg in 24 hours was exceeded.

Statistics presented for the collected data (maximum, 99th, 95th and 90th percentiles, median, average) are also included.

For a summary of Continuous PM10 monitoring readings at site boundaries, refer to

- Attachment 3 in Compliance Report for Air Quality Management Jan-Jun 2014, 2-250-329-REP-TRE-8054 Rev 00

- Attachment 3 in Compliance Report for Air Quality Management July-Dec 2014, 2-250-329-REP-TRE-8071 Rev 00

Some exceedances were recorded from February 2014 to February 2015. Causes of this exceedance we have:

- Weather conditions: predominant winds (from up to 40 km/h) were East to West or Southeast to Northwest, thus dust fall to west side of our site.
- Re mobilisation of machinery on site after Christmas break.
- Site conditioning works after Christine cyclone.
- Crushing activities in Area 1 and 2 Area North.
- Trench excavation for cable pulling between weather station (located on TEOM TRA1 area) and YPNPL MMC.
- Backfilling of Unit 71 (Area III).
- Surface preparation of foundations and pedestals (Area I &II).
- Backfilling of North West Protective wall (Area I).
- Importing backfilling material for laydown area and quarantine area with road trains.

The response action taken to date:

- Follow up of the water used for dust suppression.
- Water truck and water suppression reinforced on roads on site and stockpiles.
- Crushing activities stopped during break.

7.5.1.2 CSIRO rock art sensitive receptors

Air quality monitoring for rock art is being undertaken at three (3) sites to monitor air quality impacts pre- and post-operation. The monitoring locations for the baseline monitoring and operational monitoring will be the same at the Dampier Archipelago (including Burrup Peninsula) National Heritage Place, specifically at the rock art sites below as stipulated in the Commonwealth Approval:

Following equipment has been installed in each site (Site 5 Burrup Road site, Site 6 Water tanks site, Site 7 Deep Gorge site):

- One dust deposition gauge (TSS).
- One MIE ADR-1500 particulate monitor (PM10).
- One ADS Atmospheric Precipitation sampler.
- One tipping rain gauge.
- A Minivol TAS for PM10 in Water Tanks site (Site 6).
- NH3, NOx, SOx diffusion tubes (duplicate collocated at each monitoring site).

Note: a Minivol TAS for PM10 has been installed at Water Tanks site in order to compare readings between MIE ADR-1500 and Minivol TAS.

Position of the sampling inlet of PM10 monitoring equipment and dust gauges considers the AS/ NZS 3580.1.1:2007.

In addition, the following species are monitored at the identified rock art sites to satisfy the Commonwealth conditions in relation to baseline levels and operational impacts to air quality:

- NH_3 concentration.
- NO_2 concentration.
- SO_2 concentration.
- Dust deposition.
- TSP/PM10 concentration.

Equipment has been running since reinstallation on January 12th 2014 (removed due to Tropical Cyclone Christine). Data obtained from MIE ADR-1500 particulate monitor (PM10) and Minivol TAS for PM10 is below set alarm (30µg/m^3). Analysis of diffusion tubes still on hold. At this stage, it is only possible to conclude that equipment installed is adequate for gather data for baseline study.

Refer to Figure 7-7, Figure 7-8 and Figure 7-9 for information about the quality monitoring equipment in each Site.

Figure 7-7 Site 5 Burrup Road

Figure 7-8 Site 6 Water tanks.

Figure 7-9 Deep gorge.

Readings from MIE ADR-1500 PM10 are downloaded at TANPF site office. A data acquisition and reporting software (Envitas Air Resources Manager) provides automatic reports and remote data download through an internet connection in a deskop. Alarm has also been set up (30µg/m^3).

Analysis of dust deposition gauge (TSS), readings for Minivol TAS for PM10 and collection of ADS Atmospheric Precipitation sampler/tipping rain gauge are carried out by the personnel of the Laboratory of YPFPL Ammonia Plant.

Two NH3, NOx, SOx diffusion tubes are collocated at each monitoring site, and sent to CSIRO for analysis. Table 7-9 includes the mixing ratios of nitrogen dioxide, nitric acid, sulphur dioxide and ammonia gases at the three sampling sites between 1st September to 29th December 2013. Table 7-9 has average mixing ratio for each gas and the 95% confidence intervals for them.

The following results are obtained from each site (Site 5 Burrup Road site, Site 6 Water tanks site, Site 7 Deep Gorge site) from January 2014 to the end of December 2014.

For continuous PM10 data received from MIE ADR-1500, refer to reference shall be made to the specific Compliance Reports (Table 7-1).

Table 7-6 Suspended Solids at the three Sites

Date	Location	Volume of sample (mL)	TSS mg/L	Remarks
Jan 2014	M5-Burrup RD	100	313	
Jan 2014	M6-Water Tank	100	375	
Jan 2014	M7-Deep George	100	175	
Feb 2014	M5-Burrup RD	100	-	Dismantled for cyclone
Feb 2014	M6-Water Tank	100	-	Dismantled for cyclone
Feb 2014	M7-Deep George	100	260	
Mar 2014	M5-Burrup RD	100	17	
Mar 2014	M6-Water Tank	100	85	
Mar 2014	M7-Deep George	100	82	
Apr 2014	M5-Burrup RD	100	6	
Apr 2014	M6-Water Tank	100	5	
Apr 2014	M7-Deep George	100	5	
May 2014	M5-Burrup RD	100	4	
May 2014	M6-Water Tank	100	10	
May 2014	M7-Deep George	100	2	

Table 7-7 Readings for Minivol TAS for PM10

SR NO	Date	Initial filter paper wt (µg)	Final filter paper wt (µg)	Particulate matter (µg/m^3)
1	12/09/13	886	890	0.60
2	17/09/13	895	898	0.45
3	23/09/13	901	903	0.30
4	29/09/13	904	909	0.75
5	5/10/13	894	897	0.46
6	11/10/13	904	905	0.15
7	17/10/13	890	893	0.46
8	23/10/13	892	902	1.52
9	29/10/13	898	900	0.46
10	4/11/13	912	913	0.15
12	16/11/13	896	902	0.92
20	4/03/14	909	922	1.68
21	23/03/14	897	900	0.46
22	28/03/14	901	903	0.31
24	9/04/14	896	898	0.31
25	15/04/14	902	903	0.16
26	3/05/14	898	901	0.46
27	21/05/14	902	915	1.98
28	27/05/14	898	900	0.30
29	02/06/13	903	904	0.15
30	08/06/13	901	925	3.66

SR NO	Date	Initial filter paper wt (µg)	Final filter paper wt (µg)	Particulate matter (µg/m^3)
31	26/08/14	900	908	1.20
32	06/09/14	904	922	2.72
45	23/10/14	905	905	0
46	31/11/14	901	905	0.60
47	31/11/14	919	928	1.36
48	31/11/14	901	901	0

Table 7-8 Analysis of dust deposition gauge (TSS)

Date	Location	Volume (mL)	TSS mg/L
Jan 2014	M5-Burrup RD	-	-
Jan 2014	M6-Water Tank	-	-
Jan 2014	M7-Deep George	-	-
Feb 2014	M5-Burrup RD	-	-
Feb 2014	M6-Water Tank	-	-
Feb 2014	M7-Deep George	-	-
Mar 2014	M5-Burrup RD	100	17
Mar 2014	M6-Water Tank	100	85

Date	Location	Volume (mL)	TSS mg/L
Mar 2014	M7-Deep George	100	82
Apr 2014	M5-Burrup RD		
Apr 2014	M6-Water Tank		
Apr 2014	M7-Deep George		
May 2014	M5-Burrup RD	100	6
May 2014	M6-Water Tank	100	5
May 2014	M7-Deep George	100	5

Table 7-9 Mixing ratios of nitrogen dioxide, nitric acid, sulphur dioxide and ammonia gases at the three sampling sites between 1st September to 29th December 2013

Date & Time	Date & Time	NO_2	HNO_3	SO_2	NH_3
on	off	(ppbv)	(ppbv)	(ppbv)	(ppbv)
Site 5	**Site 5**				
01/09/2013 11:24	01/10/2013 12:45	3.4	0.2	0.9	0.1
01/10/2013 12:50	01/11/2013 12:50	3.4	0.6	0.9	0.8
01/11/2013 12:50	01/12/2013 11:00	2.7	0.5	0.7	0.6
01/12/2013 11:00	29/12/2013 09:30	2.6	0.3	0.9	0.3
Average		**3.0**	**0.4**	**0.8**	**0.4**
95% confidence		**±0.4**	**±0.2**	**±0.1**	**±0.3**
Site 6	**Site 6**				
01/09/2013 10:54	01/10/2013 12:25	2.1	0.6	0.7	0.7
06/10/2013 03:30	01/11/2013 12:40	2.7	0.3	0.7	6.3
01/11/2013 12:30	01/12/2013 09:30	1.7	0.7	0.6	0.4
01/12/2013 09:30	29/12/2013 10:00	1.8	0.6	0.7	0.5
Average		**2.1**	**0.6**	**0.7**	**2.0**
95% confidence		**±0.4**	**±0.1**	**±0.1**	**±2.9**
Site 7	**Site 7**				
01/09/2013 11:40	01/10/2013 13:05	1.4	0.3	0.6	0.2
01/10/2013 13:05	01/11/2013 13:05	1.7	0.5	0.6	1.3
01/11/2013 13:05	01/12/2013 10:00	1.4	0.5	0.5	0.4
01/12/2013 10:00	29/12/2013 10:30	1.7	0.2	0.5	1.4
Average		**1.6**	**0.4**	**0.6**	**0.8**
95% confidence		**±0.2**	**±0.1**	**±0.1**	**±0.6**

Table 7-10 Collection of ADS Atmospheric Precipitation sampler/tipping rain gauge

Site	Date	Volume (ml)
Water tank	Jan 2014-	Cyclone
Burrup road	Jan 2014	Cyclone
Deep Gorge	Jan 2014	39
Water tank	Feb 2014	Cyclone
Burrup road	Feb 2014	Cyclone
Deep Gorge	Feb 2014	4
Water tank	Mar 2014	26
Burrup road	Mar 2014	24
Deep Gorge	Mar 2014	20
Water tank	Apr 2014	0
Burrup road	Apr 2014	0
Deep Gorge	Apr 2014	0
Water tank	May 2014	0
Burrup road	May 2014	0
Deep Gorge	May 2014	0
Water tank	Jun 2014	0
Burrup road	Jun 2014	0
Deep Gorge	Jun 2014	0

Site	Date	Volume (ml)
Water tank	July 2014-	0
Burrup road	July 2014	0
Deep Gorge	July 2014	0
Water tank	August 2014	0
Burrup road	August 2014	0
Deep Gorge	August 2014	0
Water tank	September 2014	0
Burrup road	September 2014	0
Deep Gorge	September 2014	0
Water tank	Octubre 2014	0
Burrup road	Octubre 2014	0
Deep Gorge	Octubre 2014	0
Water tank	November 2014	0
Burrup road	November 2014	0
Deep Gorge	November 2014	0
Water tank	December 2014	0
Burrup road	December 2014	0
Deep Gorge	December2014	0

7.6 Mitigation measures

The dust generation was minimized through the use of the following mitigation measures:

- Follow up of the water inventory consumed for dust suppression and raised it up during the peaks).
- Preconditioning of material with water prior to be crushed up.
- Crushing activities stopped during workers' break.
- Site traffic speeds is kept at 20 kilometres per hour (kph), which is indicated by means of speed limit signs along the tracks and is explained to all drivers during site induction.
- Unsealed tracks are watered at a rate of 2 litres/^{m2}/hour during operational hours when required. The water is spread by water trucks.
- Stockpiles of earth and topsoil are not allowed at TANFP. After grubbing and clearing, friable material shall be removed immediately.
- Movement of materials that generates dust use water sprays as a suppressant.
- Drop distances are minimised for material transport to prevent dust dispersal.
- Trucks delivering friable material to site are sheeted until arrival on site.
- Trucks removing friable material from the site are sheeted subsequent to leaving the site gate.

Additionally, site induction also requests workforce:

- Report any air pollution that it is identified.
- Ensure equipment and machinery are in good working conditions and properly maintained.
- Turn off any engine while not in use.

7.7 Conclusions

The Compliance Reports for Air Quality Management (Table 7-1) form the basis for proactive reporting to SEWPaC and DEC/OEPA on status of the project and its performance between July and December 2014.

Periodic Site inspection / audit conducted at Site by YPNPL and TRSA to review the implementation level of the HSE Management System.

In order to comply with Commonwealth Approval – Conditions 9 (EPBC 2008/4546), air quality monitoring equipment have been installed at three CSIRO site sensitive receptor (site 5 Burrup road, site 6 water tanks, site 7 Deep gorge. Equipment has been installed in 22nd August in order to be run continuously (only removed due to Tropical Cyclone Christine, generator failures or maintenance). Data obtained from MIE ADR-1500 particulate monitor (PM10) and Minivol TAS for

PM10 is below set alarm (30µg/m3). Analysis of diffusion tubes still on hold. At this stage, it is only possible to conclude that equipment installed is adequate for gather data for baseline study

Monitoring win the western and eastern boundaries vicinity of the TANPF is performed by the construction HSE team. Site records for Air Quality Management are shown on the monitoring on dust deposition at site boundary, and monitoring on PM10 at site boundary. Exceedance of trigger thresholds have been also discussed and assessed in these reports. Mitigation measures have been implemented and followed up during project execution.

Deposited dust was monitored by determining the amount of dust collected over an exposed surface in a fixed period of time (by moth / year) as per the CEMP. Measurement was by means of a funnel and collection bottle, which simply caught the dust settling over a fixed surface area over a period of one month (see Appendix 1 of the Attachment 2). Collection and analysis were carried out in accordance with Australian/New Zealand Standard AS/NZS 3580.10.1:2003 Method 10.1 Determination of particulates – Deposited Matter – Gravimetric method. The sample collection was carried out by the Environmental Coordinator and the analysis was carried out independent third party NATA accredited ALS.

There have been recorded several exceedances along the year 2014. The causes of this disproportionate exceedance at TEOM1 West compared with the TEOM2 East are the following:

- Due to the installation of stick and modular buildings, and the delivery on site of more modular structures, there was not enough space on the construction site for the crushing and stockpiles area and this area needed to be relocated. After a few attempts on other places, at the end of May, from 29th, 2014 this area was placed between the operating YPFPL Ammonia plant and the TANPF construction site, which is the area, were TEOM TRA1 is originally placed.
- Readings of TEOM TRA1 are conditioned by crushing activities, stockpiling and deliveries of material. This is the reason why TEOM TRA1 is recording high readings while TEOM TRA2 is having low and stable readings.
- The Weather conditions: predominant winds were East to West or Southeast to Northwest, thus dust fall to west side of our site is predominant.
- Unpaved roads.
- Civil works activities on site with traffic of concrete trucks.
- Mobilisation of trucks for MAMOET and transport of the final shipment of the modules.

The response actions taken to date when exceedance has occurred have been the following:

- Water used for dust suppression.
- Measures taken on site and around stockpiles and crushing areas up to date is water suppression and minimising to as low as possible the traffic, monitoring speed limits and trying to decrease the number of vehicles on site.
- Planning of activities and construction development. Major dust sources are minimised as site blasting, crushing and preparation of main Site access were completed.

A formal audit was carried out by the HO HSE team between 15th and 19th of December 2014. Two sections were audited: HSE System and Documentation (91.53% of compliance) and Field execution (88.80% percentage of compliance). An audit report was issued detailing all findings and

deviations as well as corrective actions to be implemented. Refer to Report Health, Safety and Environmental Audit Closed-Out Meeting Report (IASM-2080-03). As outcome, the audit concluded that the performance of the construction site to implement CEMP is successful.

Based on the findings of the Compliance reports (Table 7-1), it is concluded that Construction environmental Management processes and practices at TAN Burrup site are adhering to the key requirements for Air Quality Management within the legislative framework and specific conditions from SEWPaC, and DEC/OEP thus meeting the objectives for monitoring as follows:

- Identifying triggers for implementation of construction management response measures;

- Assessing the effectiveness of dust control measures during construction;

- Ensuring the construction activities' contributions for dust concentrations and deposition remain below relevant air quality criteria at the receptors;

- Provide data suitable to demonstrate compliance with the SEWPaC/WA Environmental Protection Authority (EPA); and

- Provide baseline measurements at the sensitive rock art sites for species to be emitted during operation of the facility.

8. ASSESSMENT OF COMPLIANCE AGAINST WATER QUALITY MANAGEMENT REQUIREMENTS

8.1 General

The Construction Water Quality Management Plan (CWQMP) is included in the CEMP as attachment 02. The purpose of this CWQMP is to determine appropriate strategies to manage all forms of water taking into account site location and groundwater conditions so as to ensure environment protection and project environmental impacts minimization. It defines the measures and water quality monitoring regime required to reduce this impact on the groundwater, surface water and marine water affected environment.

Two Compliance Reports for Water Quality Management (Table 8-1) have already been issued to comply with SEWPaC requirement of a Compliance Monitoring Report every six months. Both reports outline the monitoring activities and commitments, thus providing discussion and evidences of how compliance with each requirement was met.

Table 8-1 Compliance Reports

Environmental Compliance Report
Compliance Report for Water Quality Management Jan-Jun 2014, 2-250-329-REP-TRE-8063 Rev 00
Compliance Report for Water Quality Management July-Dec 2014, 2-250-329-REP-TRE-8072 Rev 00

8.2 Water Quality Standards

Recommended surface water parameters are listed in Table 8-2 along with acceptance criteria based most commonly on ANZECC (2000) trigger levels for lowland rivers of tropical Australia.

Table 8-2 Monitoring Parameters and Trigger Levels during Construction

Analyte	Units	Trigger Levels
pH	pH units	6.0-8.0[1]
Oil and Grease	Visible	None visible[2]
Total Suspended Solids (TSS)	mg/l	50[2]
Turbidity	NTU	25[1]

1. ANZECC (2000) trigger values for physical and chemical stressors for lowland rivers for tropical Australia.
2. Trigger Level based on recognised industry standard.

The baseline results are recorded as attachment of CWQMP, approved by SEWPaC on the 22nd November 2012 and, available at www.ypnpl.com.au/project-updates.html.

The baseline data collected to date has been used to calculate the Site specific trigger levels. To monitor potential impacts to groundwater quality during construction the suite of parameters listed

in Table 8-3 are recommended. EPA Condition 8.4 states the proponent shall set groundwater monitoring trigger values at a value of 10% above the baseline contaminant concentrations obtained from the hydrogeological studies required by Condition 8-1.

The methodology for calculating the Site specific trigger levels involved using the maximum concentration of an analyte detected plus 10%. In the case where a range in concentration is applicable (i.e. pH), the maximum concentration plus 10% and minimum concentration minus 10% has been used to calculate the trigger levels during construction.

Table 8-3 shows the list of analytes to be collected during construction along with site specific trigger levels where applicable.

Table 8-3 Groundwater Monitoring Parameters and Trigger Levels during Construction

Analyte	Units	Trigger Level (construction only)
pH	pH Units	6 – 8.4
Total Dissolved Solids	mg/L	143,000
Total Suspended Solids	mg/L	2,090
Alkalinity (total) as CaCO3	mg/L	561
Ammonia	mg/L	0.04
Aluminium (filtered)	mg/L	0.021
Arsenic (filtered)	mg/L	NA
Cadmium (filtered)	mg/L	NA
Calcium (filtered)	mg/L	1210
Chloride	mg/L	95,700
Chromium (filtered)	mg/L	NA
Copper (filtered)	mg/L	NA
Iron (filtered)	mg/L	0.26
Iron (total)	mg/L	143
Lead (filtered)	mg/L	NA
Manganese (filtered)	mg/L	0.242
Magnesium (filtered)	mg/L	5,170
Mercury (filtered)	mg/L	0.0001
Nickel (filtered)	mg/L	NA
Nitrate (as NO3-)	mg/L	9.57
Nitrogen (total)	mg/L	5.6
Zinc (filtered)	mg/L	0.052
Oil and Grease	Visible	None visible[2]

1. NA – Not Available. There are a number of metals for which results have shown concentrations below the laboratory detection limits (Arsenic, Cadmium, Copper, Chromium, Lead and Nickel), and so a reliable trigger level has not been able to be determined at this stage.
2. Trigger Level based on IECA (2008)

8.2.1.1 Groundwater management

The construction activities also have the potential to impact groundwater quality, with the addition of water seepage, as a result of accidental spills or leaks on pervious areas of the Site resulting in potential groundwater impacts within the site and down hydraulic gradient (supra-tidal flats).

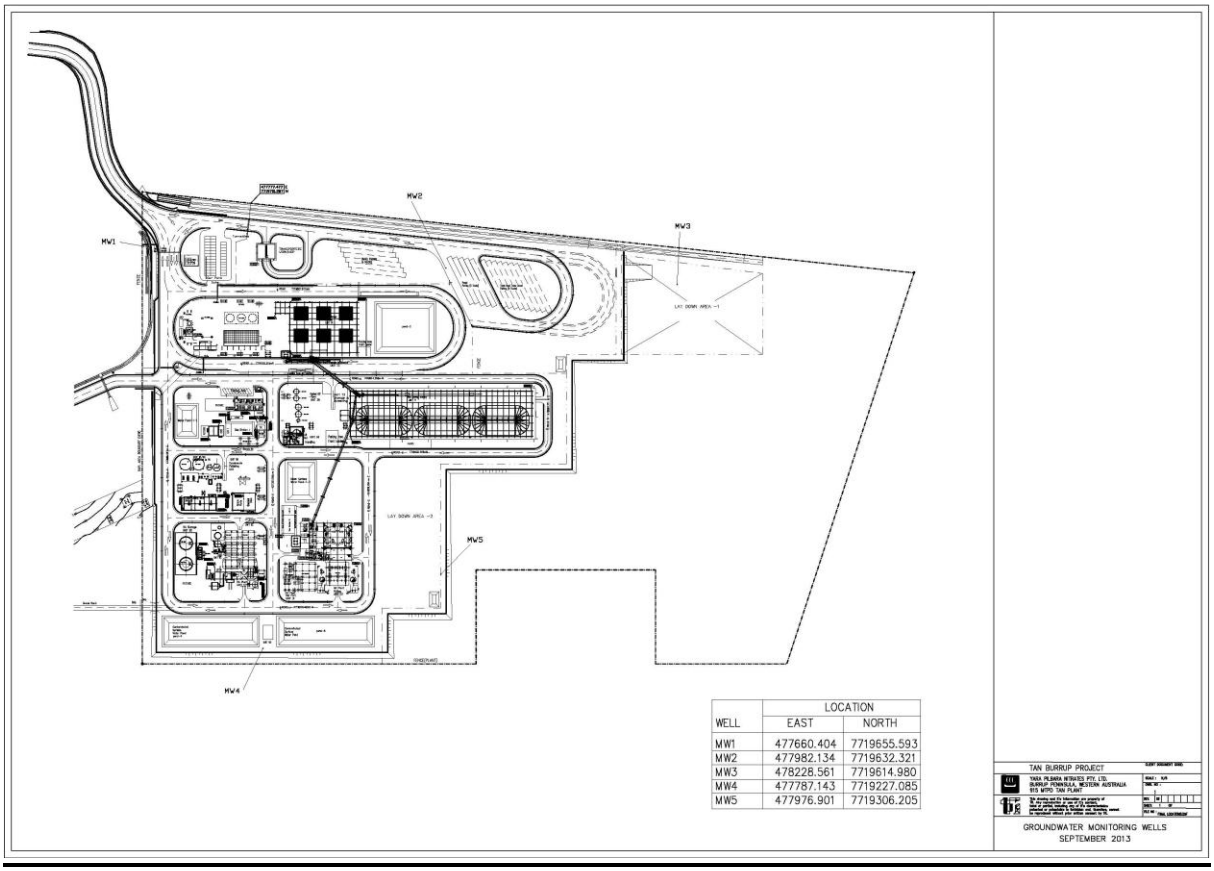
Detailed information about the Groundwater Monitoring events (GMEs) and the installation of two new bores can be found in the Compliance Reports for Water Quality Management Doc. Nos. 2-250-329-REP-TRE-8031&8053.

8.2.1.1.1 Monitoring Network

Five groundwater wells were drilled (MW1, MW2, MW3, MW4 and MW5) during the hydrogeological and hydrological investigation undertaken by ERM (2012) to satisfy EPA *Condition 8.1*. The baseline data collected from these wells have been used to calculate the Site specific trigger levels.

Wells MW1 and MW4 were decommissioned as a result of construction activities, two additional bores were drilled on the 7th September by GHD. Location of these new bores is shown in Figure 8-1.

Figure 8-1 Groundwater monitoring wells location



WELL	LOCATION	
	EAST	NORTH
MW1	477660.404	7719655.593
MW2	477982.134	7719632.321
MW3	478228.561	7719614.980
MW4	477787.143	7719227.085
MW5	477976.901	7719306.205

8.2.1.1.2 Monitoring Schedule

Routine six monthly water level gauging and water quality monitoring should continue to be undertaken at the monitoring wells (as per EPA *Condition 8-4*), to complement existing baseline data. Groundwater monitoring surveys have been carried out in April 2014 and October 2014.

8.2.1.1.2.1 Laboratory analysis

Groundwater samples from April 2014 and October 2014 GME's were submitted to SGS Australia Pty Ltd (SGS), a NATA accredited laboratory. Samples were analysed for a suite of compounds including:

- Cations and anions including calcium, magnesium, sodium, potassium, phosphate, ammonia, carbonate, bicarbonate, chloride, sulphate, nitrate, nitrite and silica.
- Total dissolved solids (TDS), and total alkalinity.
- Dissolved metals including; aluminium, arsenic, cadmium, chromium, iron, lead, manganese, mercury, selenium and zinc.

8.2.1.1.2.2 Results and discussion

The results of the water quality monitoring event (April 2014 and October 2014) show that reactive phosphorus in MW1, MW3 and MW5, selenium in MW4 and aluminium in MW3 were detected at concentrations slightly above trigger values. All other analytes were below current maximum acceptable values. The results continue to support the fact that the observed variability in the groundwater chemistry with no clear trends suggests the results depict a combination of natural variability in groundwater chemistry and off site contributions as opposed to increasing concentrations of analytes associated with site activities. None of the analytes observed exceeding the trigger levels are regarded as directly attributed to current on site activities.

There is an existing adjacent fertiliser manufacturing plant that could contribute to the chemical loading observed in the shallow groundwater at the facility. The increased footprint of buildings and hard stand and surface drainage systems may result in less rainfall infiltration into the ground under the site reducing the potential effects of leaching of metals and chemicals in the existing sub soils into the underlying groundwater. Once the construction phase is complete and prior to operation phase, the groundwater data collected since April 2011 will be used to reassess and reset trigger levels where deemed applicable.

The details of the exceedences are outlined below and the full October 2014 groundwater monitoring results (including historical data) are provided in the attachment 2.

Reactive Phosphorus as P:

- Exceedance at MW1 – 0.018 mg/L compared to the maximum acceptable baseline value of 0.011 mg/L. Historical results have been below the maximum acceptable baseline value with concentrations between <0.0002 and 0.0008 mg/L.
- Exceedance at MW3 – 0.021 mg/L compared to the maximum acceptable baseline value of 0.011 mg/L Historical results have been below the maximum acceptable baseline value with concentrations between <0.0002 and 0.0006 mg/L.
- Exceedance at MW5 – 0.013 mg/L compared to the maximum acceptable baseline value of 0.011 mg/L. Historical results have been in general below the maximum acceptable

baseline value with concentrations between <0.0002 and 0.0009 mg/L and one exceedance in April 2013 with a similar concentration (0.014mg/L).

Aluminium (filtered)

- Exceedance at MW3 – 0.024 mg/L compared to the maximum acceptable baseline value of 0.0209 mg/L. Similar marginal exceedances have been recorded at this well in March and April 2013 with concentration values of 0.072 mg/L and 0.021 mg/L respectively.

Selenium

- Unable to verify results at MW4 as the detection limit of 0.004 mg/L is higher compared to the maximum acceptable baseline value of 0.0033 mg/L. In all previous GME the detection limit for this analyte was above the maximum acceptable baseline value, but compared to the historical GME, in Oct 2014 the achieved reportable detection limit was improved from 0.01 to 0.004 mg/L, a value very close to the baseline value of 0.0033 mg/L.

Alkalinity (hydroxide) as CaCO3

- Unable to screen results at all wells (MW1, MW2, MW3, MW4 and MW5) for this analyte as the detection limit of 1000 mg/L is higher compared to the maximum acceptable baseline value of 693 mg/L. Total alkalinity concentration is below the maximum acceptable baseline, therefore this potential exceedance is considered unlikely.

It is noted that well MW4 well head has been partially damaged the protective metal well head being removed and the PVC casing bent. ERM was able to sample this well and from the first review of the results its condition does not appear to have affected the results (see photo attached of damaged well head). The metal well head (which was found lying on the ground next to the monitoring has been reinstalled and the PVC pipe covered with a proper sealing cap, to minimise further damage.

8.2.1.2 Surface water management

It is important that all potentially contaminating materials used or stored on the Site (fuel, oils) be prevented from entering the groundwater or surface water systems. This is achieved through storage in designated secondary containment areas (internally bunded shipping containers or purpose built structures). A Hazardous Management Plan Doc. No. 2-250-329-PRO-TRE-0122 has being issued to ensure hazardous materials are handled, used, stored, transported and removed from the site in an appropriate manner that minimizes environmental impact generated on workers and, especially, on the surrounding community, sensitive habitants, terrestrial fauna and vegetation and rock art.

Provision of spill kits and training of Site personnel in their use ensure that in the event of any spills appropriate action can be taken rapidly to prevent and minimise impacts to surface waters or groundwater. Wherever possible, activities that have potential for spills will be located in areas that drain to sediment basins; otherwise appropriate safeguards and spill containment facilities will be installed. Section 4.3.4 of Emergency response management plan Doc. No. 2-250-329-PRO-TRE-0113 highlights that any release, both of hazardous and/or non hazardous material shall be immediately reported and controlled, thus listing a set of steps in order to minimize environmental impact.

Construction Environmental Management Plan (CEMP), Hazardous Material Management Plan (HMMP) and Emergency Response Management Plan (ERMP) were sent to SEWPaC on 22nd September 2012 and approved on 22nd November 2012 (Letter reference: 2012/08279).

8.3 Conclusions

The Compliance Reports for Water Quality Management (Table 8-1) form the basis for proactive reporting to SEWPaC, and DEC/OEPA on the status of the TANPF development project in regards to the water management performance between July and December 2014.

The objectives for the construction phase of the TANPF with regard to water quality management are to:

- maintain the quality of surface water and groundwater by minimising the potential for contamination; and
- maintain the existing quality of water resources within and surrounding the Site (including the surrounding supra-tidal flats).

These objectives have been achieved through implementing appropriate mitigation and management measures as follows:

1) Carrying out ongoing groundwater quality monitoring to stablish baseline information on groundwater levels and groundwater quality and to allow prompt identification of any changes that can be attributed to construction activities. Groundwater quality monitoring at the existing wells allocated in the site during construction was carried out in April 2014 and October 2014.

2) As per the TANPF development stage (end of construction / pre-commissioning described in section **Error! Reference source not found.**), Civil works have partially been completed the network of bunded areas and trenches of the TANPF so that any potentially contaminated water is kept completely isolated from rainwater.

3) The clean surface water ponds and the contaminated surface water ponds are utilised at the facility to manage the various liquid streams, if required.

4) The water ponds are surrounded by bunding and located at an altitude above sea level sufficient to secure against ingress of flood water or storm surge. The ponds comply with Department of Water requirements for constructing contaminated surface water ponds, and measures to deter birds from these ponds are considered.

5) It is not allowed to discharge water from any evaporation water ponds (contaminated or not contaminated) to the environment or external sewer system.

6) Temporary sediment basins are not used within the TANPF.

7) Dewatering activities were not required due to the low number of excavations required at this stage of the project and the rainfall events;not interception of groundwater has occurred during any excavation.

8) Weekly HSE Inspection was conducted by YPNPL and TRSA. Corporative TRSA HSE team also carried out an audit on 15th and 19th of December 2014. This quarterly audit verified that the performance of the construction site to implement CEMP is successful.

Based on the findings of the Compliance reports (Table 8-1), it is concluded that construction environmental management processes and practices at TAN Burrup site are adhering to the key requirements for Water Quality Management within the legislative framework and specific conditions from SEWPaC, and DEC/OEP.

9. ASSESSMENT OF COMPLIANCE AGAINST EROSION CONTROL AND STORMWATER MANAGEMENT REQUIREMENTS

9.1 General

Attachment 03 of CEMP includes Erosion Control and Stormwater Management Plan (CESMP), which outlines the required surface water and soil conservation management requirements for the construction phase of the project to ensure environment protection and compliance with all conditions, commitments and requirements. The CESMP describes therefore the controls and measures required to minimize erosion and sedimentation within the disturbed area by proposing and establishing methods to manage stormwater within, and entering the YPNPL lease, and the immediate surrounding land.

Two Compliance Reports for Erosion Control and Stormwater management (Table 9-1) have already been issued to comply with SEWPaC requirement of a Compliance Monitoring Report every six months. Both reports outline the monitoring activities and commitments, thus providing discussion and evidences of how compliance with each requirement was met.

Table 9-1 Compliance Reports

Environmental Compliance Report
Compliance Report for Erosion Control and Stormwater Jan-Jun 2014, 2-250-329-REP-TRE-8056 Rev 00
Compliance Report for Erosion Control and Stormwater July-Dec 2014, 2-250-329-REP-TRE-8073 Rev 00

9.2 Introduction to Erosion control and Stormwater Management

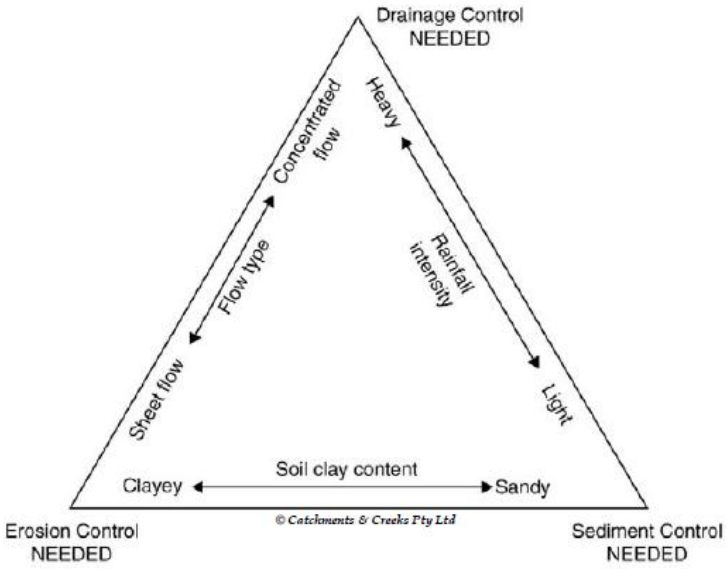
Erosion is the wearing away of the land by water, rainfall, wind, ice or other geological agents. Natural erosion occurs under natural conditions, undisturbed by humans and occurs over long geological time periods. Erosion control is about trying to control the accelerated erosion caused by the action of rainfall, wind, and runoff on land surfaces disturbed by human activity.

Drainage is one means of minimising erosion. As soon as we concentrate water flow, or allow it to increase velocity we substantially increase the risk of erosion. Therefore, it is essential that we use flow-paths which are resistant to erosion and are large enough to contain the expected (design) flow of water.

The sediment is controlled principally by slowing the water so that the particles settle due to gravity. This is done with a variety of structures. The most common structures are sediment fences and sediment basins. Because it is impractical to construct huge sediment control structures, it is important to divert all of the water from outside the works around the job using banks or drains.

Therefore, erosion control and sediment control are two different processes. Whilst most sites have a combination of both, there will be an emphasis on one or the other depending on the soil types present on the site.

Figure 9-1 Erosion, Drainage and Sediment Control Processess



Factors that can influence erosion are:

- Rainfall: High-intensity, short-duration storm events have much greater erosion potential than low intensity, longer duration storm events with the same runoff volume. Intense storms produce larger raindrops, and are more likely to break up the soil and dislodge particles.
- Soil erodibility: It is determined by the soils ability to resist detachment and transport due to rainfall, runoff and infiltration capacity. Well-structured soils with a high clay content are generally least erodible. Some clays are dispersible meaning that they break down when wet and become highly erodible. Silts and fine sands are highly erodible.
- Length and steepness of slope. Steeper slopes cause runoff flow velocities to increase, resulting in increased erosion. As the slope length increases the opportunity for runoff to concentrate and achieve an erosive velocity increases.
- Soil surface cover such as vegetation and mulches protect the soil surface from raindrop impact, reduce flow velocity, disperse flow, and promote infiltration and the deposition of sediment. This is the most important and easily managed aspect to erosion control. Consequently, the site management must aim to reduce soil surface exposure, and to increase ground cover to minimise the erosion potential.

Therefore, goals of construction site erosion and sediment control are to:

- Protect the land surface from erosion.
- Intercept, divert, and safely dispose of clean run-on water from undisturbed areas, clear of any disturbed areas, or to pass clean water through the site without mixing with dirty (sediment contaminated) site run-off.
- Progressively revegetate or stabilise disturbed areas.
- Prevent sediment-contaminated water leaving the site.

These goals can be achieved by applying the following principles:

1. Integrate project design with site constraints.
2. Plan and integrate erosion and sediment control with construction activities.
3. Minimise the extent and duration of disturbance.
4. Control stormwater flows onto, through and from the site in stable drainage structures.
5. Use erosion controls to prevent on-site damage.
6. Use sediment controls to prevent off-site damage.
7. Control erosion and sediment at the source.
8. Stabilise disturbed areas promptly.
9. Inspect and maintain control measures.

9.3 Stormwater Quality Monitoring

Two significant rainfall events had happened in 2013. The first one was on 24th June 2013 (209.4 mm). Surface water monitoring was performed for recording this event, and results were included in the attachment 01 of Compliance reports for erosion control and storm water management (Table 9-1). A second event happened on 31st December 2013 (112.8 mm) due to Tropical cyclone (TC) Christine. Site was closed because Christmas break and surface water monitoring was not performed for recording this event.

9.3.1 Surface Water Monitoring Parameters and Trigger Levels

Recommended surface water parameters are listed in Table 9-2 along with acceptance criteria based most commonly on ANZECC (2000) trigger levels for lowland rivers of tropical Australia.

Table 9-2 Monitoring Parameters and Trigger Levels during Construction

Analyte	Units	Trigger Levels
pH	pH units	6.0-8.0[1]
Oil and Grease	Visible	None visible[2]
Total Suspended Solids (TSS)	mg/L	50[2]
Turbidity	NTU	25[1]
1.ANZECC (2000) trigger values for physical and chemical stressors for lowland rivers for tropical Australia. 2.Trigger Level based on recognised industry standard.		

Any negative impacts on surface water quality that are identified through the monitoring program will be investigated and reported accordingly.

9.4 Summary of Erosion Control and Stormwater Management Actions

9.4.1 Site inspections

TRSA has performed periodical inspections thus using the Attachment 02 – Site Inspection Checklist from the Erosion Control and Stormwater Management Plan included as attachment 03 of the CEMP.

Evidences to show compliance to CEMP´s requirements have been included in the Compliance reports for Erosion Control and Stormwater management (Table 9-1).

None damage/alteration to the declared rare flora and priority flora survey on site construction area have occurred. This has already been confirmed in the Compliance reports for Terrestrial Vegetation and Flora management Doc. Nos. 2-250-329-REP-TRE-8038/45.

9.4.2 Temporary channels

The temporary/permanent channels already built up, worked out well, and impact on site was minimum (Figure 9-2).

A significant rainfall event has happened on 31st December 2013 (112.8 mm) due to Tropical cyclone (TC) Christine (attachments 02 and 03). Tan Burrup site was closed between 21st December and 5th January. Therefore, surface water monitoring was not performed for recording this event.

Another rainfall event occurred on May 6th 2014 (107.4 mm). Impact on site was minimum. Diversion channels worked out well. Inspection was carried out after the event and after assessment no impact on site was considered.

Information on the rain events were included as part of the Compliance Report (Table 9-1). Drainage channels and creek diversions are inspected on a periodically basis, and prior to, during and after a rainfall event or cyclone alert.

Figure 9-2 Routing Temporary Channels in TAN Burrup Project

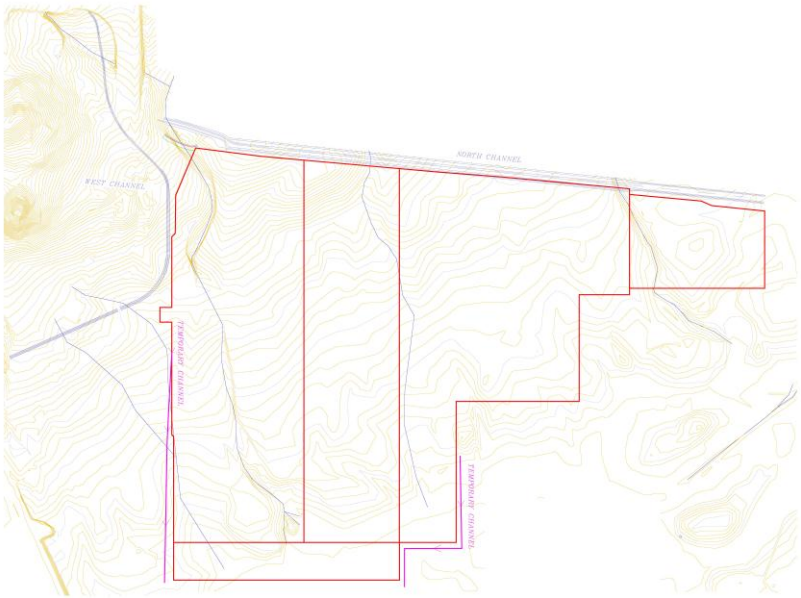


Figure 9-3 North Creek Diversion

Figure 9-4 North West Creek diversion

Figure 9-5 North Creek diversion once complete

9.4.3 Mitigation measures

Additional actions for managing storm water and erosion/sedimentation and for responding to any incidents are:

- Clean stormwater discharges take in natural watercourse. Discharge is to open, shallow, gentle sloping drains.
- Construction of drainage channels at north and west side of the site area has started at an early stage.
- The total area to be disturbed is 35 ha area required for TANFP and laydown areas, with disturbance to remaining landforms to be minimised where practicable.

- Stockpiles of earth or topsoil are not allowed at TANFP. After clearing and grubbing, all friable material shall be removed from site immediately. Only piles of rock for embankment or rip rap had remained on site. Therefore, there is not risk of sediment run off.
- A single stabilised access to the site to prevent mud tracking. Access is prohibited outside approved disturbance boundary. A Heritage Permit Approval shall be raised to YPNPL if a work needs to be carried out outside of the site fence. Signs are installed at the entrance to the Project Area and also at no less than 50m intervals along the fence. The signs state that no construction and operation staff is permitted to enter areas surrounding the Project. This also includes controls for movement of vehicles and personnel on-site to avoid disturbance to undisturbed drainage lines or vegetation which may lead to increased erosion and/or sedimentation.
- A designated concrete washout basin has been installed at the site. Regularly monitor to ensure basin is emptied as required and concrete is disposed of appropriately.

9.5 Conclusions

The Compliance Reports for Erosion control and Stormwater management (Table 9-1) form the basis for proactive reporting to SEWPaC, and DEC/OEPA on status of the project and its performance between July and December 2014.

None damage/alteration to the matter of environmental national significance, declared rare flora & priority flora survey on site construction area have occurred. This has already been confirmed in the Compliance Reports for Flora Management.

The highest risk time for mobilisation of sediment is during site clearing, earthworks, blasting, and laying foundations. These activities have already been completed by WBHO Civil (Subcontractor).

No cyclones have affected the Site or surroundings during the cyclon season. A significant rainfall event occurred on May 6th 2014 (107.4 mm) and impact on site was negligible.

Erosion on site is monitored through periodicals site inspections, particularly following rainfall and cyclone events, to check conditions of drainage channels and creek diversions.

A formal audit was carried out by the HO HSE team between 15th and 19th of December 2014. Two sections were audited: HSE System and Documentation (91.53% of compliance) and Field execution (88.80% percentage of compliance). An audit report was issued detailing all findings and deviations as well as corrective actions to be implemented. None deviations were identified in relation to erosion control management. Refer to Report Health, Safety and Environmental Audit Closed-Out Meeting Report (IASM-2080-03).

Based on the findings of the Compliance reports (Table 9-1), it is concluded that Construction environmental Management processes and practices at TAN Burrup site are adhering to the key requirements for Erosion control and Stormwater management within the legislative framework and specific conditions from SEWPaC, and DEC/OEP.

10. ASSESSMENT OF COMPLIANCE AGAINST WASTE MANAGEMENT REQUIREMENTS

10.1 General

The Construction Waste Management Plan is included in the CEMP as attachment 04. The purpose of this plan is to identify and take all necessary measures, especially preventive measures, to achieve an appropriate waste disposal during the execution of the TANFP. This Plan describes in detail how solid and liquid waste generated during Construction, Pre-Commissioning and Commissioning shall be handled, treated and disposed of according with environmental provisions stated in the Construction HSE Plan.

Two Compliance Reports for Waste Management (Table 10-1) have already been issued. Both reports outline the monitoring activities and commitments, thus providing discussion and evidences of how compliance with each point has been met.

Table 10-1 Compliance Reports

Environmental Compliance Report
Compliance Report for Waste Management Jan-Jun 2014, 2-250-329-REP-TRE-8062 Rev 00
Compliance Report for Waste Management July-Dec 2014, 2-250-329-REP-TRE-8074 Rev 00

10.2 Philosophy of waste management

The Construction Waste Management Plan outlines below philosophy of waste management:

- Establishing an adequate hierarchy while planning waste management strategy:
    1. Source reduction.
    2. Reuse when possible.
    3. Recycling when possible.
    4. Treatment (under specialized waste management companies).
    5. Responsible disposal (under specialized waste management companies).
- Reconsidering the use of substances with problematic waste characteristics and choosing substances or materials that are re-usable or recyclable where practicable (early planning).

10.3 Solid waste management

Collection, segregation and storage of waste are carried out according with the following principles:

- Waste storage areas and waste containers are properly identified by means of signs and pictures to help workers segregate waste.

- Waste is collected and segregated according to waste classification so that no different types of waste are mixed.
- Hazardous and non-hazardous wastes are never mixed.
- Waste storage areas are protected against soil and groundwater contamination because of potential accidental spills.
- Waste storage areas are provided with fire prevention measures, pest control, and odour control measures.
- Stock-piling of waste material and/or waste burning is forbidden.
- All leaks, spills and releases recorded and reported in Compliance Reports for Waste Management (Table 10-1)
- Storing areas are inspected and audited on a periodic basis to ensure they comply with requirements and no contamination is produced.

In case of the controlled waste, the following requirements are considered:

- Containers are marked with warning labels and waste composition identification.
- Storage is done in specific areas clearly identified and provided with emergency response equipment (fire extinguishers, spill kits, MSDS, first aid cabinet, eyewashes).
- Waste is handled according to the initial products manufacturer's instructions.
- Containers are appropriate for the waste stored and provided with secondary containment for liquid wastes so as to minimize the potential for an uncontrolled release.
- Carriers, drivers and vehicles and tanks must be licensed according with the Environmental Protection (controlled waste) regulations 2004.

10.4 Liquid waste management

Only sanitary wastewater is generated at this stage of TANFP. Sanitary Wastewater is driven to septic tank until it is collected by truck and carried to an offsite treatment plant for necessary treatment prior to disposal. Additional information can be found in Compliance Reports for Waste Management (Table 10-1).

10.5 Training

All parties are required to participate in the site induction prior to the commencement of work. Waste management is discussed, thus tackling:

- How to handle, store and manage any kind of waste.
- Potential environmental problems recognition (e.g. spills, improper handling or storage, etc.) for all waste streams.
- The recommended practices for reusing, recycling and disposal of different types of waste.
- Communication protocols in order to solve problems.

Records, which detail the attendees, content of the induction/training as well as any additional information provided, are maintained.

10.6 Solid waste inventory

Waste generated, removed and disposed of is controlled and identified. A waste inventory register is produced and updated on a monthly basis including all relevant information required to allow waste traceability and identification at any moment.

The Compliance Report for Waste Management (Table 10-1) summarises the waste for this reporting year.

As per the stage of the TANPF development, the type of waste generated during between February 2014 and February 2015, is shown is Table 9-2.

Table 10-2 Waste generated

Activity	Type of waste	Waste Classification	Waste Identified
Blasting	Rocks	Clean Fill	-
	Non detonated material	Hazardous	-
Clearing/ Excavations	Soil	Clean Fill (not contaminated soils)	-
		Hazardous (contaminated soils)	-
		Intractable (significantly contaminated soils)	-
	Rest of vegetation not re-used, mainly spinifex.	Clean Fill	-
Civil works	Scrap metal, wood, paper, cardboard	Inert-Type 1	YES
	Concrete/ Stained concrete soil	Inert-Type 1	YES
	Plastics	Inert-Type 1 or 2	YES
	Resins, striking material	Hazardous. See MSDS	YES
	Paint drums, waste oil, waste paint, solvents.	Hazardous.	YES
	Contaminated soil by accidental spill.	Hazardous (contaminated soils)	YES
		Intractable (significantly contaminated soils)	YES
Modules erection and hook ups	Scrap metal, wood, paper, cardboard	Inert-Type 1	YES
	Plastics	Inert-Type 1 or 2	YES
	Paint drums, waste oil, waste paint, solvents.	Hazardous.	YES
	Insulation material	Inert	YES
		Hazardous (See MSDS)	YES
	Radiographic waste	Intractable	YES
	Contaminated soil by accidental spill.	Hazardous (contaminated soils)	YES
		Intractable (significantly contaminated soils)	YES
Precomissioning and	Hydrotesting water	Depending of the products used	YES

Activity	Type of waste	Waste Classification	Waste Identified
Commissioning	Cleaning materials (chemical products)	(see MSDS). In case of doubt, sampling and analysis may be needed.	-
	Dirty cloths	Inert-Type1 (if not contaminated)	-
		Hazardous (if contaminated)	-
	Filters, gaskets and other consumables, plastic, cardboard	Inert-Type 1 or 2	YES

The wastes generated in the different facilities are:

Facility	Type of Waste	Waste Classification	Waste Identified
Temporally facilities	Paper, plastic, cardboard	Putrescible	YES
	Batteries	Hazardous (if contains Hg)	YES
Canteen	Bio degradable material	Putrescible	YES
	Paper, plastic, cardboard		YES
First Aid	Bio medical waste	Special waste	YES
	Paper, plastic, cardboard	Putrescible	YES

10.7 Conclusions

The Compliance Reports for Waste Management (Table 10-1) form the basis for proactive reporting to SEWPaC, and DEC/OEPA on status of the project and its performance between July and December 2014.

Daily inspections are carried out by HSE team. Housekeeping, hazardous material management, waste disposal, spill management and first aid facilities are part of the HSE daily inspection checklist.

All necessary measures have been taken to prevent hydrocarbon (e.g. oil, diesel, etc.) and chemical (caustic, acid, detergent, etc.) contamination of soil and groundwater. The TRSA HSE Site Manager makes sure that maintenance operations done to vehicles and equipment are correctly performed and that all equipment and machinery is in safe working conditions so that no spill shall occur. Three evenst of minor spills have occurred and reported and immediate action has been taken following the instructions of this Plan and Yara-T0PS 5-04.

Waste generated, removed and disposed is controlled and identified at TAN Burrup Project. The waste inventory is updated periodically thus including all relevant information required to allow waste traceability and identification at any moment. .

A formal audit was carried out by the HO HSE team between 15th and 19th of December 2014. Two sections were audited: HSE System and Documentation (91.53% of compliance) and Field execution (88.80% percentage of compliance). An audit report was issued detailing all findings and

deviations as well as corrective actions to be implemented. None deviations were identified in relation to waste management. Refer to Report Health, Safety and Environmental Audit Closed-Out Meeting Report (IASM-2080-03).

Based on the findings of this Compliance reports (Table 10-1), it is concluded that Construction environmental Management processes and practices at TAN Burrup site are adhering to the key requirements for Waste Management within the legislative framework and specific conditions from SEWPaC, and DEC/OEP.

11. ASSESSMENT OF COMPLIANCE AGAINST TRAFFIC MANAGEMENT REQUIREMENTS

11.1 General

The Construction Traffic Management Plan (CTMP) is included in the CEMP as attachment 05. The purpose of this plan is to identify and analyse all traffic movements foreseen during TANFP so as to prevent adverse environmental impact due to traffic operations. The main aim of this Plan is to ensure traffic is managed in an adequate manner so that all vehicle movements are performed in safe conditions and so that no impact is generated on the surrounding community, road users, sensitive habitants, terrestrial fauna and rock art.

Two Compliance Reports for Traffic Management (Table 11-1) have already been issued. Both reports outline the monitoring activities and commitments, thus providing discussion and evidences of how compliance with each point has been met.

Table 11-1 Compliance Reports

Environmental Compliance Report
Compliance Report for Traffic Management Jan-Jun 2014 2-250-329-REP-TRE-8065 Rev 00
Compliance Report for Traffic Management July-Dec 2014, 2-250-329-REP-TRE-8075 Rev 00

Between February 2014 and February 2015, below documents have been developed and issued to ensure that traffic operations are carried out safely onsite and offsite TANFP:

- Traffic management at Tan Burrup site.
- Traffic Management plan for YPFPL's Ammonia Plant.
- Traffic Management Plan. Heavy haulage of modules from an off-loading point at Dampier Port Authority Warf to Laydown Tan Burrup site.
- Transport Management Plan. Heavy haulage of oversize modules from an off-loading point Dampier Port authority to Tan Burrup site laydown.
- HSE Notices and Traffic Management Bulletins issued TRSA and Subcontractors.
- Site Instructions.
- Travel plan.
- Site security. Vehicle/Plant and Mobile Equipment Access form. Vehicle Hygiene and Weed inspection form.

Traffic issues are discussed as part of Site induction. Specific toolboxes about traffic rules, positive communication, Shift pre start motor vehicle inspection and interaction between Heavy vehicles and Light vehicles have been carried out.

11.2 Mitigation measures

Mitigation measures that are implemented to mitigate the traffic impact are described below:

- Most of workforce (TRSA, WBHO, WENCO, DOWNER) is bussed to and from the site to avoid significant traffic impacts.
- Circulation routes are properly planned, identified and signalised so that vehicles and equipment movements are under control, minimised and, therefore, potential impacts minimised.
- Dust minimization policies and best practices are applied while transporting soils and ground material by means of dump trucks (covers placed over trucks).
- Concrete trucks are washed after its use inside the site in the specific area designed for such purpose to ensure no remains are spread while driving back to origin concrete plant across Western Australia's roads.
- All vehicles, equipment and machinery entering the site are properly inspected and maintained so that neither accidental spill nor non-expected air emission takes place.
- Records on such inspections and performed maintenance are provided to HSE team who shall keep them for evidence.
- Random inspections and controls to vehicles and equipment are carried out on a periodic basis in order to ensure compliance with all applicable requirements and statutory regulations.
- Any vehicle found non-compliant will be removed from the site; movements and operations with it will be stopped until deviations are corrected and evidenced in writing.
- Awareness and training regarding circulation routes, timeframe criteria and traffic best practices will be provided to all workers to promote traffic impact minimization.
- Restrict site traffic to designated internal roadways to prevent disturbance of vegetated or natural areas.

11.3 Conclusions

Based on the findings of this Compliance report, it is concluded that construction environmental management processes and practices at TANPF site are adhering to the key requirements for Traffic Management within the legislative framework and specific conditions of TANPF environmental approval.

This Compliance Reports for Traffic Management (Table 11-1) form the basis for proactive reporting to SEWPaC and DEC/OEPA on status of the project and its performance between July and December 2014.

None traffic incidents impacting in matters environmental national significance had happened at TAN Burrup Project.

None traffic incidents had happened at TAN Burrup Project.

Daily inspections are carried out by HSE team. Identified deviations are reported and followed up.

Weekly HSE Inspection was conducted by YPNPL and TRSA. Corporative TRSA HSE team also carried out an audit on 15th and 19th of December 2014. This quarterly audit verified that the performance of the construction site to implement CEMP is successful.

Based on the findings of the Compliance reports (Table 11-1), it is concluded that Construction environmental Management processes and practices at TAN Burrup site are adhering to the key requirements for Traffic Management within the legislative framework and specific conditions from SEWPaC and DEC/OEP.

12. ASSESSMENT OF COMPLIANCE AGAINST BLASTING MANAGEMENT REQUIREMENTS

12.1 General

A Blast Management Plan was included as an attachment 06 of the CEMP to describe in detail how blasting activities will be managed at the TANFP to ensure compliance with works approvals, applicable regulations and standards so as to grant personnel, asset's, environment, heritage and operating neighboring plant protection.

TANFP required blasting to achieve Final Excavation Level with blasting generally required down to a maximum depth of 5.5m. Blasting in this area is typified by 'shallow' blasting, where the depth of blast holes is not significantly greater than the distance between blast holes. Good control of blasting operations ensures that this type of blast does not generate flyrock and airblast. The major hazards identified were due to the proximity to the neighboring (YPFPL) plant, heritage areas and the temporary construction facilities.

Two Compliance Reports for Blasting operations (Table 12-1) have already been issued. Both reports outline the monitoring activities and commitments, thus providing discussion and evidences of how compliance with each point has been met. In addition, a Noise and Vibration monitoring report for Blasting Operations Doc. No. 2-250-329-REP-TRE-8042 has also been issued once blasting has been finalized.

Table 12-1 Compliance Reports

Environmental Compliance Report
Compliance Report for Blasting management Jan-Jun 2013, 2-250-329-REP-TRE-8035
Compliance Report for Blasting management July-Dec 2013, 2-250-329-REP-TRE-8044

12.2 Noise regulations and standards

Airblast conditions for TANFP are:

Table 12-2 Air blast limits

AIRBLAST LIMITS FOR HUMAN COMFORT CHOSEN BY SOME REGULATORY AUTHORITIES (see Note to Table J5.4(B))

Category	Type of blasting operations	Peak sound pressure level (dBL)
Human comfort limits		
Sensitive site*	Operations lasting longer than 12 months or more than 20 blasts	115 dBL for 95% blasts per year. 120 dBL maximum unless agreement is reached with occupier that a higher limit may apply
Sensitive site*	Operations lasting for less than 12 months or less than 20 blasts	120 dBL mm/s for 95% blasts. 125 dBL maximum unless agreement is reached with occupier that a higher limit may apply
Occupied non-sensitive sites, such as factories and commercial premises	All blasting	125 dBL maximum unless agreement is reached with the occupier that a higher limit may apply. For sites containing equipment sensitive to vibration, the vibration should be kept below manufacturer's specifications or levels that can be shown to adversely effect the equipment operation

* A sensitive site includes houses and low rise residential buildings, hospitals, theatres, schools, etc., occupied by people.

1. for 95% of blasts, air blast over pressure must not exceed 115dB (Linear Peak);
2. airblast over pressure must not exceed 120dB (Linear Peak);

Table 12-3 Ground vibration limits

GROUND VIBRATION LIMITS FOR HUMAN COMFORT CHOSEN BY SOME REGULATORY AUTHORITIES (see Note to Table J4.5(B))

Category	Type of blasting operations	Peak component particle velocity (mm/s)
Sensitive site*	Operations lasting longer than 12 months or more than 20 blasts	5 mm/s for 95% blasts per year 10 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply
Sensitive site*	Operations lasting for less than 12 months or less than 20 blasts	10 mm/s maximum unless agreement is reached with occupier that a higher limit may apply
Occupied non-sensitive sites, such as factories and commercial premises	All blasting	25 mm/s maximum unless agreement is reached with occupier that a higher limit may apply. For sites containing equipment sensitive to vibration, the vibration should be kept below manufacturer's specifications or levels that can be shown to adversely effect the equipment operation

*A sensitive site includes houses and low rise residential buildings, theatres, schools, and other similar buildings occupied by people.

NOTE: The recommendations in Table J4.5(A) are intended to be informative and do not override statutory requirements with respect to human comfort limits set by various authorities. They should be read in conjunction with any such statutory requirements and with regard to their respective jurisdictions.

Vibration conditions for the project are:

1. for 95% of blasts ground vibration must not exceed 5mm/sec peak particle velocity;
2. ground vibration must not exceed 10 mm/sec peak particle velocity.

Above airblast and ground vibration limits are the same as applied to quarry blasting operations, which comply with Australian Standard (AS2187.2-2006) Explosives-Storage and use Part 2: Use of Explosives. This standard provides information on hazards presented by explosives and ways to manage and control the identified risks at a level that is acceptable to the community and in accordance with safe and secure industrial practice.

Australian Standard (AS 2436-2010) Guide to noise and vibration control on construction, demolition and maintenance sites provides guidance on noise and vibration control in respect to construction, demolition and maintenance sites. This standard provides guidance for the

preparation of noise and vibration management plans, work method statements and environmental impact studies.

12.3 Air Blast and ground vibration monitoring results

Table 12-4 summaries the ground vibration and airblast levels recorded during twelve blasting operations carried out between 18th March and 31st July 2013.

Table 12-4 Summary of Airblast and ground vibration measurements

Blast Design (TRS-WBH-BLST-)	Date	Time	Area	Airblast (dB(A))		Ground vibration (mm/s)	
				Estimated	Measured	Estimated	Measured
001	18-Mar-13	17:15	Area 1 Southern Face	87.4	102.8	1.1	1.89
002	27-Mar-13	17:26	Area 1 South to north	106	109	4.2	5.12
003	10-Apr-13	17:30	Area 1	104	109.5	2.9	4.11
004	17-Apr-13	17:24	Area 1	104.3	107.5	2.3	3
005	24-Apr-13	17:16	Area 1 and 2	106.3	105.9	3	2.6
006	1-May-13	17:16	Area 1	105.9	114.8	2.1	2.57
007	8-May-13	17:24	Area 1 and Area 3	106.6	101.9	1.7	1.33
008	16-May-13	17:30	Area 1, Area 2 and Area 3	107.5	116.9	2.9	2.45
009	22-May-13	17:15	Area 1, Area 2 and Area 3	108.1	108.3	2.4	1.48
010	14-Jun-13	17:30	Main access	113.6	114.8	8	6.55
011	20-Jun-13	17:30	Main access	112.1	110.8	5.1	3.4
012	31-Jul-13	17:30	Main access	104.3	110.8	3.1	3.21

As per Table 12-4, it is confirmed that blasting activities has complied with trigger limits within the Australian Standard (AS2187.2-2006) Explosives-Storage and use Part 2: Use of Explosives.

Airblast measurements for TANFP were:

1. For 95% of blasts, air blast over pressure must not exceed 115dB (Linear Peak) => only in blasting TRS-WBH-BLST-008 was measured 116.9 dB (A).

2. Airblast over pressure must not exceed 120dB (Linear Peak) => it was complied with in all cases.

In case of ground vibration measurements:

1. For 95% of blasts ground vibration must not exceed 5mm/sec peak particle velocity => only blastings TRS-WBH-BLST-002/10 measured 5.12 and 6.55 mm/s respectively.

2. Ground vibration must not exceed 10 mm/sec peak particle velocity) => it was complied with in all cases.

The recorded airblast and ground vibration measurements complied with trigger limits within the Australian Standard (AS2187.2-2006) Explosives-Storage and use Part 2: Use of Explosives.

12.4 Conclusions

Based on the findings of this Compliance report (Table 12-1), it is concluded that construction environmental management processes and practices at TANPF site are adhering to the key requirements for Blasting Management within the legislative framework and specific conditions from SEWPaC and DEC/OEP.

13. ASSESSMENT OF COMPLIANCE AGAINST NOISE MANAGEMENT REQUIREMENTS

13.1 General

Attachment 07 of CEMP includes Construction Noise Management Plan (CNMP), which lays down the measures to be adopted to minimise noise generation during the construction of the TAN Burrup Project so as to ensure that noise impact does not affect workers, the nearby public and/or amenities and that it complies with applicable statutory regulations.

Two Compliance Reports for Noise Management (Table 13-1) have already been issued. Both reports outline the monitoring activities and commitments, thus providing discussion and evidences of how compliance with each point has been met.

Table 13-1 Compliance Reports

Environmental Compliance Report
Compliance Report for Noise Management Jan-Jun 2014, 2-250-329-REP-TRE-8059 Rev 00
Compliance Report for Noise Management July-Dec 2014, 2-250-329-REP-TRE-8076 Rev 00

13.2 Definitions

LAeq T. This is the continuous equivalent sound level. It is a widely used noise parameter that calculates a constant level of noise with the same energy content as the varying acoustic noise signal being measured. The letter “A” denotes that the A-weighting has been included and “eq” indicates that an equivalent level has been calculated. Hence, LAeq is the A weighted equivalent continuous noise level. A-weighting is a filter incorporated into a sound level meter which when measuring noise replicates the sensitivity of human hearing.

LAeq, 8h (daily noise exposure level). It means an 8 hour equivalent continuous A-weighted sound pressure level in decibels (dB(A)) referenced to 20 micropascals, that is to say, the steady noise level which would, in the course of an 8 hour period, cause the same A-weighted sound energy that would be caused by the actual noise during an actual working day, determined in accordance with Australian/New Zealand Standard AS/NZS 1269.1.

LC,peak. It means peak noise level, that is to say, C-weighted peak hold sound pressure level in decibels (dB(C)) referenced to 20 micropascals determined in accordance with Australian/New Zealand Standard AS/NZS 1269.1.

LASN, T percentile levels. The level of A-weighted noise exceeded for N% of the measurement time. LAS90, T is often used as a measure of background noise in many standards and guidelines. The LAS90, T parameter would therefore represent the level exceeded for 90% of the measurement period, T. Likewise the LAS10, T would indicate the level exceeded for 10% of the measurement period, T indicating the higher noise levels measured.

LANmax. Maximum A-weighted noise level measured with N time weighting, and usually given as LAFmax for fast (F) time weighting, or LASmax for slow (S) time weighting. It is the highest levels

of environmental noise occurring during the measurement time, often used in conjunction with another noise parameter (e.g. LAeq) to ensure a single noise event does not exceed a limit.

13.3 Noise standards and guidance

Environmental Protection (Noise) Regulations 1997 states that main construction activities are not subject to assigned noise levels set forth in such regulations (except for blasting) but that noise shall be dealt with by making every effort to reduce noise emission at source.

Hearson's Cove and Deep Gorge are considered noise sensitive premises according with regulations' definitions. Amenity criterion level of 50 dB(A) for Hearson Cove beach has been established by the former Department of Minerals and Petroleum Resources (SKM, 2002).

Section 4 of Construction Noise Management Plan Doc. No. 2-250-329-PRO-TRE-0111-att07 records predicted noise levels at site boundary, as below.

Table 13-2 Predicted noise levels at TANPF's site boundary

SITE PREPARATION		
Activity	**Source**	**Noise level prediction** *Sound pressure level at boundary*
Blasting	Explosion (shot)	< 125 dB(A)
Earth moving & backfilling	Excavators, trucks	< 60 dB(A)
CIVIL WORKS		
Activity	**Source**	**Noise level prediction** *power / pressure at boundary*
Earth moving & excavations	Excavators, trucks	< 60 dB(A)
Back filling	Leveller	<75 dB(A)
Roads & pavement	Engines and equipment.	< 75 dB(A)
Concrete pouring	Concrete pump, vibrator	< 75 dB(A)
MECHANICAL ERECTION & MODULE HOOK UPS		
Activity	**Source**	**Noise level prediction** *power / pressure at boundary*
Equipment erection, piping installation, lifting operations	Engines, equipment, signals.	< 75 dB(A)
Scaffolding erection	Material lifting and tools use.	< 50 dB(A)

PRE-COMMISSIONING & COMMISSIONING		
Activity	**Source**	**Noise level prediction** *power / pressure at boundary*
Chemical cleaning	Material being swept	< 85 dB(A)
Air / steam blowing	Material being swept	< 85 dB(A)
Material transport	Trucks	< 65 dB(A)

Therefore, measurements of existing ambient noise levels without any activity related to the TANPF should be carried out to identify the impact of noise level increases over low ambient noise levels at sensitive premises and site boundary.

The exposure standard for noise set in the Occupational Safety and Health Regulations 1996 is:

• A daily noise exposure level, $L_{Aeq,8h}$ of 85 dB(A); or

• A peak noise level, $L_{C,peak}$ of 140 dB(C)

measured at the position of the person's ear without taking into account any protection which may be provided to the person by personal hearing protectors.

An $L_{Aeq,8h}$ of 85 dB(A) means that the actual energy of varying noise levels experienced by a person over the working day is equivalent to the energy from 8 hours of exposure to a constant noise level of 85 decibels.

Table 12-3 below shows a range of noise levels and exposure times that are all equal to an LAeq,8h of 85 dB(A).

Table 13-3 Noise levels and exposure times

Noise Level dB(A)	Exposure Time
85	8 hours
88	4 hours
91	2 hours
94	1 hour
97	30 mins
100	15 mins
103	7 ½ mins

The 85 dB(A) exposure standard for noise in Western Australia is legally the maximum acceptable exposure level for noise at the workplace. Workplace noise exposure levels therefore must not exceed 85 dB(A), and should be kept below that level where practicable.

Peak noise levels, $L_{C,peak}$, above 140 dB(C) can cause immediate hearing damage from a single event and must therefore be avoided.

13.4 Noise Studies

13.4.1 Environmental Noise baseline report

A baseline noise survey was carried out to support the Construction Noise Management Plan with aim of ensuring that compliance with all applicable statutory regulations is achieved and there is no adverse impact on the sensitive premises (Hearson Cove and Deep Gorge).

13.4.1.1 Methodologhy

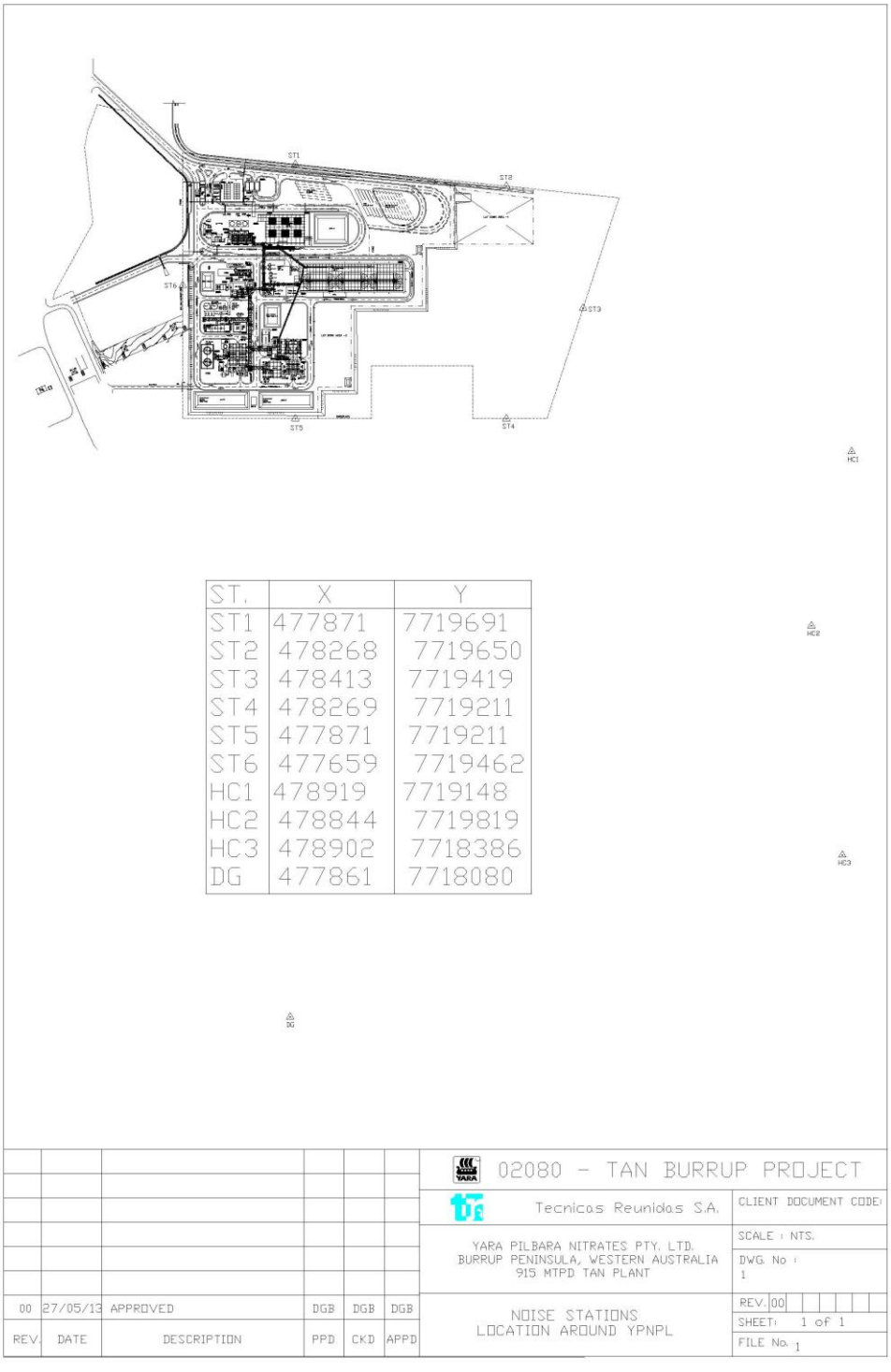
A series of short-term measurements were recorded during the day, evening and night on 10th-11th May, and 16th June 2013. Measurements for each period were recorded only once due to the remoteness of the site and associated security risks.

The baseline noise survey was undertaken in accordance with best practice as specified in AS1055.1-1997.

Short-term measurements were recorded at a total of six locations at TANPF's site fence, three locations in Hearson Cove and one location in Deep Gorge. Noise monitoring sites are shown in Figure 15.

Measurements were recorded for 16 minute intervals during ante meridiem (a.m) and post meridiem (p.m) hours at each location. Time periods are classified as follows: daytime (7 a.m to 7 p.m), evening (7 p.m to 10 p.m) and night (10 pm to 7 a.m).

Figure 13-1 Noise measurement locations at site fence and sensitive premises



13.4.1.2 Results

Table 13-4 summaries the baseline noise measurement results recorded at each of the ten noise monitoring locations.

Table 13-4 Summary of Ambient Noise Level across the Project Site

Measurement location		Noise Metric				Higher noise records
		Lowest LAeq dB(A) (16min)	Highest LAeq dB (A) (16min)	Highest LAFmax dB(A)	Lowest LA90 dB(A)	
Sensitive areas	HC1	38.5	48.5	57.6	35.8	Evening
	HC2	41.7	52.1	66.8	37.7	Daytime
	HC3	43.4	53.3	77.3	41.5	Daytime
	DG	39.7	50.8	58.7	36.6	Evening
Site fence	ST1	40.2	59.1	67.3	37.9	Evening
	ST2	41.1	45.9	68.5	40.1	Daytime
	ST3	40	53.1	56.3	37.1	Night
	ST4	40.6	44.5	51.5	38.4	Night
	ST5	44	52.4	68.5	40.1	Evening
	ST6	43.5	57.2	65	40.7	Evening

The environmental noise baseline of Tan Burrup area is a combination of noise due to visitors, natural environmental sounds and the existing industry. As result of that, Table 13-4 shows that background noise level in sensitive areas are already higher than the amenity criterion level of 50 dB(A) set up by for the WA Department of Mineral and Petroleum Resources.

During evening and night hours, readings in Hearson Cove are a combination of environmental sounds due to the proximity of the shore to noise monitoring locations (high tide, waves, wind) as well as birds and insect noise. Moreover, readings in daily noise levels are also affected by activities of beach users (traffic along the beach as well as in the parking or picnic area). In addition, Hearson Cove is in the route of Helicopters from Karratha Airport to Offshore facilities. In case of Deep Gorge, higher noise measurements were recorded during evening and night period. Environmental noise sounds are the main contributors of the noise readings.

The background noise at TANPF's site boundary is due to the existing YPNPL facility and also the environmental noise from wind, birds and insect noise as well as the route of Helicopters from airport.

Construction Noise Management Plan records a predicted noise at site boundary level between 60 and 75 dB (A) during Site Preparation and Civil works stages. The background noise level at site fence is still lower than the above criterion level, in spite of proximity of noise monitoring locations (ST05, ST06 and ST01) to the YPNPL boundary.

13.5 Mitigation measures

General practices implemented in TANFP to minimise noise are:

- Accurate construction strategy planning.
- Subcontractors to use quietest equipment and machinery available and practicable.
- Organizing and signalling circulation routes so as to minimise vehicle movement during deliveries and plant operation on site.
- Subcontractors to perform regular and effective maintenance of equipment, vehicles and machinery.
- Promoting workers' awareness on noise reduction while performing their assigned tasks (take care while driving vehicles and equipment).
- Promoting supervision awareness on noise control and plant inspection for deficiencies in requirements or defective maintenance.
- If during periodic inspections carried out, any equipment and/or machinery is found to be generating more noise than desirable or expected, maintenance certificates and records are required. Non compliances are identified and immediately corrected and equipment and/or machinery removed from the site until deficiencies disappear.

In addition, site induction includes a couple of slides related to noise management, personal protective equipment (PPE) and also the identification of which of PPEs to be worn as result of the Job Hazard Analysis (JHA).

13.6 Conclusions

The Compliance Reports for Noise Management (Table 13-1) form the basis for proactive reporting to SEWPaC, and DEC/OEPA on status of the project and its performance between July and December 2014.

None noise incidents impacting in matters environmental national significance had happened at TAN Burrup Project.

Sound level measurements have been carried out and results recorded and reported accordingly as required. The main noise sources are trucks and machinery required for the works during construction phase of the TANPF (civil works and mechanical completion). Commissioning activities as chemical cleaning and seam/air blowing are still not initiated. Results concluded that no impact is being generated at sensitive premises due to compliance.

A Brüel & Kjaer 2250 Type II sound level meter (Serial Number: 3003618) with microphone model 4950 (Serial Number: 2847427) and Brüel & Kjaer 4231 Acoustic calibrator (Serial Number: 3006553) were used for the short-term measurements. The sound level meter was calibrated before and after each measurement and no significant calibration drift was detected. Calibration

certificates are provided under 2-250-329-REP-TRE-8076-Att01 of this report. Bi-annual calibration of the sound meter by NATA will be in April 2015.

Weekly HSE Inspection was conducted by YPNPL and TRSA. Corporative TRSA HSE team also carried out an audit on 15th and 19th of December 2014. This quarterly audit verified that the performance of the construction site to implement CEMP is successful.

Additionally, the findings of this report indicate that no noise incidents were observed to be occurring, or to have occurred, at the TAN Burrup site.

Therefore, it is concluded that Construction environmental Management processes and practices at TAN Burrup site are adhering to the key noise requirements.

14. ASSESSMENT OF COMPLIANCE AGAINST TERRESTRIAL FAUNA MANAGEMENT REQUIREMENTS

14.1 General

Attachment 08 of CEMP includes the Construction Terrestrial Fauna Management Plan (CTFMP), which describes in detail the management strategies to be implemented to ensure fauna (including terrestrial and subterranean) are managed in an appropriate manner during project execution of TANFP.

Two Compliance Reports for Terrestrial Fauna management (Table 14-1) have already been issued. Both reports outline the monitoring activities and commitments, thus providing discussion and evidences of how compliance with each point has been met.

Table 14-1 Compliance Reports

Environmental Compliance Report
Compliance Report for Terrestrial Fauna Management Jan-Jun 2014, 2-250-329-REP-TRE-8061 Rev 00
Compliance Report for Terrestrial Fauna Management July-Dec 2014, 2-250-329-REP-TRE-8077 Rev 00

None rare fauna sightings have been recorded and reported to DEC / SEWPaC (Nature Conservation).

During Site preparation, year 2014, a set of reports, register and fauna catalogues have been developed to support Fauna management activities at TANFP:

- Fauna Habitat report. Fauna is considered to have the potential to suffer harm if not removed from the work site and any fauna that may be perceived to pose a threat to the safety of persons within the workplace, is to be removed to a suitable location. This report aimed to identify the fauna habitats located within the immediate vicinity and the fauna groups that are likely to utilise these habitats.
- Site clearing report. This report has been prepared as an account of the fauna, flora and weeds recorded during the clearing process of the TANFP. Clearing occurred during January 2013 with all fauna encountered recorded by HSE team present on site during this time.

During reporting period (Feb 2014 – Feb 2015), the Fauna register is as follows:

Number	Date	Scientific Name	Common Name	Location	Zone	Dead/alive	Relocated
1	17/01/2014		*Finch nest*	Quarentine secure area. Inside stored structure	Ground level	Alive	Yes
2	20/01/2014	*Macropus Rufus*	Baby Red Kangaroo	Water Pond	Inside (water)	Alive	Yes
3	22/01/2014	*Pseudechis*	King Brown	Unit 32	Ground	Alive	Yes

Number	Date	Scientific Name	Common Name	Location	Zone	Dead/alive	Relocated
		australis	Snake		level		
4	25/01/2014	*Accantophis antaticus*	Death Adder	Office car park	Ground level	Alive	Yes
5	14/02/2014		Bungarra lizard	Warehouse area	Ground level	Alive	No
6	17/02/2014	*Macropus Rufus*	Red Kangaroo	Water pond	Inside (water)	Alive	Yes
7	18/02/2014	*Macropus Rufus*	Red Kangaroo	Water pond	Inside (water)	Alive	Yes
8	19/02/2014	*Macropus Rufus*	Red Kangaroo	Water Pond	Inside (water)	Alive	Yes
9	22/02/2014	Diploriphora Valens	Southern Pilbara Tree Dragon	Warehouse area	Ground level	Alive	No
10	01/03/2014		Red ant	Office Car park	Ground level	Alive	No
11	11/03/2014		Pilbara Dragon	North Channel	Ground level	Alive	No
12	19/03/2014		Razor lizard	Warehouse Fence	Ground level	Alive	No
13	10/04/2014		Bungarra Lizard	Warehouse area	Ground level	Alive	No
14	16/04/2014		Bungarra Lizard	Warehouse area	Ground level	Alive	No
15	05/05/2014		Kingfisher	Unit 35	Alive	Alive	Yes
16	12/06/2014		Pink and grey galah x2	Security Hut	Alive	Alive	No
17	04/09/2014	Macropus fuliginosus	Grey Kangaroo	Pond 1	Inside (water)	Alive	
18	12/09/2014	Guttata Castanotis	Mandarin diamond birds	Compressor Area	Ground level	Alive	Pilbara Wildfire Association
19	12/09/2014	Guttata Castanotis	Mandarin diamond birds	Compressor Area	Ground level	Alive	Pilbara Wildfire Association
20	22/09/2014	Macropus fuliginosus	Grey Kangaroo	Pond 1	Inside (water)	Dead	
21	29/09/2014	Grallina Cyanoleuca	Magpie lark	Unit 12	Near structure low level	Alive	Pilbara Wildfire Association
22	11/10/2014	Pseudechis Australis	King Brown	Pond 5	Inside	Alive	Outside site boundary
23	11/10/2014	Pseudechis Australis	King Brown	Pond 5	Inside	Alive	Outside site boundary
24	05/11/2014	Pseudechis Australis	King Brown	Unit 32	Low level	Alive	Outside site boundary
25	06/12/2014	Pseudechis Australis	King Brown	Unit 32	Below piperack;	Alive	Outside site boundary

Number	Date	Scientific Name	Common Name	Location	Zone	Dead/alive	Relocated
					inside scafolding		
26	13/01/2015	Pseudechis Australis	King Brown	Area 81	In the vicinity of the raw water pond 3 in area 81 North West.	Alive although bleeding	Outside site boundary
27	06/02/2015	Macropus fuliginosus	Grey Kangaroo	Pond 2	Inside (no water)	Alive	Outside site boundary
28	16/02/2015	Liasis Olivaceous Barroni	Juvenile Olive Pilbara Python	Unit 12	Ground Level	Alive	Outside site boundary
29	10/03/2015	Liasis Olivaceous Barroni	Pilbara olive python	Unit 12	Ground Level	Alive	Outside site boundary
30	23/03/2015	Macropus fuliginosus	Grey Kangaroo	Pond 2	Inside (no water)	Alive	Outside site boundary
31	31/03/2015	Liasis Olivaceous Barroni	Pilbara olive python	TR offices	Ground Level	Alive	Outside site boundary

HSE Notices and Fauna toolboxes have been carried out by TRSA HSE team.

TRSA staff has performed snake training about snakes and safe catching techniques course in September 2014. TANFP HSE team has been granted the licence as per the Reptile Removalist License Regulation 17 Wildlife conservation (reptiles and amphibians) regulation 2002.

14.2 Summary of Monitoring and commitments

14.2.1 Excavations and trenching inspections and monitoring for fauna protection

Site inspections are undertaken in accordance with what is outlined in the Construction Terrestrial Fauna management plan (CTFMP). For fauna this comprises the inspections of open excavations. Job Hazard Analysis (JHA) for earthworks and excavations include statement related to inspect excavation, before commencing works and after breaks, and during backfilling. All JHAs include statement of inspect machine prior start-up for fauna presence, and in case of interaction with fauna, to contact with HSE team. All project staff shall report and monitor if any fauna is spotted.

14.2.2 Management actions and responsibilities

Below requirements were considered in order to carry out clearing and grubbing:

- Before proceeding, a work permit for clearing shall be issued by Subcontractor and approved by TRSA.

- Footprint shall be clearly marked on a drawing and physically flagged on the ground during clearing to ensure only the minimum area required is cleared.
- Mechanical clearing will progress in a systematic manner, slowly progressing so as not to create habitat islands and allow fauna within the area of disturbance to move out of the area of their own accord.
- Trained HSE team is present during clearing activities to remove fauna (including snakes) from the site with appropriate efforts taken to minimise stress to animals.
- HSE tem and TANFP site held appropriate licences for the translocation of fauna with the DEC / SEWPaC prior to clearing.

The compliance assessment reports and the monitoring performed indicate that the following performance measures or development consent condition have been complied with and therefore not exceeded:

- No unauthorised disturbance of vegetation or fauna habitat beyond approved Site areas.

- Vehicle speeds limited to 20 km/h on unformed access tracks and construction worksite.

- No relative increase in the number of road kill or vehicle impacts recorded over the reporting period.

- Site fenced following clearing to avoid entrance by fauna.

- Trenches left open for a limited period of time.

- Fauna refuges are placed in the trenches (and other construction related voids) at intervals not exceeding 50 m.

- Inspection and clearing of fauna from trenches and other construction related voids by dedicated HSE fauna teams at least twice daily and no more than half an hour prior to backfilling as per Attachment 02.

- No increase in the number of fauna species (diversity and/or abundance) reported during the trench monitoring operations.

- No increase in the number of fauna injuries or mortality reported during the trench monitoring operations.

- In the event of rainfall (and following the clearing of fauna from the trenches) any pooled water, with the exception of groundwater, is pumped out and discharged via a mesh to adjacent vegetated area.

- Designated fauna handlers are appropriately trained and have all of the required licences and equipment.

- All fauna spotted or relocated is recorded in the Fauna register and a Fauna Catalogue is filled.

- Signage warning drivers of the potential of fauna on the road, is posted at the main entrance of YPFPL's Ammonia plant.

14.3 Conclusions

The Compliance Reports for Terrestrial Fauna management (Table 14-1) form the basis for proactive reporting to SEWPaC, and DEC/OEPA on status of the project and its performance between June and December 2014.

Daily Fauna inspection and monitoring is performed by HSE team members. Training has been provided to the HSE team members, who participate in fauna inspection or clearing activities.

Weekly HSE Inspection was conducted by YPNPL and TRSA. Corporative TRSA HSE team also carried out an audit on 15th and 19th of December 2014. This quarterly audit verified that the performance of the construction site to implement CEMP is successful.

Based on the findings and measures implemented described in the Compliance reports (Table 14-1), it is concluded that Construction Environmental Management processes and practices at TAN Burrup site are adhering to the key requirements for Terrestrial Fauna management within the legislative framework and specific conditions from SEWPaC, and DEC/OEP. Therefore, objectives in regards to the terrestrial fauna values of the Site are meet as follows:

- minimising impacts to terrestrial fauna and habitats, in particular those of conservation significance;
- monitoring the presence of significant fauna at the Site; and
- minimising accidents to fauna as a result of activities associated with the TANPF construction (e.g. vehicle strike and entrapment).

15. ASSESSMENT OF COMPLIANCE AGAINST TERRESTRIAL VEGETATION AND FLORA MANAGEMENT REQUIREMENTS

15.1 General

Attachment 09 of CEMP includes the Construction Terrestrial Flora and Vegetation Management Plan (CTFVMP), which details the required vegetation and flora conservation management requirements for the construction phase of TANFP. The CTFVMP outlines the controls and measures required to minimize adverse impacts to terrestrial vegetation and flora within the affected area as follows:

- minimise impacts to terrestrial vegetation and flora, in particular those of conservation significance as a result of activities associated with the construction of the Project (eg. land clearing); and
- monitor the presence of significant vegetation and flora at the Site.

Two Compliance Reports for Terrestrial Vegetation and Flora management (Table 15-1) have already been issued. Both reports outline the monitoring activities and commitments, thus providing discussion and evidences of how compliance with each point has been met.

Table 15-1 Compliance Reports

Environmental Compliance Report
Compliance Report for Terrestrial Vegetation and Flora management Jan-Jun 2014, 2-250-329-REP-TRE-8057
Compliance Report for Vegetation and Flora management, July-Dec 2014, 2-250-329-REP-TRE-8078 Rev 00

During Site preparation (February 2013 and February 2014), a set of reports have been issued by HSE team to record Flora management activities at TANFP:

- Site Clearing Report. This report has been prepared as an account of the fauna, flora and weeds recorded during the clearing process of the TAN Burrup Project.
- Declare Rare Flora and Priority Flora Survey for West location of Air Quality Monitoring Equipment. Equipment for Air Quality Monitoring has been installed on an area of land (Site) between the current project and the pre-existing YARA Ammonia Plant (west site boundary). The project area was subjected to environmental surveying as part of the approvals process for TANFP (ERM 2010) and this targeted Declared Rare Flora (DRF) survey was undertaken of the additional site to be cleared.
- Declare Rare Flora and Priority Flora Survey for Unit 60 and Main Access road. Native vegetation was cleared on an area of land between the current project and the pre-existing YARA Ammonia Plant (west site boundary). The project area had previously been

subjected to environmental surveying as part of the approvals process and this targeted Declared Rare Flora (DRF) survey was undertaken for two additional sites to be cleared.

- An area of native vegetation, referred to as Unit 60' was cleared between the TAN Burrup Project and the Yara Nitrate Plant. This area covered less than 1.5 hectares (ha) and will contain infrastructure joining the TAN Burrup Project to the existing plant.
- A second area of native vegetation was cleared from the corner of Village Road to the Western Access at Tan Burrup. This area was 0.7 ha and is to facilitate the delivery of large construction modules during the construction of the TANFP.

Above DRF reports documented the results of the Level 1 flora survey of the area to be cleared.

Reinstatement Plan for the Widening of King Bay Road January 2014 0.514 hectares of native vegetation within Lot 646 on plan 28839, King Bay Road, were cleared for the purpose of road widening. A permit was granted under section 51 E of the Environmental Protection Act 1986 by Department of Environment and Conservation (DEC). This report documents the results of the survey performed on the 11th January 2014. The objectives of the report were:

- Confirm findings of previous surveys. Record any additional finding issued during the visit.
- Establish the environmental impact that will occur during the clearance and to establish the actions necessary to ensure minimum disturbance in the area.
- Develop a program for restoration of the area to be cleared.

During the reporting period Feb 2014 – Feb 2015, it has been updated the Weed Mapping Report. This report was prepared as a record of the occurrence and distribution of weed species in TANFP. During May and December 2013, vegetation on the site was traversed and species of vegetation identified as invasive were recorded and mapped.

None threatened rare flora or DEC/SEWPaC Priority listed species have been recorded in TANFP site in any of the above reports.

15.2 Summary of Monitoring and commitments

15.2.1 Routine Site inspections

Site inspections are undertaken in accordance with what is outlined in the Terrestrial Flora and Vegetation Management (CTFVMP). Site HSE team members are properly skilled and trained in the identification and survey of rare and threatened flora species likely to occur on Site. Different reports have been issued to record these activities. Reports are included as attachments in Compliance Reports for Terrestrial Vegetation and Flora Management.

15.2.2 Management actions and responsibilities

All personnel shall attend to TANFP´s site induction and inducted on the requirement to protect threatened flora and vegetation.

Specific activities and requirements shall be complaint prior clearing and grubbing, and are already discussed in sections above.

Prohibit access to green field areas outside approved disturbance boundary. A Heritage Permit Approval shall be raised to YPNPL if any work needs to be carried out outside of the site fence. Signs are installed at the entrance to the Project Area and also at no less than 50m intervals along the fence. The signs state that no construction and operation staff is permitted to enter areas surrounding the Project.

Establishing and maintaining plant, vehicles and equipment hygiene as per the Construction Weed Management Plan. Vehicles/Plant and mobile equipment must be in safe operating condition and are subjected to a HSE inspection.

15.3 Conclusions

The Compliance Reports for Terrestrial Vegetation and Flora Management (Table 15-1) form the basis for proactive reporting to SEWPaC, and DEC/OEPA on status of the project and its performance from July 2014 to end of December 2014.

None damage/alteration to the matter of environmental national significance, declared rare flora & priority flora survey on site construction area have occurred.

Monitoring is performed by HSE team members. Records of these activities are shown on the Site Clearing Report, Declare Rare Flora and Priority Flora Survey Reports and in the Weed mapping report). Refer to Compliance Reports for Terrestrial Vegetation and Flora Management (Table 15-1

Weekly HSE Inspection was conducted by YPNPL and TRSA. Corporative TRSA HSE team also carried out an audit on 15th and 19th of December 2014. This quarterly audit verified that the performance of the construction site to implement CEMP is successful. None deviations were found by audit team in relation to Terrestrial Vegetation and Flora Management.

Based on the findings of this Compliance reports (Table 15-1), it is concluded that construction environmental management processes and practices at TANPF site are adhering to the key requirements for Terrestrial Flora and Vegetation Management within the legislative framework and specific conditions from SEWPaC, and DEC/OEP.

16. ASSESSMENT OF COMPLIANCE AGAINST WEED MANAGEMENT REQUIREMENTS

16.1 General

The Construction Weed Management Plan (CWMP) is included in the CEMP as attachment 10.

The purpose of this CWMP is to manage weeds so as to meet weed management obligation by weed control, prevention and rehabilitation actions such as: prevention of weed introduction, control or reduction of existing weed populations in order to protect WA natural ecosystems and agricultural industries.

Two Compliance Reports for Weed management (Table 16-1) have already been issued. Both reports outline the monitoring activities and commitments, thus providing discussion and evidences of how compliance with each point has been met.

Table 16-1 Compliance Reports

Environmental Compliance Report
Compliance Report for Weed management Jan-Jun 2014, 2-250-329-REP-TRE-8064 Rev 00
Compliance Report for Weed management July-Dec 2014, 2-250-329-REP-TRE-8079 Rev 00

Following documents have been developed during this reporting period:

- Site clearing report.
- Weed mapping report.
- Declare Rare Flora and Priority Flora Survey for West location of Air Quality Monitoring Equipment.
- Declare Rare Flora and Priority Flora Survey for Unit 60 and Main Access road.
- Reinstatement Plan for the Widening of King Bay Road January 2014.

A Biosecurity Management Plan and a Site Plan for Department of agriculture actions for the modules shipments have also been developed and implemented for TANFP. Both documents address activities for identification of seeds, which are classified as a Biosecurity risk and therefore must be removed immediately from any cargo or module. The risk of seed contamination can be further mitigated during Module wash down or final cleaning and by means of housekeeping through implemented plant and weed eradication programs.

- Quarentine Inspection reports.

19-SEPTEMBER-2014	NSB-YAR-0010-INDONESIA	QUARENTINE INSPECTION REPORT MAASGRACHT Total Packages: 44 pieces + 12 x 40OT Containers. Total Volume: 9,008,60M3.
4-OCTOBER-2014	NSB-YAR-0008-INDONESIA	QUARENTINE INSPECTION REPORT Total Packages: 4 Modules: PAU 88, PAU 32, PAU32, PAU35+ 8 x FCL Containers

All personnel shall attend to TANFP´s site induction, which includes information about Flora and Weeds management. Quarentine Approved Premises Class one sea and air freight deports Accreditation training was also organised for the site team who will be involved in the inspection of modules and the management of the Quarentine secure area.

16.2 Summary of Monitoring and commitments

16.2.1 Site inspections

Site inspections are undertaken in accordance with what is outlined in the Terrestrial Flora and Vegetation Management plan, Weed Management Plan, Biosecurity Management Plan and Site Plan for Department of agriculture actions for the modules shipment.

Since construction activities started, there have not been introduced weed species on the newly exposed areas at TANFP site. Designated HSE team members are properly skilled and trained in the identification and treatment of weed species.

16.2.1.1 Weed surveys.reports

Weed survey reports have been issued as a record of the occurrence and distribution of weed species in the TANFP site. Last survey was carried out on December 2014, the remnant vegetation on the site was traversed and species of vegetation identified as invasive were recorded and mapped. This report was included as an attachment in the Compliance report for Weed Management (Table 16-1).

Three species of flora, Cenchrus ciliaris (Buffel Grass), Aerva javanica (Kapok Bush), and Vachellia farnesiana, have previously been recorded within the project area. Of the three species identified as occurring in the project area prior to clearing, only two, Cenchrus ciliaris (Buffel Grass) and Aerva javanica (Kapok Bush) were encountered during the survey.

Due to Buffel Grass being widespread outside of the project area, control of this species in the remnant vegetation is unachievable. This is mainly due to the dispersal of this species' seeds being by wind. However, as the Kapok occurs only in isolated clumps the management of this species within the TAN Burrup Project Area is a lot more feasible. It is recommended to keep spraying of individuals in order to remove this specie from within the project area.

When monitoring indicates that a performance indicator has been exceeded, or likely to be exceeded, the TRSA has implemented the contingency measures indicated in Attachment 04 of

the Compliance report for Weed Management (Table 16-1).. Limited spreading of weeds from the undisturbed areas to the main office building area which was cleared (newly exposed soil) during site preparation has been identified. The HSE team activated the Weed Management Contingency Plan. Chemical and physical weed removal techniques are analysed and the hand pulling has been the technique chosen to control the weeds as it is the most environmentally friendly and labour intensive method of weed control. The key to hand pulling has been to remove the entire plant, ensuring propagules are not left behind to prosper. Weed monitoring and eradication has been performed by HSE/construction team members. Records of these activities are shown on Attachments 03 and 04 of the Compliance report for Weed Management (Table 16-1).

16.2.1.2 Biosecurity inspections

All cargo and modules shipped via Dampier Port, pre inspection at the vessel and in the containers will be carried out by TRSA and Department of Agriculture, if all found to be clean, the cargo will be delivered to TANPF site and unload in the warehouse, quarantine laydown area.

Modules that are found and clean of BRM were allocated straight away to footings or alongside foundations. If any suspect material is found, material will be bagged, tagged and given to the Department of agriculture.

Biosecurity inspections will be recorded and reported to the Department of agriculture. These reports have already been included as an attachment of Compliance Report for Integrated Pest Management (Table 16-1).

16.2.2 Management actions and responsibilities

All staff is inducted on the requirement to prevent the spread of weeds:

- No access is allowed to greenfield areas outside of approved disturbance boundary.
- All off road vehicles and equipment is free of any weed propagules.
- Water trucks are available on site in case of wash-down is needed.

All Vehicles/Plant and mobile equipment are subject to Vehicle Hygiene and Weed inspection once they arrive on site. Inspections of all earthmoving machinery are conducted prior to enter the undisturbed portions of the Site, to ensure they are clean of mud and plant debris, which may contain weed propagules.

Fill material is coming from Six Mile Quarry between Burrup and Karratha. Therefore, fill is obtained from a suitable weed free source. Results of organic analysis of fill material are kept in the Quality folders.

16.2.3 Conclusions

This Compliance Reports for Weed Management (Table 16-1) form the basis for proactive reporting to SEWPaC, and DEC/OEPA on status of the project and its performance between July and December 2014.

The objectives for the construction phase of the TANPF as per the CEMP with regard to invasive weeds have been met. The objectives for weed management are the following:

- preventing the introduction and spread of introduced species;
- controlling and/or eradicating both noxious and environmental weeds within the Site; and
- minimising impacts to terrestrial flora and fauna habitat, in particular those of conservation significance.

To comply with these objectives, weed monitoring has been performed in order to assess the impact of the construction activities against the following performance indicators:

- To avoid the introduction of any new weed species within and/or beyond the approved Site boundary.

- To minimise the spread of existing weed species within and/or beyond the approved Site boundary.

When monitoring indicates that a performance indicator has been exceeded, or likely to be exceeded, the TRSA has implemented the contingency measures indicated in the Weed Management Plan.

During the reporting period, limited spreading of weeds from the undisturbed areas to the main office building area which was cleared (newly exposed soil) during site preparation has been identified. The HSE team activated the Weed Management Contingency Plan. Chemical and physical weed removal techniques are analysed and the hand pulling has been the technique chosen to control the weeds as it is the most environmentally friendly and labour intensive method of weed control. The key to hand pulling has been to remove the entire plant thus ensuring propagules are not left behind to prosper. Weed monitoring and eradication has been performed by HSE/construction team members. Records of these activities are shown on Attachments 03 and 04.

A Biosecurity Management Plan and Site Plan for Department of agriculture actions for the modules shipments have also been developed and implemented. Both plans were approved by Quarantine Authorities.

Weekly HSE Inspection was conducted by YPNPL and TRSA. Corporative TRSA HSE team also carried out an audit on 15th and 19th of December 2014.

This quarterly audit verified that the performance of the construction site to implement CEMP is successful.

Based on the findings of this Compliance reports (Table 16-1), it is concluded that construction environmental management processes and practices at TANPF site are adhering to the key requirements for Weed Management within the legislative framework and specific conditions from SEWPaC, and DEC/OEP.

17. ASSESSMENT OF COMPLIANCE AGAINST INTEGRATED PEST MANAGEMENT REQUIREMENTS

17.1 General

The Integrated Pest Management Plan (IPMP) is included in the CEMP as attachment 11.

The purpose of this IPMP is to set thresholds for pest populations, monitoring for pests, prevention of pest and establishment and control of pests choosing the safest and most effective tools to prevent damage and impact from pest species. It also addresses all mosquito and other nuisance insects outlining how to achieve an acceptable level of mosquito control based on an integrated approach that combines various methods to minimize interaction between mosquitoes and the public and to reduce the risk of mosquito-borne disease.

Two Compliance Reports for Integrated Pest management (Table 17-1) have already been issued. Both reports outline the monitoring activities and commitments, thus providing discussion and evidences of how compliance with each point has been met.

Table 17-1 Compliance Reports

Environmental Compliance Report
Compliance Report for Integrated Pest management Jan-Jun 2014, 2-250-329-REP-TRE-8058 Rev 00
Compliance Report for Integrated Pest management July-Dec 2-250-329-REP-TRE-8080 Rev 00

No records of mosquito nuisance and breeding grounds on TANFP site. Therefore, sampling of larvae, and use of chemical larvicides or adulticides has not been taken place.

Documents related to pest management and issued in the report period are:

- Biosecurity Management Plan. If wasps, moths, bees, bats, ants or other hitchhiker pests, or nests or houses that pose biosecurity risk are detected in any cargo, it shall be reported to Department of agriculture and the area thoroughly cleaned utilizing an approved cleaning agent.
- Site Plan for Department of Agriculture actions for the modules shipments. The purpose of this document is to establish the procedure to comply with the Quarantine requirements on the landing and installation of the modules and cargo when arriving at the site.
- Quarentine Inspection reports.
- A Quarentine Approved Premises Class one sea and air freight deports Accreditation training was also organised for the site team who is involved in the inspection of modules and the management of the Quarentine secure area.

NOTE: Integrated Pest management has not been included as part of the site induction. Specific training and awareness was provided to personnel on the mosquito and nuisance insect problem, and the management strategies and responsibilities for their own health when required. Refer to

First Annual Environmental Compliance Report February 2013/February 2014, 2-250-329-REP-TRE-8055.

- Media releases for Mosquito-borne disease risk. Two media releases for mosquito-borne disease risk were issued by Shire of Roeburne and Dampier Port Authority. Both media releases were distributed to all workforce.
- Toolboxes have been carried out on site:
  - Bites and stings safety talk on 28th September 2013.
  - First aid training in case of bites on 5th October 2013.
  - Ross river presentation on 26th October 2013.

17.2 Site inspections.

In the reporting period (February, 2014 – February 2015), there have not been records of mosquito nuisance and breeding grounds within TANFP site. Therefore, sampling of larvae was not carried out in any of the following considered as potential source of mosquitos:

- Ponds and basins.
- Stormwater drainage systems.
- Low lying areas.

Site inspections are undertaken by HSE team in accordance with what is outlined in the Integrated Pest Management Plan. Preventive measures to avoid mosquito breeding were raised as result of these inspections.

The site is visually inspected for all containers and vessels capable of holding water to prevent water pooling. Laydown areas, including pipes and under pallets, are also inspected for nests and other signs of pest presence.

Routine inspections, and control measures for other pests such as spiders (red backs), bees and wasps have been carried out.

Findings and records of site inspections have been included in Compliance Reports for Integrated Pest management (Table 17-1).

17.3 Management actions and responsibilities

Personnel have been trained and are aware of preventive measures such as:

- Avoid being outdoors at peak biting times, specifically at dusk.
- Avoid areas of dense vegetation near breeding sites.
- Information about clothing, because it is recommended to wear hats, socks, light coloured clothing with long pants and long sleeves. Head nets (with 1-1.5 mesh) and gloves are also recommended to be worn. Sleeves and collars are kept buttoned and trousers tucked into boots.
- Use of mosquito repellents. TRSA has distributed mosquito repellent Red-eyed Gotchal neutral scent between workforce when required.

Preventive measures already considered in the design are:

- Basins and swales are designed to empty in less than seven days to prevent the completion of mosquito breeding cycles.
- Design of final drainage system shall prevent material accumulation and debris.
- Surface water run-off from non-process/storage areas and building roofs are directed to the clean water pond to be evaporated.
- Erosion control measures will be installed on drain batters to prevent silting. Embankments and drainage systems for final plant are under construction at this stage of the project.
- Temporary channels and swales are well maintained and free of sediments.

Good practices already implemented at the Construction stage are:

- Temporary channels and swales are already built on site.
- Irrigation rates for dust suppression are effectively managed to prevent the creation of temporary pools.
- Reinstated sites are re-contoured to the original surface profiles to prevent ponding. Backfilling of excavation is carried out as soon as civil works are completed for each foundation.
- TANPF drainage is designed so that no stagnant ponding occurs during and after construction.
- Vegetation is removed from paths and buildings.
- Rubbish is removed daily from all buildings.
- Hoppers and bulk bins are removed and emptied regularly.
- All discarded or unused material, including pallets and cardboard boxes, is removed off the site as soon as possible. Waste segregation is performed at TANFP.
- Food is consumed only in designated areas.
- Feeding of wildlife is forbidden. This is already included in the site induction.
- Water holding systems, including air conditioners are maintained to prevent water leaks.
- Machinery, if left idle, is regularly checked for any infestation or nests. Prior to start up, machinery is checked by operators.

17.4 Conclusions

This Compliance Reports for Integrated Pest Management (Table 17-1) form the basis for proactive reporting to SEWPaC, and DEC/OEPA on status of the project and its performance between July and December 2013.

Visual site inspection is performed by HSE team members. As result of such activity, preventive measures and management protocols for pest control have been implemented (attachments 01 and 02). Training and awareness programs have been also carried out (attachments 03, 04 and 09).

A Biosecurity Management Plan (Attachment 06) and Site Plan for Department of agriculture actions for the modules shipments (attachment 07) have been developed and implemented successfully for the first two shipments (attachment 08).

Weekly HSE Inspection was conducted by YPNPL and TRSA. Corporative TRSA HSE team also carried out an audit on 15th and 19th of December 2014. This quarterly audit verified that the performance of the construction site to implement CEMP is successful. None deviations were found by audit team in relation to Terrestrial Vegetation and Flora Management.

Based on the findings of this Compliance reports (Table 17-1), it is concluded that Construction environmental Management processes and practices at TAN Burrup site are adhering to the key requirements for integrated Pest Management within the legislative framework and specific conditions from SEWPaC, and DEC/OEP.

18. CONCLUSION

This Annual Environmental Compliance Report February 2014/2015 forms the basis for proactive reporting to SEWPaC, and DEC/OEPA on status of the project and its performance between 2013 and 2014.

Project overall progress achieved is 94.22% as follows:

- 100 %: Engineering.
- 99.96 % Manufacturing,
- 100 %: Module construction at yard (Indonesia)
- 80.08 % to construction at site.

The following plans have been issued for TANPF for the management of environmental issues during construction.

- Construction Environmental Management Plan (CEMP) comprising of:
    - Air Quality Management Plan;
    - Water Quality Management Plan;
    - Erosion Control and Storm water Management Plan;
    - Waste Management Plan;
    - Traffic Management Plan;
    - Blasting Management Plan;
    - Noise Management Plan;
    - Terrestrial Fauna Management Plan;
    - Terrestrial Flora and Vegetation Management Plan;
    - Weed Management Plan;
    - Integrated Pest Management Plan;
    - Construction HSE Management Plan;
- Hazardous Material Management Plan.
- Emergency Response Management Plan.
- Aboriginal Heritage Management Plan.

The following reports (Table 18-1) have been issued for TANPF and submitted to SEWPaC in order to follow up and demonstrate compliance with all applicable requirements and commitments (section 4.4.2 of CEMP).

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Table 18-1 Compliance Reports issued between February 2014 and February 2015

Environmental Plan	Environmental Compliance Report
Air Quality Management Plan	Compliance Report for Air Quality Management Jan-Jun 2014, 2-250-329-REP-TRE-8054 Rev 00 Compliance Report for Air Quality Management July-Dec 2014, 2-250-329-REP-TRE-8071 Rev 00
Water Quality Management Plan	Compliance Report for Water Quality Management Jan-Jun 2014, 2-250-329-REP-TRE-8063 Rev 00 Compliance Report for Water Quality Management July-Dec 2014, 2-250-329-REP-TRE-8072 Rev 00
Erosion Control and Stormwater Management Plan	Compliance Report for Erosion Control and Stormwater Jan-Jun 2014, 2-250-329-REP-TRE-8056 Rev 00 Compliance Report for Erosion Control and Stormwater July-Dec, 2-250-329-REP-TRE-8073 Rev 00
Waste Management Management Plan	Compliance Report for Waste Management Jan-Jun 2014, 2-250-329-REP-TRE-8062 Rev 00 Compliance Report for Waste Management July-Dec 2014, 2-250-329-REP-TRE-8074 Rev 00
Traffic Management Management Plan	Compliance Report for Traffic Management Jan-Jun 2014 2-250-329-REP-TRE-8065 Rev 00 Compliance Report for Traffic Management July-Dec 2014, 2-250-329-REP-TRE-8075 Rev 00
Noise Management Management Plan	Compliance Report for Noise Management Jan-Jun 2014, 2-250-329-REP-TRE-8059 Rev 00 Compliance Report for Noise Management July-Dec 2014, 2-250-329-REP-TRE-8076 Rev 00
Fauna management Management Plan	Compliance Report for Terrestrial Fauna Management Jan-Jun 2014, 2-250-329-REP-TRE-8061 Rev 00 Compliance Report for Terrestrial Fauna Management July-Dec 2014, 2-250-329-REP-TRE-8077 Rev 00
Terrestrial Vegetation and Flora Magement Plan	Compliance Report for Terrestrial Vegetation and Flora management Jan-Jun 2014 2-250-329-REP-TRE-8057 Compliance Report for Terrestrial Vegetation and Flora management July-Dec 2014, 2-250-329-REP-TRE-8078 Rev 00

Environmental Plan	Environmental Compliance Report
Weed management Management Plan	Compliance Report for Weed management Jan-Jun 2014, 2-250-329-REP-TRE-8064 Rev 00 Compliance Report for Weed management July-Dec 2014, 2-250-329-REP-TRE-8079 Rev 00
Integrated Pest management Management Plan	Compliance Report for Integrated Pest management Jan-Jun 2014, 2-250-329-REP-TRE-8058 Rev 00 Compliance Report for Integrated Pest management July-Dec 2014, 2-250-329-REP-TRE-8080 Rev 00
Air Quality Management Management Plan	Compliance Report for Air Quality Management Jan-Jun 2014, 2-250-329-REP-TRE-8066 Rev 00 Compliance Report for Air Quality Management July-Dec2014 , 2-250-329-REP-TRE-8081 Rev 00

None incidents of environmental national significance had happened at TANPF.

Based on the findings of the Compliance reports (Table 18-1), it is concluded that construction environmental management processes and practices at TANPF site are adhering to the key requirements for Environment Management within the legislative framework and specific conditions of TANPF environmental approval.

In addition, as per conditions 10 of EPBC Licence 2008/4546, a Heritage Monitoring of 6 sites within 2 km of the Yara Pilbara Nitrates Pty Ltd plant site (Western Australia) in the Burrup Peninsula have been measured 2013 and 2014. The engravings and background rocks were measured in situ. Measurement of the annual colour and mineralogical changes utilised two spectrophotometer techniques, the Analytical Spectral Device (ASD) and the BYK colour spectrophotometer. An examination of the colour measurements as a function of time, as well as a comparison of the two measurement techniques, has been conducted and no significant change was identified. The 3D pictures were acquired for both years and change was not detected. Refer to attachment 1 in this report.

YPNPL acknowledges the importance of preserving environment across site boundaries and surrounding environment. This report shows the monitoring activities and corrective actions already taken at TANFP site in order to comply with requirements gathered under different Works approval, legislation, standards and within CEMP.

YPNPL is looking forward to the inputs and comments of SEWPaC, DEC and OEPA and also continuing the construction of TANFP with a strong commitment to environment.

19. REFERENCES

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Attachment 1

Heritage Monitoring of 6 sites within 2 km of the Yara Pilbara Nitrates Pty Ltd plant site (Western Australia) 2015

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Heritage Monitoring of 6 sites within 2 km of the Yara Pilbara Nitrates Pty Ltd plant site (Western Australia) 2015

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EP152895
30th April 2015

Yara Pilbara Nitrates Pty Ltd

CSIRO Minerals Down Under Flagship

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Copyright and disclaimer

Important disclaimer

Contents

Figures

Tables

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Executive summary

The Burrup Peninsula is located at around 1300 km from Perth in Western Australia and contains Australia's largest collection of indigenous petroglyphs. Alongside the petroglyphs, the Burrup Peninsula has several large industrial complexes including iron ore, liquefied natural gas production, salt production and fertilisers with one of Australia's largest ports. Some of the petroglyphs are located next to these industrial areas and some concerns were expressed that the petroglyphs could be damaged by emissions from the industry. To respond to these concerns, The Western Australian government established the independent Burrup Rock Art Monitoring Management Committee (BRAMMC) that commissioned a number of studies to monitor the petroglyphs under the auspices of the Burrup Rock Art Technical Working Group monitoring program (BRATWG). They included, in particular, colour change and mineral spectroscopy studies undertaken by CSIRO for the last 10 years.

Yara Pilbara Nitrates Pty Ltd (YPNPL) is building a Technical Ammonium Nitrate Production Facility Project (or TAN) on the Burrup Peninsula. To respond to the requirements of the Environment Protection and Biodiversity Conservation Act 1999, YPNPL needs to engage a heritage monitor to survey the rock art sites within a two kilometre radius of the project site. CSIRO has been a heritage monitor for the West Australian Government Department for Environmental Regulation for the monitoring of the Burrup petroglyphs for the last decade and was considered appropriate to be the heritage monitor for YPNPL.

The rock art study dedicated for the TAN Project required the heritage monitoring of petroglyphs sites within 2km of the plant site. Selected sites were determined in consultation with members of Murujuga Aboriginal Corporation to respect the cultural laws of the traditional owners for the entitlement of access. The selected petroglyphs were firstly evaluated for their appropriateness for scientific study, including petroglyph size and quality, direction of exposure, elevation, dominant winds direction within 2 km of the TAN project location.

From the six selected monitoring sites; three were already part of the decade-old and ongoing BRATWG monitoring program and an additional three sites were also selected. In July 2014, the three new sites became part of the BRATWG monitoring program. On each monitored petroglyph panel, eight (8) sampling areas or "spots" were selected; four (4) areas classified as 'engraving' – defined by the pecking marks that constitute the image and four (4) area classified as 'background' – a section of the adjacent rock surface unmarked by the petroglyph.

Three types of measurements were carried out for the monitoring and included (1) colour contrast monitoring, (2) spectral mineralogy and (3) 3D visual imaging to assess the surface of the petroglyphs.

Based on the two years of monitoring, no significant change was detected.

1. Introduction

The Burrup Peninsula is around 30 km long and 6 km wide and is located 1300 km from Perth in Western Australia. The peninsula is of unique cultural and archaeological significance as it contains Australia's largest and most important collection of indigenous petroglyphs. Alongside the petroglyphs, the Burrup Peninsula has several large industrial complexes including iron ore, liquefied natural gas production, salt production and fertilisers with one of Australia's largest ports. Since some of the petroglyphs adjoin industrial areas there has been very public concern expressed that the petroglyphs could be damaged by airborne emissions from the industry. In 2002, The Western Australian government established the independent Burrup Rock Art Monitoring Management Committee (BRAMMC) to review the available expertise and oversee the studies that were conducted to establish whether industrial emissions are likely to affect the petroglyphs under the patronage of the Burrup Rock Art Technical Working Group monitoring program (BRATWG). In 2003 the BRAMMC commissioned a number of studies to monitor the petroglyphs. They included air dispersion modelling studies, air quality and microclimate; colour change, dust deposition and accelerated weathering study and mineral spectroscopy carried out by CSIRO. The studies were based on the monitoring of seven sites with two control sites located on the northern Burrup area and the other five located further south on the lower Burrup Peninsula, closer to the industrial areas. For the last 10 years (2004 to 2013), petroglyphs at seven specially selected sites (chosen under the guidance of indigenous elders) in the Burrup Peninsula were measured using colour and reflectance spectroscopy measurements.

Yara Pilbara Nitrates Pty Ltd (YPNPL), formerly Burrup Nitrates Pty Ltd (BNPL), is a joint venture between Yara, Orica and Apache. In November 2013, YPNPL approached CSIRO to assess its ability to become the heritage monitor for the TAN Project on the Burrup Peninsula and to provide a written endorsement of the proposed monitoring strategy. Yara Pilbara Nitrates Pty Ltd is constructing a Technical Ammonium Nitrate Production Facility on the Burrup Peninsula adjacent to the existing Yara Pilbara Fertilisers Pty Ltd ammonia plant. Environmental approval under the EPBC Act is subject to a number of conditions including a requirement for monitoring of rock art within two kilometres of the plant site. The site construction commenced on the 18th February 2013 and in agreement with the varied condition the first rock art monitoring associated with the TAN project should be completed by 18 June 2014. The approach for rock art monitoring is to involve monitoring sites within 2km of the plant site. Following a presentation at meeting of the Murujuga Circle of Elders and a subsequent visit to the proposed monitoring sites with two elders and a Murujuga ranger during December 2013, the Circle of Elders on 28 March 2014 provided their agreement to the use of the particular petroglyph panels for non-disturbance monitoring.

CSIRO was to assess the location and number of monitoring sites within 2 km of the YPNLT plant site and to conduct, colour contrast monitoring, field spectral mineralogy and 3D visual imaging of rock art at the three sites on the Burrup Peninsula.

2. Location and sampling of the petroglyphs

For the BRATWG study, the sites for monitoring were determined by the Rock Art Management Committee, and the final decision for a representative petroglyph at each site (each site contains one or more petroglyphs) was determined in consultation with the Committee's Technical Advisor and nominated representatives of the local indigenous communities including members of Murujuga Aboriginal Corporation. Respecting the cultural laws of the traditional owners for the entitlement of access, the selected petroglyphs were firstly evaluated for their suitability for scientific study, including aspect (e.g. elevation and direction of exposure). For this study, a similar approach was chosen that takes into account the location of the plant site and its 2 km radius relative to the wind main directions through the year (Figure 1 and Figure 2). The ultimate decision was made by the Elders of the Murujuga Aboriginal Corporation. The monitoring consists of six monitoring sites within 2km of the plant site. Three existing sites labelled 5 or Burrup Road, 6 or Water Tanks and 7 or Deep Gorge (Figure 1) from the (BRATWG) monitoring program and three additional monitoring sites within 2km of plant site labelled 21 or Yara West, 22 or Yara North East and 23 or Yara East (Figure 1, Figure 2 and Table 1). In July 2014, the three additional sites (21, 22 and 23) will become part of the BRATWG monitoring program with a new total of 10 monitoring sites.

On each monitored petroglyph panel, sampling areas were chosen based on a uniform colour over a minimum area of 20 mm, so that comparative measurements could be made between the various measuring instruments. For the BRATWG study, originally, three pairs of sampling 'spots' on each of the seven selected petroglyphs were identified (i.e. six sampling points per petroglyph):

- An area classified as 'engraving' – defined by the graffito lines or pecking marks that constitute the image;
- An area classified as 'background' – a section of the adjacent rock surface unmarked by the petroglyph.

In 2013, an additional pair of sampling "spots" was measured bringing the total pairs of spots for each site to 4 (4 engravings and 4 backgrounds).

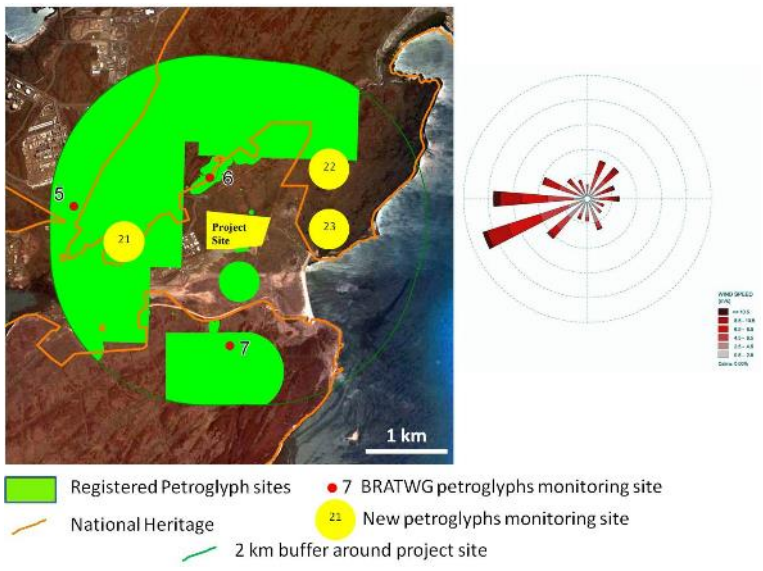


Figure 1 Proposed new sites (Yellow numbers) with dominant wind directions and speed in the rose wind

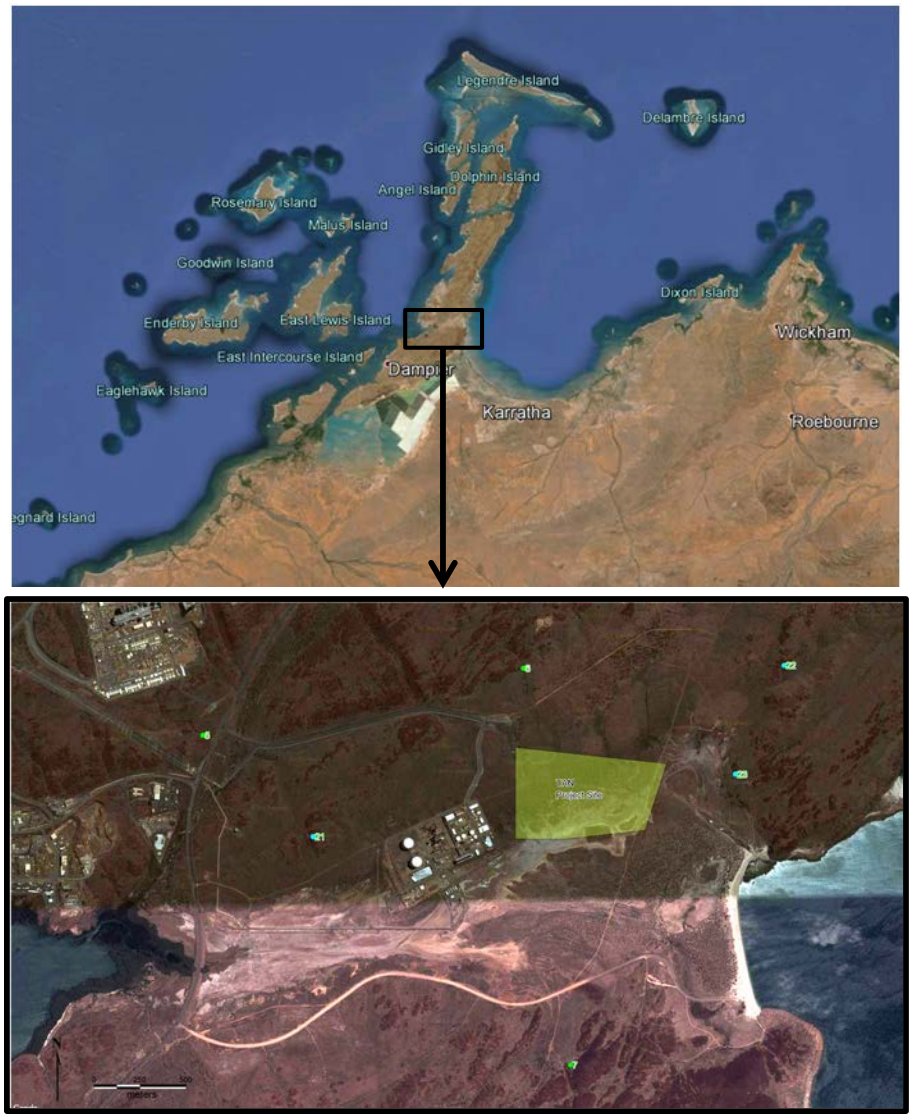


Figure 2: Google Earth® maps of the Burrup Peninsula with the petroglyphs location.

Table 1 Coordinates (GDA 94, Zone 50) of the 6 sites measured for the TAN monitoring project

Site	Site name	Coordinates (GDA 94, Zone 50)	
5	Burrup Rd	475,959	7,719,771
6	Water Tanks	477,698	7,720,137
7	Deep Gorge	477,956	7,717,987
21	Yara West	476,558	7,719,223
22	Yara North East	479,112	7,720,155
23	Yara East	478,849	7,719,565

3. Instrumentation

3.1 Spectrophotometer

Portable, hand-held spectrophotometry was identified as a suitable technique. It has been recognised as a repeatable way of recording colour in units of standard CIE chromaticity coordinates in many contexts, including archaeological situations (Mirti, 2004). CIE chromaticity coordinates are an internationally recognised numerical system of permanently and objectively describing the colour of a surface or material as a point in three-dimensional L*a*b* colour space, identifying a tristimulus value (L*a*b*) for each sample point.

In situ monitoring of degradative change through colour measurement has been reported by Mirmehdi *et al.* (2001), who undertook a pilot study designed for monitoring and modelling the deterioration of paint residues in a cave environment through digital image comparisons with a reference image. The template-matching technique was considered unsuitable and impractical for the Burrup study for two reasons:

a) Template matching, as described by Mirmehdi *et al.* (2001), would require the collection of digital images with repeatable and controlled spectral illumination, angle of incidence and collection. Burrup petroglyphs are located in remote, exposed locations, and it would not be possible to control the colour, temperature and angle of the ambient lighting easily without blocking all the ambient daylight, or collecting images in the night with the ambient moon and starlight removed.

b) The effect of metamerism in relation to the reference template and rock surface has not been accounted for. It is well known that surfaces appearing similar in colour under one set of illumination conditions can appear dramatically different with another spectral illuminant or angle of incidence. The reference template is a glossy (laminated) smooth surface, while the rocks in this study are significantly rougher.

The difference between two colours measured instrumentally is ΔE. It derives from the German word – *Empfindung* – which means a difference in sensation. A ΔE value of zero represents an exact match. It is the standard CIE colour difference method, and measures the distance between the two colours, calculated in 3D L*a*b* colour space. In this way, colour difference can be evaluated through measuring the tristimulus values of points over time, and calculating ΔE to evaluate the colour difference with time. This enabled the colour contrast between an engraving and a rock surface to be monitored to evaluate whether it is decreasing.

The difference between two colours, ΔE, can be evaluated using the 1976 CIE colour difference formula (Hunter, 1987). In CIE L*a*b* space, the difference is:

$$\Delta E^*ab = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{0.5}$$

This was used to evaluate the colour change of single points between consecutive years over which the monitoring occurred.

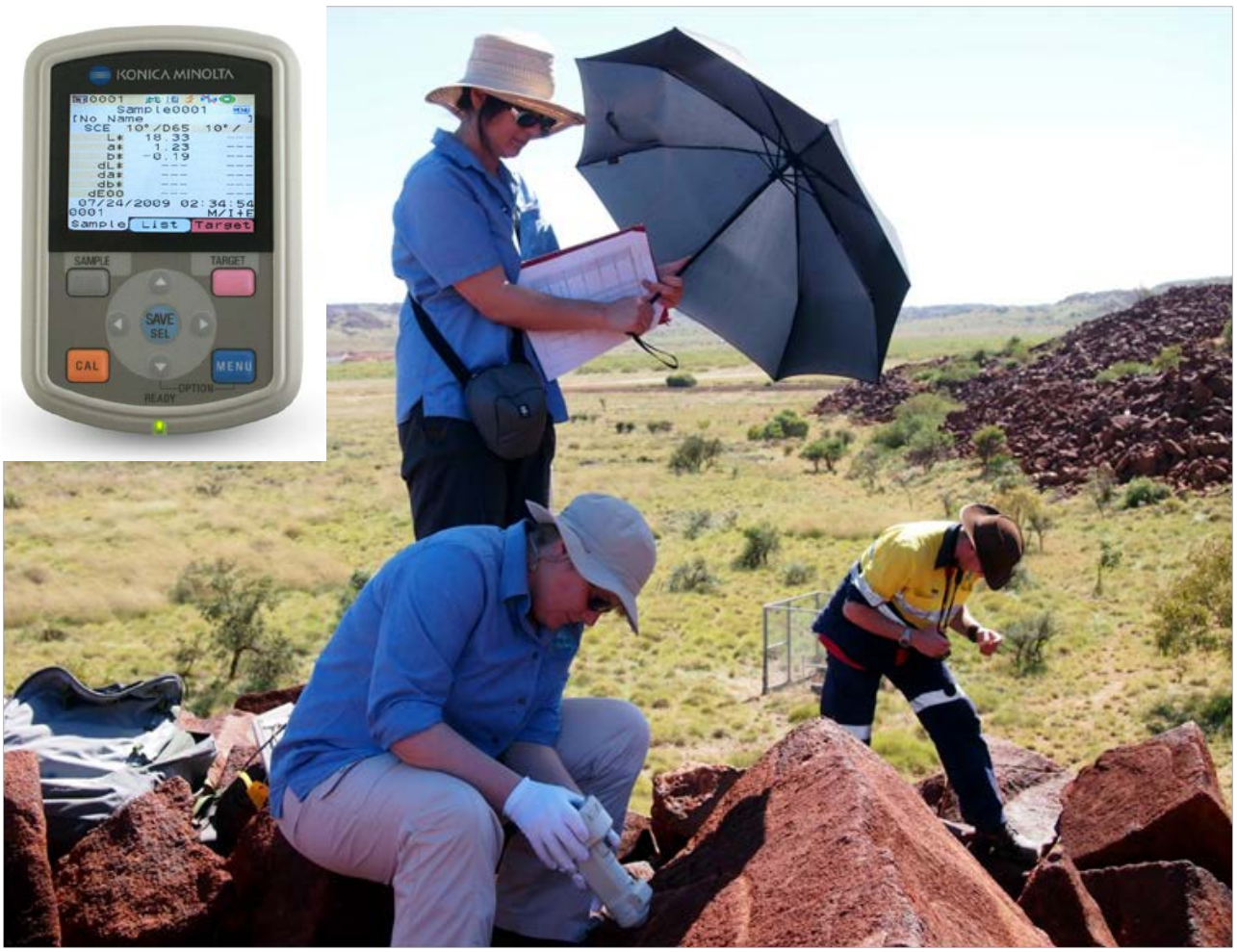


Figure 3. Konica Minolta Photospectrometer in use for the measurement of Petroglyphs (Site 7)

The instrument used for colour measurement is a portable Konica Minolta CM-700/600d spectrophotometer with inbuilt spectral illuminants (Figure 3).

It is essential to use an artificial light source for reproducibility and determination of colour change, as the fluctuations in the natural daylight spectrum due to time of day, season and weather means naturally illuminated measurements would be inconsistent and unreliable.

At each monitoring spot, 21 separate measurements were made, lifting the instrument head off the surface between each measurement.

3.2 Reflectance spectrometer

Reflectance spectroscopy is now available as a field tool for geologists through the development of portable instruments like the Analytical Spectral Device (ASD) FieldSpecPro field spectrometer. These systems measure diagnostic mineral spectral features that are particularly suitable for quantitative analysis of many geological materials. Some of the advantages of the technique include little sample preparation (if any), and rapid measurement (around 1 s) though the measurement is restricted to the sample's surface (< 50 µm).

Reflectance spectroscopy, the analysis of reflected light, between 380 and 2500 nm is now a proven technique for mineral analysis in both the laboratory and in the field. Reflectance spectroscopy has been used intensely to characterise weathering minerals such as iron oxides and clay minerals. The most common iron oxides minerals (hematite, maghemite and goethite) have broad absorptions between 380 and 1000 nm (visible and near infrared or VNIR), whereas OH-bearing minerals such as phyllosilicates, inosilicates as well as carbonates and sulphates show narrow absorption features between 1000 to 2500 nm (short wave infrared or SWIR). The combination of these wavelength ranges provides a step forward towards quick and accurate mineral characterisation.

The Analytical Spectral Device (ASD) FieldSpec Pro covers the spectral range 380-2500 nm with a spectral resolution of 3 nm at 700 nm using 3 detectors: a 512 element Si photodiode array for the 380-1000 nm range and two separate, TE cooled, graded index InGaAs photodiodes for the 1000-2500 nm range. The input is through a 1.4 m optic fibre. The average scanning time to acquire a spectrum is 1 second. There are two ways of operating the ASD, it consists of either using (1) an external source of light (sun or artificial) or (2) an internal source of light. The absolute measurements are obtained using a white reference plate that reflects 100% of the light in the 380 to 2500 nm wavelength range. For this study, the second option for lighting was used as it eliminates any external light interference.

The measurements involved 10 sets of measurements at each monitoring spot - five readings were taken for each set, then the sampling head was lifted off and repositioned on the surface for the next set.

Figure 4 ASD FieldSpecPro and Konica Minolta CM-700dspectrophotometer operating on petroglyphs in the Burrup Peninsula (2013)

3.3 3D imaging camera

The 3D mapping to monitor sub-millimetre depth change to both the engravings and the background was completed using a very high resolution digital Nikon D200 camera with an AF Micro Nikkro 60 mm 1:2.8 D lens. A first photograph is acquired at a known distance from the petroglyph followed by the acquisition of a second photograph at the same distance from the petroglyph but moved laterally at 1/6 of the first photograph to generate a 3 D image. Two rulers are visible in the pictures and provide scale.

4. Results

4.1 Petroglyphs engraving and background spots

Four engravings and four background spots were chose for each of the six petroglyphs locations (Sites 5, 6, 7, 21, 22 and 23) and their pictures and locations are shown in Table 2. The original three original sites from the decade-old BRATWG monitoring study include 5, 6 and 7. Site 5 or "Burrup Road" consists of a 26 x 15 cm waterbird engraved on a weathered granophyre. Site 6 or "Water Tanks" exhibits a 50 x 25cm petroglyph with pecked bird footprints also on weathered granophyre. Site 7 or "Deep Gorge" shows a 70 x 35cm macropod on a weathered gabbro. The new sites include 21, 22 and 23. Site 21 or "Yara West" consists of a 65 x 60cm petroglyph with anthropomorphs and turtle engraved on a weathered granophyre. Site 22 or "Yara North East" shows a 13 x 9cm geometric figure as part of 40 x 40cm panel of circles chiseled on a weathered gabbro. Site 23 or "Yara East" exhibits a 57 x 67cm petroglyph depicting a fishing net on weathered gabbro. On each petroglyph 4 pairs of spots have been selected. Each pair includes 1 engraving and 1 background (Table 2).

4.2 Colour and spectral information

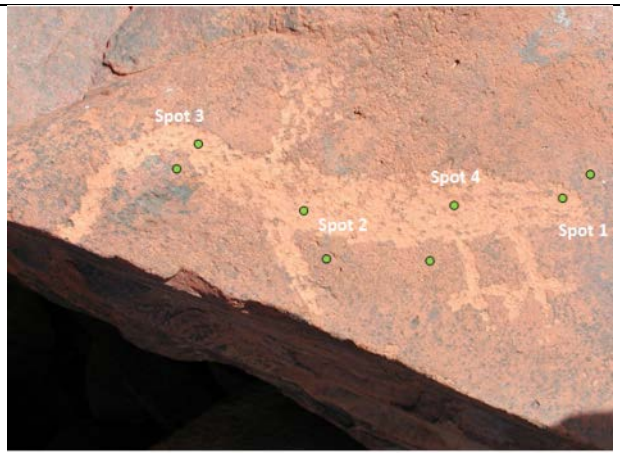
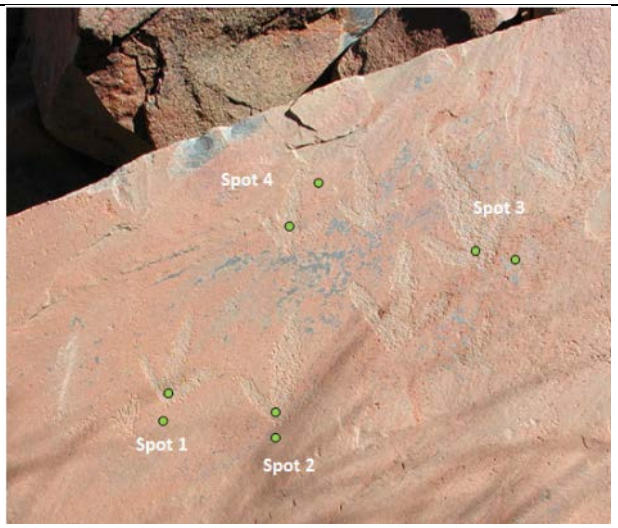
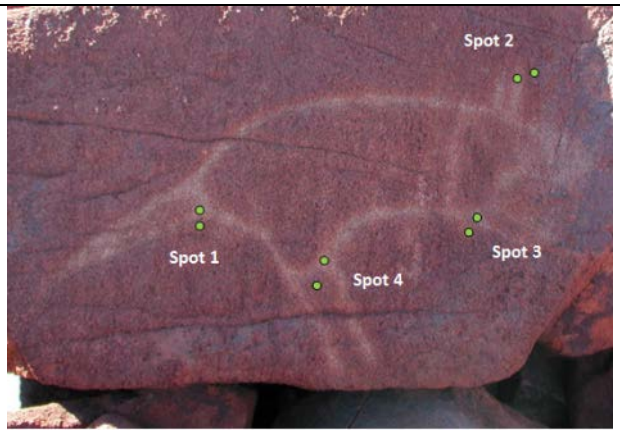
All the reflectance spectra, colour values and colour differences between engravings and background are provided in Table 3, Table 4, Table 5, Table 6, Table 7, Table 8 and Table 9 for the 6 sites.

All the reflectance spectra have been averaged per engraving and background spots.

To statistically evaluate the variability of the colour measurements, 21 independent measurements were taken at each sample point, to reduce sample variance introduced by surface heterogeneity or roughness, and by systematic error. For clarity, the raw L*a*b* data data has not been included here, but averages of the data are presented with the colour difference measurements calculated with the standard CIE methods.

These spectra and colour values are the data that will be used as baseline for the future studies: that is new data acquired in the next three years starting in July 2014 will be compared to the current dataset to estimate potential changes for colour and spectral mineralogy.

Table 2 Location of the engravings and background spots for the 6 petroglyphs

Location and description of the petroglyphs	Photographs with engravings and background spots location
Site 5 Burrup Road 26 x 15cm waterbird on granophyre	
Site 6 Water Tanks 50 x 25cm pecked bird footprints on granophyre	
Site 7 Deep Gorge 70 x 35cm macropod on gabbro	

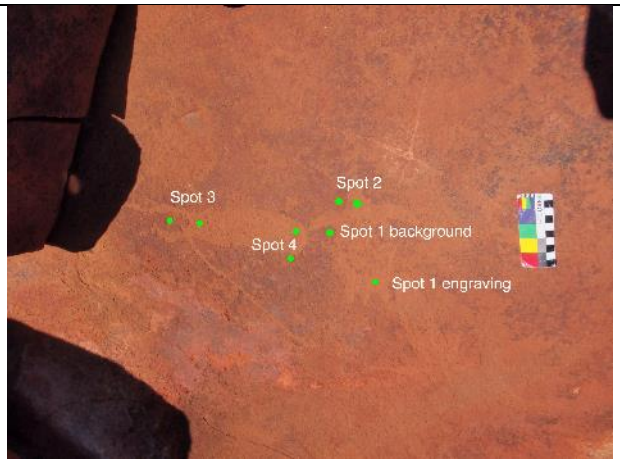
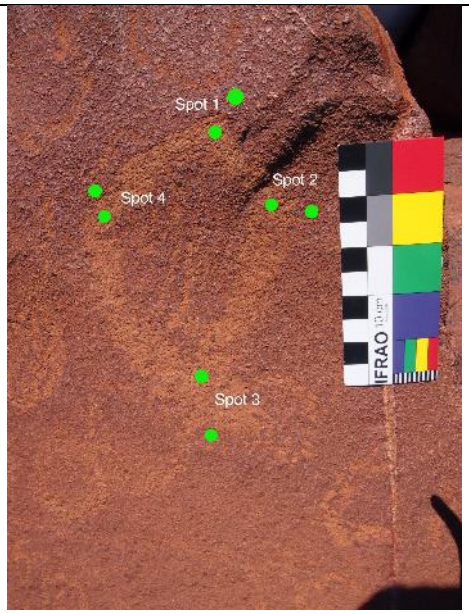
Site 21 Yara West 65 x 60cm anthropomorphs and turtle on granophyre	
Site 22 Yara North East 13 x 9cm geometric figure as part of 40 x 40cm panel of circles on gabbro	
Site 23 Yara East 57 x 67cm fishing net on gabbro	

Table 3: Average Colour Measurements for Site 5 – Burrup Road (2013 – 2014).

Sample	Colour scale			Colour difference* ΔE (change from previous year)
	L*	a*	b*	
Site 5 Spot 1 Engraving				
Average 2014	36.69	16.83	19.25	0.80
Average 2013	35.93	16.78	19.48	
Site 5 Spot 1 Background				
Average 2014	34.88	14.65	15.33	2.65
Average 2013	35.78	15.77	17.56	
Site 5 Spot 2 Engraving				
Average 2014	38.59	20.21	23.54	3.98
Average 2013	35.15	18.61	22.35	
Site 5 Spot 2 Background				
Average 2014	30.28	14.76	15.20	0.94
Average 2013	31.09	14.44	14.87	
Site 5 Spot 3 Engraving				
Average 2014	39.00	18.68	23.08	0.86
Average 2013	38.21	18.94	22.85	1.46
Site 5 Spot 3 Background				
Average 2014	32.62	11.61	12.22	1.01
Average 2013	32.53	12.21	13.02	
Site 5 Spot 4 Engraving				
Average 2014	37.27	19.30	22.02	0.49
Average 2013	37.69	19.24	22.26	
Site 5 Spot 4 Background				
Average 2014	32.93	15.58	16.40	1.13
Average 2013	32.44	14.87	15.68	

Table 4: Average Colour Measurements for Site 6 – Water Tanks (2013 – 2014).

Sample	Colour scale L*	a*	b*	Colour difference* ΔE (change from previous year)
Site 6 Spot 1 Engraving				
Average 2014	40.29	10.89	16.68	1.47
Average 2013	40.92	11.80	17.65	
Site 6 Spot 1 Background				
Average 2014	39.47	12.75	17.08	0.25
Average 2013	39.24	12.65	17.11	
Site 6 Spot 2 Engraving				
Average 2014	39.24	11.96	17.10	0.90
Average 2013	39.86	11.36	16.85	
Site 6 Spot 2 Background				
Average 2014	37.08	12.16	15.21	2.14
Average 2013	38.52	12.80	16.66	
Site 6 Spot 3 Engraving				
Average 2014	38.18	11.36	15.93	0.86
Average 2013	38.92	11.68	16.22	
Site 6 Spot 3 Background				
Average 2014	38.72	11.79	15.83	1.62
Average 2013	38.48	13.00	16.88	
Site 6 Spot 4 Engraving				
Average 2014	39.47	11.26	16.42	1.68
Average 2013	41.12	10.97	16.58	
Site 6 Spot 4 Background				
Average 2014	38.94	13.10	16.68	0.68
Average 2013	39.43	13.37	17.05	

Table 5: Average Colour Measurements for Site 7 – Deep Gorge (2013 – 2014).

Sample	Colour scale			Colour difference* ΔE (change from previous year)
	L*	a*	b*	
Site 7 Spot 1 Engraving				
Average 2014	37.24	14.40	18.37	3.10
Average 2013	34.24	13.87	17.79	
Site 7 Spot 1 Background				
Average 2014	31.05	15.58	16.21	3.14
Average 2013	29.54	13.15	14.93	
Site 7 Spot 2 Engraving				
Average 2014	31.22	15.24	16.45	1.95
Average 2013	32.87	14.21	16.49	
Site 7 Spot 2 Background				
Average 2014	27.38	12.73	12.27	0.91
Average 2013	27.39	12.91	13.16	
Site 7 Spot 3 Engraving				
Average 2014	32.53	14.04	16.07	1.60
Average 2013	34.09	14.02	16.40	
Site 7 Spot 3 Background				
Average 2014	30.38	14.52	15.19	0.95
Average 2013	30.87	14.55	16.01	
Site 7 Spot 4 Engraving				
Average 2014	35.81	14.81	18.28	2.47
Average 2013	38.03	15.29	19.25	
Site 7 Spot 4 Background				
Average 2014	27.38	12.07	12.65	3.27
Average 2013	30.26	12.88	13.97	

Table 6: Average Colour Measurements for Site 21- Yara West (2013 - 2014).

Sample	Colour scale L*	a*	b*	Colour difference* ΔE (change from previous year)
Site 21 Spot 1 Engraving				
Average 2014 (July)	39.07	17.29	22.14	1.59
Average 2014 (February)	38.04	16.35	21.38	
Site 21 Spot 1 Background				
Average 2014 (July)	32.85	14.03	13.75	1.37
Average 2014 (February)	31.59	13.76	13.26	
Site 21 Spot 2 Engraving				
Average 2014 (July)	37.55	15.55	20.36	1.52
Average 2014 (February)	36.08	15.33	20.04	
Site 21 Spot 2 Background				
Average 2014 (July)	34.94	14.40	16.13	1.19
Average 2014 (February)	33.77	14.19	16.23	
Site 21 Spot 3 Engraving				
Average 2014 (July)	38.54	17.96	22.82	2.56
Average 2014 (February)	38.57	16.01	21.17	
Site 21 Spot 3 Background				
Average 2014 (July)	31.95	14.23	15.22	0.63
Average 2014 (February)	31.56	13.99	15.64	
Site 21 Spot 4 Engraving				
Average 2014 (July)	38.71	15.71	20.23	2.80
Average 2014 (February)	37.41	17.28	22.16	
Site 21 Spot 4 Background				
Average 2014 (July)	32.89	13.69	14.83	2.16
Average 2014 (February)	31.53	12.39	13.77	

Table 7: Average Colour Measurements for Site 22 – Yara North East (2013 - 2014).

Sample	Colour scale L*	a*	b*	Colour difference* ΔE (change from previous year)
Site 22 Spot 1 Engraving				
Average 2014 (July)	39.12	13.54	19.02	2.91
Average 2014 (February)	36.82	13.54	17.23	
Site 22 Spot 1 Background				
Average 2014 (July)	34.08	12.21	12.63	0.39
Average 2014 (February)	33.80	12.11	12.37	
Site 22 Spot 2 Engraving				
Average 2014 (July)	37.08	14.33	18.65	2.60
Average 2014 (February)	35.15	13.64	17.04	
Site 22 Spot 2 Background				
Average 2014 (July)	33.85	12.72	13.90	1.54
Average 2014 (February)	32.32	12.52	14.00	
Site 22Spot 3 Engraving				
Average 2014 (July)	38.34	14.49	19.51	1.71
Average 2014 (February)	37.11	14.41	18.33	
Site 22 Spot 3 Background				
Average 2014 (July)	33.71	12.53	13.82	0.53
Average 2014 (February)	34.06	12.75	14.15	
Site 22 Spot 4 Engraving				
Average 2014 (July)	36.12	13.99	17.71	1.43
Average 2014 (February)	37.32	14.11	18.48	
Site 22 Spot 4 Background				
Average 2014 (July)	33.96	12.41	13.31	1.07
Average 2014 (February)	33.63	11.92	12.42	

Table 8: Average Colour Measurements for Site 23 - Yara East (2013 - 2014).

Sample	Colour scale L*	a*	b*	Colour difference* ΔE (change from previous year)
Site 23 Spot 1 Engraving				
Average 2014 (July)	36.71	9.61	16.09	1.72
Average 2014 (February)	38.39	9.59	16.49	
Site 23 Spot 1 Background				
Average 2014 (July)	34.54	11.54	15.42	1.00
Average 2014 (February)	35.16	12.08	16.00	
Site 23 Spot 2 Engraving				
Average 2014 (July)	32.86	11.53	18.35	2.93
Average 2014 (February)	35.36	12.90	19.05	
Site 23 Spot 2 Background				
Average 2014 (July)	37.26	14.00	19.05	0.43
Average 2014 (February)	36.93	14.28	19.04	
Site 23 Spot 3 Engraving				
Average 2014 (July)	37.71	10.69	17.28	0.48
Average 2014 (February)	38.17	10.72	17.42	
Site 23 Spot 3 Background				
Average 2014 (July)	31.86	14.14	16.13	0.70
Average 2014 (February)	31.70	13.65	15.65	
Site 23 Spot 4 Engraving				
Average 2014 (July)	37.82	10.65	17.36	1.47
Average 2014 (February)	36.39	10.94	17.20	
Site 23 Spot 4 Background				
Average 2014 (July)	32.12	7.46	10.56	3.24
Average 2014 (February)	31.61	9.92	12.60	

Table 9: Colour difference between background and petroglyph

Spot 1	Site 1	Site 2	Site 4	Site 5	Site 6	Site 7	Site 8	Site 21	Site 22	Site 23
Average 2014	**10.9**	**6.5**	**7.0**	**4.8**	**2.1**	**6.7**	**4.4**	**10.9**	**8.2**	**3.0**
Average 2013	12.4	10.0	7.1	2.2	2.0	5.5	5.1	10.7	5.9	4.1
Spot 2										
Average 2014	**12.0**	**19.2**	**3.9**	**13.0**	**2.9**	**6.2**	**6.5**	**5.1**	**6.0**	**5.1**
Average 2013	10.7	18.7	3.4	9.5	2.0	6.5	6.4	4.6	4.3	2.1
Spot 3										
Average 2014	**11.3**	**8.9**	**5.5**	**14.4**	**0.7**	**2.4**	**6.6**	**10.7**	**7.6**	**6.9**
Average 2013	11.4	9.8	6.7	13.2	1.5	3.3	5.8	9.2	5.4	7.3
Spot 4										
Average 2014	**7.6**	**6.7**	**6.3**	**8.0**	**1.9**	**10.5**	**5.6**	**8.2**	**5.2**	**9.4**
Average 2013	12.1	7.1	6.4	9.4	3.0	9.7	5.3	11.4	7.4	6.7

5. Spectral Mineralogy

5.1 Reflectance spectroscopy

Reflectance spectroscopy is now available as a field tool for geologists through the development of portable instruments like the Analytical Spectral Device (ASD) FieldSpecPro field spectrometer. These systems measure diagnostic mineral spectral features that are particularly suitable for quantitative analysis of many geological materials. Some of the advantages of the technique include little sample preparation (if any), and rapid measurement (around 1 s) though the measurement is restricted to the sample's surface.

CSIRO has been involved in the development of reflectance spectroscopy research (Ramanaidou et al., 2008 and references within) techniques for characterising iron ore, gold, bauxites, mineral sands, talc, lateritic nickel and asbestos. Using field reflectance spectrometry, the mineralogy of the samples can be characterised on the basis of key spectral features.

Reflectance spectroscopy, the analysis of reflected light, between 400 and 2500 nm is now a proven technique for mineral analysis in both the laboratory and in the field. Reflectance spectroscopy has been used intensely to characterise weathering minerals such as iron oxides and clay minerals. The most common iron oxides minerals (hematite, maghemite and goethite) have broad absorptions between 400 and 1000 nm (visible and near infrared or VNIR), whereas OH-bearing minerals such as phyllosilicates, inosilicates as well as carbonates and sulphates show narrow absorption features between 1000 to 2500 nm (short wave infrared or SWIR). The combination of these wavelength ranges provides a step forward towards quick and accurate mineral characterisation.

The Analytical Spectral Device (ASD) FieldSpec Pro covers the spectral range 400-2500 nm with a spectral resolution of 3 nm at 700 nm using 3 detectors: a 512 element Si photodiode array for the 400-1000 nm range and two separate, TE cooled, graded index InGaAs photodiodes for the 1000-2500 nm range. The input is through a1.4 m fibre optic. The average scanning time to acquire a spectrum is 1 second. There are two ways of operating the ASD, it consists of either using (1) an external source of light (sun or artificial) or (2) an internal source of light. The absolute measurements are obtained using a white reference plate that reflects 100% of the light in the 400 to 2500 nm wavelength range. For this study, the second option for lighting was used as it eliminates any external light interference.

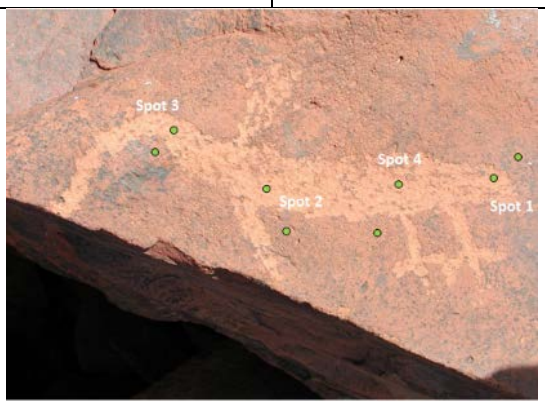
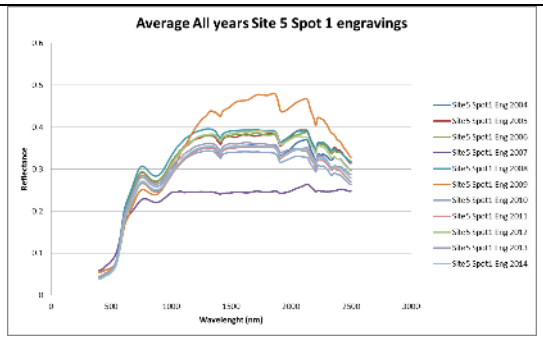
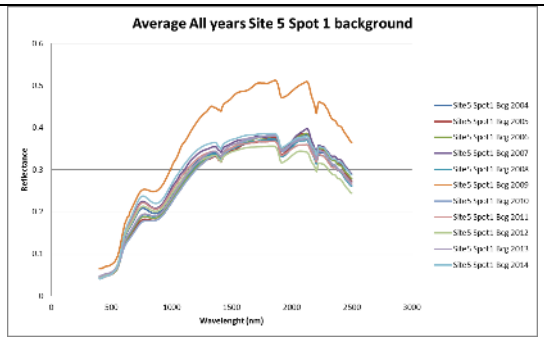
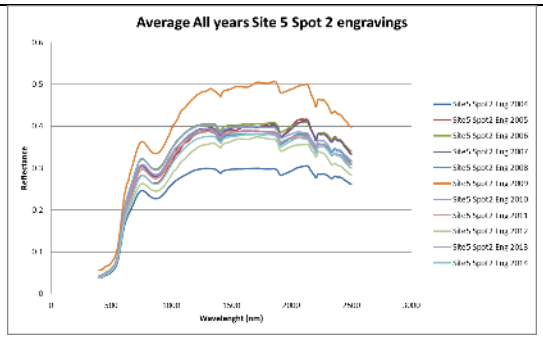
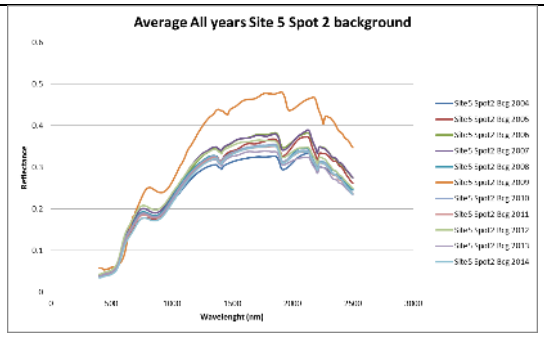
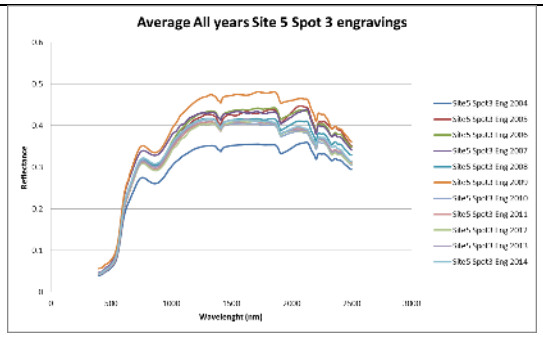
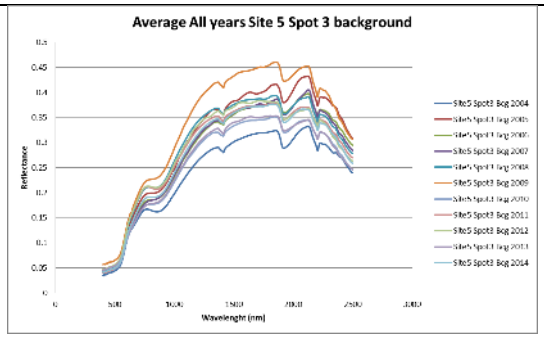
5.2 Spectral Results for 2013-2014

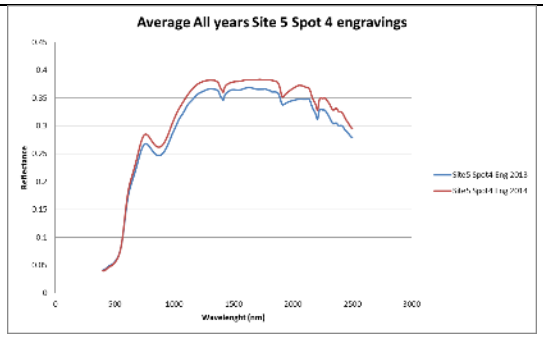
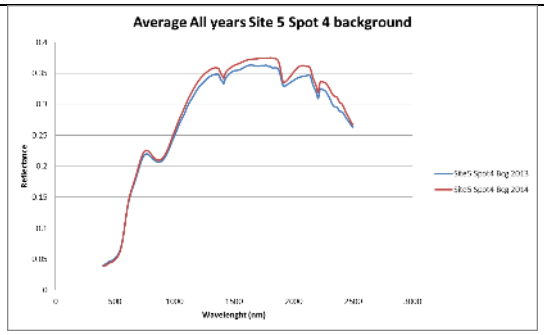
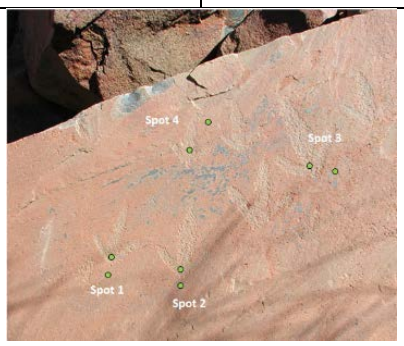
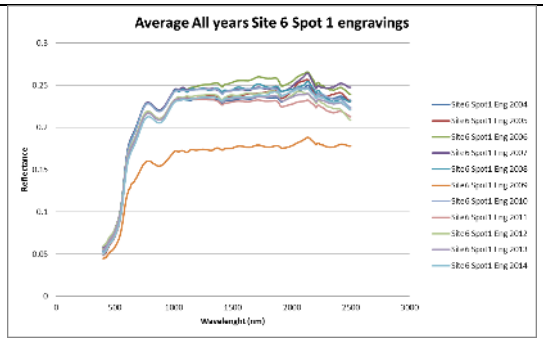
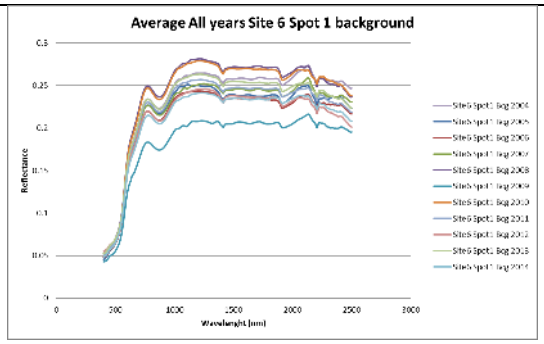
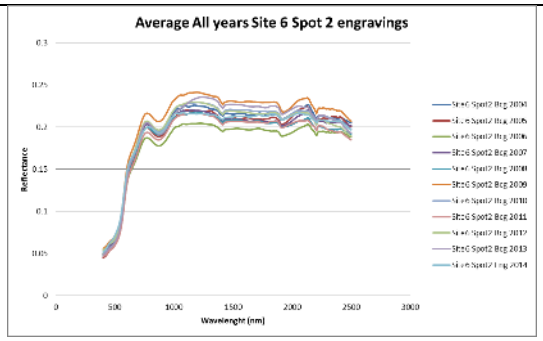
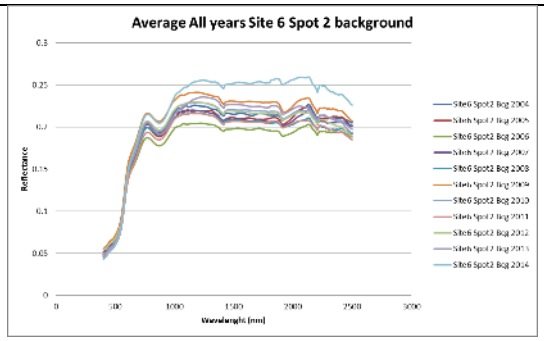
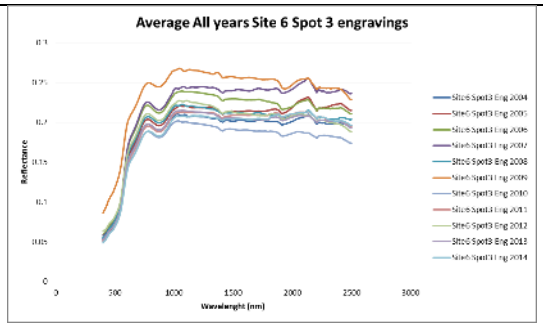
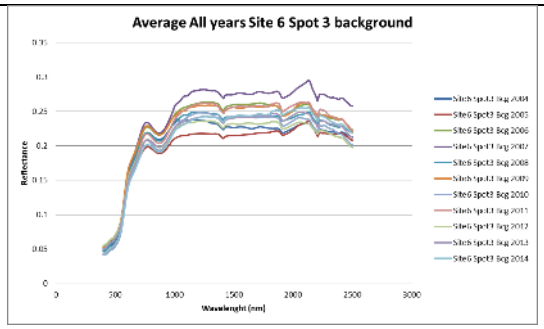
5.2.1 PICTURES AND SPECTRA

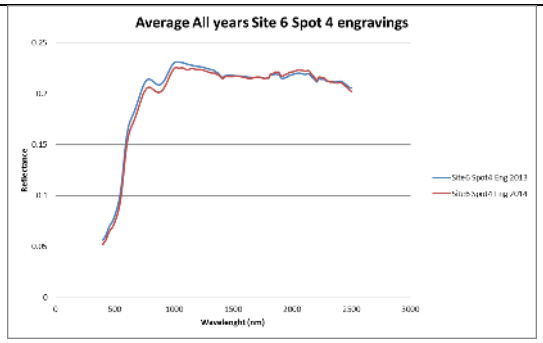
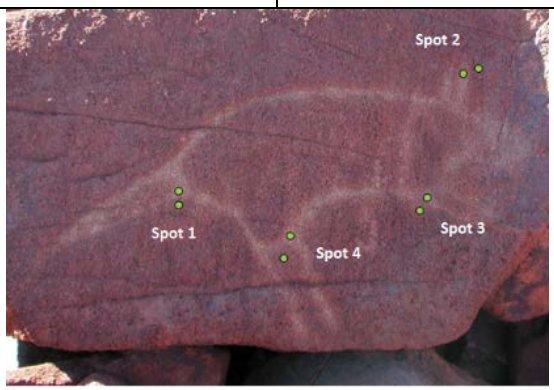
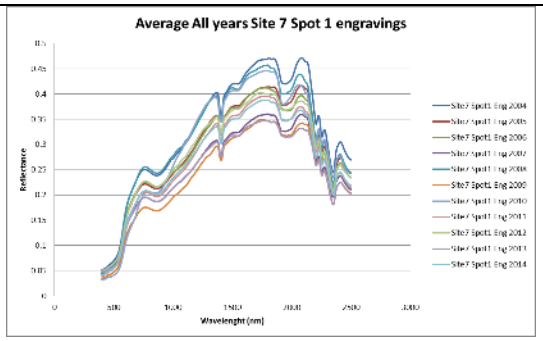
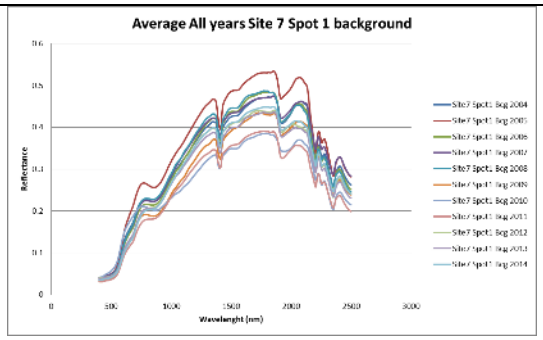
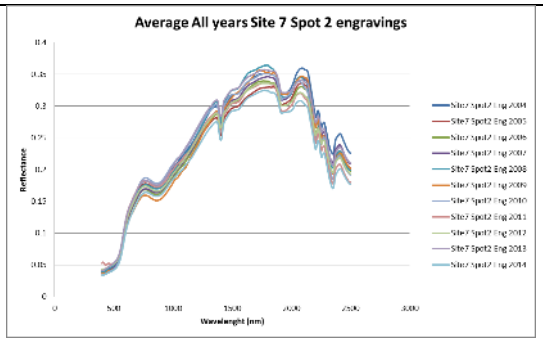
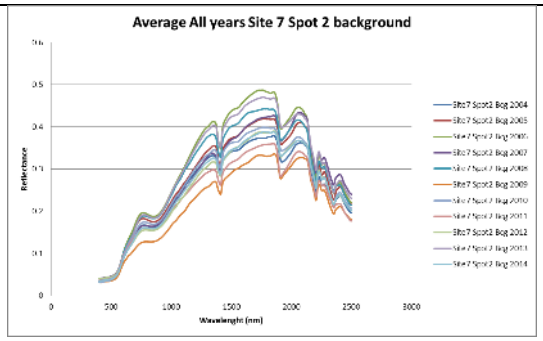
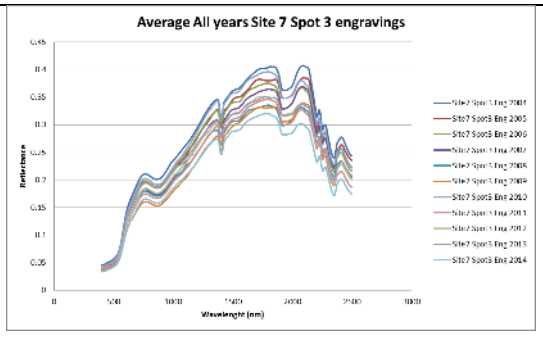
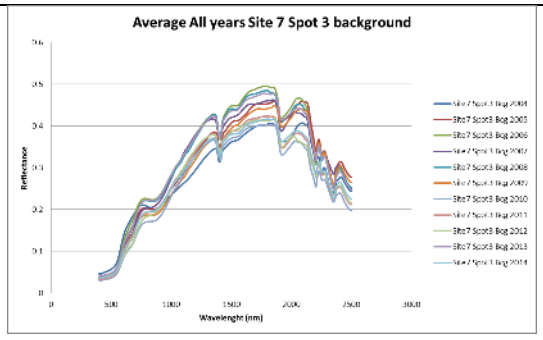
For each site, the description and interpretation include:

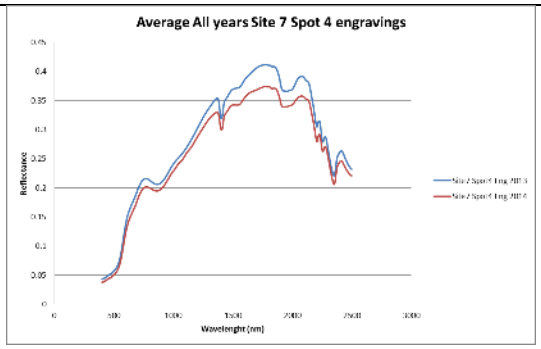
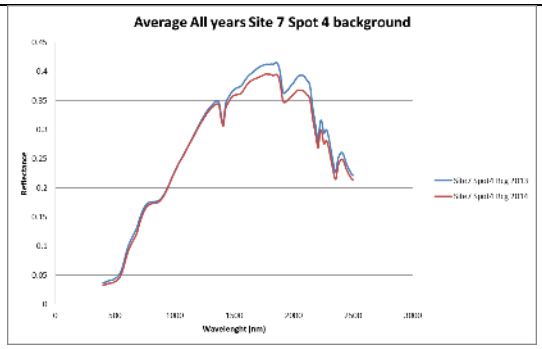
- A digital image of the engraving with the location of the measurements: spot 1, 2, and 3 and 4 for both engraving and background for the six sites; 5, 6, 7, 21, 22 and 23.
- Comparison of the average spectra for the engravings and background for each of the four spots between 2013 and 2014. For sites 5, 6 and 7, all the spectra from the 2004 to 2012 year (from the 11 years monitoring study in the Burrup (Murujuga) Peninsula are plotted to show the variability of the measurements.
- The following pages present photographs of the monitored petroglyphs at each site, showing the sampling points of engravings and background rock, and the average colour measurements that were recorded at these points each year (Table 10. Photographs of the monitored petroglyphs at each site, showing the sampling points of engravings and background rock, and the average colour measurements that were recorded at these points each year (Table 10).

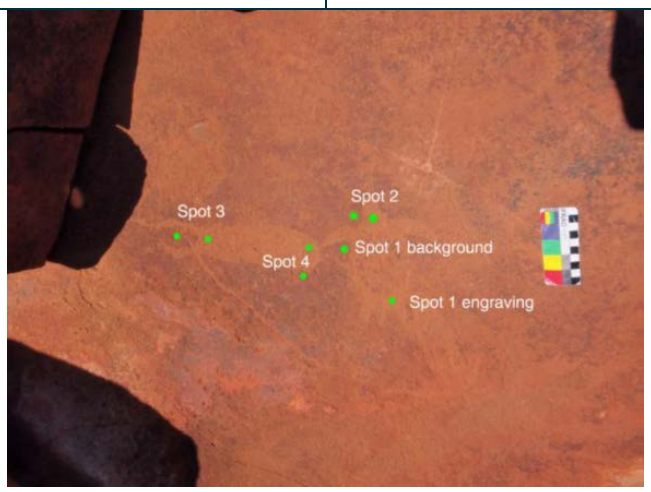
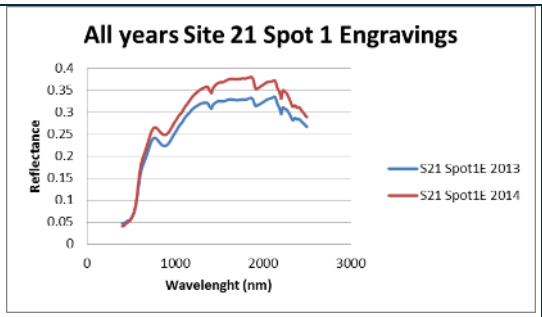
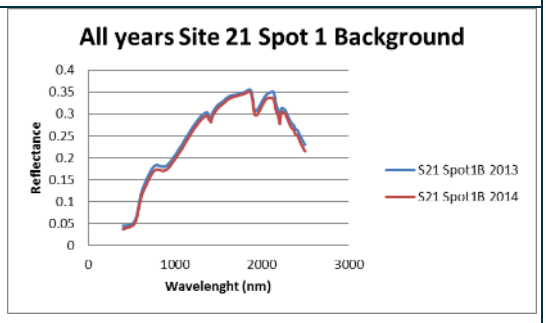
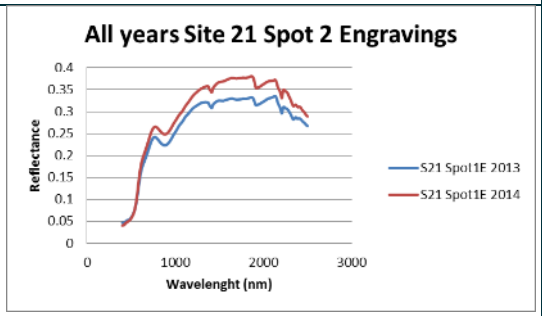
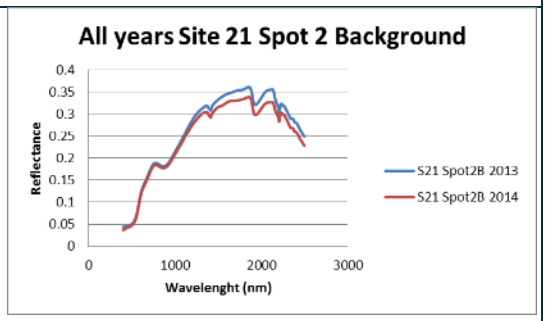
Table 10. Photographs of the monitored petroglyphs at each site, showing the sampling points of engravings and background rock, and the average colour measurements that were recorded at these points each year

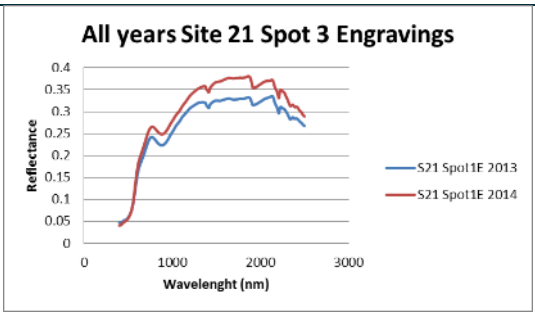
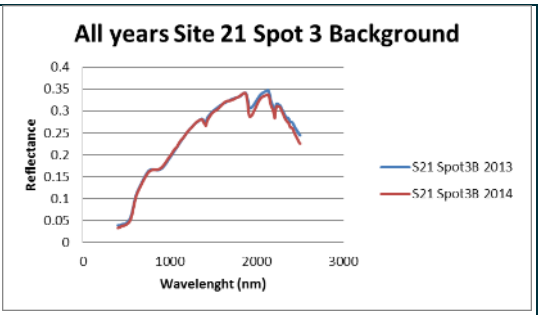
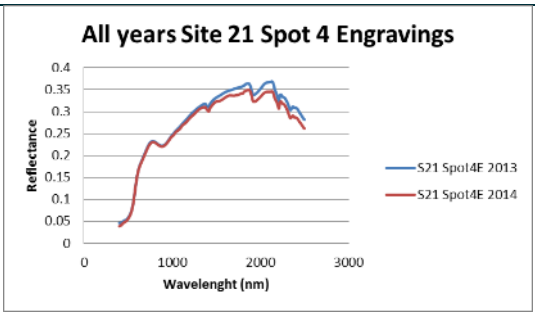
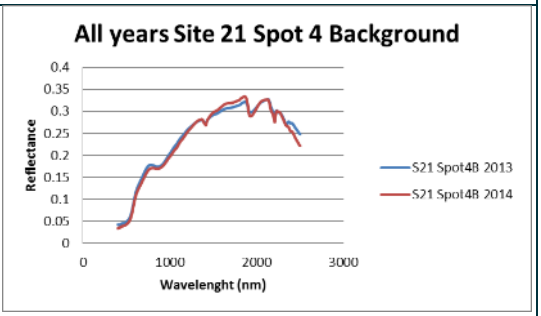
Location	Spectra Engraving	Spectra Background
		
Site 5 Spot 1		
Site 5 Spot 2		
Site 5 Spot 3		

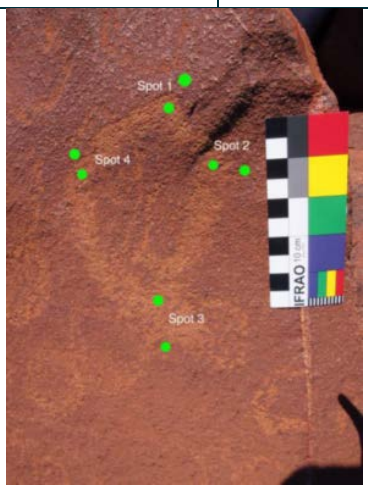
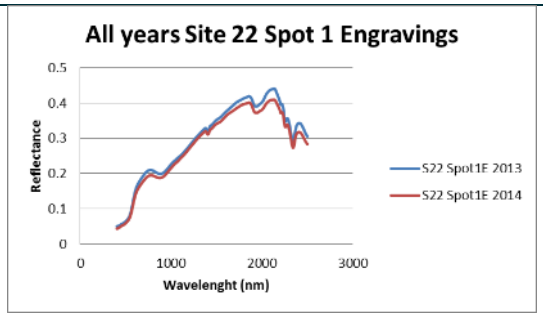
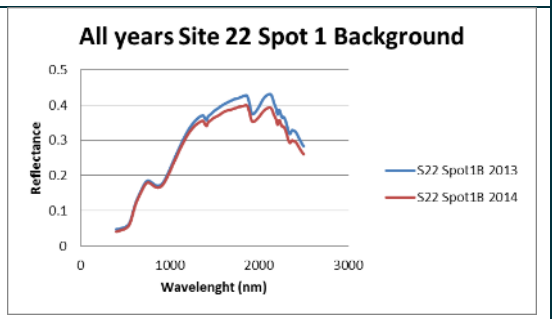
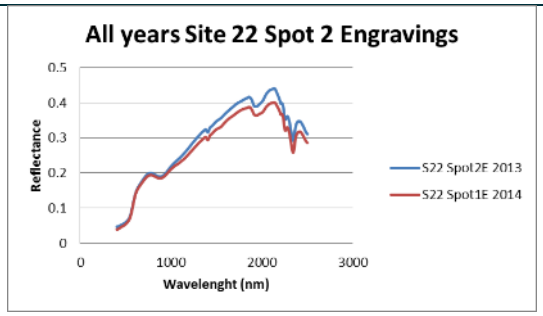
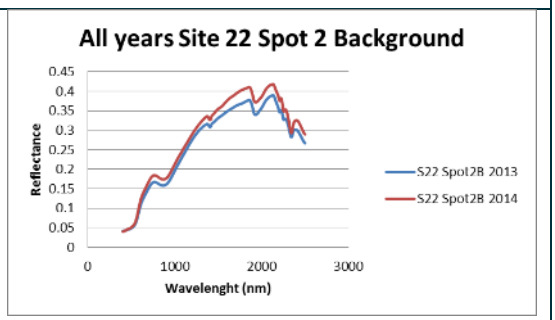
Site 5 Spot 4		
Location	Spectra Engraving	Spectra Background
		
Site 6 Spot 1		
Site 6 Spot 2		
Site 6 Spot 3		

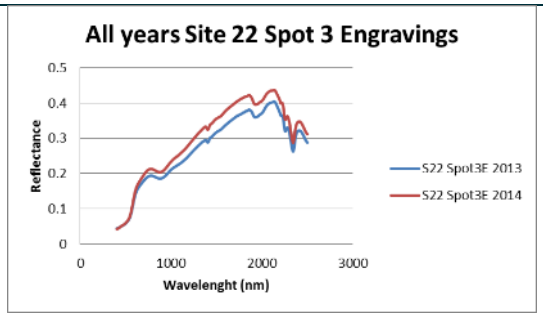
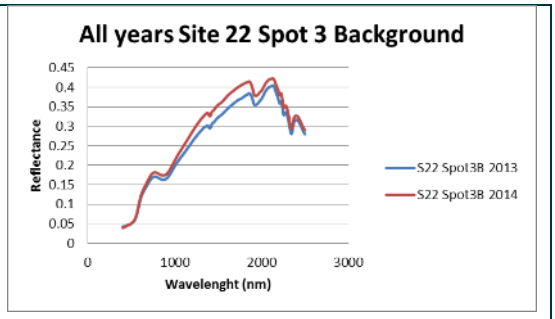
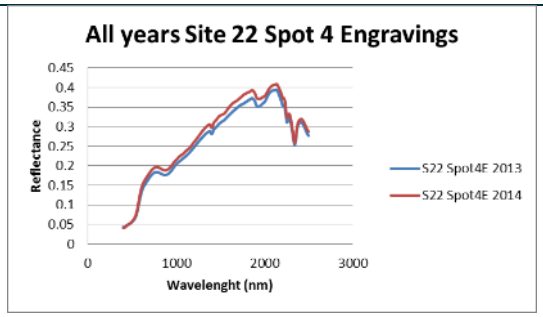
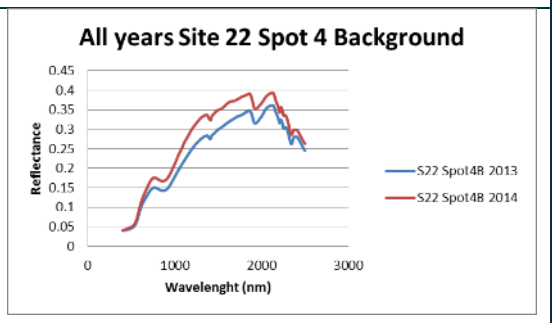
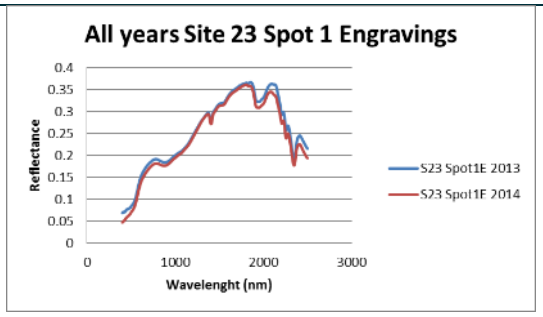
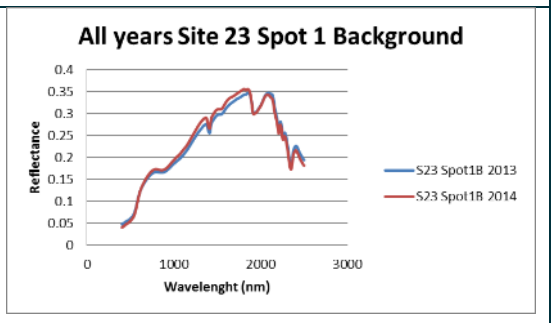
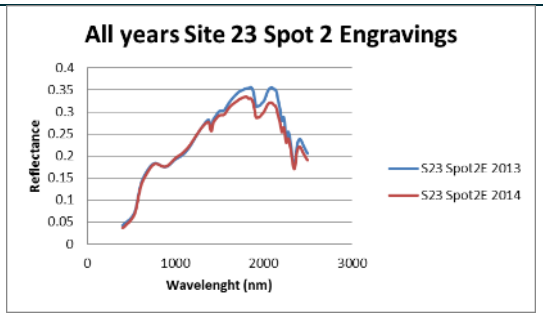
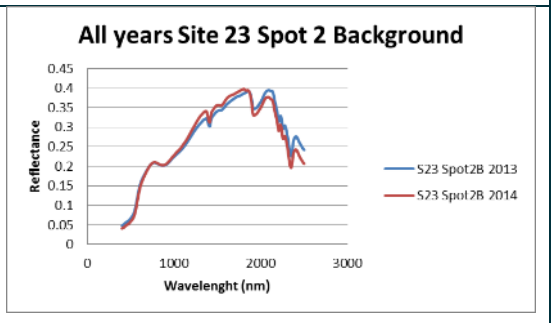
Site 6 Spot 4		
Location	Spectra Engraving	Spectra Background
		
Site 7 Spot 1		
Site 7 Spot 2		
Site 7 Spot 3		

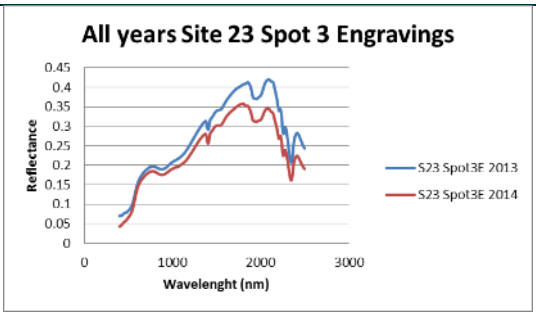
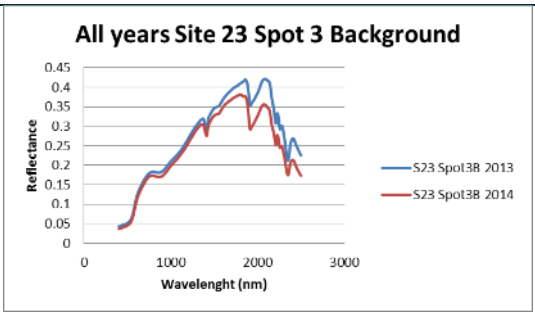
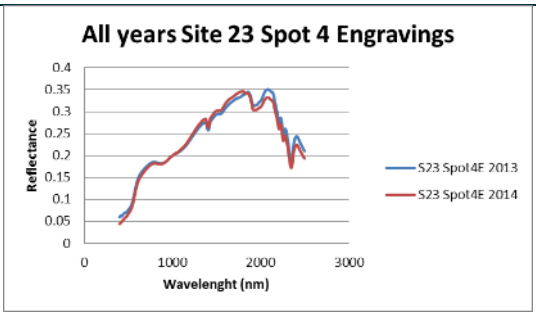
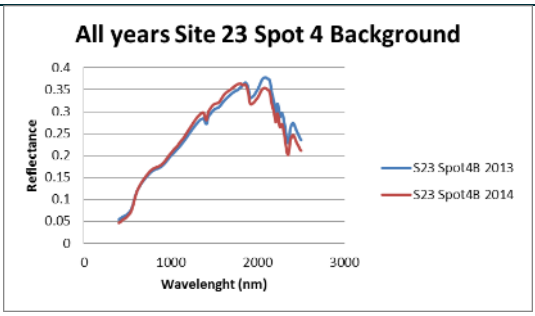
Site7 Spot 4		

Location	Spectra Engraving	Spectra Background
Site 21		
Site 21 Spot 1		
Site 21 Spot 2		

Site 21 Spot 3		
Site 21 Spot 4		

Location	Spectra Engraving	Spectra Background
Site 22		
Site 22 Spot 1		
Site 22 Spot 2		

Site 22 Spot 3		
Site 22 Spot 4		
Location	Spectra Engraving	Spectra Background
Site 23		
Site 23 Spot 1		
Site 23 Spot 2		

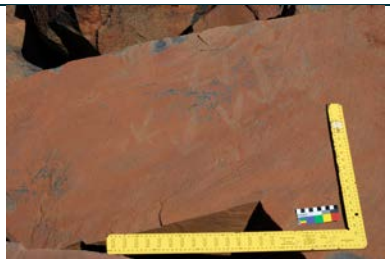
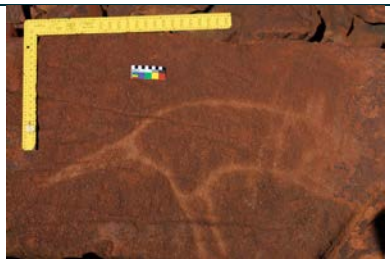
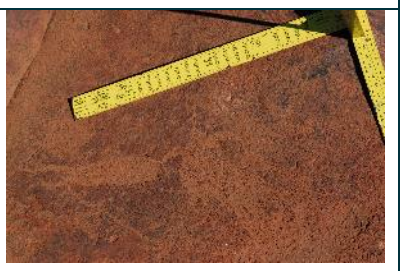
Site 23 Spot 3		
Site 23 Spot 4		

6. 3D Mapping

The 3D mapping provides an approach of assessing the change in the surface of the petroglyphs. As explained for the colour and spectra measurements, the 3D images acquired this year will be used as a baseline for the following years to establish if the surface of the petroglyphs shows variations or changes.

The first photograph of the petroglyph was acquired at a known distance (180 or 300 cm based on the size of the petroglyphs). The second photograph was taken at the same distance from the petroglyph but was moved laterally at 1/6 distance of the first photograph to generate a 3 D image (Table 10). Two rulers are used to provide scale and dimension. To observe the 3D images a dedicated software called sirovision™ is required.

Table 11 Photographs information for the generation of the 3D mapping

Site	Photographs
6	
7	
21	
22	

23	

7. Conclusion of 2013-2014 study

The Heritage Monitoring of 6 sites within 2 km of the Yara Pilbara Nitrates Pty Ltd plant site (Western Australia) in the Burrup Peninsula have been measured 2013 and 2014. The engravings and background rocks were measured *in situ*. Measurement of the annual colour and mineralogical changes utilised two spectrophotometer techniques, the Analytical Spectral Device (ASD) and the BYK colour spectrophotometer. An examination of the colour measurements as a function of time, as well as a comparison of the two measurement techniques, has been conducted and no significant change was identified. The 3D pictures were acquired for both years and change was not detected.

8. References

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