



Environmental Plan Summary

NT-2050-15-MP-0010

Environmental Plan Summary

Beetaloo Sub-Basin

Review Record

Rev	Date	Reason for Issue	Prepared	Checked	Approved
1	12/01/2017	Issued for Use	SD	AS	SD

Next Review Date: 12/01/2017

Once printed, this is an uncontrolled document unless issued and stamped *Controlled Copy* or issued under a transmittal.

THIS PAGE INTENTIONALLY LEFT BLANK

Table of Contents

1.	Introduction	1
1.1	Contact Details	1
1.2	Location	1
2.	Description of the Activity	3
3.	Existing Environment	4
3.1	Land Use	4
3.2	Climate	4
3.3	Topography and Land Systems	4
3.4	Surface Water and Drainage	4
3.5	Groundwater	4
3.6	Flora and Fauna	4
3.6.1	Traffic and Infrastructure	5
3.7	Cultural Heritage	5
4.	Environmental Hazard, Risks and Management Measures	6
5.	Consultation	14

1. Introduction

Origin Energy Resource Limited (Origin), as operator for Exploration Permits (EP) EP98, EP117 and EP76 intends to undertake exploration drilling in EP98 and EP117 in calendar year (CY) 2015. The proposed exploration drilling program involves the installation of three vertical exploration wells and associated infrastructure (access tracks, drill pad and camp) at the following sites:

- Kalala S-1
- Amungee NW-1
- Beetaloo W-1
- Beetaloo C-1 (note: Beetaloo C-1 at this stage is not included in the CY2015 program, however it has been included in the Environmental Plan to allow some flexibility in the program).

1.1 Contact Details

The nominated liaison person for the project is:

Stephanie Stonier
Corporate Affairs Manager (Northern Australia)
Email: community.team@originenergy.com.au

1.2 Location

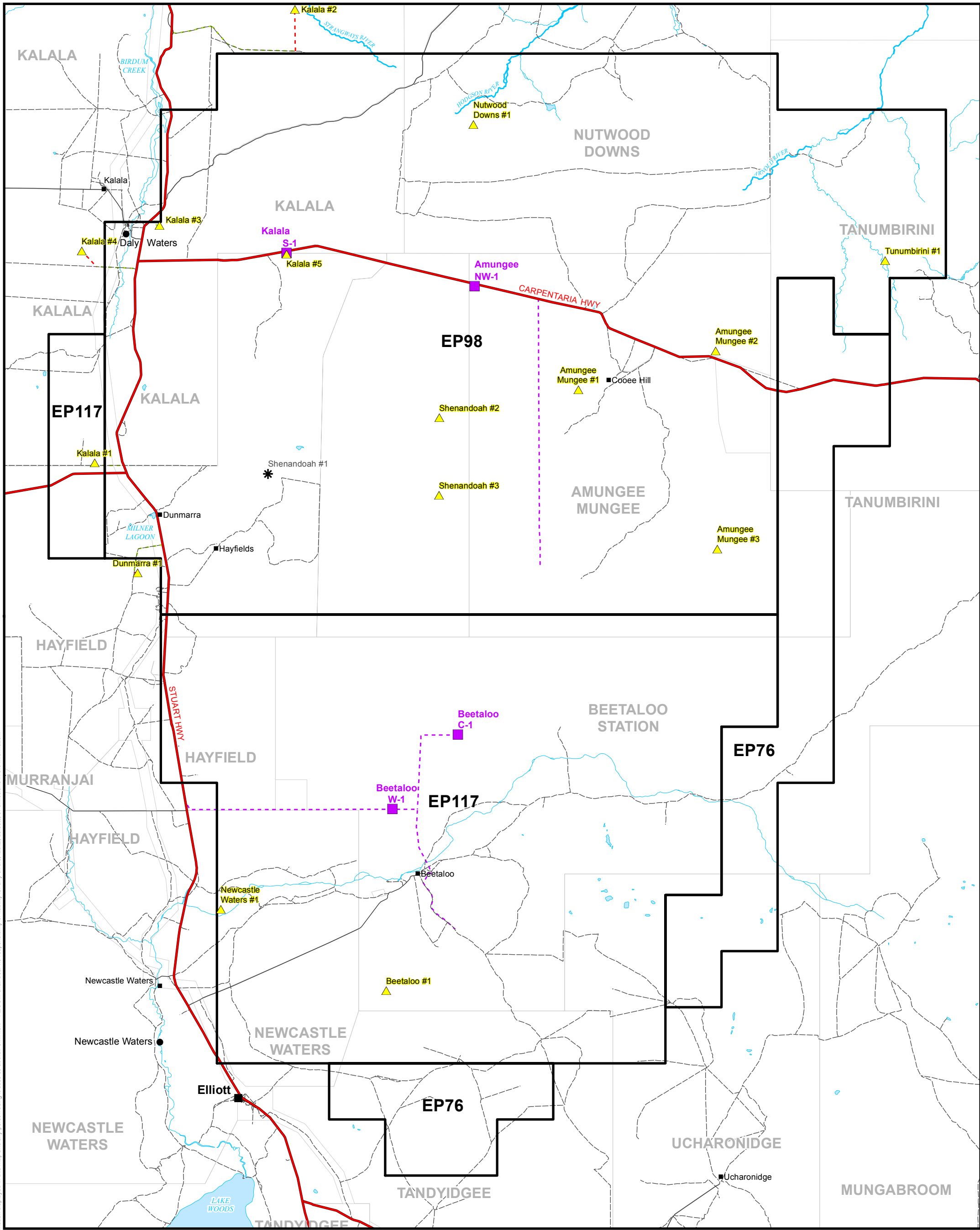
The Beetaloo Basin is located in the central north of the NT, approximately 180km south-east of Katherine. The nearest townships are Daly Waters and Dunmarra.

The exploration permits cover 18,512 square kilometres (km²) of pastoral lease on the Sturt Plain, part of the Barkly Tableland, Northern Territory. Refer to Figure 1 for the regional location of the exploration permits and proposed exploration wells.

Table 1: Coordinates of Centre of Proposed Drill Site Locations

Exploration Permit	Well Name	Zone*	Easting	Northing
EP98	Kalala S-1	53	351740	8198030
EP98	Amungee NW-1	53	391676	8190013
EP117	Beetaloo W-1	53	368312	8106695
EP117	Beetaloo C-1	53	378594	8118946

* Universal Transverse Mercator (UTM) geographic coordinate system is Geocentric Datum of Australia (GDA) 94.



AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

AECOM
www.aecom.com

GEOCENTRIC DATUM OF AUSTRALIA 94
0 5 10 20
Kilometers
1:570,000 (when printed at A3)

LEGEND

■ Homestead	--- Tracks
● Place Name	- - - Access Routes
■ Populated Place	- - - Existing Tracks
■ Proposed Test Wells	- - - Proposed New Tracks
▲ Drill Sites	— River
△ Other Drill Sites	— Creek
* Other Drill Sites	□ Cadastre
— Highway	□ Permit Areas
— Minor Road	

LOCATION

Data sources:
Permit Area, Cadastre - NT Gov 2014
Places - Austl Gov 2014
Highways, Roads, Drainage - StreetPro 2014

**ORIGIN ENERGY RESOURCES LIMITED
2015 DRILLING ENVIRONMENTAL PLAN**

Location of Permit Areas, Proposed Test Wells and Access Tracks, 2015 Program

PROJECT ID	600330255
CREATED BY	smithc5
LAST MODIFIED	18-Sep-2014
VERSION	1

Map 1

2. Description of the Activity

The proposed exploration activities for the CY2015 drilling program consist of:

- Upgrade and/or widening of existing access track in EP117 on the Beetaloo pastoral lease for moving equipment (e.g. drilling rigs, trucks, etc.) and people.
- Development of the three nominated drill sites including:
 - construction and maintenance of a well pad and associated pits, as required, to facilitate the drilling activity. Proposed well lease area is between 1 and 2 hectares;
 - drilling of the vertical wells targeting the Velkerri Formation, with total depths of approximately 2,200 mTVD to 3,200 mTVD;
 - installation of water bores for drilling and civil activities; and
 - construction of an on-site office and living accommodation for 24 hour operations and activities.
- Water quality protection, monitoring and management comprising of:
 - baseline water quality sampling for water bores and the well bore to ensure that pre-operational references of water quality provide a tracking tool and future rehabilitation criteria; and
 - ongoing monitoring.
- Rehabilitation work as consistent with the requirements of DME.

Upon completion of the drilling process the wells will either be plugged and abandoned (P&A) or suspended for future use. This Environmental Plan does not cover hydraulic stimulation activities. Should Origin seek to undertake hydraulic stimulation activities in the future a separate submission will be prepared.

The drilling program is expected to take approximately 40-60 days for each site.

3. Existing Environment

3.1 Land Use

The current land use in the project area is pastoral. All of the land within the permit area is Leasehold Land.

3.2 Climate

The climate of the permit areas can be described as arid to semi-arid, with rainfall decreasing in frequency and quantity from north to south. The climate is monsoonal, with a distinctive wet and dry season experienced through the year. The area experiences a wet season during the summer months between October and March, which is dominated by hot and wet conditions. During the winter months, dry season, from May to August, mild days and cool nights are experienced. September and April are transitional months, with occasional rainfall. The average annual rainfall in the north of the permit area is listed at 680 mm at Daly Waters. The southern portion of the permit area records an average annual rainfall of 535 mm at Newcastle Waters and 608 mm listed at Elliott. Approximately 90% of the rainfall occurs during the wet season.

3.3 Topography and Land Systems

The permit area is located within three main topographic zones. These are primarily made up of black soil plains in the south, laterite plains in the north and small sections of bedrock hills in the south west and north east of the permit areas.

The CY2015 drill sites all occur in the Beetaloo Land System which is characterised by:

- gently undulating lateritic plains and rises.
- lateritic red earths and lateritic podzolic soils.
- *Acacia shirleyi* (Lancewood) forest.

3.4 Surface Water and Drainage

The permit area is located within three main drainage basins. These include the Barkly, Roper and Wiso Basins. Inland drainage occurs in the Barkly Basin and parts of the Wiso Basin. The proposed exploration activities are located within the Wiso Basin. The Wiso Basin is drained by the Georgina River and its major tributaries.

3.5 Groundwater

The Georgina Basin Gum Ridge Formation and Anthony Lagoon Beds form an extensive regional groundwater flow system, the Cambrian Limestone Aquifer (CLA), which forms a significant water resource for the pastoral industry and communities within the region.

The Georgina Basin Gum Ridge Formation and Anthony Lagoon Beds form an extensive regional groundwater flow system, the Cambrian Limestone Aquifer (CLA), which forms a significant water resource for the pastoral industry and communities within the region.

Regional groundwater flow within the CLA in the Beetaloo Basin is separated into a western and an eastern section. The main body of the Beetaloo Basin overlies the Georgina Basin CLA, groundwater flow is to the north-west and discharges around 200km north of the basin as spring flow in the Roper River. A small section in the west of the Beetaloo Basin overlies the Wiso Basin, regional flow within the CLA is to the north toward discharge points in the Flora and Roper Rivers.

Extensive baseline monitoring of the groundwater in the permit areas has been undertaken.

3.6 Flora and Fauna

The main vegetation communities within the exploration permit areas are woodlands, typically dominated by bloodwoods (*Corymbia spp.*) and tall shrublands and woodlands of Bullwaddy and Lancewood with open grassland understorey. Other less common vegetation

communities within the area include Acacia shrubland over spinifex and Bullwaddy-dominated woodland. Three of the proposed well sites consist of Eucalypt woodland (Kalala S-1, Beetaloo W-1, Amungee N-1) and one site (Beetaloo C-1) consisted primarily of Lancewood and Bullwaddy. The access track into the Beetaloo sites had a high density of Bullwaddy/Lancewood patches.

No Commonwealth threatened plant species were identified as occurring by the Protected Matters Searches.

The region supports a diverse array of fauna. The NT Fauna database provides records for 32 species of mammal, 198 species of birds, 96 species of reptiles and 19 species of frogs. During the pre-drilling survey, based on non-invasive observational data at the proposed drill sites, access tracks and incidental observations recorded 44 bird species, four mammal species and two reptile species.

3.6.1 Traffic and Infrastructure

The Stuart Highway and Carpentaria Highway will be used to access the sites. There are also numerous gravel roads connecting properties, and internal property tracks.

3.7 Cultural Heritage

Three Native Title determinations and one Indigenous Land Use Agreement (ILUA) are current over the permit areas:

Table 2: Native Title and ILUA

Type	Name	Summary
Native Title	NTD21/2010 Shenandoah Pastoral Lease	Native Title exists in parts of the determination area and is held by the Kinbinunggu and Bamarrnganja groups
	NTD27/2010 Beetaloo Pastoral Lease	Native Title exists in parts of the determination area and is held by the Karranjini group; the Bamarrnganja group; the Warranangku group; the Pinda (OT Downs) group; and the Lija/Muwartpi group
	NTD17/2010 Amungee Mungee Pastoral Lease	Native title exists in parts of the determination area and is held by The Karranjini group; the Bamarrnganja group
Indigenous Land Use Agreement	D12004/014 Jingaloo CLA ILUA	Registered for Community Living Area and Tenure resolution

No culturally sensitive landforms were identified during the pre-drilling survey. One Aboriginal archaeological site (BT-IA1-14, an isolated artefact) was identified during the field survey on the previously disturbed Beetaloo access track 5.3 km to the west of exploration drill site Beetaloo W-1. The isolated artefact was not insitu and has likely been redeposited as the result of low level fluvial activity across this area.

4. Environmental Hazard, Risks and Management Measures

Origin has a strong Health, Safety and Environment Management System (HSEMS) and Health, Safety and Environment Policy. The Environmental Plan details how Origin intends to manage and minimise its impacts during drilling activities in the Beetaloo Sub-basin.

The assessment of potential impacts and management has been based on the following key exploration activities associated with the project:

- Project Management and design (civil)
- Civil construction (including construction of access track/roads, camp site, drill pad and water bore drilling)
- Drilling operations
- Camp operations
- Rehabilitation.

Potential environmental impacts and the risk level of these exploration activities were assessed based on knowledge of the existing environment, relevant studies and assessments and previous experience in similar exploration activities.

The table below outlines the potential environmental impacts and some examples of management measures that Origin will implement to manage the environmental hazard.

Table 3: Environmental Impacts and Management Measures

Environmental Aspect	Potential Impacts	Management Measures
Soils and erosion	<ul style="list-style-type: none"> • Soil disturbance and degradation of soil profile resulting in: <ul style="list-style-type: none"> ○ soil instability ○ soil erosion from vegetation loss ○ soil compaction ○ loss of topsoil and land suitability / capability ○ soil contamination. 	<ul style="list-style-type: none"> • Design and construction of new roads and well lease will incorporate drainage and erosion and sediment control devices. • Vegetation clearance to be minimised. • An Erosion and Sediment Control Plan (ESCP) to be developed and implemented. • Activities to be undertaken during the dry season. • Only approved access tracks will be used and designated parking and vehicle movement areas will be established.
Surface water	<ul style="list-style-type: none"> • Earthmoving equipment altering natural drainage lines or sinks. • Access tracks and site pads altering natural surface water flow, creating ponding and or erosion. • Contamination or pollution of surface waters through hydrocarbon or chemical spill or leak. 	<ul style="list-style-type: none"> • Location of watercourses, lakes and other surface water bodies; and property and stock watering holes to be taken into consideration during design of roads and well lease. • Drainage works are to be installed as early as practicable in the programme to protect disturbed areas

	<ul style="list-style-type: none"> Contamination or pollution of surface waters through waste or waste water impact. 	<p>from run-off and to convey stormwater away from, or through sediment control devices on the site.</p> <ul style="list-style-type: none"> Visual inspections of the sites stormwater and waste water containment systems to be undertaken weekly. Storage of fuel and hydrocarbons in accordance with AS1940:2004 <i>The storage and handling of flammable and combustible liquids</i>. Refuelling and chemical transfer away from drainage lines. Waste water systems will be maintained in working order. Monitoring of local weather and climate information will be undertaken to make informed decision regarding site operations.
Groundwater	<ul style="list-style-type: none"> Contamination or pollution of groundwater through hydrocarbon or chemical spill or leak. Extraction of groundwater for the use during construction activities, drilling operations and camp operations impacting on groundwater supply for exploration operations and the wider area. Well integrity issues resulting in groundwater impacts. Contamination of shallow aquifer through onsite disposal of drilling mud, cuttings and fluid 	<ul style="list-style-type: none"> Locate well drilling operations away from any groundwater fed environmentally sensitive areas such as wetlands or springs. Baseline groundwater quality sampling. Any excavations designed to hold liquids will be appropriately designed to prevent contamination of groundwater. Drilling methods that will seal off groundwater resources from the exploration wells will be utilised. Oil-based mud formulations will not be used. The wells will be drilled with a combination of air and KCl/Polymer water based mud and cased and cemented as required to ensure well integrity and aquifer isolation. Mud pit remediation methodology will maximise the stability of retained material to mitigate the

		<p>potential for contaminant migration</p> <ul style="list-style-type: none"> • Groundwater quality monitoring around sumps post commissioning
Noise and Vibration	<ul style="list-style-type: none"> • Occupational health and safety issues such as physical damage to humans through short-term exposure to loud noise and/or long term exposure to noise sources through use of mechanical equipment. • Nuisance noise impacts on surrounding communities or exploration workers through use of mechanical equipment. • Disrupting or altering fauna feeding, breeding or other activities through noise, vibration and lighting from use of mechanical equipment. • Interference with pastoral activities if noise, vibration and lighting affects behaviour of stock. 	<ul style="list-style-type: none"> • Proposed operating hours: <ul style="list-style-type: none"> ○ Construction operations carried out during daylight hours only. ○ Drilling operations carried out over 24 hours with two 12 hour shifts. • Communicate with Pastoralists during scheduling of construction and drilling activities to take into consideration stock movements. • Noise attenuation devices fitted to drill rig and other machinery used on site will be maintained in good working order.
Waste Management	<ul style="list-style-type: none"> • Contamination of soil or water through generation of or use of hazardous materials, domestic, industrial and drilling wastes and wastewater. • Encouragement of pest species to waste sites. 	<ul style="list-style-type: none"> • Designated waste storage and handling area to be provided onsite. • Consider recycling capabilities when awarding waste contract for drilling program. • All waste should be removed from site during civil construction activities. • Site and/construction vehicles to be equipped spill clean-up equipment. • Chemical packaging, lube oils, batteries, tyres, maintenance and other industrial wastes will be segregated and safely stored and labelled for proper disposal to recycling and approved landfill facilities. • Mud pits or other containment structures of sufficient capacity to meet the volumes of drill cuttings

		<p>and fluids anticipated for storage will be used.</p> <ul style="list-style-type: none"> • A portable sewage treatment plant will be installed at each well site camp. The capacity of the sewage treatment plant will be capable of treating the influent for up to 40 people. • Domestic refuse to be disposed of in accordance with NT waste guidelines. No incineration of wastes on site. • Mud pit remediation methodology will maximise the stability of retained material to mitigate the potential for contaminant migration
Air quality and emissions	<ul style="list-style-type: none"> • Potential for an increase in dust during site preparation and resulting from vehicular traffic. • Potential for an increase in exhaust emissions from contractors' vehicles and generators. • Potential for an increase in volatile hydrocarbons present in air surrounding drill sites, as petroleum compounds are moved to the surface. 	<ul style="list-style-type: none"> • Vegetation clearance to be minimised. • All vehicles and equipment used on site will be well maintained to minimise emissions. • Water trucks will be used to manage dust emissions during clearing and earth moving activities. • All access roads, culverts and creek crossings will be maintained in proper working order. • Vehicle movements will be minimised and restricted to designated access roads. • Speed limits will be enforced on access tracks and well lease.
Vegetation	<ul style="list-style-type: none"> • Reduction in native vegetation. • Removal of important habitat and flora. 	<ul style="list-style-type: none"> • Vegetation clearance to be minimised. • Areas to be cleared will be clearly demarcated. • Vehicle movements will be restricted to designated access roads. • Scrub and vegetation cleared from the access track, drill pad and camp site will be placed adjacent to the area where practical to facilitate future use for rehabilitation activities.

		<ul style="list-style-type: none"> • Topsoil will be stripped and stockpiled for site rehabilitation following cessation of exploration activities.
Fauna	<ul style="list-style-type: none"> • Disturbance of fauna. • Disturbance to and loss of fauna habitat, particularly through the clearing of drill and camp sites. 	<ul style="list-style-type: none"> • Access tracks and well lease will be designed to avoid fauna habitat. • Areas to be cleared will be clearly demarcated. • Vehicle movements will be minimised and restricted to designated access roads. • Speed limits will be enforced on access tracks and well lease. • Lease pad to be stock fenced.
Weeds and Pests	<ul style="list-style-type: none"> • Transport of weeds or other exotic species and plant diseases between regions through transport operations that may compromise existing habitats or vegetation and impact on pastoral or cultural activities in the area. • Degradation of the existing environment as a result of altering existing landscapes through exploration activities and enhancing opportunities for weeds species to become established and/or spread. • Introduction of feral and pest species. 	<ul style="list-style-type: none"> • Weed hygiene requirements prior to entering individual properties will be determined with relevant landholders. • Vehicles, machinery and equipment entering the permit areas will be cleaned and free of vegetative matter, or have a valid weed hygiene certificate. • If areas containing declared weeds are encountered, all earthmoving machinery will be cleaned prior to leaving a property with known declared weeds. • Any vehicle cleaning will be within designated areas. • No rubbish (<i>i.e.</i> food packaging) to be left on drill sites. • Domestic refuse will be disposed of in accordance with NT waste guidelines. • Wastes will be stored in dedicated waste storage areas.
Bush Fires	<ul style="list-style-type: none"> • Bush fires resulting from exploration activities, causing: <ul style="list-style-type: none"> ○ impacts upon fauna and habitat ○ increased erosion and impacts upon soil and 	<ul style="list-style-type: none"> • Fire breaks (minimum of 4 m) to be incorporated into infrastructure design. • Ensure adequate fire fighting equipment is available and in accordance with the Emergency Response Plan.

	<p>surface water as a result of vegetation loss</p> <ul style="list-style-type: none"> o impacts upon other stakeholder activity and resource use o damage to or loss of culturally significant sites o damage to or loss of public infrastructure, private infrastructure and equipment or community lands o possible safety risk to humans (i.e. personnel on site) o creation of greenhouse gases. 	<ul style="list-style-type: none"> • Liaise with pastoralists about fire management practices, including timing for any planned burns. • Flare pits will be located a safe distance from the site and any public area and ensure they are designed to contain the flare and prevent fire. • Vehicles and equipment to be fitted with spark arrestors. • Driving through long dry grass will be avoided. • Fire or unprotected flame will be kept at least 45 metres from unprotected sources of flammable vapour. • Storage of fuel and hydrocarbons in accordance with AS1940:2004 <i>The storage and handling of flammable and combustible liquids</i>. • Smoking will only be allowed in designated areas. • Hotwork activities will be managed under a work permit system. • Whenever hotwork activities are undertaken, the area surrounding the work site should be cleared combustible materials and appropriate fire fighting equipment kept on hand during such operations. • Diesel engines must not be used within 15 metres of a well or other source of flammable vapour unless fitted out appropriately.
<p>Cultural Heritage</p>	<ul style="list-style-type: none"> • Misunderstandings arising as a result of non-Indigenous workers being unfamiliar with the Aboriginal traditions, life-style, customs and cultural values. • Damage to or loss of culturally significant artefacts, areas or species. • Disruption of activities of Indigenous stakeholders in 	<ul style="list-style-type: none"> • Prior to the commencement of any on-ground activities, undertake a Site Clearance program, to be facilitated by the NLC with assistance from the Aboriginal Areas Protection Authority and the Office of Environment and Heritage, as required or directed by the NLC. • Identify location of culturally sensitive areas and ensure design avoids these areas

	<p>culturally significant areas.</p> <ul style="list-style-type: none"> • Cultural and environmental awareness issues may lead to a lack of protection of sacred sites or culturally significant places and artefacts. • Lack of cultural and environmental awareness may lead to intrusion on Aboriginal land of special significance to the local people. 	<p>where applicable.</p> <ul style="list-style-type: none"> • Site inductions are to be undertaken to ensure that all personnel are aware of cultural awareness obligations. • Seek advice from the NLC on appropriate persons to fulfil the role of Aboriginal Liaison Officers, who are able to speak for certain areas and on behalf of certain groups. These relationships may provide useful links with local Aboriginal groups.
Land use and access	<ul style="list-style-type: none"> • The staff and activities associated with the proposed drilling program may have an effect on local residents' access to services. 	<ul style="list-style-type: none"> • Prepare a Code of Conduct for employees and contractors to assist in the prevention of any possible anti-social behaviour that will affect the local residents. • Access approval from landholders prior to carrying out any on-ground activities will be sought. • Local businesses will be assessed and pre-qualified under Origin's contractor HSE governance directives and procedures for provision of civil services for 2015 drilling program, where practicable. • A Traffic Management Plan will be prepared and implemented. • A register should be kept of all incidences relating to access issues, unauthorised access and requirements of pastoralists, recognising that these requirements may change seasonally.

In addition to the management measures outlined in the table above, other measures to manage potential impacts on the environment include:

- Developing an environmental monitoring program
- Conducting audits and Environmental Plan reviews
- Identifying relevant training and ensure all employees and contractors complete a site specific induction
- Reporting (routine and non-routine) provisions included in the Environmental Plan.

5. Consultation

Local stakeholders have been consulted over a period of time, commencing with Sweetpea Petroleum in 2003. Consultation has been conducted with affected pastoralists, the NT Cattleman's Association, Barkly LandCare, the NLC and Central Land Council (CLC), the Barkly Region Member of the Legislative Assembly, government agencies, and town councils.

Stakeholders that Origin has engaged in respect of the Beetaloo project include:

Impacted:

- Landholders directly impacted by the Beetaloo project in 2014/15
- Landholders within the boundaries of Origins project area
- Indigenous people living and/or with a connection to the land in the project area as identified by the Northern
- Land Council
- Local Aboriginal Group representatives - Northern Land Council.

Interested:

- Local residents, councils, businesses and suppliers in Elliot
- Local residents, councils, businesses and suppliers in Katherine.

Origin has developed a Stakeholder Consultation Plan that will assist in meeting the obligations and commitments that have been identified during the consultation process.