Karoon Gas Pty Ltd

ENVIRONMENT PLAN
FOR
DRILLING OPERATIONS

Onshore Gippsland 2006-07

Upstream Petroleum Controlled Document No. 34461-HS-04-0001

Revision 0, September 2006

I: DOCUMENT CONTROL

This Environment Plan for Drilling Operations is a "controlled document". Should the recipient (user) become aware of any changes or corrections that are required please photocopy this page and the relevant page(s) to be changed, note the corrections and deliver them to:

Phil Harrick

HSEQ & Training Manager

Upstream Petroleum

Level 3, 342 Flinders St, Melbourne, 3000

Tel: (613) 8625 8406

Fax: (613) 9620 9938

Mob: +61 403 499 863

II: DOCUMENT REVISIONS

The HSEQ & Training Manager Upstream Petroleum is responsible for controlling and ensuring any revision of this Environment Plan. Responsibility for managing change in this document is detailed within the Upstream Petroleum (UP) Change Management Procedure *(UP/00/SP/DOC/PC05).*

This Environmental Plan shall be revised in the following circumstances:

- After a period of five (5) years;
- On discovery of a significant new or changed environmental effect or risk;
- Significant change in the drilling program or drilling operations.

Name: .....

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Section: ..... Pages: .....

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REVISION HISTORY

Rev	Date	Description	By	Chkd	App
0	06/10/06	Issued for approval	DP	LDC	PH

III: APPROVALS

This Environment Plan has been reviewed by Upstream Petroleum Pty Ltd and Karoon Gas Pty Ltd and is approved for the drilling of the Megascolides-1 (re-entry), Megascolides-2 and Raniformis-1 in 2006/7.

Approval: Karoon Gas Pty Ltd

NAME	Signature	Date
Lino Barro Karoon Gas Engineering Manager		

Karoon Gas Pty Ltd/Upstream Petroleum organisation have reviewed the contents of this Environment Plan, agree that the specific requirements are achievable and commit to implementing them before or during the well (as appropriate).

Approval: Upstream Petroleum Pty Ltd

NAME	Signature	Date
Terry Greaney UP Drilling Manager		
Phil Harrick UP HSEQ & Training Manager		

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1 INTRODUCTION

1.1 Environment Plan Objectives

This Environment Management Plan (EMP) has been prepared for the Megascolides-1 (re-entry), Megascolides-2 and Raniformis-1 Exploration Drilling Programs. This document has been produced to fulfil the environment-related requirements of the operation plan for the above wells, as required under the Victorian *Petroleum Act 1998* and associated regulations (see Chapter 2). Safety-related requirements, which forms the other part of the operation plan, are addressed on the Safety Management Plan (Ref: 34661-HS-03-0001)

The proposed wells are located within the Exploration License 4537 (EL 4537)/Petroleum Exploration Permit 162 (PEP 162) within the western on-shore Gippsland Basin in Victoria southeast (**Figure 1.1**). All the proposed drill sites are located on private grazing farming properties approximately 9 km south and 14 km southwest of the town of Warragul in West Gippsland, respectively. This EMP details the proposed drilling program for EL 4537/PEP 162, identifies and risk assesses potential environmental hazards, and details the management controls to ensure the listed environmental performance objectives and standards are achieved.

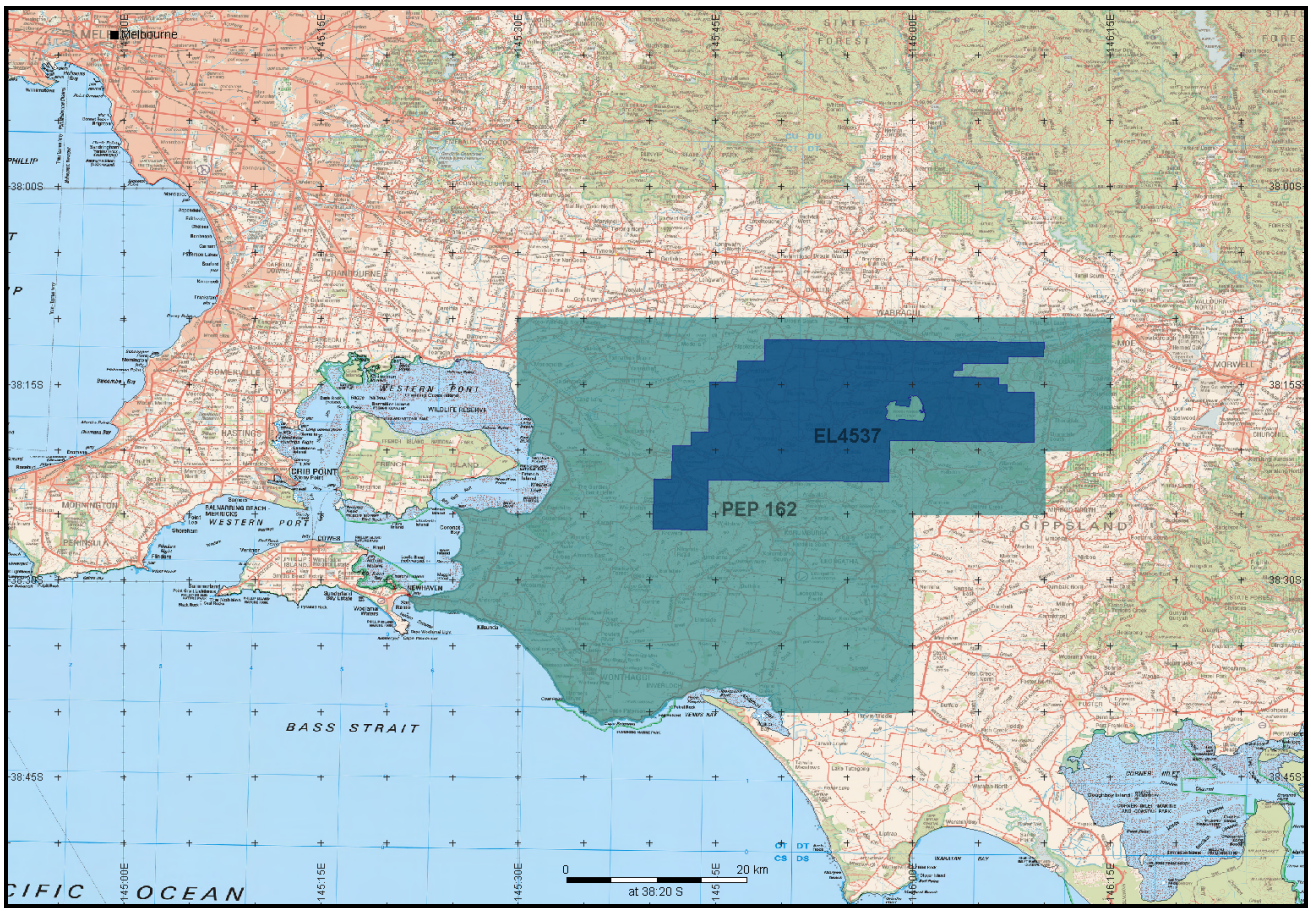

Figure 1-1 EL 4537/PEP 162 Location Map

1.2 Environment Plan Scope

The scope of this EMP includes site preparation, drilling, testing, completion and rehabilitation of the Megascolides-1, Megascolides-2 and Raniformis-1 wells.

The EMP addresses the following issues:

- Section 2 provides a summary of the legislative framework and relevant legislation applicable to the drilling program;
- Section 3 provides a description of the drilling program for the three wells;
- Section 4 the existing environment of the project site and the issues and potential impacts at the sites; and
- Section 5 provides details of the environmental management strategies to be adopted during drilling. This includes environmental management strategies, monitoring and auditing requirements and consultation strategies;

1.3 Review and Update of the Environment Management Plan

This EMP is developed based on the previous Environmental Assessment and Management Program:

- Environmental Assessment and Management Program: Upstream Petroleum Pty Ltd, Karoon Gas 2004 Drilling Program (*Ref: CR1139_1_v2*) prepared by Enesar Consulting

This EMP is intended to cover all re-entry and drilling activities associated with the Megascolides 1 & 2 and Raniformis-1 exploration wells. In the event that drilling methodologies alter, new activity is planned or if a new significant environmental effect is identified/alters, this plan will be revised and resubmitted to the regulator for approval.

2 LEGISLATIVE FRAMEWORK

2.1 Approvals Process

The Victorian Government, through the *Petroleum Act 1998*, has regulatory jurisdiction for exploration and development of onshore petroleum resources. Prior to commencement of any petroleum operations the following requirements must be complied with (Section 147, *Petroleum Act 1998*):

- Any petroleum operation on any land;
  - § The written consent of the Minister in accordance with section 138.
  - § Reasonable steps taken to ensure non-contravention of legislation referred to in section 146.
  - § 21 days (or any shorter period that is agreed) written notice given to owner, occupier or person or body responsible for management of the land in accordance with section 128.
- Any petroleum operation on private land or native title land, except land owned by that person;
  - § An operation plan accepted by the Minister in accordance with section 161 (of which this EP forms part of).
  - § Insurance obtained and maintained, as directed by the Minister, in accordance with section 171.
  - § A rehabilitation bond acceptable to the Minister obtained in accordance with section 173.
  - § Consent of owners and occupiers of land; or compensation agreement entered into with owners and occupiers; or amount of compensation payable to owners and occupiers determined in accordance with section 128.

2.1.1 Operation Plan

In accordance with the Act an operation plan must be submitted to the relevant government Minister for his acceptance (via the Department of Primary Industries, DPI). According to Section 161 of the Act the operation plan must contain information:

a) that identifies the risks of injury or damage that the operation may pose to the environment, to any community, person, land user, land or property in the vicinity of the operations and to any petroleum, source of petroleum or reservoir that the operation might affect; and

b) that specifies what the holder of the authority will do to eliminate or minimise those risks; and

c) that specifies what the holder will do to rehabilitate the land that will be affected by the operation; and

d) that sets out any other matters required by the regulations.

Section 6 of the Petroleum Regulations 2000 states that for drilling or workover operations the operation plan must include:

(a) details of the operation, including the location of wells and any equipment to be used;

(b) an environment and safety assessment which:

(i) identifies the environment, health and safety hazards and risks associated with the operation; and

(ii) provides and assessment of the risks; and

(iii) identifies the measures to be used to eliminate the hazards and to minimise the risks so far as is practicable;

(c) a description of the management systems required by regulation 4.

As stated in Section 1.1, this document has been produced to fulfil the environment-related requirements of the operation plan for Megascolides-1 & 2 and Raniformis-2 as required under the Victorian *Petroleum Act 1998* and associated regulations.

2.2 Commonwealth Legislation

2.2.1 Environment Protection and Biodiversity Conservation Act

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) enables the Commonwealth to join with the states and territories in a national scheme of environment protection and biodiversity conservation.

Under the EPBC Act, actions that are likely to have a significant impact on a matter of national environmental significance will trigger Commonwealth involvement in the state assessment and approval process.

Matters defined as nationally significant include:

- World Heritage properties.
- National Heritage places.
- Wetlands of international importance (Ramsar sites).
- Nationally listed threatened species and ecological communities.
- Internationally listed migratory species.
- Commonwealth land and marine areas.
- Nuclear actions.

A search of the Department of Environment and Heritage (DEH) EPBC Act protected matters website listed all threatened terrestrial and migratory species that may occur within a 1 km buffer of each of the proposed drill sites and the campsite. The search found fifteen (3 flora and 12 fauna) threatened species (endangered or vulnerable) and eight migratory bird species. **Sections 4.4** and **4.5** of this document contain a list of these flora and fauna species, respectively, and an assessment of their likely occurrence at the sites.

No significant impact to these species is anticipated from the drilling operations. This assessment is based on a number of factors including the very low likelihood that these species occur at or near the sites due to the current disturbed (cultivated) status of each site, the short time frame of drilling operations, the small 'footprint' of each site and the management and mitigation measures proposed. Impacts on flora and fauna species are assessed in more detail in Sections **4.4.2** and **4.5.2** respectively.

The EPBC Act website indicated that there are no threatened ecological communities, no world heritage and no national heritage properties within 1km of the proposed projects sites. Two wetlands of international significant (RAMSAR sites) were revealed during the search but both wetlands are located more than 30 kilometres away from the proposed drill sites.

On the basis of the above information it is concluded that no significant impacts to matters of national environmental significance will result from the drilling program with activities expected to attract a 'non-controlled action' status. A referral to DEH under the EPBC Act has not been made and is not considered warranted.

2.2.2 Native Title Act

The Commonwealth *Native Title Act 1993* applies indigenous land rights to Crown land, but not to freehold, road reserves and forestry lands in Victoria. A search of the National Native Title Tribunal database reveals there are no Native Title determinations or claims or Indigenous Land Use Agreements (ILUAs) currently over the proposed project sites

2.3 State Legislation

The drilling operations must comply with relevant Victorian legislation, including:

- *Archaeological and Aboriginal Relics Preservation Act 1972*.
- *Catchment and Land Protection Act 1994.*
- *Country Fire Authority Act 1958.*
- *Dangerous Goods Act 1985.*
- *Environment Protection Act 1970.*
- *Flora and Fauna Guarantee Act 1988.*
- *Heritage Act 1995.*
- *Petroleum Act 1998.*
- *Water Act 1989.*
- *Wildlife Act 1975.*

The project must also comply with all relevant State Environment Protection Policies (SEPPs) and Industrial Waste Management Policies (IWMPs) during drilling operations. These include:

- SEPP (Air Quality Management)
- SEPP (Waters of Victoria)
- SEPP (Groundwaters of Victoria)
- SEPP (Prevention & Management of Contaminated Land)
- IWMP (Prescribed Industrial Waste)
- Environment Protection (Prescribed Waste) Regulations 1998

2.4 APPEA Code of Environmental Practice

The Australian Petroleum Production and Exploration Association (APPEA) have developed general industry guidelines as to those operating practices which are considered to represent good industry practice in the petroleum industry. While these guidelines have no legislative force, they provide general industry guidance and minimum environmental standards.

3 PROJECT DESCRIPTION

3.1 Proponent Details

Karoon Gas Australia Limited was incorporated as a public company in November 2003 and was listed on the ASX on 8 June 2004. Karoon Gas's core focus and strategy is to identify, explore and develop acreage that is highly prospective for oil and gas. Karoon Gas Australia Limited, through its wholly owned subsidiary Karoon Gas Pty Ltd, has a 100% interest in EL 4537 and a 100% registered interest in Petroleum Exploration Permit 162 (PEP 162). EL 4537 was granted to Nexus Energy Australia NL (Nexus Energy) on 6 May 2003 for all minerals and coal, with Karoon Gas since taking mortgage of Nexus Energy's interest in the exploration license. PEP 162 was granted to Karoon Gas (then Bass Petroleum Holding) on 25 May 2001 and, after grant of an extension, is current until August 13, 2007. This project will be operated by Karoon Gas Pty Ltd.

Upstream Petroleum Pty Ltd (UP) has been contracted by Karoon Gas to act as Project Manager for the drilling of the EL 4537/PEP 162 wells. UP is an Australian integrated oil and gas service provider and provides expertise in exploration and production activities under contract to the oil exploration and production industry across a broad range of upstream professional disciplines from well completions to facility management.

The registered office for the operating proponent is:

Karoon Gas Pty Limited (A.B.N. 45 056 976 642)

Suite 7a, 34 Lochiel Avenue,

Mt Martha VIC 3934

Telephone Number: +61 3 5974 1044

Fax Number: +61 3 5974 1644

Email: scotthosking@karoongas.com.au

Contact Person: Scott Hosking

The operations office and address for correspondence of the proponent's Project Manager is:

Upstream Petroleum Pty Ltd (A.B.N. 49 080 394 985)

Level 3, 342 Flinders St

Melbourne, VICTORIA, 3000

Victoria Australia

Telephone Number: +61 3 8625 8400

Fax Number: +61 3 9620 9938

Email: melbourne@upstreampetroleum.com.au

Contact Person: Phil Harrick

3.2 Project Location

The project area is located about 100 km southeast of Melbourne in the West Gippsland region of Victoria. The Karoon Gas 2006 Drilling Program requires three small project sites, as outlined below:

- Megascolides-1 – situated north-east of the corner of Lardners Track and Hunters Road, Ellinbank, on private land (**Figure 3-2**). This site was cleared for the previous drilling program in 2004.
- Megascolides-2 – situated on western end of Hunters Road, Ellinbank, on private grazing land about 1 km east of Megasoclides-1 (**Figure 3-3**). This site is slightly sloping.
- Raniformis-1 – situated south south-west of the corner of Brock Road and Main South Road, Hallora on private grazing land (**Figure 3-4**). This site is relatively flat.
- Camp site – will be situated at the site previously used for the 2004 drilling. It is situated at the eastern end of Burnt Store Road, Lardner, on private cattle grazing land, Lardner, immediately inside the property boundary and utilising the existing farm driveway (**Figure 3-5**). This site is flat.

The Victorian Government, through the *Petroleum Act 1998*, has regulatory jurisdiction for exploration and development of onshore petroleum resources. In accordance with the act, Victorian Department of Primary Industry (Vic DPI) administers EL 4537/PEP 162. The location of the proposed well is provided in **Table 3-1** and **Figure 3-1**.

Table 3-1 Karoon Gas 2006 Well Locations

Wellhead MGA Coordinates (GDA94,UTM Zone 55S)				
Well	**Longitude**	**Latitude**	**Easting (m E)**	**Northing (m N)**
Megascolides-1	145º 52’ 51”	-38º 13’ 58”	402044	5767943
Megascolides-2	145º 53’ 39”	-38º 14’ 5.2”	403221	5767657
Raniformis-1	145º 49’ 52”	-38º 14’ 21.6”	397711	5766985

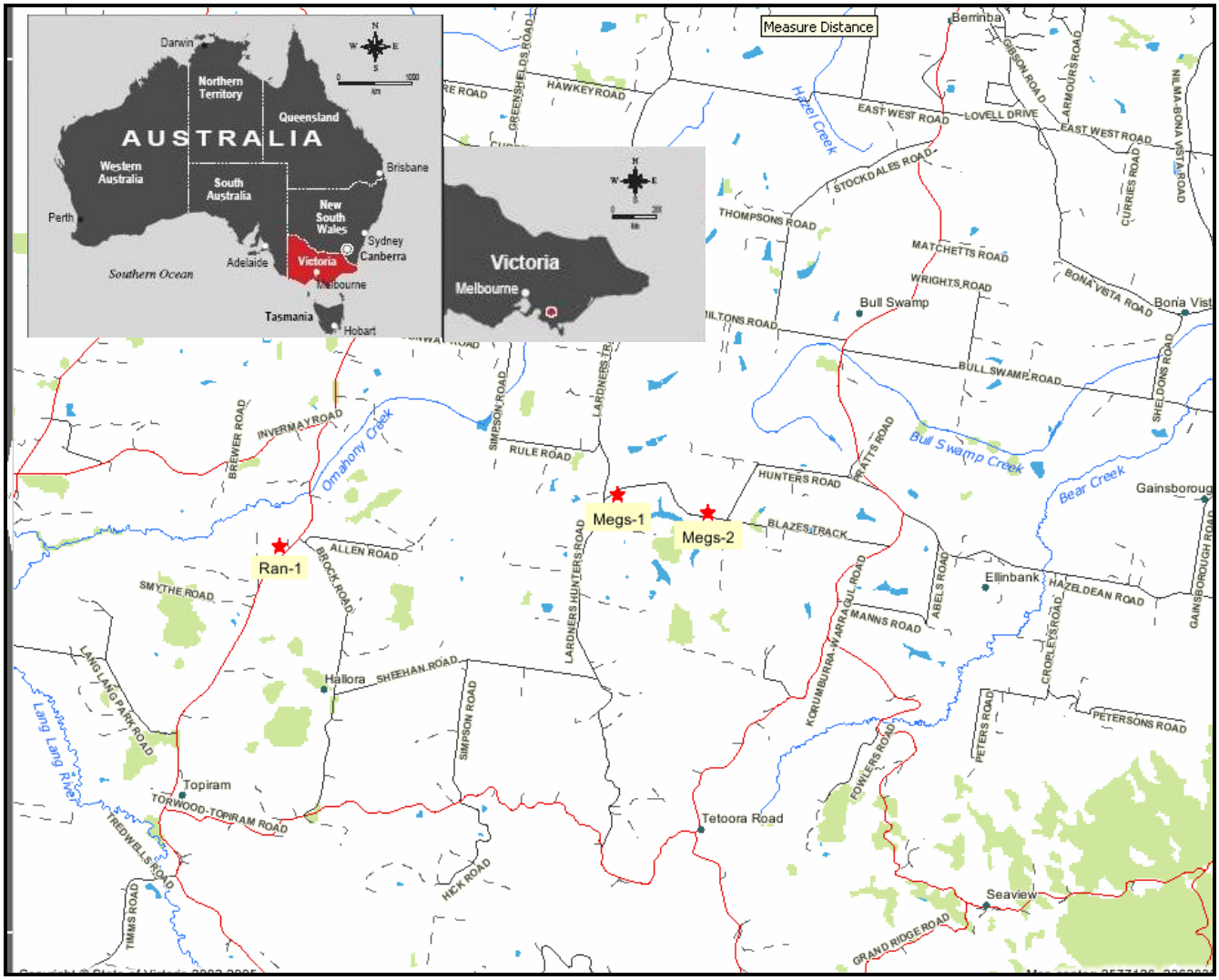

Figure 3-1 Location of the proposed drill sites (DSE, 2006)

3.3 Reservoir Hydrocarbon Properties

The Megascolides-1 & 2 and Raniformis-1 sites are within the Gippsland Basin. The main hydrocarbon reservoir targeted is the Crayfish Formation which had oils shows during the drilling of Megascolides-1 in 2004. The oil is believed to be a waxy crude similar to Gippsland Basin offshore crudes as described in **Table 3-2**.

Table 3-2 Expected Fluid Composition

Component	
API Gravity	47
Sulphur	0.09 % (wt)
Water Content	< 0.025% (vol)
Reid Vapour Pressure	35 kPa
Density at 15 deg C	0.7923 gm/cc
Pour Point	9 deg C
Kinematic Viscosity	
20 deg C	3 mm^2/s or cSt
40 deg C	2 mm^2/s or cSt
Ashphaltenes	0 % (wt)
Waxes	8% (wt)
Yield on Crude	
Naptha (18-70 deg C)	11% (vol)
Naptha (70-190 deg C)	32% (vol)
Kerosene (190-230 deg C)	7% (vol)
Gas Oil (230-360 deg C)	28% (vol)
Vacuum Gas Oil (360-530 deg C)	18% (vol)
Residue (>530 deg C)	2% (vol)
Metals	
Copper	<1 ppm
Iron	<1 ppm
Nickel	<0.5 ppm
Sodium	1 ppm
Vanadium	<0.5 ppm
Nitrogen	0.0092 % (wt)
Molecular Weight	N/R
Molecular Weight Heptanes plus	N/R

3.4 Project Description

3.4.1 Site Preparation

Preparation of the drill lease areas involves:

- Site access to drilling and camp sites (including access road construction).
- Clearing of the drill pad sites as necessary
- Removal and stockpiling of top soil.
- Laying of hard stand material.
- Excavation of a flare pit.
- Construction of sump, cellar and turkey's nest.

The drill site will each occupy an area of approximately 130 m by 100m (1.3ha) excluding access roads. Typical drill site arrangement is shown in **Figure 3-6**. However, the layout for each site may differ slightly, depending on field conditions and constraints.

Topsoil removed during drill pad and access road preparation will be stockpiled in accordance with landowner requirements.

The campsite will occupy approximately 60 m by 70 m (0.4Ha) inside the entry gate of the Lardner property (**Figure 3-5**). The camp site will consist of six sleeping quarters, a kitchen and dining area, recreation room / dry store / office, ablutions (toilets, showers and laundry), electricity generators, a freezer, a water tank / fuel tank, a rubbish skip and lighting. Potable water for the campsite will be provided by the landowner or external source (see **Figure 3-7** for layout). There will be restricted access for private vehicles.

Figure 3-2 Megascolides-1 site

Figure 3-3 Megascolides-2 site

Figure 3-4 Raniformis-1 site

Figure 3-5 Campsite

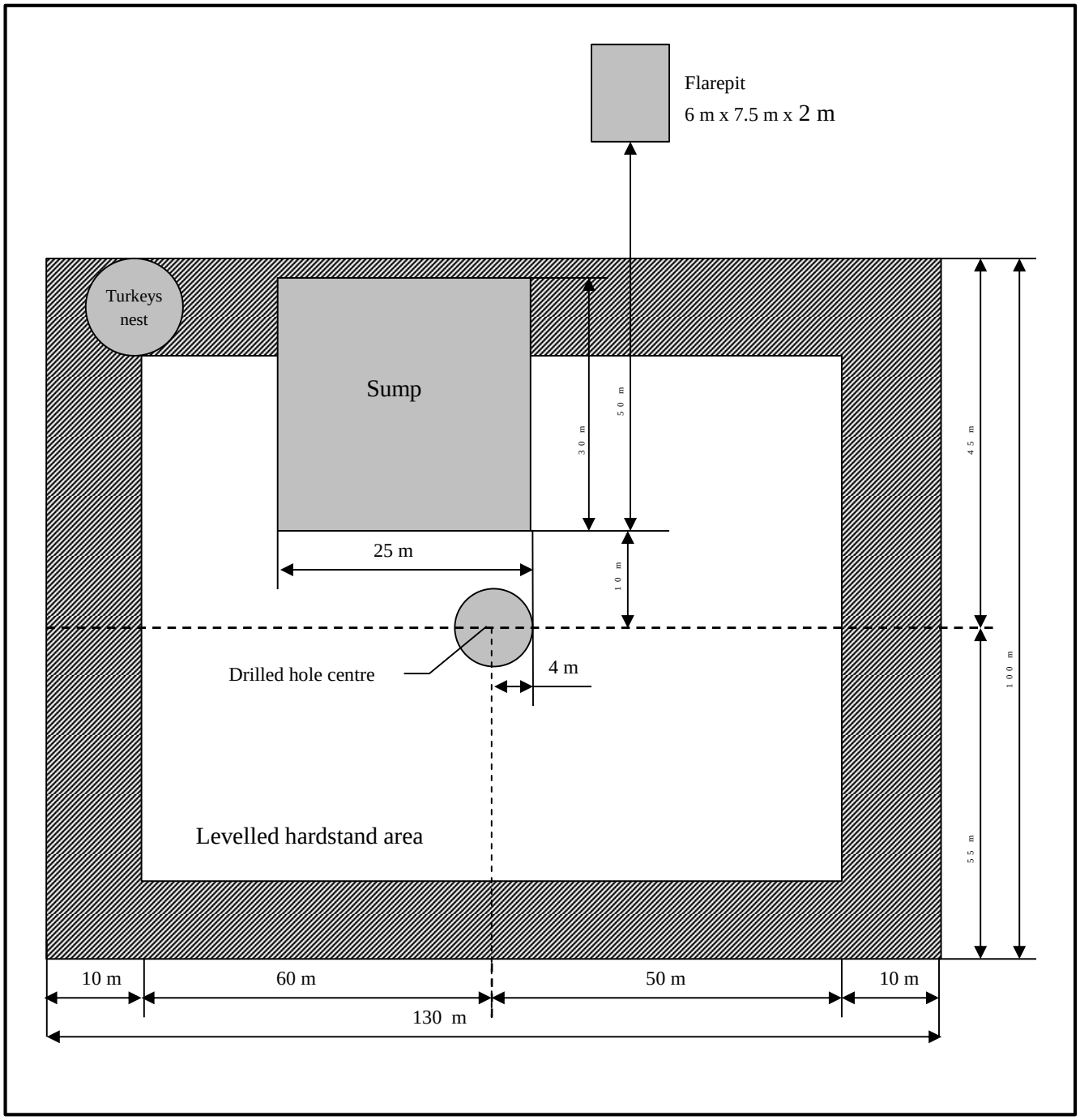

Figure 3-6 Typical Drilling Site Arrangement

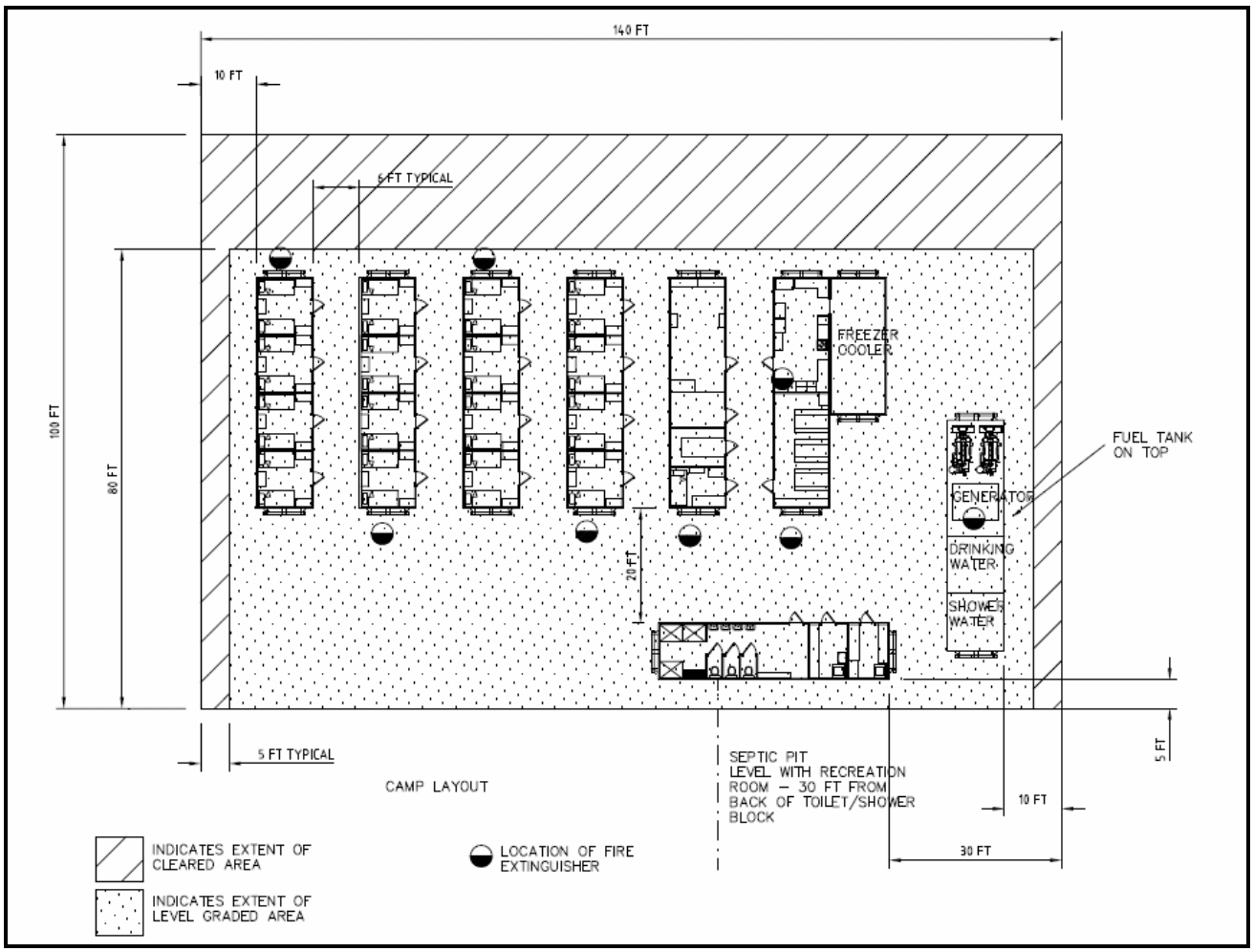

Figure 3-7 Typical Camp Layout

3.4.2 Drilling Program

Karoon Gas is proposing to drill the three wells during the period November 06-February 07 using the Century Rig 11. The program will start with the re-entry and sidetracking of Megascolides-1 followed by drilling of Megascolides-2 and Raniformis-1.

The wells will be drilled using standard onshore drilling operations and procedures, which include:

- Drilling and coring with a rotary drilling rig using recirculated non-oil-based muds;
- Wireline logging of the production holes;
- Openhole Drillstem testing of prospective zones (flow testing)
- Cementing of the well casing(s) or abandonment if non-commercial;
- In the event that hydrocarbons are discovered and the discovery appears commercial, the well will be suspended and cased for completion and further production testing to be carried out after the drilling rig has left to assess commercial viability
- Site rehabilitation following the drilling of the wells, or in the event a well is a commercial success, a reduced area will be retained for the wellhead facilities and workover access

The key features of the proposed drilling operations for Megascolides-1 & 2 and Raniformis-1 are summarised in **Table 3-3**.

Table 3-3 Well Details

Feature	Description	Description	Description
	Megascolides-1	**Megascolides-2**	**Raniformis-1**
Location	Ellinbank	Ellinbank	Hallora
Exploration Licence No.	PEP 162 (also on EL4537) – Operations will be under PEP 162		
Well site coordinates (GDA94)	145º 52' 56.8" -38º 13' 52.3"	145º 53' 40" -38º 14' 1.3"	145º 49' 51" -38 º 14' 26.4"
Timing of drilling operation	4 weeks	4 weeks	4 weeks
Drill pad area	1.3 ha	1.3 ha	1.3 ha
Accommodation	Camp site at Burnt Store Road for max 32 people		
Expected well depth	2000m	2100m	1700m
Target formation	Crayfish	Crayfish	Crayfish
Surface hole diameter	12.25" (re-entry)	12.25"	12.25"
Surface casing diameter	9-5/8" (re-entry)	9-5/8"	9-5/8"
Surface Casing Depth	500mKB	500mKB	500mKB
Production hole diameter	8.5"	8.5"	8.5"
Production casing diameter	7" (if required)	7" (if required)	7" (if required)
Drill rig	Century Rig 11	Century Rig 11	Century Rig 11
Proposed rig mobilisation route	Qld to Drouin or Warragul then local roads to Hunters Rd. Camp to Burnt Store Rd, Lardner. Local route will be established via transport plan consultation.	Along Hunters Rd. Not planning to move camp. Local route will be established via transport plan consultation.	From Hunters Rd via Lardners Track, Burnt Store Rd, Main South Rd to Hallora region near Brock Rd intersection. After drilling is completed rig will be moved via Main South Rd to Drouin then via Melbourne to Port Campbell – Warrnambool region. Local route will be established via transport plan consultation.

3.4.3 Schedule

The expected durations for construction, drilling, de-mobilisation and site rehabilitation at each of the four sites is outlined in **Table 3-4**.

Table 3-4 Drill and Camp sites Construction Duration

Activity	Megascolides-1	Megascolides-2	Raniformis-1	Camp Site
Lease and access road construction	4 days	7 days	7 days	0 days
Mobilisation and set up	14 days	4 days	4 days	2 days
Rig/camp on location (excluding mob)	18 days	25 days	20 days	90 days
Rig/camp demobilisation	4 days	4 days	6 days	2 days
Site rehabilitation	5 days	5 days	3 days	1 days

3.4.4 Drilling Fluids

The upper sections of the well will be drilled utilising water and pre-hydrated bentonite sweeps to clear the hole. Bentonite is natural clay and is considered inert with very low toxicity (Swan et al, 1994). The lower sections of the well will be drilled using a partially hydrolysed polyacrylamide (PHPA) polymer / KCL water based mud. Synthetic based drilling fluids will not be used on this drilling program.

Table 3-5 provides details of the WBM composition, the additive function and the toxicity details for each of the additives.

Water for drilling operations (such as for mud mixing and cementing) will be supplied from a property dam for the Megascolides-1 site, while water for drilling operations at the Megascolides-2 site will be sourced from the dam on the southern side of the road by arrangement with the property owner. Water for Raniformis-1 will be sourced from nearby suitable dam, after agreement with the property owner. Mains water will also be used if necessary.

Table 3-5 Water-based Mud Constituents & Toxicity

Chemical Name	Function	Concentration (ppb)	LC_{50} (mg/l)	Toxicity Classification
Upper Hole Sections				
Bentonite	Viscosifier	20-40	>1,000,000[1]	Non-toxic
Barite	Weighting Agent	-	>1,000,000[1]	Non-toxic
Caustic Soda	pH control	0.2	594,000[2]	Non-toxic
Lower Hole Section				
Caustic Potash	pH control	0.2	241,600[3]	Non-toxic
Partially Hydrolyzed Polyacrylamide	Shale Inhibitor	2	585,000[4]	Non-toxic
KCL	Shale inhibitor	2	585,000[5]	Non-toxic
Polyanionic Cellulosic Polymer	Viscosifier / Fluid Loss Agent / Shale Inhibitor	1.0	849,000[6]	Non-toxic
Aldehyde	Biocide	0.1	159,400[7]	Non-toxic
Barite	Weighting Agent	30	>1,000,000[8]	Non-toxic
Oxygen Scavenger	O_2 Scavenger	0.5	341,700[9]	Non-toxic
Xantan Gum Biopolymer	Viscosifier	0.5-2.0	PLONOR[10]	-

[1] Source: Swan et al (1994)

[2] NaOH LC_{50} based on *Mysidopsis bahia* @ concentrations of 3ppb

[3] KOH LC_{50} based on *Mysidopsis bahia* @ concentrations of 3ppb

[4] Partially Hydrolyzed Polyacrylamide LC_{50} based on *Mysidopsis bahia* @ concentrations of 2ppb

[5] KCl LC_{50} based on *Mysidopsis bahia* @ concentrations of 30ppb

[6] Polyanionic Cellulosic Polymer LC_{50} based on *Mysidopsis bahia* @ concentrations of 1ppb

[7] Aldehyde LC_{50} based on *Mysidopsis bahia* @ concentrations of 0.1ppb

[8] Barite LC_{50} based on *Mysidopsis bahia* @ concentrations of 50ppb

[9] Oxygen LC_{50} based on *Mysidopsis bahia* @ concentrations of 3,000ppb

[10] A listed foodstuff – toxicity testing is not required.

3.4.5 Production Testing/Well Clean Up

Open hole and / or cased hole production testing operations may be instigated at the proposed well sites, should hydrocarbons be detected in either reservoir. This process involves the controlled release of oil and /or gas from the well via a surface valve system. For Crayfish it is expected that oil with some associated gas may be encountered. If the oil has minimal associated gas the produced oil may be diverted to a test tank for collection, otherwise due to safety considerations it would be diverted to the flare pit for combustion. A separator may also be mobilised if deemed necessary for open hole testing or later for cased hole testing. The oil & gas flow rate will be calculated during the test and reserves can be estimated, giving an assessment of the field viability for further exploration and production. Further production testing may occur after production casing is set and the well completed. For example, volatile / gaseous liquid hydrocarbons would require testing with a separator to recover produced liquids.

In the event that commercial quantities of hydrocarbons are discovered, extended well testing will be performed and more wells may be drilled. Oil from the well would be trucked to the refinery at Geelong. If oil is encountered in sufficient quantities it may be tied in to the Longford – Geelong oil pipeline. If gas is encountered in commercial quantities, flowlines from the wells may be constructed to connect to existing gas pipelines within EL 4537, such as the GasNet Longford to Dandenong gas pipeline.

3.4.6 Abandonment

Well abandonment procedures are designed to mitigate the risk of contamination between subsurface aquifers with different pressures and salinity. During drilling the surface casing will isolate all shallow aquifers to the programmed depth setting of approximately 500 m. If the well is to be abandoned at the end of the drilling stage then an abandonment program will be lodged with the DPI for approval.

In general terms, abandonment will involve the following:

- Placing cement plugs in the open hole as required to isolate aquifers, and across the surface casing shoe.
- Cutting the surface casing at 1 m below the surface and setting of a 6-m surface cement plug.
- Removal and backfilling of cellar.
- Posting an abandonment plaque on the nearest fence line.
- All waste drilling fluids and solid wastes from the sump will be disposed of according to EPA guidelines.
- Removing any hydrocarbon contaminated soil
- Backfilling excavations and site restoration, including the removal of road gravel and sheeting materials.
- Ripping the cleared surface, respreading of any stockpiled topsoil and reseeding as necessary (in consultation with the landowner).
- Retaining perimeter fencing until vegetation is re-established.

4 EXISTING ENVIRONMENT & IMPACT ASSESSMENT

This chapter describes the existing environment of the project site and the issues and potential impacts at the sites. The potential impacts are assessed on the basis that mitigation and management measures, as outlined in **Section 5**, are implemented.

4.1 Regional Description

The project area is located in the West Gippsland region of Victoria, approximately 14 km south of the town of Warragul, within the Shire of Baw Baw. The region has a temperate climate with warm, dry summers and cool, wet winters. The mean annual rainfall for Warragul is 1,029 mm, with a mean maximum temperature of 19ºC and mean minimum temperature of 8.3ºC (BoM, 2006). The region has a strong agricultural industry, including beef and horticultural industries. About 40 km east of the project area lies Victoria's main coal mines and electricity generators at Morwell and Yallourn North.

4.2 Geology and Soils

4.2.1 Existing Environment

4.2.1.1 Geology

The project sites are located within the Gippsland Basin geological zone. The geology of this landscape is characterised by erosional and depositional landscapes of low to moderate relief, developed predominantly in sedimentary and igneous rocks of Palaeozoic (570 to 225 million years ago) and Cainozoic age (65 million years ago to present) (Walker et al., 1983).

Specifically, DPI mapping of the area indicates that Megascolides-1 & 2 and the campsite are located on sedimentary rocks (DPI, 2006a). The youngest rocks are Palaeogene (Oligocene, 36 to 24 million years ago), and the oldest date back to the Palaeogene (Eocene, 58 to 36 million years ago). Lithology is described as extrusive (tholeiitic and minor alkaline basalts) (DPI, 2006a).

The Raniformis-1 drill site is located within the Childers Formation, which dates from Eocene (58 to 66 million years ago) to Oligocene (36 to 24 million years ago). Its lithology is described as fluvial (sand, clay, gravel and conglomerate) (DPI, 2006a).

Elevation around the Warragul and Drouin area is between 100 to 250 m above sea level (asl) (DPI, 2006a), with the campsite, Megascolides-1, Megascolides-2 and Raniformis-1 drill sites lying at about 150 m, 120 m, 150m and 90m asl, respectively.

4.2.1.2 Soils

The project sites are located within the Bairnsdale–Dundas soil-landscape province of Region VIII (Walker et al., 1983). Dominant soils in this landscape province are solodic soils, red-brown earths, red podsolic soils and yellow podsolic soils on upper Mesozoic and Cainozoic sedimentaries (Walker et al., 1983).

Mapping of the West Gippsland region completed by Sargeant and Imhof (2003) (cited in DPI, 2006a) at a 1:100,000 scale show the project sites occurring from acidic red ferrosol soils (mapped as Warragul) on the rolling hills and undulating rises and acidic yellow dermosols (mapped as Athlone) to radoxic hydrosols (mapped as Ripplebrook) occurring along the creek lines (DPI, 2006a).

Soils of the region are productive and predominantly support the grazing (beef and dairy cattle) and horticulture industries.

4.2.2 Potential Impacts

4.2.2.1 Loss of Topsoil

Potential impacts to productive topsoils can be mitigated by minimising the area disturbed, and by removing topsoil from the project sites and access road areas prior to construction. Topsoil removed from the construction areas will be stockpiled off site for subsequent respreading and site rehabilitation.

4.2.2.2 Erosion and Sedimentation Potential

Erosion is the most common potential environmental risk associated with construction projects. Drilling primarily consists of earth-coring activities that disturb soil structure in a relatively minimal cross-sectional area. Poor drainage control of topsoil/spoil stockpiles may lead to erosion and sedimentation within catchments.

UP will adhere to industry guidelines (e.g., APPEA Code of Environmental Practice, 1996) and protocols relevant to the installation of erosion control devices. Controls such as erosion berms and silt barriers will be installed in a manner that suits local conditions and they will be inspected and maintained regularly and prior to, and after, heavy rain events.

Erosion controls will also be put in place to minimise sediment entering the drainage lines and smothering the roadside vegetation.

4.2.2.3 Compaction

Drilling operations require light compaction of hardstand areas to ensure rig stability. Compaction of the soils will also occur at the campsite and access tracks. Soil ripping and scarifying of compacted areas during rehabilitation, where necessary, will remediate impacts caused during drilling operations.

4.2.2.4 Importation of Materials

Materials imported to site (e.g., gravel for hardstands) have the potential to introduce weed species or soil pathogens. Imported material will be sourced from an existing municipal borrow pit, with a quarry at Trafalgar (25 km east of the project area) being the nominated site. Other suitable quarries may be substituted as required.

4.2.2.5 Subsidence

Soils have the potential to subside if disturbed. Consequences of subsidence include changes to local drainage patterns, which may in turn lead to erosion. Soils at the proposed lease areas may be subject to subsidence.

4.2.2.6 Contamination

There is a potential for soil contamination, particularly around flare and chemical storage area. To prevent contamination, chemicals will be stored within an on-site containment system and controlled in a manner that prevents environmental harm. Also, flarepit and sump pit will be lined or will be constructed from compacted clay materials to prevent leaching of contamination to land or groundwater.

4.3 Hydrology

4.3.1 Existing Environment

No natural wetlands exist in the immediate vicinity of the project sites. All project sites are located within the Bunyip River Basin, an area covering over 380,000 ha and which drains to Western Port Bay (DSE, 2006). None of the project sites are located within any water supply catchments, and gully erosion is insignificant within the region (DSE, 2006).

The proposed Megascolides-1 drill site is located about 150 m upslope of a shallow drainage line that drains nearby paddocks and flows into O'Mahony Creek and then the Lang Lang River. According to the landowner, the drainage line has a permanent water flow. Its banks contain very little or no native riparian vegetation, and runs through local grazing lands, subjecting it to moderate levels of sediment and nutrient inputs. A large dam also exists on the property but it will not receive surface water runoff from the paddock on which the drill site will be located. A stock watering well that has water pumped into it from the creek and the dam are located upslope of the proposed drill pad and will not be impacted by construction or drilling.

The proposed Megascolides-2 drill site is located about 200 m upslope of a dam. There is no waterway immediately near the proposed drill site.

The proposed Raniformis-1 drill site is located about 600 m South of O'Mahony Creek. There is a drainage line, and a small damp depression leading to the drainage line, leading to a small dam on the paddock where the proposed Raniformis-1 is located.

4.3.2 Potential Impacts

There is potential for contamination of surface-water (i.e., the drainage lines near the drill sites) or groundwater through contaminated water runoff from the drill sites or leaching of chemicals stored on site through soils (see **Section 3.2**) if control measures are not put in place. The implementation of best practice construction and refuelling techniques/locations, hazardous substance storage and spill management will mitigate the potential for such contamination.

If necessary the site will be constructed with sediment control drains around the disturbed work areas to prevent sediment run-off from leaving the site.

When excavating the sump, an assessment will be made as to whether a liner is required. Should the soil appear highly permeable and/or if contamination of shallow groundwater is likely, a polyurethane sump liner will be installed prior to drilling, and will be removed after drilling. Otherwise, initial drilling fluid waste will line the soil surface with a layer of bentonitic clays that will reduce seepage into the surrounding soil. Additional bentonite can be spread, as required, to further seal the soil.

Drill fluids, with drill cuttings and wastewater will be temporarily stored in an excavated sump at each drill site. At the completion of drilling, all liquids will be disposed of according to EPA guidelines. Solid wastes from the sump will be buried on-site. The sump will be backfilled as soon as practicable to avoid water collection.

Sewage from the campsite will not be discharged without treatment to waters (including groundwater). Holding tanks will be put in place to contain both grey water and black wastes. The holding tanks will be emptied regularly by a licensed third party.

4.4 Flora

4.4.1 Existing Environment

The project sites are all situated on privately owned farmland that is currently used for feedstock, horticulture or cattle grazing. Historic clearing and grazing has significantly altered the species richness and abundance of indigenous flora and fauna in the area.

4.4.1.1 Megascolides-1

The Megascolides-1 drill site had been cleared for the 2004 drilling program (see **Figure 3-2**). The southern boundary of the paddock at this site consists of an overstorey planting of non-locally indigenous eucalypts (*Eucalyptus* spp.) and wattles (*Acacia* spp.), which are up to 12 m in height. No native understorey is present beneath the canopy. This windbreak provides some soil stability, and a limited food source (leaves, nectar, seed) and habitat for local fauna. Grazing takes place under the canopy.

4.4.1.2 Megascolides-2

The vegetation of the drill site at the Megascolides-2 drill site is comprised of pasture grasses. The proposed site is bordered by stand of Cypress trees. A dense grassy understorey dominates the southern boundary of the paddock along Hunter Road. Daffodils are planted on the property on the east side of the proposed drilling site. The access track to the site will be most likely constructed off an existing property track through the grassy, predominantly weedy understorey of the road reserve.

4.4.1.3 Raniformis-1

The vegetation of the drill site at the Raniformis-1 drill site is comprised of pasture grasses. Alongside the eastern fenced boundary of the property, along the Main South Road, is remnant

native roadside vegetation. It consists of mature overstorey trees eucalypts and a dense grassy understorey dominated by variable sword-sedge (*Lepidosperma laterale*) with a sparse abundance of exotic species such as blackberry (*Rubus fruticosus* spp. agg), bracken (*Pteridium esculentum*) and pasture grasses.

Figure 4-1 Cypress and Eucalypt trees bordering the Megascolides-2 site

Figure 4-2 Native Roadside Vegetation at Raniformis-1 location

4.4.1.4 Camp Site

The campsite is devoid of any native vegetation and is comprised of pasture grasses (see **Figure 3-5**). Two large eucalypts exist near the boundary fence of the property, but these are located outside of the camp site footprint.

4.4.1.5 Nationally Significant Flora

Three nationally threatened plant species may occur within 1-km of the drill sites and campsite (**Table 4.1**), as listed on the DEH EPBC Act protected matters website (DEH, 2006a). The likelihood of their occurrence at the sites is outlined in **Table 4.1**.

4.4.1.6 State Significant Flora

A search of the DSE Biodiversity Information Management (DSE, 2006) reveals that no species of state conservation significance (i.e., threatened species) exist in or around the project sites. A full list of flora species recorded is provided in Appendix 1.

Table 4-1 Significant Flora (DEH, 2006a)

Flora	EPBC Status	Potentially Present at Sites				Likelihood of Occurrence at Sites
		M-1	M-2	R-1	C	
Matted flax-lily *Dianella amoena*	E	√	v	√	√	Could occur in open paddocks, but unlikely due to intense grazing.
Strzelecki gum *Eucalyptus strzeleckii*	V	√	v	√	√	No remnant native trees present within the project footprint at any site.
Maroon leek-orchid, French's leek-orchid. *Prasophyllum frenchii*	E	√	v	√	√	Could occur in open paddocks, but unlikely due to intense grazing. Found in grasslands, heathlands and grassy woodlands on rich sandy and black clay loams (Backhouse and Jeans, 1995).

Key: M-1 = Megascolides-1, M-2 = Megascolides-2, R-1 = Raniformis-1, C = campsite.
E = endangered, V = vulnerable.
Source: EPBC Act Protected Matters Search Report, 2006.

4.4.2 Potential Impacts

The proposed drilling operations will affect approximately 1.3ha of land, which is already highly disturbed due to grazing, feedstock or horticultural activities. It is possible that some species of conservation significance, including the nationally threatened flora species listed in **Table 4-1** may exist in the vicinity of the project sites. However, if species are present they are likely to be in the road verges where disturbance is less frequent (infrequent mowing versus intense grazing). They are not likely to be within the project's footprints at any site.

It is preferred that no trees are removed during the drilling and construction phase of the project and this will be the case if preferred access routes can be used. If any trees present an obstacle to movement along the access track, trimming of branches will be the preferred option. Clearing will be limited to grassy understorey (predominantly weedy) to construct access way to the proposed drill sites. If non-preferred access route have to be used two trees may need to be removed to access

Raniformis-1. One tree may need to be removed at Megascolides-1 to provide a second access route for safety enhancement. No tree is expected to be removed at Megascolides-2 proposed site.

Each site will be returned to current vegetation composition of pasture grasses (using seed mixes agreed with each landowner) following completion of operations and rehabilitation.

A permit will be submitted to the Country Fire before conducting production testing.

4.5 Fauna

4.5.1 Existing Environment

4.5.1.1 Nationally Significant Fauna

There are a range of habitat types within the broader area, including open paddocks, creeks, dams, riparian vegetation and remnant roadside vegetation. The proposed drilling operations are located within paddocks with no native vegetation (refer to **Section 4.4.1**). Small native mammals are unlikely to use this habitat because of lack of suitable vegetation cover (i.e., a shrubby protective understorey) and food sources. Introduced mammal species however, such as the rabbit (*Oryctolagus cuniculus*) and fox (*Vulpes vulpes*), are likely to be common in the area. Birds species are likely to comprise common open country birds such as the magpie (*Gymnorhina tibicen*), common starling (*Sturnus vulgaris*) and raven (*Corvus spp.*), as well as wetland species and other water birds that are attracted to the area by the creeks and farm dams.

A search of EPBC database (DEH, 2006a) indicated that twelve threatened fauna species (endangered or vulnerable) and 8 migratory species may occur within 1 km of the three drill sites and campsite (see Table 4-2).

A search of the DSE Biodiversity Information Management (DSE, 2006) has indicated many frogs and fish from around the project sites. A full list of fauna species recorded is provided in Appendix 1. The giant Gippsland earthworm (*Megascolides australis)* has been recorded within 1 km of all three project sites on several occasions between 1947 and 1991.

A further search on the EPBC database indicated that 4 additional migratory species may occur within 5 km of the proposed well sites. These species are Fork-tailed swift (*Apus pacificus*), great egret (*Ardea alba)*, cattle egret *(Ardea ibis*), Rainbow bee-eater (*Merops ornatus*).

4.5.1.2 State Significant Fauna

A search of the DSE Biodiversity Information Management (DSE, 2006) has indicated many frogs and fish from around the project sites. A full list of fauna species recorded is provided in Appendix 1. The giant Gippsland earthworm (*Megascolides australis)* has been recorded within 1 km of all three project sites on several occasions between 1947 and 1991.

Table 4-2 Significant Fauna (DEH, 2006a)

Scientific Name	EPBC Status	Potentially present at sites				Likelihood of Occurrence in Project Area
		M-1	M-2	R-1	C	
Birds						
Swift parrot *Lathamus discolor*	E	v	v	v	v	Breeds in Tasmania and migrates to mainland Australia in Autumn (Swift Parrot Recovery Team, 2001). Feeds on winter-flowering eucalypts in Victoria. Proposed drilling sites are not likely to provide critical habitat due to sparse eucalypt cover. Swift Parrots are also not expected to occur in the area because drilling occurs in summer.
Australian painted snipe *Rostratula australis*	V	v	v	v	v	A wetland species predominantly recorded from the Murray-Darling Basin (Garnett, 1992). No wetlands at project sites
Regent honeyeater *Xanthomyza phrygia*	E, M	v	v	v	v	Occurs mainly in box-ironbark open-forests and riparian stands of Casuarina on the inland slopes of the Great Dividing Range. Feeds on nectar taken from 16 species of Eucalypts (key species: Red Iron bark, Whitebox and Yellow box) and 2 species of mistletoe.
White-bellied sea-eagle *Haliaeetus leucogaster*	M	v	v	v	v	A marine species not likely to find suitable resources in project area.
White-throated needletail *Hirundapus caudacutus*	M	v	v	v	v	Breeds in Asia, migrating to Australia in October (Cayley, 1972). Entirely aerial and not known to land in Australia (Slater, 1970). May migrate through project area
Black-faced monarch *Monarcha melanopsis*	M	v	v	v	v	Breeds within temperate rainforest, dispersing into open woodland after breeding. Wide distribution along eastern Australia (Pizzey, 1987). May migrate through project area.
Satin flycatcher *Myiagra cyanoleuca*	M	v	v	v	v	Breeds within heavily vegetated gullies in forests and woodlands, uses trees in woodland, scrub and open country during migration. Wide distribution along eastern Australia (Pizzey, 1987). May migrate through project area.
Rufous fantail *Rhipidura rufifrons*	M	v	v	v	v	Prefers dense, damp rainforest, woodland and scrubland, straying to open country during migration (arriving in Victoria in October) (Pizzey, 1987). May migrate through project area.

Scientific Name	EPBC Status	Potentially present at sites				Likelihood of Occurrence in Project Area
		M-1	M-2	R-1	C	
Latham's snipe, Japanese snipe. *Gallinago hardwickii*	M	v	v	v	v	May overfly or forage in fresh water wetlands (Lane, 1987; Garnett, 1992) east of the project sites. Not likely to occur in project area.
Painted snipe *Rostratula benghalensis s. lat.*	M	v	v	v	v	May overfly or forage in shallow, freshwater wetlands (Lane, 1987) east of the project sites. Not likely to occur in project area
Mammals						
Spot-tailed quoll, tiger quoll *Dasyurus maculatus maculatus (s. lat.)*	E	v	v	v	v	Project sites are within marginal habitat. Insufficient understorey cover (Strahan, 1995) present at all project sites for this species.
Southern brown bandicoot *Isoodon obesulus obesulus*	E	v	v	v	v	Prefers sandy soil with scrubby vegetation burnt from time to time (Strahan, 1995). Insufficient understorey cover present at all project sites for this species.
Grey-headed flying-fox *Pteropus poliocephalus*	V	v	v	v	v	May use windbreak and roadside vegetation to forage or roost in, but not likely to be critical habitat. Has extensive distribution up the east coast of Australia (Strahan, 1995).
Long-nosed potoroo (SE mainland) *Potorous tridactylus tridactylus*	V	v	v	v	v	Prefers sandy soil with thick ground cover (Strahan, 1995). Insufficient understorey cover present at all project sites for this species and outside of known distribution.
Konoom, Smoky mouse *Pseudomys fumeus*	E	v	v	v	v	Prefers healthy ridgetops and slopes within sclerophyll forests, heath land and open forest. Habitats are characterised by a diverse array of shrub species (NSW National Parks and Wildlife Species, 1999)
Fishes						
Dwarf galaxias *Galaxiella pusilla*	V	v	v	v	v	May be present in local creeks and rivers.
Australian grayling *Prototroctes maraena*	V	v	v	v	v	May be present in local creeks and rivers.

Scientific Name	EPBC Status	Potentially present at sites				Likelihood of Occurrence in Project Area
		M-1	M-2	R-1	C	
Frogs						
Southern bell frog, growling grass frog, warty bell frog. *Litoria raniformis*	V	v	v	v	v	Found in vegetation within or at the edges of permanent water (Cogger, 1996; Robinson, 1995). Not expected at project sites due to lack of permanent water. AVW records indicate it is likely to be present in the general area (DSE, 2004b).
Worms						
Giant Gippsland earthworm *Megascolides australis*	V	v	v	v	v	Endemic to South and West Gippsland. Generally found in blue grey clay soils on flats near the bank of stream or along soaks and watercourses on south or west facing slopes (Taylor et al, 2004).

Key: M-1 = Megascolides-1, M-2 = Megascolides-2, R-1 = Raniformis-1, C = campsite.
E = endangered, V = vulnerable, M = Migratory.
Source: EPBC Act Protected Matters Search Report, 2006.

4.5.2 Potential Impacts

The open paddock habitats of the project sites are not considered significant for the survival of any of the fauna species of state or national conservation significance. No significant impacts to these species (as defined by the EPBC Act Administrative Guidelines on Significance) are expected.

The wetlands east of the project sites may be of importance to migratory wetland birds, such as those listed in State Significant Fauna Table 4.2 but these habitats will not be directly or indirectly affected by the drilling program.

A search of the DSE Biodiversity Information Management System (DSE, 2006) has indicated many frogs and fish from around the project site. A full list of fauna species recorded is provided in Appendix 1. The giant Gippsland earthworm (*Megascolides australis*) has been recorded within 1 km of all three project sites on several occasion between 1947 and 1991.

During the drilling and construction phase of the project, fauna utilising the windbreak and the roadside vegetation at the proposed Megascolides-1 & 2 and Raniformis-1, may be temporarily disturbed by noise. The level of noise disturbance is not considered to be significant because of its short duration and because fauna in the area are currently subject to noise emanating from traffic, farm machinery and cattle. Artificial light from floodlights at the project sites may discourage native nocturnal species (such as possums) from frequenting nearby habitat for the duration of the project. Kangaroos that may graze in the area have sufficient pasture resources surrounding the sites and are adapted to numerous ongoing disturbances. Therefore, kangaroos are unlikely to be affected by temporary drilling activities. Additional slow-moving traffic associated with the drilling program is not

likely to pose any greater threat of road injury or death to ground-dwelling animals than what currently exists. Traffic controls measures will be instituted as necessary.

Of the species listed in Table 4-2 , only the giant Gippsland earthworm (*Megascolides australis*) has the potential to be impacted by the drilling program. The giant Gippsland earthworm grows to an average length of 80 cm and lives in complex and extensive subsoil burrows in moist, blue-grey clay soils generally on flats near the banks of streams or along soaks or watercourses (Taylor et al, 2004). The giant Gippsland earthworm is susceptible to threat such as alteration to local drainage pattern, earthworks, and changes in existing land uses that involve cultivation of soil (Taylor et al, 2004). The clearing of topsoil at the project sites has the potential to impact on some individual earthworms directly (wounding) and/or indirectly (burrow destruction).

Megascolides-1 site have been cleared and compacted for the 2004 drilling program, therefore it is considered unlikely that Giant Gippsland Earthworm occurs in that site. A survey was undertaken to assess the potential impacts of the drilling operations, if any, on Giant Gippsland Earthworms prior to construction commencing on the proposed Megascolides-2 and Raniformis-1 drill sites. The results of the survey indicate both sites did not appear to support any potential giant Gippsland earthworm habitat and there was no evidence of giant Gippsland earthworms found during sampling. Given that there was no evidence of the presence of GGE within the immediate vicinity or surrounding area of the proposed earthworks, it is considered extremely unlikely that the proposed well exploration activities at the Megascolides-2 and Raniformis-1 sites will impact upon any giant Gippsland earthworm populations (Van Praagh, 2006a & Van Praagh, 2006b).

Given the small footprint of the project sites and short time-span in which works will occur, potential impacts on native fauna from the drilling program and associated activities are expected to be minor.

4.6 Aboriginal Heritage

4.6.1 Existing Environment

Aboriginal cultural heritage remains are a record of the past occupation of the landscape by Aboriginal people. There is the potential for isolated Aboriginal archaeological artefacts (e.g., stone tools) or surface scatters (e.g., shell middens) to be present on land within the project area. These are more likely to occur in areas close to sources of permanent water (rivers, creeks and wetlands) or around stony rises.

Aboriginal Australia Victoria holds no records for Aboriginal archaeological sites or places within the proposed drilling sites and campsite. For the purposes of the Commonwealth Act, Megascolides-1 & 2 and the camp site are located within the area of the West Gippsland Aboriginal Co-op, which is no longer operational. The Raniformis-1 site is located on the boundary between West Gippsland Co-op Area and an area without a legislated community.

Prior to the drilling of Megascolides-1 in 2004, Karoon has contracted Perspective Heritage Solutions Pty Ltd (Perspective Heritage Solutions) to undertake the Aboriginal heritage assessment The West Gippsland Aboriginal Co-operative is responsible for an area in which the Megascolides-1

drill site and campsite are located. An archaeological surface survey of the Megascolides-1 drill site and campsite was undertaken by Perspectives Heritage Solutions in conjunction with an indigenous representative of the West Gippsland Aboriginal Co-operative on the 13th of August 2004. These surveys found no surface Aboriginal archaeological artefacts. Both sites have been subject to ploughing (which would disturb and bring artefacts to the surface) and are distant from permanent creeks, giving these sites an overall low potential to yield undiscovered archaeological material during construction. Based on this assessment, the indigenous representative agreed that pre-construction sub-surface testing was not necessary.

A thorough survey and impact assessment for Aboriginal heritage sites and places will be undertaken prior to construction commencing on the proposed Megascolides-2 and Raniformis-1 drill sites. The survey aims to identify any Aboriginal cultural heritage sites and to provide recommendations for the effective management of their heritage values. The results of the survey will be submitted to the DPI in a bridging document.

4.6.2 Potential Impacts

Construction and drilling activities for the Karoon Gas 2006 Drilling Program will not impact on any registered archaeological sites. Potential impacts to unknown Aboriginal archaeological artefacts are only likely to occur during site construction (i.e., topsoil removal), though this is unlikely given the absence of surface artefacts and the low site potential at Megacolides-1 and the campsite, which is also likely to be the case at the Megascolides-2 and Raniformis-1 drill sites.

If necessary, an Aboriginal Consultant will be engaged to oversee the removal of top soils. Mitigation and management measures, should an artefact be uncovered during construction, are outlined in **Section 5.3** (**Table 5-1**).

4.7 European Heritage

4.7.1 Existing Environment

Visits to the project sites and a search of the Victorian Heritage Register (Heritage Victoria, 2006) indicate there are no registered significant heritage sites (of non-Aboriginal origin) at or near the sites.

4.7.2 Potential Impacts

No impacts to registered significant heritage sites will occur as a result of the drilling program.

4.8 Air and Noise

4.8.1 Existing Environment

4.8.1.1 Air Quality

The existing air quality of the local area is good, due to the lack of heavy industry, sparse population and subsequent low level of air pollutant emissions in the immediate area. Local and regional sources of air emissions are from large dairy operations, and vehicle and machinery use. However, the coal mines 50 km east of the project sites, at Morwell and Yallourn North (in the Latrobe Valley) contribute significant amounts of pollution to the general Gippsland region from the burning of brown coal.

4.8.1.2 Noise

While noise in the area can be highly variable, it is considered low when compared to a metropolitan area. Sources of existing noise in the local region are dominated by natural noise such as wind and fauna (i.e., birds, insects and livestock), farm machinery and vehicle noise from local roads.

4.8.2 Potential Impacts

4.8.2.1 Air Quality

The primary impact on air quality during drilling operations is typically from dust generated from the clearing of soils during construction and from exposed soils during drilling. To travel to each of the project sites, drilling-related traffic will be required to travel on short sections of unsealed roads that will generate dust. The high rainfall of the area means dust generation is not likely to be significant in terms of quantity of dust generated or length of time dust is generated. There are few sensitive receptors (residences) near the project sites. Given the small scale and temporary nature of soil clearing and drilling, the dust impacts will not cause a significant long-term nuisance.

Emissions of nitrous oxides, sulfur oxides and carbon monoxides associated with the exhaust of the drilling machinery, support vehicles, compressors, generators and flares will occur. These emissions are temporary and minor in quantity and are not likely to result in significant air quality impacts during drilling operations.

4.8.2.2 Noise

Drilling operations will give rise to a temporary increase in ambient noise levels within the immediate vicinity of the drill sites. Noise emissions will result from the drill rig's pumping, rotating, winching & power generation equipment, vehicles and construction machinery. The noise levels generated by construction will vary in intensity and characteristics depending upon the combination of equipment in operation at any one time and the location and duration of the individual activities. Construction and rehabilitation activities will be limited to daylight hours, but drilling operations will take place 24 hours/day. Prevailing winds and weather conditions will also affect the noise levels experienced in the vicinity of the drill site.

The nearest occupied dwellings are located approximately:

- 200 m east and south-east of the Megascolides-1 drill site.
- <100 m south of the Megascolides-2 drill site.
- 100-150 m north and 100-200 m east of the Raniformis-1 drill site
- 50 m west of the campsite.

At these dwelling, EPA Interim Guidelines for Control of Noise from Industry in Country Victoria (N3/89) applies. In accordance to the guideline, noise during the construction of an industry should not exceed 68 dB(A) during day time, 37dB(A) in the evening and 32 dB(A) at night time. Also, EPA Noise Control Guidelines for Construction Sites (Section 12 of EPA (1992)) will not be met during drilling operations because drilling will occur 24-hours a day and will therefore be outside 'normal hours' (7 am to 6 pm Monday to Friday and 7 am to 1 pm Saturdays). It is likely that noise levels at these dwellings will be greater than the specified guideline.

Mitigation measures to reduce the impact of noise during drilling will include consultation with the nearest residents to the project sites and appropriate selection, and where practical modification, of equipment. Nearby residents will be notified ahead of potentially noisy events such as gas production testing & velocity surveys. Where necessary, landowners will be offered the opportunity to temporarily relocate for the duration of drilling activities.

During well testing, the noise and light will emanate from the flare. The flare line will be dug into a pit to reduce noise and light emissions. Given the expected short duration of any testing operations, minimal flare emissions are anticipated.

4.9 Roads and Traffic

4.9.1 Existing Environment

The Princes Freeway is the major transport route for the region and connects it to Melbourne. Lardners Track links the Megascolides-1 & 2 drill site and campsite to Warragul, and is a sealed, split-road for most of its length. The Main South Road, which services the Raniformis-1, is a major road that links the town of Drouin South and Poowong East, and is a sealed, split-road for its entire length. These sealed roads have a minor traffic load, consisting of light and heavy vehicles, such as freight vehicles and dairy trucks. Most of the other minor roads in the vicinity of the project sites are single lane, unsealed roads used predominantly by local traffic with a light traffic load.

4.9.2 Potential Impacts

There is likely to be minor disruption to local traffic during drilling operations. Equipment and material transport routes and schedules will be planned to minimise disruption to local residents and the general public. Project-related vehicles, machinery and the drill rig (truck-mounted during transport) will use the Princes Highway as the main transport route to the drill sites, with escort vehicles and other traffic management methods employed as required to ensure the safety of other road users.

The majority of heavy vehicle traffic for the project will occur during construction and decommissioning at each drill site. During drilling operations, traffic will comprise mainly light vehicles travelling the short distance between the campsite and drill site and occasional fuel, water & supply trucks. There will be minimal traffic increase on these roads, as the 20-person crew involved in the project will use company pool vehicles. Off-road parking will be provided at the drill sites to minimise the safety hazard of vehicles and trucks parking along road verges and to allow monitoring of vehicles entering and exiting the drill sites.

4.10 Land Use and Infrastructure

4.10.1 Existing Environment

All project sites are located on privately owned farmland. Megascolides-1 site has been cleared for the previous drilling program in 2004. Megascolides-2 and Raniformis-1 are located on farmlands, primarily used for dryland dairying.

Infrastructure on these properties includes sheds, gates, fences, stock watering points and dams. Below-ground telecommunication cables are present at the campsite along the private driveway and at Megascolides 1, and may be present at the other drill sites, in addition to possibility of water, sewage and gas pipelines.

Two power poles with overhead power cables are located in the vicinity of the proposed Raniformis-1 drill site. No above-ground power or telecommunication cables are present within the project footprints at any of the other two sites. Numerous groundwater bores are present within the area, though none are present at the project sites. The Longford to Melbourne underground gas pipeline (Gasnet Gas Pipeline) is located about 7 km north of the Megascolides-1 drill site, while two other buried pipelines (likely to be water mains) are located about 5 km north of the same site. Besides Megascolides-1, no oil or gas wells are known to have been previously drilled to this depth in the immediate area.

4.10.2 Potential Impacts

The drilling operations will cause a temporary reduction in the area available for grazing. It is recommended that grazing is not undertaken on the disturbed areas until vegetation has re-established which may take up to six months. During construction and drilling operations, the presence of the drill rig and vehicles attending the site may cause some disturbance to farm management practices. The drill pads and camp site will be separated from surrounding farming operations by temporary fencing or negotiation with the landholder to move livestock to other paddocks. Access to residences will not be impeded. No long-term impact to land use is expected.

Potential impacts to existing infrastructure include the disturbance of and damage to third party infrastructure or property. Disturbances of this nature can lead to disruptions of services such as electricity and telephone networks. The drill site at Raniformis-1 will be built with buffer distance from the power poles and overhead cables. Spotter will be engaged if needed.

4.11 Visual Amenity

4.11.1 Existing Environment

The project sites are located within a rural landscape, dominated by dryland pasture and interspersed with farm dams, windbreaks and roadside vegetation

4.11.2 Potential Impacts

Due to the open pasture nature of the project sites, the drill sites and the drill rig will be visible from the immediate surrounding environs, including local roads.

The campsite is located at the end of a dead-end road and it will not be within visible to nearby houses (except for the residence on the property) or the nearby school. The campsite will not be visible during the day. The Megascolides-1 drill site will be visible from Hunters Road but not Lardners Track, and will not be visible from the residence on the other side of the hill upslope of the site, or from the house across the road that is shielded by a tall, dense cypress pine windbreak. The Megascolides-2 drill site will be visible from Hunter Road and from the properties on the opposite side of the road. The Raniformis-1 drill site will be visible from the Main South Road and from the houses nearby.

All visual impacts will be minor (i.e., will not interfere with the rural nature or charm of the area) and will be short-term. The project sites will be rehabilitated upon project completion to ensure they are integrated back into the rural landscape.

Floodlighting of the project sites at night may impact on local residences (though not shining directly in to any houses) and the glow of the light may be visible for some distance. This will stand out in what is normally a dark area that does not have street lighting or other night lights as would be found in nearby towns or the suburbs of Melbourne.

4.12 Public Safety

There will be no public access to the drill sites where there will be particular safety risks associated with the exploration for natural gas. UP will ensure that these risks are managed to minimise their potential occurrences, and has prepared an Safety Management Plan (Ref: 34661-HS-03-0001) for the drilling program. A copy of this document will be maintained at the drill sites.

5 ENVIRONMENTAL MANAGEMENT

Upstream Petroleum (as responsible party for the 2006 Onshore Gippsland drilling operations) has activated its Integrated Management System (IMS) to fulfil its environmental policy and objectives and act in an environmentally responsible manner. The IMS is supported by a set of Management System Standards (MSS) which provide a framework for the management of quality, health, safety and environment throughout Upstream Petroleum's operations. The MSS applies to all aspects of UP's operations and maintenance activities including contractors and other third parties.

The MSS is designed specifically to:

- Provide a set of performance standards covering the various aspects of HSEQ management. These standards are developed to meet the requirements of UP's policies and the requirements of relevant legislation;
- Provide an auditable trail from policy statement to operational documents that define activities managed by UP; and
- Be consistent with International and Australian Standards for quality, safety and environmental management.

The MSS has been developed specifically to ensure and encourage the input of employees in developing and maintaining the procedures and initiatives which meet the MSS standards. In this way, all employees are able to perform their activities equipped with a clear understanding of their role in the processes of UP's goal of achieving HSEQ excellence. The MSS takes into account such aspects as:

- An on-going operational structure to implement the MSS;
- Ensuring HSE hazards/aspects (routine and non-routine) and risks are identified and subsequently eliminated or minimised as far as practicable;
- Guidelines to develop industrial practices and procedures which are shown to have good results;
- A system of audit and review to ensure the system expectations are developed, maintained and delivered;
- Contributions from UP personnel and contractors;
- Establishing and regularly reviewing environmental objectives, targets and performance objectives consistent with the commitment to continual improvement in pollution prevention;
- Identify training, awareness and competency needs for environmental matters; and
- Establish, define, document and communicate roles, responsibilities and authorities to facilitate effective environmental management.

5.1 UP Environmental Policy

Upstream Petroleum Pty Ltd (UP) has been contracted by Karoon Gas Pty Ltd to act as Project Manager for the drilling of the Mgeascolides-1 & 2 and Raniformis-1 wells. UP HSEQ Policy guides the development and implementation of all other Environmental Management System (EMS) components and is provided in **Appendix 2**.

The environmental policy describes the company's commitment to managing their environmental responsibilities and defines the performance expected of staff (including contractors) in all operations. The policy also commits the company to complying with the *Petroleum Act 1998* and *Petroleum Regulations 2000.*

5.2 Environmental Objective

The overall environmental objective is to plan and conduct the drilling and associated activities in such a way that environmental impacts are avoided or minimised.

This objective will be achieved by implementing the mitigation and management measures described in **Section 5.3.**

5.3 Mitigation and Management Measures

Site-specific mitigation and management measures have been developed for the drilling program to minimise disturbance to the environment and third parties (Table 5-1). The mitigation and management measures are based on the APPEA Code of Environmental Practice (1996).

The mitigation and management measures register forms the basis of an implementation checklist which is reviewed and completed at different stages of the drilling campaign (planning, pre-spud, audit, closeout reporting).

Table 5-1 Mitigation and Management Measures

Issue	Potential Impact	Mitigation and Management Measure
Access and Traffic	Unnecessary disturbance of land	• Access arrangements will be made in consultation with the property owners. Access to the drill sites will be via access roads crossing road reserves in order to maintain unimpeded property access for the landholders. • The private driveway at the campsite will not be blocked at any time. • No remnant vegetation will be removed during construction or drilling operations.
	Vegetation loss	• Limit vegetation clearance to clearing of only ground-level plant material. Fence off nearby trees and shrubs and do not clear trees or shrubs. Stockpile cleared vegetation on the property, in consultation with the landowner, for replacement during rehabilitation. • Minimal trees are expected to be removed for the drilling program and would only occur to ensure safe ingress & egress at the site If any trees present an obstacle to movement along the access track, trimming of branches will be the preferred option.
	Unnecessary disturbance to traffic	Equipment and material transport routes and schedules will be planned to minimise disruption to local residents, local industries and the general public.
	Safety	Heavy equipment and oversized load transport access routes to/from the drilling site will be in accordance with relevant VicRoads and Baw Baw Shire regulations. Appropriate safety measures will be implemented for heavy machinery and infrastructure transport to and from the site (e.g., warning signs, patrol vehicles and transport vehicles). Traffic management contractors will be engaged if necessary.
		Construction-related traffic will observe the speed limits along all roads and drive in a manner appropriate for weather conditions (e.g., slowing down when wet or foggy). In addition, all drilling related traffic will travel at no greater than 40 km an hour outside the Lardner Primary School on Burnt Store Road during drop-off (8 - 9am) and pick-up (3 – 4pm) hours, when travelling to and from the camp site.

Table 5-1 Mitigation and Management Measures

Issue	Potential Impact	Mitigation and Management Measure
Soil and Water Management	Topsoil erosion	• Topsoil will be removed from the access tracks and project sites. Where topsoil removal occurs, it will be graded from the area and stockpiled adjacent to the site in a location that has been protected from surface water runoff. • The project sites and access roads will be formed by bringing in sheeting materials (coarse rock). Site rehabilitation will comprise the removal of sheeting materials and replacement of topsoil. • Erosion and sediment control measures (e.g., diversion berms, silt fences to contain and filter site run-off) will be installed at the drill sites and access tracks as required to control site stormwater run-off, and prevent erosion and sedimentation into nearby drainage lines.
Land use and Infrastructure	Excavation	Borrow material for access tracks and hardstand areas is expected to be mostly from an existing quarry site in Trafalgar holding a current Extractive Mining Licence.
	Disturbance to farming operations	The drill pads and camp site will be separated from surrounding farming operations by temporary fencing or negotiation with the landholder to move livestock to other paddocks.
		UP will consult with landowners and neighbours to agree specific measures to minimise impacts, access arrangements, pre-construction conditions and rehabilitation requirements.
	Unnecessary damage to third party infrastructure or property	• Identify all above-ground and underground infrastructure including powerlines, telecommunication cables, gates and fences on site maps to avoid accidental damage. • Use the ‘Dial-Before-You Dig’ service to identify underground infrastructure.
		• All fences, gates and other farm infrastructure will be returned to pre-disturbance conditions as agreed with the landowners. • Remove hardstand gravel material from each site and return to the supplier for restock, or remove and stockpiled on each property should the landowner request it.

Table 5-1 Mitigation and Management Measures

Issue	Potential Impact	Mitigation and Management Measure
Aboriginal Heritage	Heritage site Uncovered or damaged	Retain an archaeologist (if necessary) to conduct Aboriginal heritage assessment
		§ Consult with the relevant Aboriginal communities and arrange for the appropriate level of monitoring of clearing activities to be conducted during the construction of each site. § Should an aboriginal artefact be discovered consult with Gippsland Regional Cultural Heritage and/or an archaeologist to determine appropriate action.
		§ In the event that site earthworks uncover potential Aboriginal heritage material, work will be halted at the location and an appropriate buffer established around the site (work may continue outside the buffer area). § The Aboriginal monitor will immediately notify UP. UP will arrange for an archaeologist and/or Gippsland Regional Cultural Heritage to attend the site and assess, record and register the site as per statutory requirements. The archaeologist will seek a 'Consent to Disturb' permit from Aboriginal Affairs Victoria.
		§ All personnel involved in the project will be inducted in Aboriginal heritage management procedures and provided with information for identifying heritage artefacts so as to prevent unintentional damage.
Air emissions	Exhaust emissions	§ Drilling equipment (e.g. generators, motors), vehicles and construction plant (such as generators and compressors) will be kept in good running order and vehicle exhausts will comply with EPA exhaust standards
	Dust emissions	§ Water will be used as a dust stabiliser on access tracks and disturbed soils, if necessary (i.e., if visible dust plumes are constantly created and reported by landholders to be creating a nuisance). § Vehicles speeds will be minimised on unsealed roads.

Table 5-1 Mitigation and Management Measures

Issue	Potential Impact	Mitigation and Management Measure
Noise emissions	Equipment noise emissions	Appropriate selection, and where practical modification, of equipment.
	Noise nuisance to land owners	The UP Drilling Manager will consult with landowners in the vicinity of the drill sites about noise created during drilling operations. Advanced notice of noisy periods will be provided to relevant landowners. Where necessary landowners will be offered the opportunity to temporarily relocate for the duration of drilling activities.
Waste and Hazardous Materials Management	Pollution of project area and surrounding environment	Waste management will be based on waste minimisation principles of Eliminate, Avoid, Reduce, Reuse, Recycle and appropriate disposal.
		An emphasis will be placed on housekeeping and cleanliness at the drilling sites and campsite to promote safety and minimise environmental impact (such as attraction of vermin to the sites).
		At the completion of drilling, drilling fluids will be disposed of according to EPA guidelines. The sump will be backfilled as soon as practicable to avoid water collection.
		Recyclable inert materials such as timber, metals, tyres, etc., will be stored separately on site (in containers where necessary) for removal and salvage, where practical.
		Non-recyclable wastes will be stored in containers on site for collection and disposal by a waste contractor.
		Hazardous inert materials such as oils, fuel, lubricants, chemicals and grease will be stored and, where practicable, handled within containment/hardstand areas designed to prevent the release of spilt substances to the environment.

Table 5-1 Mitigation and Management Measures

Issue	Potential Impact	Mitigation and Management Measure
Waste and Hazardous Materials Management (cont'd)	Pollution of project area and surrounding environment (cont'd)	• Hazardous wastes, such as oils, fuel, lubricants, chemicals and grease will be recovered, contained, recycled and disposed of in consultation with the Baw Baw Shire or, local waste disposal contractors or the EPA as appropriate. • Hazardous materials will not be stored within 20 m of any drainage line at the drill site. • Reporting of any oil and chemical spills will be in accordance with regulatory requirements.
		Hazardous wastes will be managed and disposed of in accordance with all relevant regulatory requirements, including the *Dangerous Goods (Storage and Handling) Regulations 2000*
		Sump pit and flarepit will be lined or constructed from compacted clay material to prevent leaching of contamination
		Contaminated soils, affected by fuel or other chemical spills etc., will be removed from site for appropriate disposal in consultation with the Baw Baw Shire or EPA, as appropriate.
		Sewage wastes from the drill sites and campsite will be contained in portable tanks and removed regularly by waste contractors.
		Re-fuelling on site will, where possible, be undertaken in daylight with at least one personnel observing the re-fuelling operation. Drip trays will be utilised during refuelling, with absorbent material available in case of a spill. The main Fuel tank will be bunded (self bunded or earthen wall).
	Spill response	Appropriate spill response equipment (i.e., absorbent pads) will be available at the drill sites.

Table 5-1 Mitigation and Management Measures

Issue	Potential Impact	Mitigation and Management Measure
Sewage Treatment and Disposal	Contamination of groundwater and waterways	Sewage treatment and disposal will occur to ensure that: • It s approved by the Baw Baw Shire • Sewage effluent will not be released to waters (including groundwater). • The disposal of sewage effluent does not cause the contamination of any water used for drinking or domestic purposes, or for consumption by animals,
Visual amenity	Negative public perception of operation Litter escape	Place a high emphasis on housekeeping and cleanliness at the project sites (see Wastes and Hazardous Materials above)).
	Nuisance light from flare	The well test flare will be situated to reduce light emissions to surrounding residences.
	Nuisance light from drill and camp sites	Lighting at the project sites will be designed to minimise light emanating outside the site footprints, whilst ensuring safety standards are maintained.
Weeds	Weed introduction	§ Prompt reseeding will be undertaken (seasonal factors allowing) after topsoil reinstatement to minimise weed establishment. § With the approval and assistance of affected landowners, inspect the rehabilitated sites for weeds following abandonment and determine if weed control measures are necessary. § Wash down the drill rig and all vehicles and equipment to remove soil and plant matter prior to commencing works at Megascolides-1 (as the first site to be accessed).

Table 5-1 Mitigation and Management Measures

Issue	Potential Impact	Mitigation and Management Measure
Spills and Clean Up Action	Loss of native vegetation Contamination of land and waterways	If a hazardous contaminant is released to land or waters, the following action will be taken immediately to: • Stop any further release, • Contain the contaminant to the affected areas with particular attention to protecting environmentally sensitive areas, • Restore or rehabilitate the environment to its condition before the release occurred, and • Prevent a re-occurrence of the release Appropriate spill response equipment (i.e., absorbent pads) will be available at the drill sites.
Rehabilitation	Loss of native vegetation and potential native fauna habitat	At all the drill sites: • Access road material will be removed. • Topsoil cleared from the site will be reinstated & compacted land ripped. • Replace cleared vegetation with the same species, or select alternative species in consultation with the landowner. • UP will consult with the Baw Baw Shire regarding any active rehabilitation that they may require at the site.

Table 5-1 Mitigation and Management Measures

Issue	Potential Impact	Mitigation and Management Measure
Rehabilitation (cont)	Disturbance of land and reduced land-use potential	Upon abandonment of the project sites, the following will take place: • Removal of all project infrastructure, including portable site facilities such as toilets, showers and offices. • Removal and disposal of wastes, including all project signage, flagging and fencing. • Backfilling of all pits (keep mud pits fenced while awaiting backfilling). • Re-grading of drill sites and camp sites and appropriate measures for rehabilitation to return each project site to current land use. In the event the well is a commercial success, a reduced area will be retained for work over access and the wellhead facilities and fenced off to prevent wellhead damage. Access tracks will be retained and gated.
		• Rip compacted areas, return topsoil to the sites, grade to original contours, re-seed, and install erosion control measures if necessary on disturbed areas that may collect runoff. • The project sites will be restored to a level that accommodates return of the current land use whilst ensuring land stability. Restored areas will be reseeded with appropriate pasture species, selected in consultation with the landowner, to ensure rapid rehabilitation and stabilisation of soil surfaces. • Fence rehabilitated areas in consultation with landowners to prevent stock access impede rehabilitation efforts. • Replace or repair damaged fences.
	Damage to wellhead	Case, plug, mark and fence wellhead infrastructure in accordance with the Petroleum Regulations 2000.

5.4 Roles & Responsibilities

As outlined in **Section 1.2**, UP is managing the 2006-07 Onshore Gippsland Drilling Program on behalf of Karoon Gas Pty Ltd. The drilling will be undertaken by a contractor, Century Drilling Limited. Century thereby resumes a responsibility for compliance with UP policy and legislative requirements on behalf of UP. All contractors working for UP are expected to demonstrate a high level of Health, Safety and Environmental commitments and have system in place for managing HSE issues. The key roles and responsibilities for ensuring protection of the environment, achieved through the implementation of commitments made in this EP are listed below.

UP Drilling Manager:

- Ensures that the requirements of the EP are implemented.
- Establishes landowner relationships for those affected by project construction and operation, and organises land access for project personnel to these properties.
- Ensures that appropriate communications are in place between drilling contractor, UP, landowners and other local stakeholders to keep them informed of project issues and developments that may affect their day to day activities.

UP HSEQ Manager:

- Ensures regulatory documents are prepared and timely regulator approvals obtained;
- Ensures all necessary personnel have access to, or a copy of, approval documents/notifications (e.g. Environmental Management Plan & Safety Management Plan), and necessary legislation;
- Ensures sufficient definition of operational requirements to meet commitments made in this EP (e.g. definition of monitoring & measurement activities, verification records, emergency exercises) provided to relevant operational groups;
- Ensures reporting/notification/documentation processes and reporting documents (monthly/audit/close-out reports) are defined and understood by all personnel;
- Provides sufficient resources to undertake audit and reporting activities to support this EP;
- Provides resources to liaise with affected parties (e.g. landowner);
- Ensures incidents are documented and appropriate levels of investigation are undertaken;
- Ensures all personnel understand their roles in any emergency response incident;

Drilling Supervisor (Onsite):

- Conducts on-site induction with drilling personnel prior to project commencement.
- Conducts a site-specific induction with the drilling rig and third party service contract management personnel prior to project commencement.
- Ensures all aspects of this EP for which he/she is responsible are carried out during drilling operations.
- Ensures a site-specific induction is conducted prior to any contractors commencing work on site, together with a 'Site Orientation Checklist' conducted by the Rig Manager, prior to any work commencing.
- Ensures a visitor induction is conducted prior to allowing any casual persons (those not having to perform work on the site) to enter the drilling site.

Century Rig Manager:

- Implements and ensures compliance to all relevant environmental legislative requirements, commitments, conditions and procedures as given in this EP and documented in the Environmental Commitments Register;
- Applies the relevant enforcement mechanisms to prevent breaches of this EP;
- Ensures all personnel have received the required site Induction & retains induction records;
- Ensures location of relevant operational plans & source documents are accessible to personnel;
- Communicates hazards and risks to the workforce and their implications and the importance of good working practices;
- Point of contact for all environmental incidents. Responsible for ensuring incident details are documented, appropriate levels of investigation are undertaken, corrective actions implemented and findings disseminated to local HSE meetings;
- Undertakes corrective actions from environmental audits

5.5 Communication

Copies of the Century Drilling Limited and UP Environmental policies and this EP are to be displayed at prominent locations at the drill sites and campsite.

Daily toolbox meetings are to be held at the drill site to review the day's programs. Any key environmental issues associated with the particular day's activity will be reviewed at this meeting including the controls outlined in this plan. Any non-routine activities requiring JSEA's to be performed will be conducted at these sessions.

5.6 Training & Awareness

The drilling and construction workforce will undergo environmental inductions prior to the commencement of site works. The environmental inductions will inform the workforce of their obligations and project-specific environmental management procedures, including responsibilities and lines of communication. Inductions will cover the issues outlined in **Table 5-1**, including:

- Environmental regulatory requirements of the project.
- Site access.
- Soil and water.
- Flora and fauna.
- Aboriginal heritage.
- Amenity (air, noise, traffic, visual).
- Land use and infrastructure.
- Waste storage, handling and disposal.
- Spill prevention.
- Rehabilitation.

5.7 Monitoring & Auditing

5.7.1 Monitoring

Within the framework of the Upstream Petroleum's IMS, an environmental monitoring program has been established to verify predicted environmental impacts and assess compliance with regulatory requirements and industry standards. Table 5-1 summarises the monitoring program for the drilling phase and lists the measurement parameters, frequency of measurement and assessment criteria.

Figure 5-1 Environmental Monitoring Programme

Aspect	Measurement	Monitoring Frequency
Drill cuttings & drilling mud	Volume and composition discharged	Daily/Total (end of program)
Stakeholders Interactions (e.g. landowners, etc)	Number of complaints	Continuous
Diesel Usage	Volume Consumed	Continuous during drilling
Production Testing Flare	Volume Flared	Continuous during Production Test
General Waste	Volumes	Routinely on waste transfer
Environmentally Hazardous waste	Waste transfer documentation	Routinely on waste transfer
Significant oil or chemical spill	Volume released to environment	Continuous during spill incident

5.7.2 Auditing

Upstream Petroleum will report on routine monitoring and auditing activities associated with drilling operations to demonstrate that environmental performance objectives and standards outlined in this Environmental Plan have been met.

During the drilling of Megascolides-1 & 2 and Raniformis-1, one compliance audit will be undertaken. A report will be submitted to DPI providing a summary of the findings and corrective action status within 3 months of drilling completion.

5.7.3 Environmental Reporting

The outcomes of the auditing and monitoring programs will be reported to the DPI at the end of the drilling program. Additionally, all environmental incident/spill reporting will also be in accordance with regulatory guidelines.

5.8 Drilling Incidents Reporting

5.8.1 Reportable Incidents

Upstream Petroleum, on behalf of Karoon, will report any of the following reportable incidents to DPI as soon as practicable after the occurrence of the first incident, or the time that Karoon becomes aware of:

- Cause, or has the potential to cause, death, serious injury or significant environmental or property damage
- Involve the release or spill of more than 80 litres of petroleum;
- Involve any uncontrollable escape by ignition of flammable or combustible materials; or
- involve a petroleum emulsion in which the petroleum concentration is greater than 30mg/L

5.8.2 Internal Reporting

All incidents occurring on the drill sites or related project areas will be recorded on the web based UP Trilogy system allowing UP management immediate access to incident details and proposed corrective actions.

5.8.3 All Incidents

Upstream Petroleum requires all environmental incidents (including any spill of chemical or petroleum) to be reported and investigated in accordance with the UP Incident Reporting & Investigation Procedure (UP/00/HSEQ/GEN/PC03) (or equivalent).

5.9 Environmental Emergency Response Planning

Environmental emergency response planning for the Karoon Gas 2006 Drilling Program will be undertaken in accordance with element 4 (risk assessment and risk management) and element 14 (emergency response) of the MSS.

MSS element 4 includes the requirement for individual crews to perform a risk/safety analysis of non-routine activities prior to the commencement of a task, which will include evaluation of the significance of risks (i.e., their likelihood of occurrence and their potential consequence) as outlined in AS/NSZ 4360: 1999 (Risk management).

The emergency response procedures in MSS element 14 outline what is required to be contained within the emergency response plans, how emergency preparedness is handled and what constitutes an emergency response.

Potential environmental emergencies resulting from the drilling program include:

- Uncontrolled fire in adjacent vegetation.
- Uncontrolled liquid hydrocarbon fire at the wellhead.
- Major spill of liquid hydrocarbons (fuel or product) outside the hardstand area.
- Major spill of a hazardous waste substance outside a containment area.

5.10 Consultation

5.10.1 Landowners

Karoon/UP has consulted extensively with landowners in preparation for the Megascolides-1 & 2 and Raniformis-1 drilling activities. Over the period August - September 2006, a series of consultations have been held with landowners in the vicinity of the drill site. A log of consultation and issues raised is maintained (Appendix 1).

5.10.2 Regulatory Agencies

Karoon will also liaise and consult with Regulatory Authorities (Victoria Department of Primary Industries) and Agencies (EPA, Aboriginal Affair Victoria, Baw Baw Shire, etc) during the planning phases of the 2006 Onshore Gippsland drilling operations.

6 GLOSSARY & ABBREVIATION

ALARP	As Low as Reasonably Practicable
API	American Petroleum Institute
APPEA	Australian Petroleum Production & Exploration Association
AS	Australian Standard
Bbl	Barrel
BOP	Blowout Preventer
CAMBA	China/Australia Migratory Birds Agreement
CO_2	Carbon Dioxide
CO_{2-e}	Carbon Dioxide (equivalent)
DEH	Commonwealth Department of Environment and Heritage
DIMT	Drilling Incident Management Team
DITR	Commonwealth Department of Industry Tourism and Resources
DOTARS	Commonwealth Department of Transport & Regional Services
DPI	Victoria Department of Primary Industry
EC_{50}	Concentration that causes 50% algal growth inhibition.
EMS	Environmental Management System
EMT	Emergency Management Team
EP	Environment Plan
EPA	Environmental Protection Authority
EPBC	Environment Protection (Biodiversity Conservation) Act
ERG	Emergency Response Group
ERP	Emergency Response Plan
GHG	Greenhouse Gas
GOR	Gas Oil Ratio
H_2S	Hydrogen Sulphide
HSEQ	Health, Safety, Environment & Quality
IMS	Integrated Management System
ISO	International Standards Organisation
JAMBA	Japan/Australia Migratory Birds Agreement
LC_{50}	Lethal Concentration for 50% specified test organism population to die over a specified period of time
MSS	Management System Standards
MSDS	Material Safety Data Sheet
OSCP	Oil Spill Contingency Plan
RAMSAR	Convention on wetlands of International Importance especially Waterfowl Habitat
UP	Upstream Petroleum Pty Ltd
WOMP	Well Operations Management Plan

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Appendix 1: DSE Flora & Fauna Search Results

Table 1 Flora Species recorded within a 1-km radius of the Karoon Gas 2006-07 proposed drilled sites (as supplied by DSE, 2006)

Scientific Name	Common Name	Status
Megascolides-1		
Eucalyptus cypellocarpa	Mountain Grey-gum	
Eucalyptus radiata s.l.	Narrow-leaf Peppermint	
Pinus radiata	Radiata Pine	*
Megascolides-2		
Eucalyptus cypellocarpa	Mountain Grey-gum	
Eucalyptus cypellocarpa	Mountain Grey-gum	
Eucalyptus radiata s.l.	Narrow-leaf Peppermint	
Raniformis-1		
Acacia dealbata	Silver Wattle	
Acacia melanoxylon	Blackwood	
Acacia mucronata subsp. longifolia	Narrow-leaf Wattle	
Acacia stricta	Hop Wattle	
Acacia verniciflua	Varnish Wattle	
Acacia verticillata	Prickly Moses	
Acaena novae-zelandiae	Bidgee-widgee	
Adiantum aethiopicum	Common Maidenhair	
Aira spp.	Hair Grass	*
Amperea xiphoclada var. xiphoclada	Broom Spurge	
Banksia marginata	Silver Banksia	
Bauera rubioides	Wiry Bauera	
Bauera spp.	Bauera	
Baumea tetragona	Square Twig-sedge	
Billardiera scandens	Common Apple-berry	
Blechnum minus	Soft Water-fern	
Blechnum nudum	Fishbone Water-fern	
Blechnum spp.	Water Fern	
Blechnum wattsii	Hard Water-fern	

Table 1 Flora Species recorded within a 1-km radius of the Karoon Gas 2006-07 proposed drilled sites (as supplied by DSE, 2006)

Scientific Name	Common Name	Status
Calochlaena dubia	Common Ground-fern	
Carex appressa	Tall Sedge	
Cassinia aculeata	Common Cassinia	
Cassytha glabella	Slender Dodder-laurel	
Cassytha spp.	Dodder Laurel	
Centaurium erythraea	Common Centaury	*
Centaurium tenuiflorum	Slender Centaury	*
Centella cordifolia	Centella	
Clematis aristata	Mountain Clematis	
Coprosma quadrifida	Prickly Currant-bush	
Cyathea australis	Rough Tree-fern	
Cyathea spp.	Tree Fern	
Dianella tasmanica	Tasman Flax-lily	
Dicksonia antarctica	Soft Tree-fern	
Dillwynia glaberrima	Smooth Parrot-pea	
Dillwynia sericea	Showy Parrot-pea	
Drosera peltata subsp. auriculata	Tall Sundew	
Drosera peltata subsp. peltata	Pale Sundew	
Epacris impressa	Common Heath	
Eucalyptus cypellocarpa	Mountain Grey-gum	
Eucalyptus obliqua	Messmate Stringybark	
Eucalyptus ovata	Swamp Gum	
Eucalyptus radiata s.l.	Narrow-leaf Peppermint	
Gahnia radula	Thatch Saw-sedge	
Gahnia sieberiana	Red-fruit Saw-sedge	
Gahnia spp.	Saw Sedge	
Galium aparine	Cleavers	*
Galium propinquum	Maori Bedstraw	
Geranium solanderi s.l.	Austral Cranesbill	

Table 1 Flora Species recorded within a 1-km radius of the Karoon Gas 2006-07 proposed drilled sites (as supplied by DSE, 2006)

Scientific Name	Common Name	Status
Gleichenia microphylla	Scrambling Coral-fern	
Gleichenia spp.	Coral Fern	
Gonocarpus humilis	Shade Raspwort	
Gonocarpus spp.	Raspwort	
Gonocarpus tetragynus	Common Raspwort	
Goodenia ovata	Hop Goodenia	
Hakea sericea s.l.	Bushy Needlewood	
Histiopteris incisa	Bat's Wing Fern	
Hydrocotyle hirta	Hairy Pennywort	
Hydrocotyle spp.	Pennywort	
Hypericum gramineum	Small St John's Wort	
Hypochoeris radicata	Cat's Ear	*
Hypolepis spp.	Ground Fern	
Kunzea ericoides spp. agg.	Burgan	
Lagenophora stipitata	Common Bottle-daisy	
Lapsana communis subsp. communis	Nipplewort	*
Lepidosperma elatius	Tall Sword-sedge	
Lepidosperma filiforme	Common Rapier-sedge	
Lepidosperma laterale	Variable Sword-sedge	
Leptospermum continentale	Prickly Tea-tree	
Lindsaea linearis	Screw Fern	
Lomandra longifolia	Spiny-headed Mat-rush	
Melaleuca ericifolia	Swamp Paperbark	
Melaleuca squarrosa	Scented Paperbark	
Microlaena stipoides var. stipoides	Weeping Grass	
Olearia lirata	Snowy Daisy-bush	
Oxalis corniculata s.l.	Yellow Wood-sorrel	
Ozothamnus ferrugineus	Tree Everlasting	
Pittosporum undulatum	Sweet Pittosporum	#

Table 1 Flora Species recorded within a 1-km radius of the Karoon Gas 2006-07 proposed drilled sites (as supplied by DSE, 2006)

Scientific Name	Common Name	Status
Poa australis spp. agg.	Tussock Grass	
Poa tenera	Slender Tussock-grass	
Polystichum proliferum	Mother Shield-fern	
Pomaderris aspera	Hazel Pomaderris	
Prostanthera lasianthos	Victorian Christmas-bush	
Prunella vulgaris	Self-heal	*
Pteridium esculentum	Austral Bracken	
Pterostylis longifolia s.l.	Tall Greenhood	
Pultenaea gunnii	Golden Bush-pea	
Pultenaea juniperina s.l.	Prickly Bush-pea	
Ranunculus lappaceus	Australian Buttercup	
Ranunculus repens	Creeping Buttercup	*
Rubus fruticosus spp. agg.	Blackberry	*
Schoenus spp.	Bog Sedge	
Senecio linearifolius	Fireweed Groundsel	
Senecio spp.	Groundsel	
Stellaria flaccida	Forest Starwort	
Tetrarrhena juncea	Forest Wire-grass	
Todea barbara	Austral King-fern	
Veronica plebeia	Trailing Speedwell	
Viola hederacea sensu Willis (1972)	Ivy-leaf Violet	
Xanthorrhoea minor subsp. lutea	Small Grass-tree	

Status Key

E Endangered in Australia: at serious risk of disappearing from the wild state within one or two decades if present land use and other causal factors continue to operate.

e Endangered in Victoria: rare and at risk of disappearing from the wild state if present land use and other causal factors continue to operate.

V Vulnerable in Australia: not presently Endangered but at risk of disappearing from the wild over a longer period (20 to 50 years) through continued depletion; or which largely occur on sites likely to experience changes in land use that would threaten the survival of the taxon in the wild.

v Vulnerable in Victoria: rare, not presently endangered but likely to become so soon due to continued depletion; occurring mainly on sites likely to experience changes in landuse which would threaten the survival of the plant in the wild; or taxa where total populations are so low that recovery form a local natural disturbance such as drought, landslip or fire is doubtful.

R Rare in Australia: rare but overall not currently considered Endangered or Vulnerable. Such species may be represented by a relatively large population in a very restricted area or by smaller populations spread over a wider range, or by some intermediate combination of distribution pattern.

r Rare in Victoria but not considered otherwise threatened (the status elsewhere in Australia not being considered). This category does not necessarily imply that the plants are substantially threatened, but merely that there are relatively few known stands.

* Non native species

Table 2 Fauna Species recorded within a 1-km radius of the Karoon Gas 2006-07 proposed drilled sites (as supplied by DSE, 2006)		
Scientific Name	**Common Name**	**Status**
Megascolides-1		
Megascolides australis	Giant Gippsland Earthworm	VU
Crinia signifera	Common Froglet	
Niveoscincus metallicus	Metallic Skink	
Litoria ewingii	Southern Brown Tree Frog	
Litoria verreauxii	Verreaux's Tree Frog	
Limnodynastes tasmaniensis	Spotted Marsh Frog	
Acrobates pygmaeus	Feathertail Glider	
Megascolides-2		
Megascolides australis	Giant Gippsland Earthworm	VU
Phascolarctos cinereus	Koala	
Raniformis-1		
Acanthiza lineata	Striated Thornbill	
Acanthiza pusilla	Brown Thornbill	
Acanthiza reguloides	Buff-rumped Thornbill	
Acanthorhynchus tenuirostris	Eastern Spinebill	
Anas superciliosa	Pacific Black Duck	
Anguilla australis	Shortfin Eel	
Anthochaera carunculata	Red Wattlebird	
Cacomantis flabelliformis	Fan-tailed Cuckoo	
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo	
Chrysococcyx lucidus	Shining Bronze-Cuckoo	
Colluricincla harmonica	Grey Shrike-thrush	
Cormobates leucophaeus	White-throated Treecreeper	
Corvus coronoides	Australian Raven	
Corvus mellori	Little Raven	
Cracticus torquatus	Grey Butcherbird	
Crinia signifera	Common Froglet	
Dacelo novaeguineae	Laughing Kookaburra	

Table 2 Fauna Species recorded within a 1-km radius of the Karoon Gas 2006-07 proposed drilled sites (as supplied by DSE, 2006)		
Scientific Name	**Common Name**	**Status**
Daphoenositta chrysoptera	Varied Sittella	
Dicaeum hirundinaceum	Mistletoebird	
Eopsaltria australis	Eastern Yellow Robin	
Euastacus kershawi	Gippsland Spiny Cray	
Falcunculus frontatus	Crested Shrike-tit	
Gadopsis marmoratus	River Blackfish	
Gymnorhina tibicen	Australian Magpie	
Hirundo neoxena	Welcome Swallow	
Lichenostomus leucotis	White-eared Honeyeater	
Litoria ewingii	Southern Brown Tree Frog	
Litoria verreauxii	Verreaux's Tree Frog	cmp
Malurus cyaneus	Superb Fairy-wren	
Megascolides australis	Giant Gippsland Earthworm	VU
Melithreptus brevirostris	Brown-headed Honeyeater	
Melithreptus lunatus	White-naped Honeyeater	
Nannoperca australis	Southern Pigmy Perch	
Nannoscincus maccoyi	McCoy's Skink	
Neochmia temporalis	Red-browed Finch	
Niveoscincus metallicus	Metallic Skink	
Pachycephala pectoralis	Golden Whistler	
Pachycephala rufiventris	Rufous Whistler	
Paratya australiensis	Common Freshwater Shrimp	
Pardalotus punctatus	Spotted Pardalote	
Perca fluviatilis	Redfin	*
Petroica multicolor	Scarlet Robin	
Phylidonyris pyrrhoptera	Crescent Honeyeater	
Platycercus elegans	Crimson Rosella	
Rhipidura fuliginosa	Grey Fantail	
Salmo trutta	Brown Trout	*

Table 2 Fauna Species recorded within a 1-km radius of the Karoon Gas 2006-07 proposed drilled sites (as supplied by DSE, 2006)		
Scientific Name	**Common Name**	**Status**
Saproscincus mustelinus	Weasel Skink	
Sericornis frontalis	White-browed Scrubwren	
Sturnus vulgaris	Common Starling	*
Threskiornis molucca	Australian White Ibis	
Trichosurus vulpecula	Common Brushtail Possum	
Wallabia bicolor	Black Wallaby	
Zoothera lunulata	Bassian Thrush	

Status Key

CR Critically Endangered
EN Endangered
VU Vulnerable
R/R Rare
NT Low Risk, Near Threatened (l in VFD output)
R/C Restricted colonial, breeding or roosting sites.
DD Data Deficient, Insufficient data.
RX Regionally Extinict
EX Presumed extinct
Cmp Comprising several taxa
* Introduced species

Appendix 2: STAKEHOLDERS CONSULTATION LOG

Date	Person	Details
25/08/2006	Wayne Notman (Owner of Megascolides-1 site)	§ Discussed Megascolides 1 & proposed #2 site and nearby landowners. § Visited McCullums Rd and walked onto Mega 2 property § He was happy with current status / agreement which had lapsed. Advised by Lino (Karoon Rep) that new agreement was on way. § Mentioned damage to Mega 1 fencepost damaged by egressing rig truck. Lino advised him to submit bill. § Didn't know anyone at Hallora site.
25/08/2006	Graham Kestle (Owner of the campsite)	§ First met David Kestle (son) and had brief chat about business / campsite. § Discussed with Graham proposed campsite use. Graham said no problem previously and seemed happy for similar arrangement this time. § Noise hadn't been a problem during 2004 drilling program
12/09/2006	Paul Rowse (lessee of proposed Mega 2 site).	§ Presentation on Karoon. § Happy for operations to occur. § Visited site. He leases off Mrs Marler and subleases current padock to a 3rd party on short term arrangement. Indicated 0.5+ ML of water available and could be pumped to site. Signed authority to enter for survey (subject owner Mrs Marler approval). § Would like high stakes if peg site.
12/09/2006	Vic & Deb Guastella (owner of proposed Raniformis-1)	§ Presentation on Karoon. § Seemed relatively happy for operations to occur. § Indicated no water available / suggested bore or possible ex creek. Gave ok to enter for survey. § Don't do earthworks.
12/09/2006	Mrs Diane Sydenham (owner with husband Alan of property close to Guastella Ran-1 site)	§ Advise of possible drilling.
12/09/2006	Graham Kestle (owner of the Camp site)	Graham & son-in-Law John indicated no issues on the re-use of the land as campsite.

Date	Person	Details
12/09/2006	Mrs Jean Marler (owner of the proposed Megascolides-2 site)	§ Presentation on Karoon. § Indicated Paul Rowse had no lease and dealings should be with Mrs M. Undisclosed issues with Paul R. § Seemed relatively happy / inquisitive re operations & longer term plan / compensation if go to prod phase. § At Cr van L request declined to sign authority to perform surveys however would revert by end of week. § Indicated water available / suggested ex Kincaids rather than ex Paul. Suggested Paul didnt own water rights / suggested he may have had access. Ok with Wayne doing lease, has good reputation.
12/09/2006	Ken Rowse (Owner of the Motor Business opposite proposed Megascolides-2)	§ Discussed drilling site / noise/ water. § Ken advised he & Kincaids owned water however Paul had lease rites but was in default over. Paul (?) has a water line to top of hill however could be cut off by Ken. Also Ken has line to tank on hill above house at 70 bbl / day. Feeling water was available. § Son also at garage queried noise. Mentioned noise survey / hotel relocation. Location should be on far side of hill. Suggested access by Marler house. We'd mentioned use of access opposite Motor business.
12/09/2006	Wayne Notman (owner of the Megascolides-1 site)	§ Promised follow up on lease. Told him of possible site modification. § WN would prefer not to cross boundary fence to west (into son Troy's property) nor to go to north into other paddock (grazing at a premium). § Happy to dig out into bank to east. Indicated trucks went behind sump on lower level last time. Awaits updated site plan.
13/09/2006	Dick Van Leewen	Email to D VL providing Entry Agreement.
18/09/2006	Jean Marler (owner of the proposed Megascolides-2 site)	Letter from JM to MW with Entry Agreement and noting grading of land.
18/09/2006	Jean Marler (owner of the proposed Megascolides-2 site)	MW Letter to JM thanking for Entry Agreement and returning signed agreement.

Date	Person	Details
19/09/2006	Mrs Jean Marler (owner of the proposed Megascolides-2 site)	LB rang and advised of earthworm survey on 21/9/06
19/09/2006	Vic & Deb Guastella (owner of proposed Raniformis-1)	LB rang and advised of earthworm survey on 21/9/06
25/09/2006	Mrs Jean Marler (owner of the proposed Megascolides-2 site)	LB rang and advised of surveyor work on 27/9/06
26/09/2006	Vic & Deb Guastella (owner of proposed Raniformis-1)	LB rang Debra and advised of surveyor work on 27/9/06
26/09/2006	Alan Sydenham (owner of property close to Guastella Ran-1 site)	MW Letter including Entry Agreement, Landowner FAQs and general info on project
26/09/2006	Alan Sydenham (owner of property close to Guastella Ran-1 site)	§ Discussed project in general. § Indicated that we would be returning to discuss means of mitigating operational problems.
27/09/2006	Vic & Deb Guastella (owner of proposed Raniformis-1)	She advised that Alan Sydenham had visited them the previous evening expressing concern about Karoon's plans.
27/09/2006	Vic & Deb Guastella (owner of proposed Raniformis-1)	Vic welcomed entry to lease site from his gate about 300m further down Main south road
27/09/2006	Ran-1	Dropped letter from JP Kenny into Sydenham letterbox- contains background letter and Entry Agreement

Appendix 2: HSEQ POLICY

HEALTH, SAFETY, ENVIRONMENTAL AND QUALITY POLICY

Upstream Petroleum is committed to providing safe and healthy workplaces for our personnel and minimising our impacts on the environment by:

- Maintaining a simple and effective management system that complies with internationally recognised standards on quality, safety and environmental management, focussed on continuous improvement.
- Ensuring a safe and healthy working environment for our personnel and control workplace risks to personnel and the environment to as low as reasonably practicable.
- Promoting safety, environmental and quality awareness and continuous improvement amongst our personnel by establishing measurable targets and objectives.
- Comply with all applicable statutory requirements wherever we operate.

Signed by : .....
Cam Rathie – Managing Director
19/03/2005