Invitation to make a submission

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal.

Toro Energy Limited proposes to develop the Wiluna Uranium Project located near Wiluna, Western Australia. The project would involve mining and processing of up to about 2 million tonnes (Mt) of mineralised ore per year over an anticipated mine life of up to 14 years, producing the equivalent of about 1200 tonnes per annum of uranium oxide concentrate. In accordance with the Environmental Protection Act 1986, a draft Environmental Scoping Document (this document) has been prepared which describes the proposal and the investigations which are proposed by Toro to investigate the likely effects of the project on the environment.

The draft Environmental Scoping Document is available for a public review period of 2 weeks from 21 June 2010 closing on 5 July 2010.

Comments from government agencies and from the public will help the EPA to evaluate the suitability of the approach described by Toro in its scoping document. EPA will advise Toro of any modifications required to the proposed scope of environmental investigations and assessment.

Where to get copies of this document

Printed copies or a CD-ROM of this document may be obtained free of charge from Ms Penny Goh at (08) 9214 2100 or by emailing penny.goh@toroenergy.com.au.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Electronic submissions will be acknowledged electronically. The proponent will be required to provide adequate responses to points raised in submissions. Submissions will be treated as public documents unless provided and received in confidence, subject to the requirements of the Freedom of Information Act 1992 (FOI Act). Submissions may be quoted in full or in part in the EPA’s report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining a group interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the draft Environmental Scoping Document or the specific proposal. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal more environmentally acceptable.

When making comments on specific elements of the draft Environmental Scoping Document:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable;
- suggest recommendations, safeguards or alternatives.
Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- attempt to list points so that issues raised are clear. A summary of your submission is helpful;
- refer each point to the appropriate section, chapter or recommendation in the draft Environmental Scoping Document; if you discuss different sections of the draft Environmental Scoping Document, keep them distinct and separate, so there is no confusion as to which section you are considering;
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name;
- address;
- date; and
- whether you want your submission to be confidential. If you want your submission to be treated as confidential you should provide the reasons why.

Information in submissions will be deemed public information unless a request for confidentiality of the submission is made in writing and accepted by the EPA. A copy of each submission will be provided to the proponent, but the identity of private individuals will remain confidential to the EPA.

The closing date for submissions is: 5 July 2010

The EPA prefers submissions to be made electronically. You can e-mail your submission to the following address: submissions@epa.wa.gov.au. Alternatively, you can use the submission form on the EPA’s website: www.epa.wa.gov.au/submissions.asp;

If you do not have access to email or you prefer to make a hard copy submission, you can post your submission to:

The Chairman, Environmental Protection Authority,
Locked Bag 33
CLOISTERS SQUARE WA 6850
Attention: Mr Ray Claudius

Hard copy submissions can be hand delivered to:

Environmental Protection Authority
Level 4, The Atrium
168 St Georges Terrace, Perth
Attention: Mr Ray Claudius

You can fax your submission to: (08) 6467 5562.
### Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>ALARA</td>
<td>As Low As Reasonably Achievable</td>
</tr>
<tr>
<td>ANZECC</td>
<td>Australian and New Zealand Environment Conservation Council</td>
</tr>
<tr>
<td>ANZMEC</td>
<td>Australian and New Zealand Minerals and Energy Council</td>
</tr>
<tr>
<td>ARPANSA</td>
<td>Australian Radiation Protection and Nuclear Safety Agency</td>
</tr>
<tr>
<td>ASNO</td>
<td>Australian Safeguards and Non-Proliferation Office</td>
</tr>
<tr>
<td>BoM</td>
<td>Bureau of Meteorology</td>
</tr>
<tr>
<td>CCD</td>
<td>Counter Current Decantation</td>
</tr>
<tr>
<td>CDNTS</td>
<td>Central Desert Native Title Services</td>
</tr>
<tr>
<td>CSIRO</td>
<td>Commonwealth Scientific and Industrial Research Organisation</td>
</tr>
<tr>
<td>DEC</td>
<td>Department of Environment and Conservation</td>
</tr>
<tr>
<td>DEWHA</td>
<td>Department of Environment, Water, Heritage and the Arts (Commonwealth)</td>
</tr>
<tr>
<td>DIA</td>
<td>Department of Indigenous Affairs</td>
</tr>
<tr>
<td>DITR</td>
<td>Department of Industry, Tourism and Resources</td>
</tr>
<tr>
<td>DoCEP</td>
<td>Department of Consumer and Employment Protection</td>
</tr>
<tr>
<td>DMP</td>
<td>Department of Mines and Petroleum</td>
</tr>
<tr>
<td>DoH</td>
<td>Department of Health</td>
</tr>
<tr>
<td>DoIR</td>
<td>Department of Industry and Resources (now DMP)</td>
</tr>
<tr>
<td>DoW</td>
<td>Department of Water</td>
</tr>
<tr>
<td>DRET</td>
<td>Department of Resources, Energy and Tourism</td>
</tr>
<tr>
<td>DRF</td>
<td>Declared Rare Flora</td>
</tr>
<tr>
<td>ESD</td>
<td>Environmental Scoping Document</td>
</tr>
<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Authority</td>
</tr>
<tr>
<td>GDA</td>
<td>Geocentric Datum of Australia</td>
</tr>
<tr>
<td>OEPA</td>
<td>Office of the Environmental Protection Authority</td>
</tr>
<tr>
<td>EPBC Act</td>
<td>Environment Protection and Biodiversity Conservation Act 1999</td>
</tr>
<tr>
<td>ERMP</td>
<td>Environmental Review and Management Program</td>
</tr>
<tr>
<td>GDE</td>
<td>Groundwater Dependent Ecosystem</td>
</tr>
<tr>
<td>GM</td>
<td>Geiger Muller</td>
</tr>
<tr>
<td>HDPE</td>
<td>High Density Polyethylene</td>
</tr>
<tr>
<td>IAEA</td>
<td>International Atomic Energy Agency</td>
</tr>
<tr>
<td>IBRA</td>
<td>Interim Biogeographic Regionalisation for Australia</td>
</tr>
<tr>
<td>ICRP</td>
<td>International Commission on Radiological Protection</td>
</tr>
<tr>
<td>MRWA</td>
<td>Main Roads Western Australia</td>
</tr>
<tr>
<td>NEPM</td>
<td>National Environmental Protection Measure</td>
</tr>
<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
</tr>
<tr>
<td>NOHSC</td>
<td>National Occupational Health and Safety Commission</td>
</tr>
<tr>
<td>NORM</td>
<td>Naturally occurring radioactive material</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Cooperation and Development</td>
</tr>
<tr>
<td>OES</td>
<td>Outback Ecology Services</td>
</tr>
<tr>
<td>PEC</td>
<td>Priority Ecological Community</td>
</tr>
<tr>
<td>pH</td>
<td>degree of alkalinity/acidity</td>
</tr>
<tr>
<td>RMP</td>
<td>Radiation Management Plan</td>
</tr>
<tr>
<td>RO</td>
<td>Reverse Osmosis</td>
</tr>
<tr>
<td>SDU</td>
<td>Sodium Diuranate</td>
</tr>
<tr>
<td>SRE</td>
<td>Short Range Endemic</td>
</tr>
<tr>
<td>TEC</td>
<td>Threatened Ecological Community</td>
</tr>
<tr>
<td>TSP</td>
<td>Total Suspended Particulates</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
</tr>
<tr>
<td>UOC</td>
<td>Uranium oxide concentrate</td>
</tr>
<tr>
<td>WNA</td>
<td>World Nuclear Association</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>$2\sigma$</td>
<td>Two sigma means “two standard deviations”. In a normally distributed population, 95% of the results lie within about 2 standard deviations of the mean value.</td>
</tr>
<tr>
<td>Bq</td>
<td>Becquerel, a unit of radioactivity</td>
</tr>
<tr>
<td>Bqm$^{-3}$</td>
<td>Becquerels per cubic metre. A volumetric measure of radioactivity.</td>
</tr>
<tr>
<td>$\text{CO}_{2\text{eq}}$</td>
<td>Carbon dioxide equivalent</td>
</tr>
<tr>
<td>GLpa</td>
<td>Gigalitres per year. One gigalitre is equal to 1,000,000,000 litres, or one million cubic metres.</td>
</tr>
<tr>
<td>Ha</td>
<td>Hectare</td>
</tr>
<tr>
<td>km</td>
<td>Kilometre</td>
</tr>
<tr>
<td>m</td>
<td>Metre</td>
</tr>
<tr>
<td>mg</td>
<td>Milligram. One thousandth of a gram.</td>
</tr>
<tr>
<td>mg/L</td>
<td>Milligram per litre, approximately equivalent to one part per million</td>
</tr>
<tr>
<td>$\mu$m</td>
<td>Micro or micrometre, a unit of length equal to one millionth part of a metre</td>
</tr>
<tr>
<td>mSv</td>
<td>Millisievert, a measure of radiation dose to tissue</td>
</tr>
<tr>
<td>Mtpa</td>
<td>Mega tonnes per annum. Same as “million tonnes per year”.</td>
</tr>
<tr>
<td>MW</td>
<td>Megawatt</td>
</tr>
<tr>
<td>ozpa</td>
<td>Ounces per annum, a measure of gold production</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>Particulate matter having an equivalent aerodynamic diameter equal to or less than 10 micrometres (a micrometre is one millionth of a metre)</td>
</tr>
<tr>
<td>TDS</td>
<td>Total dissolved solids</td>
</tr>
<tr>
<td>tpa</td>
<td>Tonnes per annum</td>
</tr>
<tr>
<td>$\mu$g/m$^3$</td>
<td>Micrograms per cubic metre</td>
</tr>
<tr>
<td>$\mu$S/cm</td>
<td>Microsiemens per centimetre, a measure of electrical conductivity</td>
</tr>
</tbody>
</table>

**Note on uranium product terminology**

Uranium is priced and sold as “U$_3$O$_8$ equivalent”. Depending upon the processing method, the actual chemical composition of any uranium product may contain more water or oxygen than the compound U$_3$O$_8$, hence the term “uranium oxide concentrate” (UOC) is used to cover a variety of uranium oxides. The product that would be produced at Wiluna has the chemical formula UO$_4$.2H$_2$O. This product contains about 70% uranium (by weight), compared to 85% uranium in U$_3$O$_8$. In order to present information in a way that is consistent with usual industry practice, the production quantities described in this scoping document may be expressed as U$_3$O$_8$ equivalents. The planned production for the Wiluna uranium project is 1200 tonnes per year of UO$_4$.2H$_2$O, which is approximately equivalent to 1000 tonnes per year of U$_3$O$_8$. 

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1 Introduction

Toro Energy Limited (Toro) is seeking approval to develop the Wiluna Uranium Project (the project) located near Wiluna, Western Australia. The project would involve mining up to about 2 million tonnes (Mt) of mineralised ore per year over an anticipated mine life of up to 14 years, producing up to 1200 tonnes per annum (tpa) of uranium oxide concentrate.

1.1 Purpose of document

Toro submitted a Referral for the project to the Western Australian Environmental Protection Authority (EPA) on 27 October 2009. The EPA set the level of assessment at an Environmental Review and Management Programme (ERMP).

Toro submitted a referral document (Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Reference no: 2009/5174) on 27 October 2009 to the Federal Department of the Environment, Water, Heritage and the Arts (DEWHA). On 27 November 2009 DEWHA determined that the proposal is a controlled action and that the proposal will be assessed under the bilateral agreement between the Federal and Western Australian State governments.

This Environmental Scoping Document (ESD):

- Describes the key elements of the Wiluna Uranium Project for which Toro will be seeking approval under Section 38 of the Environmental Protection Act 1986.
- Describes the alternatives considered prior to selecting the preferred option
- Identifies the proponent of the project
- Provides a summary of baseline environmental studies that have been completed and describes the social and biophysical setting in which the project would be implemented
- Summarises potential environmental (including cumulative) and social impacts, their significance and management responses
- Outlines the additional investigations planned to enable a realistic and robust assessment of the project’s potential environmental impacts to be finalised
- Discusses Key Environmental Factors and Principles for the project
- Identifies the statutory regime for the project
- Explains community consultation undertaken so far and outlines the ongoing consultation programme planned for the future
- Serves as the basis for the preparation of the ERMP which will be available for public comment for a 14 week period.

1.2 Proponent

Toro Energy Limited is the proponent of the Wiluna Uranium Project.

Toro (ABN 48 117 127 590) was listed on the Australian Stock Exchange in March 2006. Toro is an Australian resource company pursuing a strategy to become a significant and sustainable producer of uranium. Wiluna is Toro’s first project. Toro’s Wiluna project team is based in Perth.

The key contact for this proposal is:

Mr Richard Dossor, Project Director
Ph  + 61 8 9214 2100
Fax  + 61 8 9226 2958
Email: richard.dossor@toroenergy.com.au

Toro’s head office is in Adelaide:

Toro Energy Limited
3 Boskenna Avenue
NORWOOD, SA 5067
Phone  08 81325600
Website – http://www.toroenergy.com.au
1.3 Brief overview of project

The Wiluna Uranium Project involves the development of a uranium mine (in two deposits), associated processing plant and support infrastructure and the transport of product within Australia for export. The principal components of the project are the subject of optimisation studies and include:

- Construction and operation of a uranium mine;
- Construction and operation of an ore processing, packing and handling facility;
- Support facilities including an accommodation village, water supply from a local borefield, haul roads, power generation and transmission facilities, communications systems and water and waste management;
- Transport of the product to Darwin or Adelaide for export; and
- Rehabilitation and closure of the mine and other areas disturbed by mining and related activities.

The project area is located within the Lake Way and Millbillillie pastoral leases, south and southeast of Wiluna.

2 Project Description

2.1 Overview and project setting

The Wiluna Uranium Project is based on mining two known deposits: the Centipede deposit and the Lake Way deposit. The project is located to the south and southeast of the town of Wiluna. The Centipede deposit is approximately 30 km south of Wiluna, near the centre west margin of the Lake Way playa. The Lake Way deposit is at the northern end of the Lake Way playa, approximately 15 km southeast of Wiluna (Figures 1 and 2).

The Centipede deposit is predominantly within mining tenement M53/224, covering an area approximately 4 km long and up to 1.5 km wide, while the Lake Way deposit is within MLA53/1090 and has an areal extent of approximately 4 km long by 2.5 km wide. Minor uranium resources are known to the west of the Centipede deposit, along the Abercromby palaeochannel system.
Figure I Regional location plan
Figure 2 Wiluna Uranium Project – location plan
Figure 3 Wiluna Uranium Project – proposed operations layout
2.2 Project Justification

The principal use of uranium is in power generation. Nuclear power currently accounts for about 16% of total world electricity generation. In some countries, nuclear power generation accounts for a very substantial proportion of total power generation. France, for example derives more than three-quarters of its electricity supply from nuclear fuel. Uranium is also used in the production of medical and industrial isotopes.

Nuclear power, unlike hydrocarbon fuels (petroleum, natural gas, coal), does not generate greenhouse gases directly. Even when the energy used to produce uranium fuel (including mining, processing, waste management, and facility construction and decommissioning) is taken into account, nuclear fueled power generation results in much lower greenhouse gas emissions per kilowatt hour than electricity generated using fossil fuels. It is estimated that nuclear-powered electricity generation currently avoids the emission of about 2.1 billion tonnes of CO₂eq every year (Foratom, 2009).

Global uranium demand for electricity production is currently about 68,000 tpa (equivalent to approximately 81,000 tpa of U₃O₈) (World Nuclear Association, 2010). It is anticipated that this could increase very significantly over the next twenty years as global energy consumption increases and as nuclear power replaces higher carbon emission generation (IAEA, 2008). The United States is currently the world’s largest producer of nuclear power, accounting for slightly less than 31% of total global nuclear energy generating capacity. The potential future growth in nuclear power generation is mainly concentrated in Asia, which currently accounts for approximately 5% of global nuclear power production (IEA, 2009).

Uranium used in generating electricity can come from primary sources (uranium mines) or secondary sources (recycled uranium from stockpiled nuclear weapons; recycling of used nuclear fuel; recovery of uranium as a by-product from coal ash or other commodities).

Australia is a major supplier of primary uranium (third largest producer in the world in 2009 after Kazakhstan and Canada – World Nuclear Association, 2010b) and is estimated to have about 23% of the world’s recoverable uranium, followed by Kazakhstan at 15% and Russia at 10% (OECD / NEC / IAEA, 2007).

About 70% of the current global demand for uranium is met from primary production, with the balance from secondary sources. Because of growing demand for uranium and an anticipated continuing reduction in secondary supplies, an increased requirement for new primary production in the near term is forecast.

The major justification for the project is to respond to the strong medium to long term outlook for increased uranium demand to support nuclear power generation.

The project would provide benefits, particularly in regional Western Australia, including –

- Full-time employment during construction for up to 350 people, and 170 during the operational phase, with flow-on impacts on service industries;
- Employment, training and other community benefits to the local Wiluna community;
- Contributions to the community of Wiluna delivered through a Regional Partnership Agreement; and
- Contribution to the State economy resulting from royalties, taxes and the purchase of goods and services.
2.3 Key project characteristics (indicative)

The indicative key design and operational characteristics of the Wiluna uranium project are summarised in Table 1. Final key characteristics will be presented in the ERMP.

Table 1 Key project characteristics (indicative)

<table>
<thead>
<tr>
<th>Project Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational purpose</td>
<td>Mining of uranium mineralised ore and production of uranium oxide concentrate over a nominal project life of up to 14 years, based on current resources.</td>
</tr>
<tr>
<td>Location of operations</td>
<td>Approximately 500 km north of Kalgoorlie and between 15 and 30 km south of Wiluna</td>
</tr>
<tr>
<td>Annual production</td>
<td>Up to 1200 tpa uranium oxide concentrate</td>
</tr>
<tr>
<td>Mining method</td>
<td>Open pit, using surface miners and excavators. No blasting is required.</td>
</tr>
<tr>
<td>Estimated ground disturbance</td>
<td>~1200 ha</td>
</tr>
<tr>
<td>Processing method</td>
<td>Option 1: Crushing and screening followed by alkaline heap leach and direct uranium precipitation or Option 2: Crushing and grinding followed by agitated alkaline leach (in vessels) and direct uranium precipitation.</td>
</tr>
<tr>
<td>Power requirement</td>
<td>For Option 1 up to 4MW and for Option 2 up to 12 MW of on-site diesel or gas power generation.</td>
</tr>
<tr>
<td>Water requirement</td>
<td>For Option 1 up to 0.8 GLpa and for Option 2 up to 2.5 GLpa, sourced from an underground aquifer.</td>
</tr>
<tr>
<td>Main process reagents and fuels</td>
<td>Sodium carbonate and sodium bicarbonate (reagents), sulphuric acid (for pH control), diesel fuel</td>
</tr>
<tr>
<td>Access</td>
<td>Access to mine operations areas will be by the existing Goldfields and Gunbarrel highways. The existing Wiluna airport will be used for fly in-fly out personnel.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other key infrastructure elements</td>
<td>Accommodation village, water supply borefield and associated pipeline, communications infrastructure</td>
</tr>
<tr>
<td>Project timing</td>
<td>Construction to start in 2012 with commercial uranium production to commence in 2013.</td>
</tr>
<tr>
<td>Workforce</td>
<td>Construction – up to 350; Operations – up to 170</td>
</tr>
</tbody>
</table>

2.3.1 Tenure and land use

The land on which the project would be established is Crown Land. The Centipede deposit is predominantly within granted mining tenement M53/224, covering an area about 4 km long and up to 1.5 km wide. The Lake Way deposit is within applied for tenement MLA53/1090 and has an areal extent of about 4 km long by 2.5 km wide. Toro holds the uranium rights over the tenements included in this proposal.

The current predominant land use in the project area is pastoral. Both the Lake Way pastoral lease (3114/1164) and the Millbillillie pastoral lease (3114/1260), over which the project lies, are stocked with cattle. Lake Way was re-stocked in 2000.

The registered lessee for both the Lake Way and Millbillillie pastoral leases is Oz Minerals Agincourt & Wiluna Exploration Pty Ltd, a wholly owned subsidiary of Album Investment Pte Ltd, registered in Singapore and ultimately a subsidiary of the China MinMetals Non-ferrous Metals Co. Ltd.

Aboriginal interest in the project area is expressed through two native title claimant groups, the Wiluna and Tarlpa claims. Toro has been working through Central Desert Native Title Services (CDNTS), as the representative body for the region pursuant to the Native Title Act, to build relationships with the native title groups.
The Wiluna area has attracted mining activity since the discovery of gold in 1896 with more than 4 million ounces produced since mining began. Commercial scale production of arsenic occurred in the 1930s (Heritage Council of WA, 2002). Current gold mining operations in the Wiluna area are:

- The Wiluna Gold Mine, about 3 km south of the town, operated by Apex Minerals NL. In August 2007 the mine was closed for refurbishment and resource definition, with operations re-starting late in 2008 based on a plan to mill up to 1 Mtpa, producing initially 150,000 ounces per annum (ozpa) and building up to 200,000 ozpa from mining leases covering about 50 square kilometres, and

- Jundee gold mine, in the heart of the Yandal goldfield, almost 50 km north east of Wiluna. Operated by Newmont, production began in 1995 and continues from two underground mines, with the possibility of operations being extended by some recent near-mine ore discoveries.

Other mining operations in the Wiluna region include:

- Magellan Metals has an open pit mine 30 km west of Wiluna. The operation has been producing lead carbonate concentrate intermittently since 1995 from a treatment and concentrating plant.

- Golden West Resources is exploring the Wiluna West iron ore project about 40 km west of Wiluna. The Wiluna West Project has a current total mineral resource estimate of 141 million tonnes at 59% Fe.

2.3.2 Site preparation

Site preparation will consist of the progressive clearing of vegetation and topsoil prior to mining and processing activities. Vegetation and topsoil will be stockpiled separately to ensure maximum reuse of these resources in subsequent rehabilitation.

2.3.3 Mining

The uranium mineralisation for both resources is typically contained within a mineralised zone lying at a depth between 1m and 12m below surface. The orebody varies in thickness up to a maximum thickness of about 6.5m. The mineralised zones are laterally extensive but vertically can be irregular, with some areas of very low grade or barren material occurring within the overall mineralised zone. The detailed geology shows that the mineralisation is hosted within a typical fluvial/deltaic sequence of shallow surficial sediments ranging from narrow clay layers to areas of coarse sand and grit with minimal clay.

The shallow nature and relatively broad areal extent of the resources means that the mineral resources will be mined by open pit mining methods. The mining method selected is based on surface miners as the primary ore fleet and conventional excavators for the waste mining. Surface miners (Figure 4) are continuously operating precision machines, well suited to mining of relatively low strength materials. They offer particular advantages in situations where variable ore grades necessitate selective excavation to segregate mineralised and non-mineralised materials.

Figure 4 Surface miner

Mining would occur in a 24 hour operation with ore mining being undertaken on day shift and waste mining being completed predominantly on...
night shift. Ore mining would be achieved using the surface miner to cut 0.25m benches in ore. A loader would be used to place the ore into mine trucks. Waste mining would be completed on 1m to 2m benches using excavators and mine trucks. Both the Centipede and Lake Way deposits are “free-digging”, and require no pre-drilling or blasting.

The ore mining rate would ramp up over one year to an ore mining rate of approximately 2 Mtpa. At Centipede this would require approximately 6 Mtpa of waste rock to be moved. At Lake Way approximately 8 Mtpa of waste rock would be mined.

2.3.4 Soil and waste rock management

Surface soil cover would be stripped and stockpiled separately to be placed over the areas of backfilled pits as part of the ongoing rehabilitation. Non-mineralised overburden and waste rock would either be stockpiled next to the pit being mined or backfilled into suitable nearby mined out areas. The waste rock arising from mining is non-acid forming.

2.3.5 Dewatering

Much of the uranium resource occurs at or below the water table and dewatering of the open pits would be required. The water table is typically between 0.5m and 5m below the natural ground surface. The groundwater is contained within the shallow sediments of the delta environment and is very saline, about three times the salinity of seawater. The groundwater quality typically becomes less saline with distance away from the lake.

To minimise the amount of water to be pumped from the pits, Toro proposes to develop water barriers either as compacted, backfilled perimeter trenches or by creating a geopolymer barrier around the pit void. Trenches would be dug with an excavator and the material from the trenches backfilled and compacted into the trench. Bentonite (a type of clay mineral) or a similar product may be added to reduce the permeability of the barrier if required. A trial of this method was completed in 1979 at Lake Way with a 90% reduction in water inflows being estimated.

A geopolymer barrier is created by drilling closely spaced holes and injecting the geopolymer into the ground. The geopolymer then reacts with the groundwater and rock to form a solid barrier. Both options are planned to be trialled during project feasibility studies.

Groundwater pumped from the pits would either be recharged to the aquifer or disposed of to evaporation ponds, depending upon the character and quantity of the discharge.

2.3.6 Water requirements

The total water demand for the project is estimated to be up to 2.5 GLpa depending on the process option selected. A water treatment plant is required to produce approximately 32 m³/h of demineralised water for steam generation. Approximately 5 m³/h of potable-quality water (less than 1000 mg/L total dissolved solids) would be required for product washing and for camp and plant amenities. This high quality water would be generated by a small reverse osmosis plant.

It is proposed to refurbish and upgrade a disused borefield at West Creek, located on Miscellaneous Licence L53/150, approximately 10 km southwest of Wiluna, as the primary water supply for the project. Other areas of potential water supply are currently being investigated. Figure 5 shows the indicative water circuit proposed for the Wiluna uranium project.
Figure 5  Water circuit diagram (conceptual)

Figure 6  Process diagram (schematic)
2.3.7 Processing

The preferred ore processing method for the Wiluna Uranium Project is alkaline heap leach to produce a uranium oxide concentrate via direct precipitation of sodium di-uranate ("SDU"). However, Toro is still considering the use of a more conventional agitated leach process. Schematic diagrams showing the preferred and alternative ore processing methods are presented in Figures 7 and 8.

2.3.7.1 Option 1: Alkaline heap leach

Mined ore would be stockpiled prior to blending, crushing and (if required) agglomeration. Ongoing test work will determine if agglomeration (using a binding agent such as Portland cement) is required to enhance percolation of extractant solution through the heap.

The heap leach circuit design has been based on utilising an "on-off" heap leach pad. However, investigations will be undertaken to determine if in-pit heaps can be established instead of the proposed on-off system. An in-pit system would reduce energy consumption by reducing the need for ore handling and haulage.

Construction of the heap leach pad and under-drainage system would be based on a triple layer liner to provide protection against leakage of uranium-bearing solutions into the environment. The three layers making up the pad would comprise a base of compacted clay over which would be laid a high density polyethylene (HDPE) membrane. A leak detection layer of sand would be placed on top of the first HDPE membrane, and a second layer of HDPE placed on top of the sand. Drainage pipes would be laid on top of the second HDPE layer and coarsely crushed low grade uraniferous ore placed on top to facilitate drainage.

The "on-off" heap is effectively a batch process carried out at ambient temperatures. The ore excavated from the pit void would be placed on an engineered leach pad. A grizzly screen and ore bin would be used in conjunction with conveyors and a stacker to construct the heap/dumps to a stack height of 6m. An alkaline solution of sodium carbonate with a pH of about 9 to 10 would be applied to the ore heap via a trickle irrigation system to extract uranium from the ore. The pregnant liquor solution would be continuously circulated over the dump and returned to a pregnant liquor solution pond. The leaching would be undertaken for extended periods of time (up to 10 months) by recycling the leach solution through the dump. After approximately 240 days the dump would be flushed with clean water to recover soluble uranium and reagent and to neutralise the material from which uranium has been extracted. After washing, the spent heaps would be returned to the mine void for final safe storage.

The uranium contained in the pregnant liquor solution would be precipitated as uranyl peroxide (UO$_2$2H$_2$O), which then would be dried in an automated and fully contained furnace, packaged and shipped. The heap leach process would produce up to 1200 tpa of uranyl peroxide product (equivalent to approximately 1000 tpa of U$_3$O$_8$). More detail on the processing of ore and transport of product is provided below.

2.3.7.2 Option 2: Agitated tank leach

Ore from the mine would be delivered by truck to a milling circuit comprising a single semi-autonomous grinding mill ("SAG mill"). The mill operates in closed circuit with classifying cyclones to produce a grinding circuit product with a P$_{80}$ greater than 300 µm.

Cyclone overflow would flow by gravity to the leach feed thickener, where it is thickened prior to being pumped to the leach circuit.
Figure 7 Alkaline heap leach process

Figure 8 Conventional agitated leach process
Leaching (agitated leach process)
Leaching of the slurry would be undertaken at normal atmospheric pressure in a series of five mechanically agitated leach tanks. Steam would be injected into the tanks to heat and maintain the slurry at the operating temperature of 95°C. No additional air or oxygen would be required as the uranium species in the carnotite ore would already be in the oxidised (hexavalent) state. Leaching would be undertaken in alkaline conditions by the addition of sodium carbonate. A residence time of 18 hours would be required to obtain a leach uranium recovery in excess of 90%. The uranium would react to form the soluble uranyl tri-carbonate complex ion. A portion of the vanadium associated with the carnotite would also be leached into solution. Some of the carbonates would react with clays and other minerals within the calcrete to form bicarbonate. The leached slurry would then be pumped into the counter current decant (CCD) thickeners for recovery of leach solution and washing of leach residue solids.

Solid-liquid separation (agitated leach process)
A seven stage CCD circuit would be used to recover leach solution and wash the leach residue (solids). Solution flow would be counter current to solids flow. Underflow from the final stage of the CCD would be pumped to the Tailings Storage Facility (TSF).

The CCD circuit would be designed as a split wash circuit in order to minimise overall plant water requirements. Barren liquor from the precipitation circuit would be recycled in part as wash water to minimise carbonate losses. Process water would be used as final wash to achieve an overall CCD solution recovery of 98%.

Evaporation and clarification (agitated leach process)
A portion of the CCD overflow would be pumped to the plant via the Evaporation Pond, which would evaporate excess solution for water balance purposes. The pond would be sized based on an evaporation rate 75% of the reported pan evaporation for the Wiluna region. Pregnant liquor solution (PLS) would be recovered from the evaporation pond and pumped to a Pin Bed Clarifier (PBC).

SDU precipitation (agitated leach process)
The clarified solution would be heated to 85°C and uranium would be recovered as uranium oxide via a process that would begin with the precipitation of sodium diuranate (SDU) using sodium hydroxide.

The solution is returned to the CCD via a carbonation process where carbon dioxide from power station exhaust gases is captured and dissolved to enhance the extraction process.

Vanadium removal (both process options)
The SDU precipitate would be re-dissolved in sulphuric acid. Any remaining vanadium in the solution is removed by adjusting the solution pH to precipitate and separate from the solution by filtration.

Product Precipitation and Handling (both process options)
Uranium is precipitated from the solution by the addition firstly of hydrogen peroxide and secondly sodium hydroxide to precipitate uranyl peroxide. The barren solution would be returned to the leach circuit.

The product slurry would be thickened, centrifuged, dried and cooled before packaging in specially prepared 200L steel drums. The dried uranium oxide product would be cooled and packed from the storage hopper into plastic lined steel drums. The drums would be weighed, labelled, loaded onto pallets, stretch wrapped, and loaded into a shipping container for despatch by road transport to port. The details of each drum are documented in accordance with regulatory requirements prior to despatch.

2.3.8 Product packaging and transport
There are several Acts, Regulations, Codes of Practice and Guidelines which are applicable to
the handling, storage and transport of radioactive material as part of mining operations within Australia. Toro would manage product in strict accordance with the requirements of these documents. In particular, a Radiation Transport Programme would be prepared as required by the Code of Practice for the Safe Transport of Radioactive Material (ARPANSA, 2009). Product transport would comply with both the ARPANSA Code, and with other relevant State Acts and Regulations. Whilst it is noted that the International Atomic Energy Agency’s (IAEA) Regulations for the Safe Transport of Radioactive Material (2009 Edition), are not yet incorporated in Western Australian legislation, Toro would also comply with these regulations.

Packages used for the transport of radioactive materials are designed to retain their integrity during the various conditions that may be encountered while they are being transported. Product would be sealed in 205 litre steel drums which would be weighed and labelled appropriately. Each drum would be sealed with a secure seal and identified with a unique number prior to being stacked and strapped within a shipping container. Radiation clearance checks would be performed inside and outside the containers prior to removal from the Mining Lease and the results recorded. Approximately four shipping containers per month would be transported using road and/or rail infrastructure to port facilities in Darwin or Adelaide.

The Australian Safeguards and Non-Proliferation Office (ASNO) contributes to the operation and development of International Atomic Energy Agency (IAEA) safeguards and the strengthening of the international nuclear non-proliferation regime. ASNO is responsible for the issuing of permits for the transport of product along approved routes from the departure point in Australia to the destination port. Uranium is also subject to control under Regulation 9 of the Customs (Prohibited Exports) Regulations (1958). An export permit would need to be obtained from the Department of Resources, Energy and Tourism (DRET) prior to export. Toro would comply with all ASNO and DRET requirements in relation to the transport and security of UOC.

2.3.9 Supporting infrastructure

Toro expects that the following ancillary infrastructure would be required during project construction and operation:

- A power station of up to 12 MW capacity (depending on the processing method selected);
- A water supply borefield (nominally 2.5 GLpa depending on process option selected);
- Communications towers to support telephone and computer linkages;
- Workforce accommodation and amenities areas;
- Septic waste treatment and disposal facilities;
- Access / haul roads;
- Laydown areas and
- Water storage ponds, evaporation ponds, water pipeline and a reverse osmosis plant.

2.3.10 Workforce

A permanent accommodation village for an operations workforce of up to 170 personnel would be required. A temporary accommodation village for up to 350 construction personnel would also be required.

2.3.11 Radiation management


In addition, Toro would make use of international standards as the basis for its systems of radiation management. The International Commission on Radiological Protection (ICRP) is the primary
international body for radiation protection and regularly publishes guidelines in the form of formal recommendations. The most recent recommendations are contained in ICRP 103 and apply the overarching principles of:

- justification
- optimisation
- limitation

2.3.11.1 Occupational exposures
Toro Energy Limited has a Radiation Protection Policy stipulating the company’s high level commitments to radiation protection. Toro’s policy is consistent with the IAEA good practice guidelines to enable Toro to accomplish its mining and exploration objectives whilst minimising radiation exposure. Implementation of this policy is evidenced by current practices within Toro’s existing areas of operation.

Toro has made the following specific commitments:

- Keep exposures well below prescribed limits.
- Comply with all laws and regulations and adopt international best practice standards where practicable.
- Employ an appropriately qualified Radiation Safety Officer who will have the responsibility on behalf of the Managing Director for developing and implementing strategies and plans to ensure the protection of people and the environment.
- Integrate radiation protection practices with other programs protecting the health and safety of workers, the community and the environment.
- Ensure employees are appropriately trained in radiation knowledge and radiation protection;
- Commit adequate resources for the effective implementation of the Radiation Management System and the monitoring programs such that they will enable reliable assessments of radiation doses.

- Carry out regular reviews to drive continual improvement of the radiation protection system and demonstrate consistency with world best practice.

Toro has prepared a Radiation Management System (RMS) to assist the company in meeting the commitments made under the Radiation Protection Policy. The RMS provides the framework for radiation protection that will assist the company in minimising radiation exposure to workers, members of the public and the environment.


As required by The Code, a Radioactive Waste Management Plan (RWMP) will also be prepared and submitted for regulatory approval. The RWMP outlines the waste management systems that will be implemented to minimise the impact of Toro’s operations on the environment, and the monitoring programs which will demonstrate the effectiveness of these systems. The RWMP will take note of the guidelines set out in the Department of Mines and Petroleum Managing naturally occurring radioactive material (NORM) in mining and mineral processing guideline. NORM 4.2, Management of Radioactive Waste, 2010.

2.3.11.2 Public health and safety
Potential radiation exposures to the public as a result of implementing the Wiluna project will be assessed and described in the ERMP. The assessment will include the identification of all potential source terms. Throughout the project life monitoring of radiation levels at key locations would ensure that Member of Public radiation doses are calculated and submitted to the
regulators. The dose estimation methods and dose conversion factors used would be those provided in relevant guidelines issued by the International Commission on Radiological Protection (ICRP).

2.3.11.3 Environmental exposures
The effect of radiation on the biological environment will be assessed as per the general requirements of ICRP publication number 108 (*Environmental Protection: the Concept and Use of Reference Animals and Plants*) and other emerging internationally recognised practices. This assessment will form part of the documentation supplied with the ERMP.

2.3.12 Waste management
The main solid wastes arising from project implementation would include:

- Non-mineralised overburden;
- Washed heap leach solids from which uranium has been extracted or (if an agitate leach process is adopted) tailings;
- Solid by-product from the direct precipitation of uranium;
- Salt from water evaporation ponds;
- Waste materials that have been used in the process and may have been exposed to radioactive material (for example, gloves, oil filters, used parts, etc);
- General non-hazardous rubbish and septage from the mine accommodation and operations areas.

Washed heap leach solids and non-mineralised overburden would be returned to the pit voids as part of progressive mine rehabilitation. If an agitated leach process is adopted, the mill tailings will be washed then placed in the mine void for permanent disposal. A comprehensive waste management plan addressing management of both radioactive and non-radioactive wastes will be prepared and submitted as part of the ERMP.

Precipitate from the process plant would be disposed of in purpose-built containment cells or to a licensed off-site facility if it is unsuitable for on-site containment. Saline residues from evaporation ponds (including salt from the reject water produced by the reverse osmosis plant) may require encapsulation in purpose-built cells.

Domestic solid wastes would be recycled to the extent practicable. Non-recyclable materials would be disposed of to a purpose-built landfill located near the accommodation village, or would be disposed of at the Shire landfill. Septage would be treated by means of a proprietary treatment plant and disposed of in accordance with Shire of Wiluna and Department of Health requirements.

2.3.13 Rehabilitation and closure
This proposal is for a nominal 14 year life of mine. The approximate area of disturbance that would result from project implementation is 1200 ha. Most of this area comprises native vegetation, except for minor areas of existing disturbance associated with existing roads and access tracks and some existing cleared areas from previous mining trials (by others) in the project locality.

Clearing and rehabilitation or tailings would be carried out progressively, in the manner of a strip mining operation, with voids created by mining being progressively backfilled using residue and overburden from active mine pits. The maximum operational footprint at any one time would be less than 300 hectares. Initially, mining would take place at Centipede. After approximately 5 years, mining would be relocated to the Lake Way operations area.

At cessation of mining all plant would be removed from the site and final landforming and revegetation would be completed in accordance with the approved mine closure and rehabilitation plan.
2.4 Project Alternatives

2.4.1 Mining

The location and the extent of the proposed mine pits at Centipede and Lake Way are dictated by the occurrence of uranium mineralisation. There are no alternatives to the proposed location of the mine pits. However a number of alternatives were considered in relation to the method and sequence of mining, as outlined below.

There are three general methods of uranium mining: underground mining, open cut mining and in-situ leaching. The method proposed by Toro for its Wiluna project is open cut mining. The deposits at Centipede and Lake Way are too shallow to justify underground or in-situ methods.

When uranium is mined using open cut methods, it is often excavated using large trucks and shovels. Sometimes blasting is necessary to break up the rock before it can be excavated. No blasting would be required for the Wiluna project, as the ore occurs in relatively thin layers of low to medium strength rock. Toro proposes to use a machine called a surface miner to enable selective mining of the uranium ore. The surface miner is a tracked vehicle with a cutting drum which breaks up the ore.

One of the advantages of the surface miner is its ability to mine very thin layers of material. Toro proposes to enhance its ability to separate ore from non-mineralised material by using a calibrated radiation detection device. Material that registers a radiation level above the minimum ore grade would be excavated and sent for processing. Non-mineralised material would be set aside and backfilled into the pit once all ore has been removed. The proposed mining method would increase operational efficiency by reducing material handling, reducing fuel use and reducing reagent use.

2.4.2 Water Use and Management

The mineralised ore in the Wiluna project area generally lies at or slightly below the water table. In order to remove the ore, it would be necessary to remove groundwater from the pit to allow operation of mining equipment. In most conventional mining operations, pit dewatering is achieved by pumping water from in-pit sumps or by pumping water from bores located around the pit perimeter. Sometimes a combination of both methods is used.

Toro has examined the feasibility of using conventional dewatering methods, but has concluded that its preferred method of managing water flow into the pit would be to construct a barrier to limit water entry into the pit. By reducing inflows to the pit, less water would have to be discharged from the mining operation. This would significantly reduce a number of potential environmental risks, including the risk of discharging turbid or contaminated water and the risk of creating a groundwater drawdown that could affect plants or subterranean fauna that depend upon groundwater. If less water is intercepted and discharged, there is a lower risk of changing the hydrology of the area immediately around the mining operation. The overall energy use of the project would also be lower if less pumping of water is required.

Toro is considering two possible methods of controlling water inflows to its mine pits. One method involves compacting earth in a trench around the pit circumference to provide a low permeability soil barrier which would limit water flow into the pit. It is possible that an additive such as cement or bentonite (a type of clay mineral) would be added to the local soil to make the compacted soil less permeable. The second method that is under consideration involves injecting a geopolymer fluid into the ground surrounding the pit. The geopolymer solidifies and acts as a low permeability barrier to water flow.

Toro plans to trial both methods of water control as part of its further feasibility studies. The results of this work will be presented in the ERMP.

Despite the use of perimeter flow barriers, the mining operation would generate some water
requiring disposal. It is unlikely that the vertical barriers to limit groundwater inflow to the pit would be 100 percent efficient. A certain amount of water would enter the pit by upward flow through the base of the pit. Rain falling on the plant area and in the mine would also need to be managed.

Several options are being investigated for the use, treatment or disposal of surplus water from the pit or from incident rainfall. Where the water is of suitable quality, it may be used to control dust on stockpiled materials or roads. However, it is unlikely that much of the water from pit dewatering will be suitable for use in ore processing due to its very high salt content.

Water which is not suitable for dust suppression may be disposed of in purpose-built evaporation ponds, or may be recharged into the aquifer. Further studies are being conducted to investigate the most appropriate methods for disposing of surplus mine water. A water management plan will form part of the documentation submitted with the ERMP.

2.4.3 Processing

A range of alternative methods can be used to extract uranium from ore. The method used depends upon a number of factors, including the mineralogy of the ore body, the physical characteristics of the ore and the grade of the ore.

Uranium is extracted from the ore by treating it with a chemical reagent to dissolve the uranium. The solution containing the uranium is then treated to concentrate the uranium into a solid material and remove impurities. The conventional process of extracting uranium involves leaching the ore in an industrial vessel or vat. Normally this requires crushing and grinding of the ore and stirring of the ore solution as it is extracted. In-vessel leaching may be carried out at elevated pressure or temperature. Alternatively, ore can be extracted at normal atmospheric pressures and temperatures on an engineered pad. The latter process consumes less energy, but takes a longer time.

Two main types of chemical reagents are used in uranium processing: acids and alkalis. Toro proposes to use an alkaline extracting solution, sodium carbonate.

As explained in Section 2.3.7, Toro’s preferred option for the Wiluna uranium project, a heap leach extraction method, would involve recirculating carbonate solution over piles of ore which are placed on an engineered liner. It may be necessary to agglomerate the ore (form it into gravel sized lumps) by adding a small amount of cement to the ore so that the carbonate solution can flow through the ore pile. Toro is continuing to evaluate the agitated leach process option as an alternative to its preferred option of heap leach. Results of the ongoing process evaluations will be described in the ERMP.

2.4.4 Plant site options

The leach heaps would be located close to the orebody to minimise haulage costs and to avoid the need to clear large tracts of land. The plant facility and supporting infrastructure (offices, ablutions, power supply, warehouse etc) would be located in close proximity to the mine and on land that would not be mined. Potential plant locations for the Centipede and Lake Way ore bodies are shown on Figure 3.

2.4.5 Process Waste Management

In conventional open pit mining, it is common to store overburden in above ground dumps. By-product from ore processing is sometimes placed in tailings storage facilities or may be placed within the waste rock dump. Toro proposes alternative methods for dealing with its wastes. Once uranium has been removed from the ore, the heap leach residue would be washed with water and placed back into the mine pit. The non-mineralised waste rock and overburden would also be placed back into the pit, so that at completion of mining there would be no above
ground waste storages. There are a number of benefits to the proposed backfilling of pits:

- Less visual impact;
- Less risk of creating permanent water bodies that might attract feral animals or other herbivores;
- Less risk of trapping animals in open mine voids;
- Less alteration to local hydrology;
- Less risk of erosion and sediment transport;
- Less risk of surface release of radon or gamma radiation from the pit voids.

The details of how heap leach residues would be disposed of in pit will be determined following further studies into the chemical and physical properties of these wastes. The ERMP will provide additional detail on the preferred method of residue disposal.

The processing plant includes an evaporation pond which is designed to remove natural salts that may otherwise build up in the processing circuit. The characteristics of these salts and the most appropriate methods for managing them are currently being investigated through a combination of theoretical and laboratory studies.

2.4.6 Product shipping, storage and distribution

The option of exporting product from a Western Australian port has not been considered because of a policy decision by the Western Australian Government not to permit transport of uranium to ports surrounded by residential areas. At present, only the ports of Port Adelaide and Darwin are being considered for export of product from Toro’s Wiluna operation.

A transport options study for the transport of the uranium product to the port of export is planned and will be reported in the ERMP. The proponent is currently in discussions with other potential uranium producers to collaborate on transport options, given the low volumes of product under consideration.

The study will investigate all reasonable options for transporting and, where necessary, interim holding of the uranium product. These options are likely to include road/rail via Kalgoorlie to Port Adelaide and Darwin and road only to either Port Adelaide or Darwin (via a route to be determined). Both Port Adelaide and Darwin are currently equipped to export uranium.

2.4.7 Village options

An accommodation village would be required for the construction and operations workforce. Capacity during the construction phase would be up to 350 rooms and during the operations phase up to 170 rooms.

The location of the accommodation facility has yet to be determined. However options to be considered will include a stand-alone facility that is located on the site of the demobilised village that served the Wiluna South (Matilda) mine, a facility that is integrated with the Wiluna township and utilises some town services (e.g. power, water and sewerage) or an alternative location.
## 3 Applicable Legislation, Guidelines and Standards

### 3.1 Legislation

The proposed mining and ore processing operation is regulated under a range of Commonwealth, State and local government instruments, as summarised below:

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<thead>
<tr>
<th>Agency / Authority</th>
<th>Approval required</th>
</tr>
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<tbody>
<tr>
<td>Commonwealth</td>
<td></td>
</tr>
<tr>
<td>Department of Water, Environment, Heritage and the Arts (DEWHA)</td>
<td>Approval under <em>Environment Protection and Biodiversity Conservation Act 1999</em></td>
</tr>
<tr>
<td>Commonwealth</td>
<td></td>
</tr>
<tr>
<td>Department of Resources, Energy and Tourism (DRET)</td>
<td>Approval to export product under Regulation 9 of Customs (Prohibited Exports) Regulations under the <em>Customs Act 1901 (Commonwealth)</em></td>
</tr>
<tr>
<td>Australian Safeguards and Non-Proliferation Office (Commonwealth) (ASNO)</td>
<td>Permit to possess and transport nuclear material under the <em>Nuclear Non-Proliferation (Safeguards) Act 1987</em></td>
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<tr>
<td>Department of Environment and Conservation (DEC)</td>
<td>Works approval and licence under Part V of <em>Environmental Protection Act 1986</em>; permits to take may be required under the <em>Wildlife Conservation Act 1950</em></td>
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<tr>
<td>Department of Water (DoW)</td>
<td>Licence to abstract water; permit to disturb bed and banks under <em>Rights in Water and Irrigation Act 1914</em></td>
</tr>
<tr>
<td>Radiological Council</td>
<td>Approval of radiation waste management plan; licensing of persons and premises under the <em>Radiation Safety Act 1975</em>; approval for storing, packing and transport of radioactive materials under the Radiation Safety (Transport of Radioactive Substances) Regulations 2002</td>
</tr>
<tr>
<td>Department of Indigenous Affairs (DIA)</td>
<td>Consent to disturb Aboriginal heritage sites under Section 18 of the <em>Aboriginal Heritage Act 1972</em></td>
</tr>
<tr>
<td>Native Title Tribunal</td>
<td>Agreement negotiated with Central Desert Native Title Services (CDNTS) for land access under the <em>Native Title Act 1993 (Commonwealth)</em> and the <em>Native Title (State Provisions) Act 1999</em></td>
</tr>
<tr>
<td>Shire of Wiluna</td>
<td>Building applications and other consents under the <em>Planning and Development Act 2005</em> and <em>Health Act 1911</em>.</td>
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</table>
3.2 Guidelines, Standards, Policies and International Agreements and Conventions

Development of the Wiluna uranium project and the studies carried out for the assessment of the possible impacts of the project will have regard to recommendations contained in the following guidelines, policies and standards.

Table 3 Relevant guidelines, policies standard and conventions

<table>
<thead>
<tr>
<th>Western Australia</th>
<th>Environmental Protection Authority (EPA)</th>
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<tbody>
<tr>
<td>Guidance Statement No. 56 – Terrestrial Fauna Surveys for Environmental Impact</td>
<td></td>
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## Western Australia

<table>
<thead>
<tr>
<th>Environment Protection and Heritage Council</th>
<th>National Environmental Protection Measure for Ambient Air Quality (2003)</th>
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<td></td>
<td>DEC landfill Waste Classification and Waste Definitions, 1996 (as amended)</td>
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<td></td>
<td>Western Australia State Greenhouse Strategy – Western Australian Greenhouse Task Force (2004b)</td>
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<tr>
<td>Department of Mines and Petroleum</td>
<td>Managing naturally occurring radioactive material (NORM) in mining and mineral processing — guideline (2nd edition):</td>
</tr>
<tr>
<td>Department of Premier and Cabinet Citizens and Civics Unit</td>
<td>Consulting Citizens – Planning for Success (2003)</td>
</tr>
<tr>
<td>Department of Water</td>
<td>Goldfields Groundwater and Management Plan, 1994</td>
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<td></td>
<td>Water quality protection guideline No 1 Water quality management in mining and mineral processing: an overview, 2000</td>
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<td><strong>ANZMEC and Minerals Council of Australia</strong></td>
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<td>Native Vegetation Framework Review Task Group 2010, Australia’s Native Vegetation Framework, Consultation Draft</td>
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<td></td>
<td>National Water Quality Management Strategy (various dates)</td>
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## Western Australia

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<td>On-site containment of contaminated soil, 1999</td>
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<td>Assessment of site contamination NEPM, 1999 (and related documents)</td>
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## International Organisations

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<td>Security in the transport of radioactive material, IAEA nuclear security series No 9, 2008</td>
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<td>Predisposal management of radioactive waste, general safety requirement (GSR) part 5, 2009</td>
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<td>Management system for the safe transport of radioactive materials, safety standard series number TS-G-1.4, 2009</td>
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<td>Regulations for the safe transport of radioactive materials, TS-R-1, 2009</td>
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4 Existing Environment

4.1 Social setting

The project area is located in the Shire of Wiluna in the sparsely populated Murchison region of Western Australia’s Mid West.

The town of Wiluna, located approximately 960 km northeast of Perth, is the principal centre in the Shire. The town lies along the Goldfields Highway, which connects Wiluna to Leinster (population 879, located 170 km to the south southeast) and to Meekatharra (population 931, located 130 km to the west). Wiluna township is the gateway to the Canning Stock Route. The Gunbarrel Highway extends from Wiluna to Alice Springs. The nearest regional centre to Wiluna is Kalgoorlie (population 28000, located 540 km south southeast of Wiluna).

At the last census (in 2006), the population of the town of Wiluna was 680 people, of whom approximately 37% were indigenous Australians. This does not include the approximately 950 “fly-in fly-out” workers living in various mining villages within the Shire. The mining industry is currently the largest employer in the Shire, accounting for approximately 43% of all jobs. Fewer than 7% of those employed in the Shire work in the agricultural sector. About 13% of the Wiluna workforce is employed in education, public administration and health care jobs (ABS, 2006).

4.2 Cultural heritage

4.2.1 Indigenous heritage

Wiluna has a vibrant Aboriginal heritage which functions in a traditional as well as a in a modern sense. Central Desert Native Title Services, the representative body for the Martu People of the region, describes the traditions and culture as a “living culture” which is strongly linked to Martu Law. Five of the seven elected Shire of Wiluna councillors are Martu. Local indigenous interests are strongly represented through the Regional Partnership Agreement (RPA) Steering Committee (one of only seven such RPA structures in Australia).

Wiluna occupies an important position in terms of Aboriginal culture in the Western Desert region. It is traditionally a major Law centre and plays a central role at Law time with people travelling from as far away as Docker River to conduct rituals in and around Wiluna (Sackett, L. 1977). Aboriginal people of the Western Desert began residing in Wiluna township in the late 1940’s. Contact commenced with the exchange of labour and rations and continued following the establishment of the Seventh - day Adventist Mission in 1957.

Toro and CDNTS have established protocols for the conduct of heritage surveys during the exploration and feasibility phases of the project and are discussing the negotiation of an agreement to deal with all native title and heritage issues that would arise with the construction and operational phases of the project. As part of this agreement, Toro would commit to the establishment and implementation of a Cultural Heritage Management Plan and to providing community benefits including indigenous training and employment.

Although many surveys have already been carried out in the Wiluna region, leading to the identification and registration of numerous heritage sites (Figure 9), further ethnographic and archaeological survey work to support full cultural mapping of the area is planned in 2010-2011. Registered DIA sites which occur within tenements which may form part of the proposal are listed in Table 4. It is not yet known whether any of the sites listed in Table 4 will need to be disturbed to allow implementation of mining activities. The ERMP will include a discussion of Aboriginal heritage sites within the project area and the methods used for heritage surveys as a basis for analysing the current status of heritage values and how they may be affected by project implementation.
Figure 9  Registered Aboriginal Heritage sites in the Wiluna region
### Table 4  Registered Heritage Sites

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<td>2441</td>
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<td>2617</td>
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<tr>
<td></td>
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<td>Ceremonial, Mythological</td>
</tr>
<tr>
<td>LS3/150</td>
<td></td>
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</tr>
</tbody>
</table>

#### 4.2.2  Non-indigenous heritage

Non-indigenous Australians first visited the Wiluna region in the 1890’s. An exploring party from South Australia reached the area near Lake Way in 1892. By the time members of the party returned to Lake Way in 1896, there was already an established settlement and some 300 prospectors working the gold fields in the district (Heydon, 1996). The gold industry rapidly expanded until the early part of the 20th century, when the combined effects of the first World War and the difficulties experienced in treating the more refractory ores encountered as mines became deeper resulted in a significant decline in the industry and in the local population. Mining did not recover until the late 1920’s. From then, the town thrived on gold mining with the population growing to over 9 000 by the mid 1930s. At its peak the town had a regular railway service to Perth, four hotels and many other facilities.

The beginning of World War II had a severe impact on the gold mining industry and in turn upon the population of the town. Immediately after the war, underground mining ceased in the area and gold operations wound down to virtually nothing. By 1953, fewer than 360 people remained and a decade later the local population had declined further to less than 100. In 1980, gold mining resumed to mark a resurgence which continues.

In contrast to the ebbs and flows of mining activity, the pastoral industry in the region has continued to produce quality cattle and sheep.

There is one site of European heritage significance within the general project locality. A mine manager’s house, 2 km south east of Wiluna built in 1929, is a permanent entry on the Heritage Council of Western Australia’s Register of Heritage Places. The house, known as ‘The Lodge’, is a single storey mud block and timber framed residence built for C E Prior, Manager of Wiluna Gold Mines. It has been listed as ‘one of the few substantial tangible reminders of this period of Wiluna’s history.’ (Heritage Council of Western Australia – Data Base No. 05507)

#### 4.3  Climate

Lake Way and Centipede are located in a semi-arid zone, characterised by hot dry summers and mild dry winters. The closest Commonwealth Bureau of Meteorology (BoM) weather station to the project area is located at Wiluna. The region is characterised by hot summers from October to April and by mild winters from May to September. The mean annual maximum and minimum temperatures for Wiluna are 29.1 and 14.2 respectively. The mean daily temperature ranges from 21.0°C to 37.9°C during summer and 5.4°C to 21.8°C during winter (Figure 10- Bureau of Meteorology, 2008).
Evaporation is high and rainfall is unpredictable and sporadic. High rainfall events can occur as a result of cyclonic activity during the summer months and can cause flash flooding from sheet runoff. The long-term mean annual rainfall at Wiluna is 257 mm, the majority of which falls during the summer months, although high rainfall is possible at any given time. The mean number of days of rainfall equal to or greater than 1 mm is 28.9 (Bureau of Meteorology, 2009). Median monthly rainfall varies from 1.6 mm in September and October to 18.3 mm in January (Figure 11). The average annual pan evaporation for Wiluna is 3,400 mm based on 30 years of records from 1975 to 2005 (Bureau of Meteorology, 2009).

The prevailing annual wind directions are northeasterly (at 9 am) and south easterly (at 3 pm).

Toro has operated a local meteorological station near the Wiluna project area since 2007. Good correlation exists between the historical meteorological monitoring, current Bureau of Meteorology data and the data collected by Toro at the project meteorological station.

4.4 Geology and seismicity

Regional geology of the Wiluna area comprises Archaean crystalline bedrocks dominated by granite cut through by the eastern margin of the Archaean Norseman-Wiluna greenstone belt. This belt is characterised by sedimentary and basic volcanic rocks. Granite and gneiss occur to the east, with Lake Way forming a central palaeodelta. The Lake Way and Centipede uranium deposits are associated with the broad palaeochannel deltas that empty into the Lake Way hyper-saline playa, which itself represents the remnants of a major primary palaeo-drainage system of predominantly Tertiary age.

The uranium mineralisation is located in shallow deposits consisting of calcrete, dolomite, silt, clays and sand. These deposits were laid down within the palaeochannel drainage system and so follow the ancient channel structures. The present day drainage has eroded the existing channels resulting in a complex, discontinuous ore body. The mineralisation generally occurs at or in close proximity to the current water table, typically 1 to 2m below ground level. The total thickness of mineralisation does not typically exceed 6.5m.

Uranium mineralisation at both Centipede and Lake Way is dominated by carnotite (K₂(UO)₂(VO₄)₂·3H₂O), a potassium-uranium vanadate mineral, which has been precipitated out of solution and preserved within the lower reaches of tributary palaeochannels following subtle changes in groundwater chemistry and evaporation. The carnotite (Figure 12) is found as coatings on bedding planes, in the interstices between sand and silt grains, in fissures within calcrete and dolomite, and in tubular voids in
buried soil surfaces. The carnotite appears to have been precipitated onto any available surface.

Figure 12 Carnotite mineralisation

The uranium mineralisation at Lake Way is distributed throughout a calcrete/dolomite, carbonated silty clay and carbonated sand sequence, which has been recorded to extend up to 40 m in thickness. The uranium mineralisation occurs at or in close proximity to the current water table, typically at approximately 2 metres below ground level (mbgl), and extends in places up to a depth of 12 mbgl. This calcrete/carbonated sequence is overlain by up to 2m of alluvial overburden. There appears to be no dominant mineralisation host rock.

Wiluna lies in a zone of relatively low earthquake hazard. The estimated peak seismic acceleration coefficient in the project area is 0.05 (Australian Seismological Centre, 1993).

4.5 Topography, landforms and soils

The topography in the project area comprises gently sloping sand plains, dunes and alluvial flats/playa type environments.

The Wiluna uranium project area is located over three main land systems. The Carnegie Land System is the dominant land system of the project area. The Carnegie Land System encompasses the Lake Way salt lake and fringing saline alluvial plains and surrounding sand dunes. The second most common land system, the Cunya Land System, represents the calcrete earths and platforms adjacent to Lake Way. These support halophytic shrublands, and open Mulga woodlands further from the lake's edge (OES, 2008). A third land system, the Yanganoo system, occurs in parts of the proposed West Creek borefield area. The Yanganoo system is characterised by almost flat wash plains and sandy banks on hardpan, with mulga shrublands and wanderrie grasses or Spinifex.

The majority of soils in the Centipede area are loamy sands, clayey sands, sandy loams or sandy clay loams. Surface soils are generally relatively coarse in texture, but show an increase in clay content with depth. The lake bed and lake fringe are characterised by finer textured soils.

Soils in the Centipede area are characterised by a relatively wide range of pH and salinity, and both of these attributes were related to position in the landscape. In general, soils higher in the landscape were more alkaline and less saline, while those in flat areas at lower elevation were more saline and had neutral to acidic pHs. As would be expected, soils near or on the bed of Lake Way showed relatively high salinity and neutral to alkaline pHs. None of the soils encountered in the Centipede area show pronounced hydrophobicity (water repellence); neither did the soils show a tendency to hard-setting.

Baseline testing of soils in the project area for trace elements (arsenic, cadmium, copper, lead, mercury, nickel, zinc) found no evidence of enrichment in these metals. The levels of total chromium identified within many of the samples were in excess of the values conventionally identified as potentially harmful to some agricultural plant species. However the local native plant species may show quite different tolerance to chromium in soils. There was no clear evidence of higher levels of chromium in a particular location or soil type.

4.6 Surface water

The proposed mining areas are located in the catchment of Lake Way, a large salt lake with an 11,000 km² catchment and a surface area of
approximately 245 km². The lake includes numerous islands, especially in the southern part of the lake, which together occupy approximately 15% of the area bounded by its shoreline. The surface elevation of the lake at its deepest point is approximately RL 490m. The lake has the potential to overspill to the southeast to Lake Maitland, although this is considered unlikely.

Lake Way forms part of an extensive palaeodrainage system which drains southeast into the larger Carey palaeodrainage. Lake Way is the first (most upstream) salt lake of a salt lake chain/ palaeoriver system extending to the southeast linking to Lake Maitland and Lake Carey (WRC 1999).

Present day drainage is associated with palaeochannel drainage systems which drain into Lake Way predominantly from the north and west (Aquaterra, 2007). Surface water flow is ephemeral and highly dependent on high rainfall events. The dominant Lake Way sub-catchments are located to the north and northwest of the lake. These larger catchments have generally poorly defined drainage and are believed to only flow following infrequent major rainfall events (estimated at a minimum of 100 mm). The lake receives lesser, but more regular, runoff from the smaller, steeper catchments located on the western and eastern shores of the lake and from rainfall directly on the lake surface.

None of the watercourses or drainage lines in the project area flow naturally year round. Intermittent surface water flows occur after heavy falls normally associated with cyclonic rains which typically occur in the months of January to March. Dewatering discharges from existing and historic mining operations in the northern part of Lake Way have for some years caused more or less continuous surface discharge of water to Lake Way.

The Lake Way area does not lie within a proclaimed “surface water management area” under the Rights in Water and Irrigation Act 1914 (Department of Water, 2008a).

### 4.7 Groundwater

Subsurface flow in the project area occurs within several distinct geological units (WRC, 1999), of which the calcrites are by far the most conductive. The permeability within the calcrites arises from secondary porosity, with flow occurring through solution vughs and cavities. The permeable zones within the calcrites are generally horizontal to sub-horizontal and are intercalated with silty and clayey units of lower permeability.

The palaeochannel deposits within which the orebodies occur consist of very fine to coarse grained quartz sand with minor silt, gravel and carbonaceous horizons. The materials within and underlying the ore zone comprise a sequence of earthy calcrete, siltstone, sand and clay associated with the Quaternary drainage systems. The typical stratigraphy is (Rockwater, 1980):

<table>
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<th>Depth, m</th>
<th>Description</th>
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<tr>
<td>0 – 0.7</td>
<td>SILT – firm, pale brown, sandy to clayey, slightly calcareous</td>
</tr>
<tr>
<td>0.7 – 4.7</td>
<td>CALCRETE/SILT – grey to white vuggy calcrete, with pale brown silt</td>
</tr>
<tr>
<td>4.7 – 7.0</td>
<td>SAND/SILT/CALCRETE – pale yellow brown, fine to coarse grained sand, intercalated with silt and silty sand. Calcrete content is variable.</td>
</tr>
</tbody>
</table>

Regional groundwater flow in the general project locality forms part of the Carey palaeodrainage, which flows from northwest to southeast (DoW, 1999). Under dry conditions, it is believed that evaporation from the bed of Lake Way induces water movement to the surface, from where it is evaporated, resulting in groundwater discharge from the Lake in the form of evaporation. However, given the 30 m elevation gradient to Lake Maitland, it is likely that some subsurface groundwater flow to the southeast also occurs, particularly when elevated water levels occur following extreme rainfall events.
In the proposed mining areas the groundwater table is typically 2-5m below surface and the depth to water generally reduces with proximity to Lake Way. The groundwater flow direction in the immediate project area is generally to the south and east, towards Lake Way.

A public drinking water source protection area (the water supply for the Town of Wiluna) lies approximately 7km east of Wiluna (Department of Water, 2008b and 2008c, Water Corporation, 2004). The water source protection area, which is equipped with two shallow production wells that draw water from an unconfined calcrete aquifer, lies approximately 25 km north northwest (up hydraulic gradient) of the Centipede Project area and approximately 10 km north of the Lake Way Project area.

A limited amount of groundwater quality data is available for the immediate project area. Groundwater beneath the proposed mining areas is expected to be hypersaline, with a neutral to slightly alkaline pH. Both uranium and vanadium are naturally elevated, reflecting the mineralised character of the area (Table 5).

Table 5 Lake Way groundwater chemistry

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<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Mean</th>
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</tr>
<tr>
<td>Conductivity</td>
<td>EC</td>
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</tr>
<tr>
<td>Total Dissolved Solids</td>
<td>TDS</td>
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</tr>
<tr>
<td>Soluble iron</td>
<td>Fe</td>
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</tr>
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</tr>
<tr>
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<td>2443</td>
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<tr>
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<td>3981</td>
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<tr>
<td>Chloride</td>
<td>Cl</td>
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<tr>
<td>Carbonate</td>
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<tr>
<td>Bicarbonate</td>
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<tr>
<td>Sulphate</td>
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<td>14103</td>
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<tr>
<td>Uranium</td>
<td>U</td>
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</tr>
<tr>
<td>Vanadium</td>
<td>V</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Data in Table 4 represent the results of 14 water samples recovered from the Centipede area in January 2010.

4.8 Weather and air quality

A detailed meteorological study was undertaken around the proposed Lake Way mineral deposit for over a year, starting in 1979. Hourly averages of the 96.6% data captured over this period showed that dominant wind directions over the period of the study were east to southeasterly. Temperature profiling was also evaluated as part of this study, which enabled mixing height modelling to be performed. These two factors will dictate the dust and radiation dispersion potential and associated impacts from future mining activities. Further meteorological monitoring carried out by Compliance Monitoring starting in 2007 has shown good correlation between the historical monitoring, current Bureau of Meteorology data and data collected by Compliance Monitoring on behalf of Toro Energy.

A six-month campaign of air quality monitoring was carried out in 2007-2008 to evaluate ambient concentrations of airborne dust and deposited particulate matter (Compliance Monitoring, 2008). During the monitoring period there was one exceedance of the national ambient air quality guideline (NEPM) value of 50 µg/m³ (24-hour average) for fine particulate matter (PM₁₀). The event commenced around 1am on 16 January 2008, peaked at 3 am and tapered off until about midday (Figure 13). The most likely cause of the observed high dust levels was an overnight dust storm or a bushfire, as the monitoring site is in a remote location, far removed from traffic, mining or other ground disturbing activity. No machinery was working in the area during the monitoring period.

Apart from this peak event the second highest daily PM₁₀ average was 48.2 µg/m³. The overall daily average for PM₁₀ over the 6 months monitoring was 14.6 µg/m³. This value is comparable to (but somewhat lower than) the average summer PM₁₀ values reported by the DEC during a 2-year study conducted in the Kalgoorlie region in 2006 – 2007 (DEC, 2009). Deposited dust levels recorded at Wiluna in 2007-2008 were also relatively low, averaging
approximately 1.07 g/m²/month of insoluble matter (Compliance Monitoring, 2008).

Figure 13  Air quality exceedance, Jan 2008

Further studies of particulates in air are planned to be carried out in 2010 to enable calibration of air quality modelling that will be completed as part of the Wiluna uranium environmental impact assessment.

4.9 Radiological environment

Baseline radiation surveys have been carried out to characterise existing surface level radiation conditions in the project area (Western Radiation, September 2009). The baseline radiation data can be used as background for comparison purposes and to assess the impacts of the project. Baseline surveys conducted to date include:

- Field gamma surveys
- Measurement of radon and radon decay products in air
- Measurement of radionuclides in deposited dust
- Measurement of radionuclides in soils

4.9.1 Gamma dose rate

The Centipede area was surveyed by Western Radiation Services using a 200m by 200m grid. All radiation dose rate results were linked to GPS Coordinates. The instrument used for the field Gamma Survey was a Health Physics Meter (Cypher Model 5000) coupled to a pancake Geiger Muller (GM) detection probe.

Iso-contours of the measured dose rate readings were mapped using SURFER contouring software. Generally the maximum dose rates were found over the known uranium resource. However, the surface levels of radiation are governed by the thickness of cover over the uranium rich calcrete deposit.

The dose rates measured during the baseline surveys ranged from 0.07 to 0.86 μSv/hr with the average being 0.17 μSv/hr ± 0.11 (2σ). As expected, the higher dose rates were found over the areas of mineralisation delineated by the drilling program. The sand dune areas were generally lower in dose rate and approached the normal background levels of around 0.10μSv/hr.

4.9.2 Radon

Baseline radon monitoring was carried out across the Wiluna Uranium Project Area and nearby communities on three occasions during the period from 2007 to 2009 using track-etch passive radon detectors supplied by ARPANSA. The results across all monitoring locations ranged from 9 to 142 Bq/m³, which is typical for natural background ranges observed throughout Australia. Results from the Centipede project area ranged from 13 to 66 Bq/m³ (33 ± 31.9 Bq/m³ (2σ)). The accuracy of the track etch monitoring was reported by ARPANSA to be ± 20%.

Short-term measurements of radon gas concentrations in air were carried out using a Durridge spot monitor. These spot measurements ranged from 0 to 199.3 Bq/m³ (17.6 ± 58.6 Bq/m³ (2σ)) and are consistent with the longer term average track etch measurements.

4.9.3 Radionuclides in dust

UNSCEAR (2000) reports the global average for uranium concentration in dust as 0.5 μBq m⁻³ and
it is anticipated that similar concentrations will be experienced in the Wiluna area.

A small number of results for uranium in deposited atmospheric dusts are available from baseline studies conducted in 2007-2008. Passive dust deposition gauges were located at strategic locations in the Wiluna area. Results of this monitoring indicated that the average background deposition rate of uranium was $0.041 \pm 0.024 \, \mu g/m^2/day$ ($2\sigma$).

Further monitoring of background concentrations of radionuclides in airborne dust is planned to be carried out in the first half of 2010.

4.9.4 Radionuclides in soils

Samples were taken of the surface soils at various locations and analysed for radionuclides. Samples were ground and weighed into a container of known geometry for counting by high resolution gamma-ray spectrometry. Samples that required measurement of Radium-226 were pulverised and homogenised before being placed into the sealed plastic measurement container. This mixture was allowed to stand for 30 days to allow for radon gas to grow close to secular equilibrium with the Radium-226. Radium-226 was determined by counting the gamma rays from the short-lived radon daughters by the high resolution gamma-ray spectrometer. The $187\,keV$ peak for Ra-226 can also be used with correction for U-235 interference. Some radionuclides which do not emit any useful gamma rays may still be quantified by measuring their short-lived daughter products and assuming them to be in secular equilibrium.

The concentration of radium-226 in soils ranged from 27 to 403 Bq/kg, with an average of $92 \pm 220 \, Bq/kg$ ($2\sigma$) and a median of 62 Bq/kg. Two samples were less than the minimum detectable activity (MDA) of 20 Bq/kg. The highest results occurred in surface soil samples taken in the vicinity of the two ore bodies at Lake Way and Centipede. These higher levels are to be expected on top of ore bodies that are so close to the surface.

The global median concentration of Ra-226 in soils is 35 Bq/kg with a population weighted average of 32 Bq/kg (UNSCEAR 2000). Comparing this to the above baseline data infers that the Wiluna area in general has naturally high background radiation levels.

4.9.5 Radionuclides in groundwater

Radionuclide sampling of groundwater has not yet been completed. As an indication of the concentrations that could be expected, the Lake Way 1980 Environment Impact Statement reported that two samples of groundwater near the ore body contained Radium-226 levels between 6.3 and 7.4 Bq/L, while nearby wells contained Radium-226 levels between 0.2 and 0.6 Bq/L (Brian Lancaster & Associates, 1980).

4.10 Flora and vegetation – vegetation; flora; weeds

The project area lies within the Eastern Murchison (MURI) bioregion of the Interim Biogeographic Regionalisation for Australia (IBRA - Thackway and Cresswell, 1995). Vegetation in the 7,847,996 ha Eastern Murchison subregion is dominated by Mulga woodlands, frequently rich in ephemeral species, hummock grasslands, saltbush and samphire shrublands (Cowan, 2001).

Flora and vegetation surveys have been conducted in the general project area in 2007 and 2009 (Outback Ecology, 2008; Niche, 2010). The vegetation over the project areas has been described as fitting into six broad groups (Niche, 2010), being:

- Playa vegetation – recorded at Centipede and Lake Way
- Fringing vegetation – recorded at Centipede and Lake Way
- Dune vegetation – recorded at Centipede and Lake Way
- Plains vegetation – recorded at Centipede and Lake Way
- Calcrete vegetation – recorded at Lake Way
Clay-pan vegetation – recorded at Lake Way

Within these six broad groups, there were a total of 30 vegetation units. Nine of these were found at both sites, two were found at Centipede only and nine were found at Lake Way only. The majority of these vegetation types were considered to be comparatively widespread in the region. Groundwater dependent vegetation growing within and on the banks of the West Creek is likely to be locally significant and may be regionally significant.

A database search conducted within a nominal 60 km radius of the project area found no Declared Rare Flora (DRF), as defined under the Western Australian Wildlife Conservation Act 1950, within the database search area (Niche, 2010). A total of twenty priority taxa were identified. An additional recently listed priority species (Tecticornia sp Lake Way) has subsequently been identified in the general project locality. Of the priority flora records, a total of thirteen taxa were considered as having a low probability of occurring within the Toro tenements, with the typical habitat of the priority species not noted in the project area. These priority species are all typically recorded on banded iron formation, laterite or breakaways. The remaining eight taxa (those shaded in Table 6) were all considered to have a higher likelihood of occurring within the Toro tenements.

Stackhousia clementii (P3) was considered to be likely to occur within the Toro tenements, as this species has been recorded in close proximity to the proposed West Creek borefield and is found within habitat noted as occurring within the tenements.

### Table 6  Conservation significant flora

<table>
<thead>
<tr>
<th>Species</th>
<th>Conservation Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia balsamea</td>
<td>P4</td>
</tr>
<tr>
<td>Baeckea sp. Melita Station (H Pringle 2738)</td>
<td>P4</td>
</tr>
<tr>
<td>Baeckea sp. Sandstone (C.A Gardner s.n. 26 Oct. 1963)</td>
<td>P1</td>
</tr>
<tr>
<td>Beyeria lapidicola</td>
<td>P2</td>
</tr>
<tr>
<td>Calytrix uncinata</td>
<td>P3</td>
</tr>
<tr>
<td>Eremophila congesta</td>
<td>P1</td>
</tr>
<tr>
<td>Eremophila flaccida ssp. attenuata</td>
<td>P1</td>
</tr>
<tr>
<td>Eremophila pungens</td>
<td>P4</td>
</tr>
<tr>
<td>Euryomyrtus inflata</td>
<td>P1</td>
</tr>
<tr>
<td>Hemigenia exilis</td>
<td>P4</td>
</tr>
<tr>
<td>Homalocalyx echinulatus</td>
<td>P3</td>
</tr>
<tr>
<td>Maireana prosthicocochaeta</td>
<td>P3</td>
</tr>
<tr>
<td>Mirbelia stipitata</td>
<td>P3</td>
</tr>
<tr>
<td>Neurachne langera</td>
<td>P1</td>
</tr>
<tr>
<td>Olearia mucronata</td>
<td>P3</td>
</tr>
<tr>
<td>Prostanthera ferricola</td>
<td>P3</td>
</tr>
<tr>
<td>Ptilotus astrobasius vaar. luteolus</td>
<td>P1</td>
</tr>
<tr>
<td>Ptilotus chrysocomus</td>
<td>P1</td>
</tr>
<tr>
<td>Stackhousia clementii</td>
<td>P3</td>
</tr>
<tr>
<td>Tecticornia sp Lake Way</td>
<td>P1</td>
</tr>
<tr>
<td>Tribulus adelacanthus</td>
<td>P3</td>
</tr>
</tbody>
</table>

In the report documenting the results of the flora and vegetation surveys conducted in 2007, the vegetation at the Lake Way and Centipede Project Areas was assessed as being in very good to excellent condition, according to the scale of Keighery (1994).

In the fauna assessments conducted at the same time, the vegetation cover was described as “poor” habitat, which was considered by the fauna specialists to be a consequence of the effects of altered fire regimes, grazing of the vegetation and drought. It should be noted that “poor” is not a condition of vegetation within the Keighery (1994) scale.

During reconnaissance surveys conducted over the project area in December 2009, the condition of the vegetation was noted. The condition of the vegetation was generally assessed as being good to very good (according to the scale of Keighery, 1994). There was evidence of impacts associated with altered fire regimes, grazing, low-level exploration work and track proliferation. This had led to obvious impacts to the vegetation, with impacts to the structure of the vegetation as well as damage to individual species. The scale and nature of the impact were not considered to be consistent with loss of regenerative capacity. The vegetation was relatively free of weed invasion.
There was one section of vegetation that was considered to meet the criteria to be assessed as degraded, being a section of vegetation located on the sand dunes in the Lake Way Project Area. The basic structure of this vegetation has been severely impacted as a consequence of historic logging. This section of vegetation does not appear to have the capacity to naturally regenerate.

Further assessments of vegetation condition will be carried out following the 2009/2010 wet season.

4.11 Fauna – vertebrate fauna; invertebrate fauna; subterranean fauna

The Murchison Bioregion of the IBRA comprises the northern part of the Yilgarn Craton and includes two major components, or sub-regions; the Eastern Murchison (MUR1), and the Western Murchison (MUR2). As of 2004, 7.46% of the land in the Murchison Bioregion had been vested in conservation reserves. The closest wetland of significance to the project area is the Lake Carnegie System, approximately 70 km west of Lake Way.

4.11.1 Fauna habitats

Nineteen terrestrial vertebrate fauna habitat types have been delineated in the general project locality. These include a variety of Mulga communities, mixed Acacia and Mulga shrublands, Mallee over spinifex, major and minor drainage or creeklines, chenopod floodplains, claypans, sapphire flats, red dunes, open Eucalypt woodlands and stands of Melaleuca xerophila. The habitats observed in the project area are mostly widespread and common throughout the Murchison region. Habitats such as claypans, creeklines, drainage lines and permanent or semi-permanent fresh water pools are less common and of more limited extent. No critical habitat, World Heritage Properties, Ramsar Wetland Sites or Nationally Important Wetland sites occur in or near to the project area. Spinifex and shrubland habitats over the survey area are currently significantly impacted by frequent fire. All habitats, but particularly those adjacent to Lake Way, have been heavily grazed by cattle.

4.11.2 Vertebrate fauna

Baseline fauna surveys were conducted over the project areas of Lake Way and Centipede during spring 2007 (OES, 2008) and in November and December 2009. The surveys incorporated trap line establishment and trapping, inventory sampling, spotlighting, “call playback” (targeting nocturnal birds), echolocation bat call detection, targeted searches and habitat assessment.

In total, the surveys so far conducted in the project area (including some historic surveys identified during desk studies) have identified 16 native mammal species, 106 bird species, 37 reptiles, one amphibian species and 9 introduced species. No fish have been observed.

Five species of conservation significance are likely to occur at least intermittently in the general project locality. They are: the Rainbow Bee-eater, the Australian Bustard, Bush Stone-curlew, Peregrine Falcon and Fork-tailed Swift. Of these, only the Rainbow Bee-eater has been observed during surveys conducted to date.

4.11.3 Terrestrial invertebrates

The fauna surveys conducted in 2007 and in 2009 also targeted short-range endemic invertebrates. Specimens of mygalomorph spiders, centipedes, scorpions, molluscs and pseudoscorpions were collected. With the exception of two scorpion species, no specimens of pseudoscorpions, scorpions and centipedes collected during the field survey were considered by experts at the Western Australian Museum to be short range endemics. Most of the animals collected are widely distributed in the semi-arid zone of Western Australia. Two scorpion species of uncertain taxonomy, but falling within the genus Urodacus were listed as the type specimens ‘Lakeway 1’ and ‘Lakeway 2’. The genus Urodactus is currently under review by Erich Volschenk (Ecologia Environmental) and the two
scorpions collected could not be identified to species level.

Four mollusc species were collected. These species were tentatively identified as *Glyptophysa (Glyptophysa) sp.*, *Pupoides? myoporinae*, *Pupoides? adelaidae* and *Gastrocopta? larapinta*. Slack-Smith & Whisson (2008) concluded that there is no reason to believe that, at the species level, any of these four molluscan taxa exhibit any degree of short range endemity; all are believed to belong to species that occupy wide geographical ranges.

### 4.12 Subterranean Fauna

The uranium-bearing calcrete deposits in the northern part of the Yilgarn support a rich and diverse stygofauna. The three main calcretes in proximity to the Wiluna project are the Hinkler Well, Uramurdah and Lake Violet calcretes. Many research papers have been published on the stygofauna in the general project area.

Less is known about the occurrence of troglofauna in the Northern Goldfields. Troglofauna generally inhabit air filled spaces (voids etc) and air chambers within cave networks. The compacted clays and high water table in the project area are not considered highly prospective troglofauna habitats.

Baseline subterranean fauna surveys of the project area have been carried out in 2007 and 2009. A total of 71 samples have so far been collected from 55 bores targeting the Centipede operations area. Sixty-one of the samples recovered are from the impact area and ten are from reference areas. Sixteen bores, yielding eight stygofauna samples have been sampled in the Lake Way operations area. Eight samples, all of which yielded stygofauna, have been recovered from bores in the West Creek area (proposed mine water supply borefield). Further stygofauna sampling is planned for 2010.

The stygofauna studies completed to date confirm the presence of a diverse stygal taxa in the general project area. So far, twenty-seven stygal taxa from eleven major invertebrate groups have been identified. The majority of taxa identified to date have also been found in other calcretes in the Murchison.

So far, twenty-two troglofauna traps have been deployed in the Centipede operations area, nine in the Lake Way operations area and three in the West Creek area. Sampling in the West Creek area was hindered by the presence of traps deployed by other researchers in the locations proposed for sampling. The presence of a small number of troglofauna has been confirmed in haul net samples from the Centipede and Lake Way areas. Results of troglofauna surveys using litter traps are not yet available. Further troglofauna surveys are planned in 2010.

### 4.13 Threatened and priority ecological communities

A database search has been conducted to identify Threatened Ecological Communities (TECs) and Priority Ecological Communities (as defined by the DEC) within a nominal 60 km radius of the Wiluna project area. No TECs were identified as occurring within the database search area (Niche, 2010). There are also no World Heritage areas, National Heritage areas, Ramsar wetlands or Threatened Ecological Communities as defined under the *Environment Protection and Biodiversity Conservation Act 1999* within the search area.

A total of six Priority Ecological Communities (PECs) were identified as potentially intersecting the Wiluna project area. These were:

- Wiluna West vegetation complexes (banded ironstone formation) – this is a Priority 1 ecological community located to the west of the proposed borefield. The PEC has a buffer of 17500 m, which intercepts the northeast corner of the tenement within which the proposed borefield lies. The vegetation complexes within this PEC are associated with a banded ironstone ridge. This type of geological feature does not occur within the Toro tenements and as such, the flora and vegetation values of this PEC are unlikely to
be of relevance to the Wiluna uranium project. This unit was previously a TEC.

- Hinkler Well calcrete (stygofauna) community – this is a Priority 1 ecological community, located to the west of the Centipede project area. The buffer for this PEC is 21000 m, which partly overlaps the Centipede project area and the southeast corner of the tenement on which the proposed borefield would be located.

- Lake Violet calcrete (stygofauna) community – this is a Priority 1 ecological community located between the proposed borefield and the Lake Way project area. The buffer of this PEC is 19000 m, which covers the entire proposed borefield, the Lake Way project area and a small part of the northern section of the Centipede project area.

- Millbillillie Bubble Well calcrete (stygofauna) groundwater calcrete assemblage type – this is a Priority 1 ecological community of the Carey palaeodrainage on Millbillillie Station. The 10200 m buffer of this PEC overlaps with the northwestern corner of the tenement within which the proposed West Creek borefield lies.

- Uramurdah Lake calcrete groundwater assemblage type on Carey palaeodrainage on Millbillillie Station – this is a Priority 1 ecological community centred near the Uramurdah Creek, north of the proposed Lake Way operations area. The 16000m buffer defined for the community covers the entire Lake Way project area and the northern and eastern sections of the Centipede project area.

- Wiluna BF calcrete groundwater assemblage type on Carey palaeodrainage on Millbillillie Station – this is a Priority 1 ecological community located to the north of Lake Way. The 13000m buffer defined for the community extends over the Lake Way project area.

A total of 17 ‘at risk’ ecosystems have been identified within the Murchison 1 bioregion, of which one, “Melaleuca sp. nov (M. xerophila) Low Closed to Open Forest Strand Community near Wiluna” (Cowan, 2001) was considered as occurring within the area of the Centipede deposit.

4.14 Groundwater dependent ecosystems

In addition to the calcrete ecosystems described in the previous section, a number of potentially groundwater dependent vegetation communities may exist in the project area. These include vegetation growing along major drainage channels in the proposed West Creek borefield area and vegetation growing in proximity to permanent or semi-permanent pools. Further studies of vegetation are planned for 2010 to identify groundwater dependent communities and to evaluate the potential for impacts on these communities as a result of project implementation.

4.15 Conservation estate

The nearest conservation reserve to the project area is the 53,248 ha Wanjarri nature reserve, located approximately 80 km to the southeast of the project area. Although parts of the reserve have formerly been used for pastoral purposes, a number of protected flora and fauna species have been reported to occur in the reserve (CALM, 1996). Parts of the reserve are used for camping and recreation, although this in not formally sanctioned by the DEC.

The reserve is surrounded by pastoral and mining activities. Approval was given in 1994 for the construction of a natural gas transmission pipeline running from north to south across the reserve (Ministerial Statement 374).

4.16 Noise

The Wiluna project area is remote from any sources of industrial or infrastructure noise, and the ambient noise levels are therefore expected to be low. The nearest active mining operation
to the project area is the Apex gold mine, located approximately 15 km northwest of the proposed Lake Way mining operation. The Goldfields Highway passes approximately 8 km to the west of the proposed Centipede mining area. The nearest sensitive noise receptors to the project area are:

- the station residence at Lake Way station, located approximately 40 km southwest of the Centipede deposit,
- the accommodation village serving the Apex gold mine; and
- the Bondini reserve, located about 15 km northwest of the Lake Way deposit (~3 km northeast of the Apex mine).

4.17 Traffic

The proposed Centipede operations area is located some 30 km south of Wiluna along the Goldfields Highway. A nominal 8 km long access road would connect the mining operations area to the Goldfields Highway. The current traffic flow along the section of the Goldfields Highway between Wiluna and the Centipede area is in the order of 30 vehicles per day.

The turnoff to the access road to the proposed Lake Way operations area lies approximately 13 km east southeast of Wiluna along the Gunbarrel Highway. The current traffic flow along the section of the Gunbarrel Highway and the proposed Lake Way operations area access road is in the order of 15 vehicles per day.

5 Environmental Principles

In developing the Wiluna uranium proposal, Toro has had careful regard to environmental and sustainability principles. In particular, the principles of intergeneration equity, waste minimisation, best practice management and eco-efficiency are already reflected in project design decisions and in the project alternatives currently being considered by Toro (refer Section 2.4 of this scoping document). The proposed field and laboratory studies, modelling and other investigations proposed as part of the assessment of impacts of the Wiluna project have been designed to take account of the precautionary principle and also to provide a robust basis for giving practical effect to the principle of biodiversity conservation.

A summary of how key environmental principles are embodied in the Wiluna uranium proposal is provided in Table 7.
### Table 7 Environmental Principles

<table>
<thead>
<tr>
<th>Principle</th>
<th>Applicability to this Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environmental, Social and Economic Considerations</strong>&lt;br&gt;Environmental, social and economic factors should be taken into account in government and other sectors’ decision-making processes, with the objective of improving community well-being and the benefit to future generations. The environmental practices and procedures adopted should be cost-effective and in proportion to the significance of the environmental risks and consequences being addressed.</td>
<td>Toro has carried out two formal risk workshops to date, one of which considered a wide range of risks and the second of which was entirely devoted to environmental risk. The outcomes of this work have been used to allocate resources and effort to the more significant environmental risks and to create more certainty in areas where work to date has not yet resulted in an acceptable level of understanding of environmental risk.</td>
</tr>
<tr>
<td><strong>Precautionary Principle</strong>&lt;br&gt;If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. Decision-making should be guided by: &lt;br&gt;(a) a careful evaluation to avoid serious or irreversible damage to the environment wherever possible; and &lt;br&gt;(b) an assessment of the risk-weighted consequences of the options.</td>
<td>A range of additional studies have been proposed to improve knowledge of the condition and behaviour of environmental systems in the project area. The impact assessments carried out after this additional work has been completed will specifically consider the level of certainty attached to each impact assessment. Management plans provided with the ERMP will define sensitive and robust monitoring approaches and management trigger levels to enable detection of and response to environmental changes resulting from Toro’s activities before there is a significant risk of extensive or irreversible harm.</td>
</tr>
<tr>
<td><strong>Intergenerational Equity</strong>&lt;br&gt;The present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations. This implies that the present generation has a stewardship role in the maintenance of natural capital and a responsibility to ensure its wise use.</td>
<td>The project will be implemented in accordance with all relevant regulatory requirements and will adopt best practice design and management to the extent practicable. Toro will make adequate provision for site decommissioning and rehabilitation and aims to adopt designs and operational practices that will ensure that any resources required for environmental management do not accrue disproportionately in the post-closure period.</td>
</tr>
<tr>
<td><strong>Conservation of Biological Diversity and Ecological Integrity</strong>&lt;br&gt;Biological diversity (the variety of all life forms - the different plants, animals and microorganisms, the genes they contain, and the ecosystems of which they form a part) is considered at three levels: genetic diversity, species diversity and ecosystem diversity. Biological diversity is best conserved in-situ. The close, traditional association of Western Australia’s indigenous peoples with components of biological diversity should be recognised. Although all levels of government have clear responsibility, the cooperation of conservation groups, resource users, indigenous peoples, and the community in general is critical to the conservation of biological diversity.</td>
<td>Appropriate baseline studies will be conducted to enable the potential impacts of the proposal to be understood at a genetic, species and ecosystem level. Toro is actively seeking input from a range of stakeholders, including Traditional Owners, in conducting its baseline studies. Where there are multiple options for location or layout of project plant or infrastructure, Toro would seek to adopt the option which poses the lesser risk to biological diversity. The design and sequencing of mine development will aim to minimise land clearing.</td>
</tr>
<tr>
<td><strong>Shared Responsibility</strong>&lt;br&gt;Protection of the environment is a responsibility shared by all levels of Government, industry, business, communities and the people of Western Australia. The decisions and actions of people in their daily lives, when multiplied at the community level, are</td>
<td>The efficient development of primary sources of uranium will contribute to global diversification of power sources and reduce dependency on hydrocarbon fuels which give rise to greenhouse gases.</td>
</tr>
<tr>
<td>Principle</td>
<td>Applicability to this Proposal</td>
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<tr>
<td>Principle responsible for many of our diffuse source environmental impacts. Consequently, positive changes in behaviour at the individual level can cumulatively improve the management of these impacts.</td>
<td>Toro is taking an active role in the development and implementation of stewardship programs by the Australian Uranium Association which seek to influence operations in other phases of the nuclear cycle. This proposal does not provide for disposal of wastes from nuclear energy production.</td>
</tr>
<tr>
<td><strong>Product Stewardship</strong> Producers and users of goods and services have a shared responsibility with Government to manage the environmental impacts throughout the life-cycle of the goods and services, including the ultimate disposal of any wastes.</td>
<td>Toro will monitor and report on key environmental performance indicators of its operation, including its use of energy and water and the cumulative extent of disturbance arising from implementation of the Wiluna proposal.</td>
</tr>
<tr>
<td><strong>Eco-Efficiency</strong> Producers of goods and services should produce competitively priced goods and services that satisfy human needs and improve quality of life, while progressively reducing ecological degradation and resource intensity throughout the full life-cycle to a level consistent with the sustainability of biodiversity and ecological systems.</td>
<td>The proposal specifically includes design choices aimed at: Avoiding the use of hazardous reagents (no use of solvent washing) Adopting low energy demand processes Minimising the requirement to dewater mine pits (use of geopolymer or physical groundwater barriers) Using low quality (higher salinity) water to the extent possible; Recovering power generation off-gases for use in ore processing These project design aspects will be described in detail in the ERMP.</td>
</tr>
<tr>
<td><strong>Waste Hierarchy</strong> Wastes should be managed in accordance with the following order of preference: 1. avoidance; 2. reuse; 3. recycling; 4. recovery of energy; 5. treatment; 6. containment; 7. disposal.</td>
<td>The social and environmental impact assessments presented in the ERMP will specifically consider impacts at multiple scales in both space and time.</td>
</tr>
<tr>
<td><strong>Integrated Environmental Management</strong> If approaches to managing impacts on one segment of the environment have potential impacts on another segment, the best overall environmental outcome should be sought at a local, landscape, catchment and/or regional level.</td>
<td>Toro will use the information generated through the investigations outlined in this scoping document to develop environmental management plans and procedures which are effective and practicable, having regard to, among other things, local conditions and circumstances, including costs, and to the current state of technical knowledge. In managing and monitoring radiation, Toro will adopt the most reliable and effective measures available and achievable. The management plans developed for significant aspects of the Wiluna proposal will be made publicly available, along with other ERMP documentation.</td>
</tr>
<tr>
<td><strong>Best Practice</strong> When designing policies, systems, procedures or technologies for environmental management, best practice measures available at the time should be applied (EPA 2003).</td>
<td>Toro aims to support informed public participation in the environmental impact assessment process. To this end, Toro is actively engaging with stakeholders and providing opportunities for stakeholders to learn</td>
</tr>
<tr>
<td><strong>Accountability and Transparency</strong> 1) The aspirations of the people of Western Australia for environmental quality should drive</td>
<td></td>
</tr>
</tbody>
</table>

40
<table>
<thead>
<tr>
<th>Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>2) Members of the public should therefore be given: (a) access to reliable and relevant information in appropriate forms to facilitate a good understanding of environmental issues; and (b) opportunities to participate in policy and program development.</td>
</tr>
<tr>
<td>3) Environmental decisions should be made in a transparent manner and made public.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Applicability to this Proposal</th>
</tr>
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<tbody>
<tr>
<td>about the uranium mining industry and the environmental management issues associated with uranium mining. Where safe and appropriate, Toro is promoting the active participation of the Wiluna community in environmental assessment studies. Recognising that impacts of development cannot be managed or understood in isolation, Toro will continue its constructive interaction with local communities through the Regional Partnership Agreement.</td>
</tr>
</tbody>
</table>
Toro has completed a systematic aspects and impacts analysis to identify potential impacts on a range of environmental factors of constructing and operating the Wiluna uranium project. At this stage, neither the likelihood nor the significance of the potential impacts has been assessed. In some cases, Toro has identified a need for additional investigations or testing to enable the assessment of the potential impacts of the proposal or to allow management strategies to control impacts to be defined. The proposed additional studies are outlined in Table 7.

Key studies include desk and field studies for:

- Terrestrial fauna, including short range endemic invertebrates
- Subterranean fauna
- Flora and vegetation, including bush tucker
- Soils and landforms

Modelling and field studies, including monitoring of field trials, will be carried out in order to evaluate the potential impacts of project implementation on:

- Air quality
- Surface water
- Groundwater

Laboratory testing and modelling is proposed to assess the environmental behaviour of mine wastes (heap leach residues). Greenhouse trials are proposed to investigate aspects of mine rehabilitation, including treatments to maximise the success of natural revegetation.

All investigations will be carried out in accordance with EPA guidelines or with other relevant standards or codes of practice. The results of the further investigations will be presented in the ERMP and will be used as the basis for assessing the potential environmental impacts of the proposal.
## Table 8  Proposed scope of work for the assessment of potential environmental impacts

<table>
<thead>
<tr>
<th>Environmental factor and relevant area</th>
<th>Objectives</th>
<th>Relevant aspects and potential impacts</th>
<th>Additional studies required</th>
<th>Potential Management Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biophysical factors</strong></td>
<td></td>
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</tr>
</tbody>
</table>
| Soils and landforms within the direct project footprint and in areas potentially impacted by altered surface hydrology. | To maintain the integrity, ecological functions and environmental values of soil and landforms. | **Aspects:**
|                                       |            | ▪ Site preparation (vegetation clearing and earthworks); | Planned studies in 2010 include:
|                                       |            | ▪ Water disposal; | ▪ Assessment of existing surface soil characteristics (to maximum 2m depth), corresponding to landform attributes, vegetation community boundaries, and any previously mapped soil units within the project areas;
|                                       |            | ▪ Transport, storage, dispensing and use of fuels and reagents; | ▪ Characterisation of physical and chemical properties of surface soils from soil pit excavations, and hand sampling as appropriate;
|                                       |            | ▪ Waste generation, storage, treatment and disposal (process wastes) | ▪ Mapping of soil types within Project areas (Lake Way, Centipede and Centipede West).
|                                       |            | ▪ Waste generation, storage, treatment and disposal (non-process wastes) | ▪ Evaluation of soil materials as potential rehabilitation resources within areas of major disturbance;
|                                       |            | ▪ Mine closure, decommissioning and rehabilitation. | ▪ Identification of potentially-problematic soil / regolith materials and characteristics which may influence rehabilitation practices; and
|                                       |            | **Potential impacts:** | ▪ Identification of rehabilitation strategies and recommendations to enhance rehabilitation of the soils;
|                                       |            | The Proposal will irreversibly alter the physical characteristics of the soil profile in mined areas (~900 ha), as the material backfilled into the pit voids will be finer and contain fewer large voids than did the pre-mining profile. | ▪ Soil seed bank characterisation and glasshouse germination trials. |
|                                       |            | ▪ Loss of topsoil and soil seedbank during clearing and handling of shallow soil layers. | The following management practices may be adopted to limit impacts to soils in the project area:
|                                       |            | ▪ Compaction of surface soils beneath haul roads/access roads and in other trafficked areas, such as the plant site. | ▪ Adopting designs which minimise the extent of clearing required;
|                                       |            | ▪ Contamination of soils as a result of spillage of, fuels or reagents during use, storage, dispensing or transport. | ▪ Implementation of a clearing permit system;
|                                       |            | ▪ Contamination of surface soils, surface water, or groundwater by constituents of ore, in the event of a spillage, loss of containment or inadequate segregation of mined material. | ▪ Development and implementation of procedures for the conservation of topsoil;
|                                       |            |                                        | ▪ Appropriate design and surveillance of facilities for storage and dispensing of fuels and reagents;
|                                       |            |                                        | ▪ Design of drainage and sediment control systems to accommodate extreme rainfall events;
|                                       |            |                                        | ▪ Design of mining processes to separate material types;
|                                       |            |                                        | ▪ Controls on movement of radioactive materials.
# WILUNA URANIUM PROJECT
## Environmental Scoping Document

<table>
<thead>
<tr>
<th>Environmental factor and relevant area</th>
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<th>Relevant aspects and potential impacts</th>
<th>Additional studies required</th>
<th>Potential Management Strategies</th>
</tr>
</thead>
</table>
| Flora and vegetation within the direct project footprint and in areas potentially impacted by altered surface hydrology | To maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge. | **Aspects:**
- Site preparation (vegetation clearing and earthworks);
- Water abstraction;
- Water disposal;
- Excavation, haulage and stockpiling of ore and overburden;
- Mine closure, decommissioning and rehabilitation. | Desktop studies and field surveys will be conducted to identify the presence, distribution and condition of vegetation in the project area. Surveys will be carried out in accordance with EPA Guidance Statement 51 and will have regard to EPA Position Statements 1, 3 and 5. Assessment of impacts will consider the potential cumulative impacts at a regional level on vegetation which may not be represented in secure conservation reserves. | A formal land clearing permit system has been established to prevent accidental clearing. Vegetation clearing procedures will include weed hygiene and dust control requirements. The project footprint will be minimised by co-locating facilities to the extent practicable. Results of soil seed bank studies will be taken into account in developing a rehabilitation strategy. The strategy will include provision for acquisition of local provenance plant propagules prior to the commencement of clearing. Backfilling of pit voids. Progressive rehabilitation using local provenance vegetation. |
| | To prevent the introduction and spread of weeds, and to control weeds where they occur. | **Potential impacts:**
The Proposal will result in clearing of up to 1100 ha of native vegetation. No declared rare flora (DRF) or Threatened Ecological Communities (TECs) are known to occur in the project area, however 7 priority flora species are considered to have a moderate to high likelihood of occurring in or near the project area. Land clearing and haulage activities may indirectly impact vegetation through increased levels of dust deposition in close proximity to roads and other trafficked areas. Land clearing also has the potential to result in impacts on plant-water relations as a result of changes to surface flow paths or to the duration or frequency of flow in localised areas. Movement of vehicles and materials during project construction and operation has the potential to introduce and spread weeds into mining areas and adjacent native vegetation. Uptake of radionuclides or other contaminants by vegetation established on or near backfilled pits. Mine closure may affect flora and vegetation through the creation of permanent water bodies in pit voids (which could attract herbivores), by the introduction of plants from areas outside the local area, or by the failure to re-establish self-sustaining vegetation. Soil seed bank studies are in progress to examine the possible presence of species which may not be apparent during field surveys due to the recent low rainfall in the project area. Laboratory studies to evaluate mobility of constituents of heap leach residue in soils or groundwater. Survey of bush tucker foods to identify what plants are important to local gatherers of bush tucker and to evaluate the potential for exposure of people or animals to contaminants as a result of consumption of bush foods. Further consultation will be undertaken with Traditional Owners in |
| | To prevent the introduction and spread of plant pathogens. | | | |
| | To prevent fire damage to flora and vegetation. | | | |
### Environmental factor and relevant area

<table>
<thead>
<tr>
<th>Terrestrial fauna (including fauna used as “bush tucker”) and fauna habitats within the direct project footprint and in areas with potentially significant indirect impacts (altered hydrology, fire regimes, etc)</th>
</tr>
</thead>
</table>

### Objectives

To maintain the abundance, diversity, geographic distribution and productivity of native fauna at species and ecosystem levels

### Relevant aspects and potential impacts

**Aspects:**
- Site preparation (vegetation clearing and earthworks);
- Water disposal;
- Excavation, haulage and stockpiling of ore and overburden;
- Waste generation, storage, treatment and disposal (process wastes);
- Waste generation, storage, treatment and disposal (process wastes);
- Mine closure, decommissioning and rehabilitation.

**Potential impacts:**

The proposal will disturb up to 1100 ha of native vegetation which may provide habitat for native fauna. Baseline studies to date have so far observed only one species of conservation significance in the project area (Rainbow Bee Eater), although it is possible that some other conservation species occur in the locality at least occasionally.

Land within the active operations area will be alienated from pastoral uses during the life of the project.

Other potential impacts include:
- Fauna injuries or death as a result of collision with vehicles;
- Exposure of fauna to radioactive materials or other contaminants;
- Behavioural changes arising from changes in noise or light levels;
- Changes in fauna movements as a result of changes in habitat connectivity;
- Entrapment of fauna in open excavations;

### Additional studies required

Desktop studies and field surveys will be conducted to identify the presence and distribution of native fauna. The surveys will include targeted searches for priority species which have been reported in the general project region.

Surveys will be carried out in accordance with EPA Guidance Statements 20 and 56 and will have regard to EPA Position Statements 1, 3 and 5.

Assessment of impacts to terrestrial fauna (both vertebrate and invertebrate) will take into account the potential impacts of project implementation on fauna at both a local and regional level.

Studies into the potential ecotoxicological effects of radionuclides or other contaminants on non-human biota will consider effects on animals in the foodchain.

### Potential Management Strategies

The locations of key fauna habitat will be taken into account when refining the project layout; important or better quality habitat will be avoided to the extent practicable.

Land will be progressively rehabilitated to a condition which is functionally similar to the pre-mining condition.

Development of risk based design criteria for radiation and other pollution protection controls.

Dust suppression and control mechanisms designed to meet Best Practicable Technology standards.

Designs to minimise contaminant release to surface water and groundwater.

Designs to contain designated materials within a restricted release zone.

Development of:
- Radiation Management Plan
- Radiation Waste Management Plan
- Radiation monitoring program

Land clearing procedures will include practices aimed at reducing fire hazard, controlling vehicle speed, and minimising noise.

Open excavations will be monitored (in the case of temporary works) or fenced.
### Environmental factor and relevant area

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<tbody>
<tr>
<td>Subterranean fauna within the mine pits areas and area within the projected groundwater drawdown cones at the mine and borefield.</td>
<td>• Attraction of fauna (including feral herbivores or carnivores) to areas used for storage of water or food wastes.</td>
<td></td>
<td>to prevent entrapment of fauna. Pits will be backfilled. No water impoundments will remain after mine closure. Food wastes will be managed appropriately to prevent access by scavengers.</td>
</tr>
</tbody>
</table>
| To maintain the abundance, diversity, regional distribution and productivity of subterranean fauna at the species and ecosystem levels. | **Aspects:**  
  - Water abstraction;  
  - Water disposal;  
  - Excavation, haulage and stockpiling of ore and overburden;  
  - Ore treatment;  
  - Transport, storage, dispensing and use of fuels and reagents;  
  - Waste generation, storage, treatment and disposal (process wastes);  
  - Mine closure, decommissioning and rehabilitation. | **Additional field and laboratory investigations of both stygofauna and troglobifuna are proposed to complement work completed for the project in 2007 and to supplement previous research carried out by others in the Wiluna region.** | **Adoption of strategies to reduce water use and the need for dewatering. These may include:**  
  - Use of geopolymer or physical barriers to minimise the need for dewatering the area immediately surrounding the mine voids;  
  - Use of ore extraction methods which are more tolerant of salt in process water, so as to reduce the need for water abstraction from the proposed West Creek borefield;  
  - Recycling of process water and use of low-water demand ore extraction technologies;  
  - Recharge of ground water intercepted by the pit dewatering system. |
| | **Potential impacts:**  
  Approximately 1200 ha of land will be disturbed during mining. If subterranean fauna are present in these areas, there will be a loss of habitat. It is not known whether subterranean fauna would recolonise backfilled pit voids. | | |
| | Habitat loss or alteration may also occur within the areas lying within the groundwater drawdown cones around the water supply bores and mine pits and in any areas used for recharging or disposal of surplus water. | | |

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<table>
<thead>
<tr>
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</table>
| Riparian biota of Lake Way, including cyanobacterial mats | To maintain the ecological function, at a catchment scale, of the lake ecosystem. To maintain or restore the stability and productivity of land surfaces affected by mining activities. To ensure that emissions do not adversely affect environment values or the health of biota. | Aspects:  
- Direct disturbance of surface  
- Changes to surface hydrology (duration and frequency of inundation)  
- Alteration to lake water or sediment chemistry  
Potential impacts:  
- Mechanical disturbance of biological crusts may affect soil surface stability in localised areas.  
- Altered water or sediment chemistry could affect emergence of dormant communities in the lake, altering food cycles.  
- Discharge of contaminants could result in uptake by benthic flora or fauna and introduction of the contaminants to the local food chain. | Lake ecology studies completed in 2007 will need to be reviewed to examine the significance of proposed direct and indirect impacts arising from project implementation. Further characterization of lake sediment chemistry is planned. Planned hydrological studies will provide the basis for characterizing possible changes to surface water quality and flow regimes. Planned ecotoxicological risk assessments will consider the potential consequences of exposure of lacustrine or riparian biota to waterborne or airborne contaminants. | The following management practices may be adopted to limit impacts to benthic fauna and bacterial mats in the project area:  
- Adopting designs which minimise the extent of clearing required;  
- Implementation of a clearing permit system;  
- Water management systems will emphasise containment and reuse – rather than discharge – of any surplus water;  
- Development of risk based design criteria for pollution controls;  
- Designs to contain designated materials within a restricted release zone. |
| Lacustrine biota of Lake Way, including benthic microbial fauna | | | | |
| Surface water in Lake Way and in the drainage lines discharging to or receiving flow from Lake Way. | To maintain the quality and hydrological function of surface water systems so that existing environmental values and, ecological functions are protected. | Aspects:  
- Site preparation (vegetation clearing and earthworks);  
- Water disposal;  
- Ore treatment;  
- Product storage and transport  
- Transport, storage, dispensing and use of fuels and reagents;  
- Waste generation, storage, treatment and disposal (process wastes) | Hydrological studies are planned to:  
- Characterise existing flow regimes in and near the project area, including the relationship between surface water and groundwater flow systems;  
- Characterise surface water quality (including salinity and major ion chemistry, turbidity and trace elements);  
- Estimate the frequency, magnitude | Scheduling of clearing to avoid times when intense rainfall events are more likely;  
- Provision of sediment control structures downstream of stockpiles or disturbed areas;  
- Sizing of drainage channels and culverts to prevent creation of water shadows or ponding;  
- Standard engineering controls to limit |
## WILUNA URANIUM PROJECT
Environmental Scoping Document

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<td></td>
<td>WASTE GENERATION, STORAGE, TREATMENT AND DISPOSAL (NON-PROCESS WASTES)</td>
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<tr>
<td></td>
<td>MINE CLOSURE, DECOMMISIONING AND REHABILITATION.</td>
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<tr>
<td>Potential impacts:</td>
<td>INCREASED EROSION AND SEDIMENT TRANSPORT AS A RESULT OF LAND CLEARING OR EARTHWORKS, WHICH COULD INCREASE TURBIDITY OF SURFACE WATER AT A LOCAL SCALE.</td>
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<td></td>
<td>CONSTRUCTION OF ACCESS ROADS, HAUL ROADS, DRAINAGE STRUCTURES AND FILL PLATFORMS HAS THE POTENTIAL TO ALTER THE DIRECTION, THE DEPTH AND THE VELOCITY OF SURFACE FLOWS AFTER RAINFALL EVENTS, AND MAY ALSO CHANGE THE FREQUENCY OR THE DURATION OF WATER PONDING IN SOME AREAS.</td>
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<td></td>
<td>CONTAMINATION OF SURFACE WATER AS A RESULT OF SPILLAGE OF FUELS OR REAGENTS;</td>
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<td></td>
<td>CONTAMINATION OF SURFACE WATER AS A RESULT OF LOSS OF CONTAINMENT OF ORE OR PREGNANT LIQUOR SOLUTION.</td>
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<tr>
<td>Groundwater within the project’s zone of hydrological influence</td>
<td>To maintain the quality and quantity of groundwater so that environmental values and existing uses, including ecosystem function, are protected.</td>
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<tr>
<td>Aspects:</td>
<td>WATER ABSTRACTION;</td>
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<td></td>
<td>WATER DISPOSAL;</td>
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<td></td>
<td>ORE TREATMENT;</td>
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<td></td>
<td>TRANSPORT, STORAGE, DISPENSING AND USE OF FUELS AND REAGENTS;</td>
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<tr>
<td></td>
<td>WASTE GENERATION, STORAGE, TREATMENT AND DISPOSAL (PROCESS WASTES)</td>
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<tr>
<td></td>
<td>and duration of flooding events which may affect the project area during or following the active life of the mine;</td>
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<td></td>
<td>EVALUATE THE POSSIBLE IMPACTS ON PROJECT INFRASTRUCTURE AND ON POLLUTION CONTAINMENT SYSTEMS OF A 1 IN 100 YEAR FLOOD EVENT AND HOW POSSIBLE IMPACTS OF SUCH AN EVENT WOULD BE MANAGED.</td>
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<td></td>
<td>IDENTIFY SURFACE WATER FEATURES AND ENVIRONMENTAL RECEPTORS WHICH ARE LIKELY TO BE STRONGLY INFLUENCED BY CHANGES IN SURFACE WATER FLOWS OR QUALITY (FOR EXAMPLE, RIPARIAN SYSTEMS).</td>
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<td></td>
<td>LABORATORY TESTING TO EVALUATE THE ENVIRONMENTAL MOBILITY OF CONSTITUENTS OF ORE AND HEAP LEACH RESIDUES.</td>
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<td></td>
<td>DETAILED TOPOGRAPHIC SURVEYS HAVE RECENTLY BEEN COMPLETED TO PROVIDE INPUT TO THE PLANNED HYDROLOGICAL STUDIES.</td>
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<td></td>
<td>USE OF GEOPOLYMER OR PHYSICAL BARRIERS TO MINIMISE THE NEED FOR DewaterING OF THE AREA IMMEDIATELY SURROUNDING THE MINE voids;</td>
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<td></td>
<td>USE OF ORE EXTRACTION METHODS WHICH ARE MORE TOLERANT OF SALT IN PROCESS WATER, SO AS TO REDUCE THE NEED FOR WATER ABSTRACTION FROM THE PROPOSED WEST CREEK BOREFIELD.</td>
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<td></td>
<td>RECYCLING OF PROCESS WATER AND USE OF LOW-WATER DEMAND ORE EXTRACTION TECHNOLOGIES.</td>
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<tr>
<td></td>
<td>DEVELOPMENT OF PROJECT WATER MANAGEMENT PLANS TO GUIDE OPERATING STRATEGIES UNDER BOTH ROUTINE AND EXTREME WEATHER SCENARIOS.</td>
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<tr>
<td></td>
<td>WATER MANAGEMENT SYSTEMS WILL EMPHASISE CONTAINMENT AND REUSE – RATHER THAN DISCHARGE – OF ANY SURPLUS WATER.</td>
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# Environmental Scoping Document

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<tr>
<td></td>
<td></td>
<td>Potential impacts:</td>
<td>groundwater drawdown in the mining operations areas and in the proposed water supply borefield.</td>
<td>Management Plan which identifies and mitigates the impact of any water discharge or disposal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The chemical characteristics of subsurface material from the ore zone may be affected by the alkaline leaching process. The soil pH and the mobility of trace metals may be higher in backfilled material, compared to the pre-mining condition.</td>
<td>Numerical modelling of the fate and transport of contaminants associated with ore treatment and process waste disposal facilities.</td>
<td>Project Water Management Plan to include regular monitoring of quality and quantity of water at agreed locations and provision of monitoring results to users</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Assessment of the environmental consequences of disposal of reject water from the demineralisation (reverse osmosis) plant.</td>
<td>Mitigation measures implemented by Toro where monitoring identifies their necessity</td>
</tr>
</tbody>
</table>

## Pollution management

**Radiation in the workplace and in areas potentially impacted by emissions to air or water.** To limit radiation exposure to members of the public to less than 1 mSv per year over and above background radiation exposure.

To demonstrate that management controls are maintained so that radiation exposures of all receptors are as low as reasonably achievable, taking into account relevant social, economic and technical factors.

**Aspects:**
- Site preparation (vegetation clearing and earthworks);
- Water disposal;
- Excavation, haulage and stockpiling of ore and overburden;
- Ore treatment;
- Product storage and transport
- Waste generation, storage, treatment and disposal (process wastes)
- Waste generation, storage, treatment and disposal (non-process wastes)
- Mine closure, decommissioning and rehabilitation.

**Potential impacts:**
- Dust emission from areas where ore mineralisation is near surface.
- Radon emanation from disturbed areas where mineralisation is near surface.

**Collection and analysis of radiological baseline data including:**
- Airborne radiometric survey with ground truthing to obtain area gamma dose rate;
- Radionuclides in soils
- Long lived alpha activity in airborne dust
- Airborne radon concentrations in air
- Radionuclides in selected vegetation and fauna.
- Radionuclides in groundwater and surface waters.

On- and near-site monitoring to confirm dust emission factors and radon emanation rates.

Airborne dispersion modelling to predict radon and radionuclide activities in airborne.

**Development of risk based design criteria for radiation protection controls.**
- Dust suppression and control mechanisms designed to meet Best Practicable Technology standards.
- Designs to minimise radon emanation potential
- Designs to minimise impact on surface and groundwater.
- Designs to contain designated materials within a restricted release zone.

Development of:
- Radiation Management Plan
- Radiation Waste Management Plan
- Radiation monitoring program
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<td></td>
<td>Contamination of soils, sediments, surface or groundwater by radionuclides.</td>
<td>and deposited dust. Modelling of radionuclide transport in surface and groundwater to assess potential radiation exposure pathways to member of the public and the environment. Comprehensive review of the engineering and infrastructure proposals to assess the radiological implications of the project. Determine Member of Public Critical Groups and assess current and future radiation exposures. Assess the potential radiological impacts on workers, members of the public and non-human biota, during operation and following closure. Development of an approved design for a process waste repository and design all waste disposal facilities to minimise environmental impact. Development of a public dose model post-mining Development of design criteria for the final rehabilitated landform to ensure member of the public dose, above background, will not exceed 1mSv per year.</td>
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### Environmental factor and relevant area

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</table>
| Air quality within the local airshed  | To ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and other biota. | Aspects:  
- Site preparation (vegetation clearing and earthworks);  
- Excavation, haulage and stockpiling of ore and overburden;  
- Ore treatment;  
- Product storage and transport  
- Transport, storage, dispensing and use of fuels and reagents;  
- Waste generation, storage, treatment and disposal (process wastes); and  
- Burning of fossil fuels by mobile plant and in diesel generators for power production.  
Potential impacts:  
No significant impacts on air quality are likely to occur as a result of land clearing, site preparation works or burning of fossil fuels by mobile or fixed plant. | Dust monitoring will be carried out during proposed field trials to confirm the efficacy of proposed dust control methods and to allow estimation of emission factors for use in air quality modelling.  
Predictive modelling to estimate worst case environmental exposures to particulates and other airborne contaminants.  
Modelling of SO2 emissions from power generation and evaluation of potential impacts of airborne emissions from fuel burning on air quality at sensitive receptors, including the mine site accommodation village. | Standard dust control practices including use of water carts on roads and other cleared areas; scheduling clearing to avoid extremely windy periods and minimising the extent of clearing at any given time.  
Dust control systems will be built into all fixed plant. |
| Noise in the project sites and immediate surrounds | To protect the amenity of sensitive receptors by ensuring the noise levels meet statutory requirements and relevant standards. | Aspects:  
- Site preparation (vegetation clearing and earthworks);  
- Excavation, haulage and stockpiling of ore and overburden;  
Potential impacts:  
No significant noise or vibration impacts are likely to arise during land clearing or site preparation works. | Noise monitoring to be conducted as part of feasibility studies to check emissions from plant and process.  
Noise modelling will be undertaken to confirm that the project will not result in noise or vibration effects that contravene the Environmental Protection (Noise) Regulations 1997  
Noise emissions are unlikely to be environmentally significant. |
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| Greenhouse emissions from on-site activities (including land clearing) and related activities such as haulage of product or transport of equipment and reagents. | To limit greenhouse emissions to as low as practicable. | **Aspects:**  
- Site preparation (vegetation clearing and earthworks);  
- Excavation, haulage and stockpiling of ore and overburden;  
- Ore treatment;  
- Product storage and transport  
- Transport, storage, dispensing and use of fuels and reagents;  
- Mine closure, decommissioning and rehabilitation.  
**Potential impacts:**  
Vehicle emissions from vegetation clearing and from earthmoving plant used during land clearing will make a modest contribution to greenhouse gases. | Greenhouse emissions estimates will be reviewed and refined when the final project implementation schedule, equipment fleet and clearing footprint have been defined. This information will be presented in the ERMP. | Minimisation of haul distances and clearing footprint by superimposing disturbance areas to the extent practicable: for example, evaporation ponds will be located in areas previously used for, or proposed to used for, mining.  
Ore treatment facilities will be located as close as practicable to the orebodies to minimise haulage.  
Carbon dioxide from power generation will be captured and used in the milling process. |
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<tr>
<td>Public health and safety</td>
<td></td>
<td>Radiation in the project area, along transport routes and in areas potentially affected by emissions from the project.</td>
<td>To limit radiation exposure to members of the public to less than 1 mSv per year over and above background radiation exposure.</td>
<td>Development of packaging and transport policies and emergency response protocols to comply with Australian and international standards through an emergency response and crisis management plan. Transport management program. Security management plan. Community consultation on uranium transport routes. Confirmation through an approved monitoring program that worker and public dose meet ALARA principles. Waste facilities all designed to Best Practicable Technology and ARPANSA standards.</td>
</tr>
</tbody>
</table>
|                                        |            | To demonstrate that management controls are maintained so that radiation exposures of all receptors are as low as reasonably achievable, taking into account relevant social, economic and technical factors. | Aspects:  
- Product storage and transport  
- Mine closure and rehabilitation | Development of a public dose model post-mining. Development of design criteria for the final rehabilitated landform to ensure member of the public dose, above background, will not exceed 1mSv per year. Chemical modelling and pilot testing of the extraction process to determine if radionuclides are concentrated in any part of the process. |
|                                        |            | Potential impacts:  
- Accident during transport resulting in release of radioactive material from containment.  
- Radiation exposure to members of the public and workers during transport.  
- Movement of radionuclides into groundwater from waste disposal areas. Gamma dose rate on surface of disposal areas.  
- Radiation exposure to members of the public on the rehabilitated landform | Review of transport routes and options  
- Assessment of transport alternatives and routes and associated risks.  
- Modelling of potential radiation exposure to members of the public and transport workers under both normal and emergency conditions.  
- Determine Member of Public Critical Groups and assess current and future radiation exposures.  
- Assess the potential radiological impacts on workers, members of the public and non-human biota, during operation and following closure.  
- On- and near-site monitoring to confirm dust emission factors and radon emanation rates.  
- Airborne dispersion modelling to predict radon and radionuclide activities in airborne and deposited dust.  
- Modelling of radionuclide transport in surface and groundwater to assess potential radiation exposure pathways to member of the public and the environment.  
- Development of an approved design for a process waste repository and design all waste disposal facilities to minimise environmental impact.  
- Development of a public dose model post-mining  
- Development of design criteria for the final rehabilitated landform to ensure member of the public dose, above background, will not exceed 1mSv per year.  
- Chemical modelling and pilot testing of the extraction process to determine if radionuclides are concentrated in any part of the process. |
<table>
<thead>
<tr>
<th>Environmental factor and relevant area</th>
<th>Objectives</th>
<th>Relevant aspects and potential impacts</th>
<th>Additional studies required</th>
<th>Potential Management Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transport</strong></td>
<td></td>
<td>- Increase noise and traffic hazard</td>
<td></td>
<td>Development of packaging and transport policies and emergency response protocols to comply with Australian and international standards through an:</td>
</tr>
<tr>
<td>Transport along road or rail corridors within Western Australia used for transport of product</td>
<td></td>
<td>- Risk of increased radiation exposure in the event of product spillage</td>
<td>- Review of transport routes and options</td>
<td>- Emergency Response and Crisis Management Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Assessment of transport alternatives and routes and associated risks.</td>
<td>- Transport Management Program</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Modelling of potential radiation exposure to members of the public and transport workers</td>
<td>- Security Management Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Community consultation on uranium transport routes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- To limit radiation exposure to members of the public to less than 1 mSv per year over and above background radiation exposure.</td>
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<tr>
<td></td>
<td></td>
<td>- To limit radiation exposure of transport worker and emergency responders to as low as reasonably achievable.</td>
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<tr>
<td></td>
<td></td>
<td>- To minimise the potential adverse affects on people or the environment associated with road or rail transport of product.</td>
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</tr>
</tbody>
</table>
### Environmental factor and relevant area

<table>
<thead>
<tr>
<th>Objectives</th>
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</thead>
<tbody>
<tr>
<td><strong>Mine Closure and Rehabilitation</strong></td>
<td>To restore disturbed land to a stable, functioning and non-polluting condition which is visually compatible with the surrounding landscape and which can support agreed post-closure land uses.</td>
<td>Aspects:</td>
<td>Physical and geochemical characterisation of process residues, waste rock and overburden;</td>
</tr>
<tr>
<td>Decommissioning of mining plant and infrastructure and rehabilitation of land or water systems affected by mining. Includes mined areas, processing facilities, built infrastructure, and waste storage or disposal areas.</td>
<td></td>
<td></td>
<td>Estimation of waste quantities and documentation of the timing of land disturbance, waste generation and progressive land rehabilitation;</td>
</tr>
<tr>
<td>Transition of community and supplier relationships to a post-operational status. Includes Wiluna community, employees and suppliers.</td>
<td></td>
<td></td>
<td>Hydrological characterisation of pit voids (including consideration of effects of perimeter barriers if left in-situ)</td>
</tr>
<tr>
<td></td>
<td>Potential impacts:</td>
<td></td>
<td>Estimation of quantities of concrete, steel, pipelines, and other materials to be salvaged or removed from site;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Modelling of surface and groundwater pathways potentially leading to human and / or ecological contaminant exposures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Modelling of longterm behaviour built landforms and associated containment systems under a range of climatic and (if relevant) seismic events</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Risk-based development of environmental performance criteria (in consultation with stakeholders)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Evaluation of the social and economic effects of closure on the Wiluna community</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rehabilitation and closure management and mitigation measures will be described in a comprehensive Rehabilitation and Closure Plan. A conceptual closure plan will be provided as an appendix to the ERMP. The closure plan would incorporate design features and management measures for the safety and effective closure of uranium mining and processing facilities (whether planned or unplanned).</td>
</tr>
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</table>
| | | Rehabilitation and closure management and mitigation measures will be described in a comprehensive Rehabilitation and Closure Plan. A conceptual closure plan will be provided as an appendix to the ERMP. The closure plan would incorporate design features and management measures for the safety and effective closure of uranium mining and processing facilities (whether planned or unplanned). |}

The strategies required to achieve closure objectives will depend in part upon discussions with regulators and other stakeholders about post-mining land uses and the associated environmental performance measures to demonstrate the attainment of agreed closure outcomes. After these outcomes have been assessed strategies for achieving them will be defined.
### Socio-economic issues

<table>
<thead>
<tr>
<th>Environmental factor and relevant area</th>
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<th>Additional studies required</th>
<th>Potential Management Strategies</th>
</tr>
</thead>
</table>
| **Heritage and culture in the project site** | To ensure that the proposal complies with the requirements of the Aboriginal Heritage Act 1972; and to ensure that changes to the biophysical environment do not adversely affect historical and cultural associations. | **Aspects:**  
- Site preparation (vegetation clearing and earthworks);  
- Mine closure, decommissioning and rehabilitation.  
**Potential impacts:**  
Potential impacts associated with land clearing include:  
- Disturbance of heritage features or places;  
- Temporary or permanent constraint of traditional cultural activities in the development area. | Continuing consultation with Aboriginal people  
Further heritage surveys and cultural mapping of the Project Area to identify sites of significance to Aboriginal people  
Assessment of impacts on any Aboriginal sites of significance in accordance with EPA Guideline 41 | Negotiation of mining agreement with native title claimants including a Cultural Heritage Management Plan to establish arrangements for protecting and managing Aboriginal Heritage and regular consultation and liaison with Traditional Owners about project impacts during the construction and operational phases.  
Community development programs in conjunction with Traditional Owners. |
| **Conservation Estate** | To protect the environmental values of areas identified as having significant environmental attributes. | **Aspects:**  
- Site preparation (vegetation clearing and earthworks);  
- Mine closure, decommissioning and rehabilitation.  
**Potential impacts:**  
The nearest conservation reserve to the Wiluna project area is the Wanjarri nature reserve, located approximately 60 km to the south-southeast of the project area. No impacts on the conservation reserve are likely to occur as a result of land clearing for the Wiluna uranium project. | Desk studies for flora and fauna will include database searches for a search window including the Wanjarri reserve.  
Fauna and flora values of the Wanjarri reserve will be taken into consideration when assessing the regional scale significance of planned flora and fauna investigations. | No impacts on the Wanjarri reserve are likely. |
<table>
<thead>
<tr>
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</tr>
</thead>
</table>
| Land access and use in the Wiluna area  | To minimise disruption to existing uses and enjoyment of land in the project area, while maintaining appropriate standards of public safety. To maximise social and economic benefits, especially to the Wiluna community and surrounding region. | Aspects:  
- Site preparation (vegetation clearing and earthworks);  
- Water abstraction  
- Water disposal;  
- Excavation, haulage and stockpiling of ore and overburden;  
- Ore treatment;  
- Product storage and transport  
- Waste generation, storage, treatment and disposal (non-process wastes)  
- Mine closure, decommissioning and rehabilitation.  
Potential impacts: Disruption of existing community and land use activities, including for pastoral and traditional uses of the land as a result of the construction and presence of the mine, processing plant and infrastructure. | A social impact assessment to determine the potential impacts of and possible opportunities from the proposed development, with a focus on the Wiluna community. The scope will include –  
- Impacts on local services and facilities  
- Employment and other implications of the construction and operational phases | Through continuing community consultation and involvement in the Regional Partnership Agreement with Commonwealth, State and Local Government Agencies, measures will be considered to minimise any adverse impacts and enhance social and economic benefits.  
A commitment by Toro to maximise local participation in the project, including by locally owned businesses |
7 Community and stakeholder engagement

7.1 Objectives

Toro is undertaking community and stakeholder engagement to support the project assessment and approval process and to ensure that all individuals, groups and agencies with an interest in the project have access to relevant information and can raise issues of interest or concern.

This will allow such issues to be addressed in the ERMP and encourage interested parties to comment on the project during the public review periods.

7.2 Stakeholder consultation

Toro has undertaken its own project specific consultation in Wiluna and the wider region and also participated in industry initiatives to provide information about uranium mining to local and regional communities. This has included participation in public forums in Kalgoorlie, Wiluna, Leonora, Laverton and Menzies.

Through CDNTS, Toro has participated in meetings of the native title claimants to provide updates on the project. Toro has established a regular presence in the Wiluna Shire offices to enable consultation with the local community as the project progresses.

Other consultation has occurred or is planned through –

Western Australian Government Agencies

- Department of Mines and Petroleum
- Environmental Protection Authority
- Department of Environment and Conservation
- Department of Transport
- Department of Water
- Department of Regional Development and Lands
- Department of Health
- Department of Indigenous Affairs

Commonwealth Government Agencies –

- Department of Environment Water Heritage and the Arts (DEWHA)
- Department of Resources, Energy and Tourism (DRET)
- Australian Safeguards and Non-Proliferation Office (ASNO)
- Geosciences Australia
- Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)

Other State and Territory Government Departments

- Department of Premier and Cabinet (South Australia)
- Northern Territory Department of Natural Resources, Environment, the Arts and Sport
- Northern Territory Worksafe

Western Australian Local Government

- Shire of Wiluna
- City of Kalgoorlie-Boulder
- Shire of Menzies
- Shire of Leonora

Environmental and Anti-Nuclear Interest Groups

- Conservation Council WA Inc
- Australian Conservation Foundation
- Malleefowl Preservation Group
- Wilderness Society WA Inc
- Anti-nuclear Alliance of WA

National and WA Industry Organisations

- Chamber of Minerals and Energy
- Australian Uranium Association

7.3 Provision of information

Toro will continue an active program of stakeholder engagement during project assessment. This will include –

- Local community information meetings
- Regional forums
8 Project and assessment schedule

Subject to government approvals, Toro proposes to start construction activities in early 2012 and to commence uranium production early the following year. The following project milestones would apply –

<table>
<thead>
<tr>
<th>Project Stage</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commence construction and pre-mining at Centipede deposit</td>
<td>2012</td>
</tr>
<tr>
<td>Commence production from Centipede deposit</td>
<td>2013</td>
</tr>
<tr>
<td>End production from Centipede and commence pre-mining at Lake Way deposit</td>
<td>2017</td>
</tr>
<tr>
<td>Complete mine closure</td>
<td>2024</td>
</tr>
</tbody>
</table>

The level of assessment for the project has been set as an ERMP with a 14 week public review period. An indicative project assessment schedule is -

<table>
<thead>
<tr>
<th>Project Stage</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Studies</td>
<td>March 2009 – July 2010</td>
</tr>
<tr>
<td>Stakeholder consultation for ERMP</td>
<td>March 2009 – approval of project</td>
</tr>
<tr>
<td>First draft ERMP for EPA review</td>
<td>November 2010</td>
</tr>
<tr>
<td>Final draft ERMP to EPA</td>
<td>February 2011</td>
</tr>
<tr>
<td>ERMP public review</td>
<td>March 2011 – June 2011</td>
</tr>
<tr>
<td>Toro’s draft response to public submissions submitted to EPA</td>
<td>August 2011</td>
</tr>
<tr>
<td>EPA assessment report issued to Minister of Environment and published</td>
<td>November 2011</td>
</tr>
<tr>
<td>Public review of EPA assessment (2 week appeals period)</td>
<td>November 2011</td>
</tr>
</tbody>
</table>

9 Matters Excluded

The scope of assessment by the ERMP will cover mining, processing and transport of uranium for export. Other aspects of the nuclear fuel cycle will not be included in the assessment.

10 STUDY TEAM

Toro Energy Limited will prepare the environmental assessment document for the Wiluna project with assistance from a team of specialist consultants.

**Toro Energy Limited**

- Richard Dossor – project director
- Dayle Kenny – technical director
- Richard Yeeles – approvals & community director
- Kathryn Taylor – health, safety, environment and radiation manager
- David Klesser – Principal environmental advisor
- Lisa Chandler - Environmental coordinator

**Technical Specialists**

- Surface hydrology and groundwater – Aquaterra
- Air quality – Air Assessments
- Radiation – Paulka Radiation & Environment Pty Ltd
- Geochemistry – CSIRO
- Soil and landforms – Outback Ecology Services
- Flora and vegetation – Niche Environmental Services
- Terrestrial fauna – Outback Ecology
- Subterranean fauna – Outback Ecology
- Heritage – David Raftery (through CDNTS)
11 Peer Review

The ERMP will be subject to peer review. Independent reviews by recognised technical experts will be carried out on for selected significant environmental aspects. The aspects for which independent review will be commissioned will be determined following completion of the additional investigations outlined in this scoping document and will focus on the more complex environmental issues or those which have a relatively higher level of risk.
12 References


Department of Water (DoW), 2000. Statewide Policy No. 5 : Environmental water provisions policy for Western Australia, 2000.

Department of Water (DoW), 2003a. Statewide Policy No. 10: Use of operating strategies in the water licensing process.

Department of Water (DoW), 2003b. Mine void water resource issues in Western Australia


EPA, 2009c. Draft Environmental Assessment Guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities.


IAEA, 2009e. Management system for the safe transport of radioactive materials, safety standard series number TS-G-1.4.


