BEVERLEY NORTH MINE

PROGRAM FOR ENVIRONMENT PROTECTION AND REHABILITATION

27 April 2016

Mine owner	**Heathgate Resources Pty Ltd**
Mine operator	**Heathgate Resources Pty Ltd**
Contact person	**Craig Bartels – President**
Contact details	**Suite 1, Level 7, 25 Grenfell Street, Adelaide SA 5000**
	Telephone: 08 8110 0500 Fax: 08 8212 5559
	Email: Andrea.Marsland-Smith@heathgate.com.au
Tenement details	**ML 6387**
Name of mining operation	**Beverley North Project**
Commodity to be mined	**Uranium**
Original PEPR application date	**21 December 2010**
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Prepared by

Heathgate Resources Pty Ltd
Suite 1, Level 7
25 Grenfell Street
Adelaide SA 5000

1 INTRODUCTION

1.1 General Description of the Project

This Program for Environment Protection and Rehabilitation (PEPR) covers the construction and operation of the Beverley North Mine to be undertaken within the Beverley North Mining Lease (ML) 6387 in northern South Australia. This document has been prepared by Heathgate Resources Pty Ltd (Heathgate) in accordance with Guidelines prepared by DSD (PIRSA 2009 - refer Appendix A). Heathgate is the owner of the Beverley North ML and will be the operator for the project.

Figure 1-1 shows the general location of the Beverley and Beverley North Mines. Beverley North uranium deposits are located on the arid plains between the Northern Flinders Ranges and Lake Frome, approximately 550 km north of Adelaide and 300 km north-east of Port Augusta. Heathgate operates both the Beverley North Mine and the adjacent Beverley Uranium Mine and currently produces up to 1,000 tonnes of uranium (expressed as U_3O_8) per annum, in the form of uranium oxide concentrate (UOC).

The Beverley North ML lies within the boundaries of Exploration Lease EL 4387 (formerly EL 3251). A Mining Lease Proposal/Public Environment Report (MLP/PER; Heathgate 2010a) covering part of EL 4387 was lodged by Heathgate in April 2010. This documentation was considered by the relevant State and Commonwealth Authorities, which resulted in the granting of the Beverley North ML. This area is shown in Figure 1-2, and is the area covered in this PEPR.

Recovery of the Beverley North uranium deposits is via in-situ recovery (ISR) methodology to provide uranium-bearing resin as part of the feedstock requirements for the Beverley Uranium Mine, which is located on the adjacent ML 6321.

The Beverley North Mine will comprise ISR wellfields and satellite resin capture plants at Beverley North, with loaded resin to be trucked to Beverley for recovery of UOC. Mining of the Beverley North deposits will extend the life of the Beverley Uranium Mine and allow for continued production of UOC at Beverley.

This PEPR demonstrates that the Beverley North Mine can be developed to meet applicable South Australian and Australian best practice guidelines, with no significant environmental impact.

1.2 Background to the Project

1.2.1 Legislative

In accordance with Mining Regulations 42(b), all MLs are subject to a requirement that operations are carried out in an orderly and skilful manner in accordance with an approved PEPR.

This PEPR has been prepared by Heathgate with reference to Guidelines dated February 2009 prepared by DSD[1] (PIRSA 2009).

[1] DSD (Department of State Development) was PIRSA at the time of release of the 2009 guidelines.

Figure 1-1 Beverley North / Beverley - Location

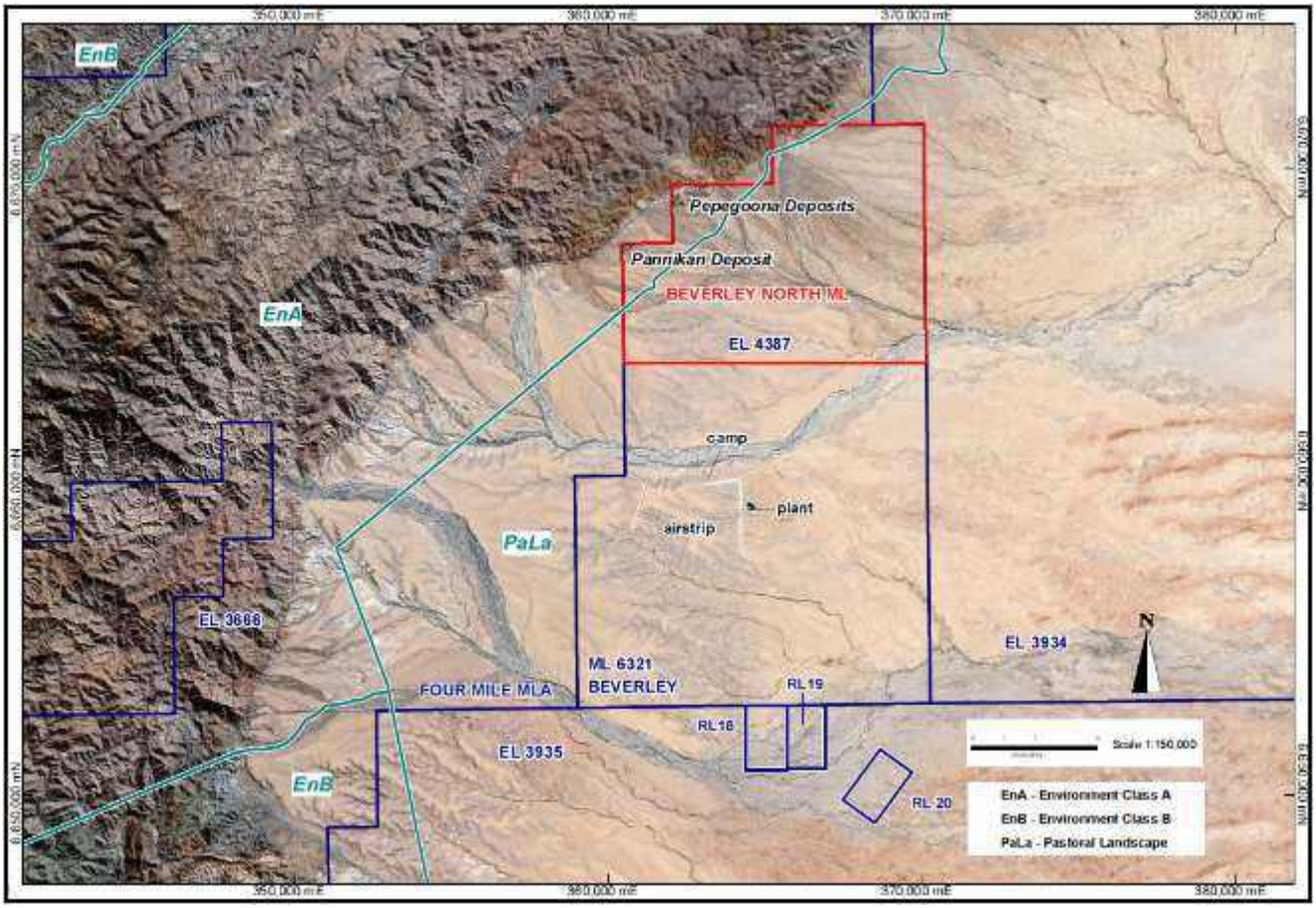

Figure 1-2 Beverley North ML and Existing Beverley Mine

The Guidelines are equivalent to those that provided guidance on the preparation of the MLP/PER for this project (Heathgate 2010a, 2010b) as well as for the preceding Beverley North Retention Lease Application – Field Leach Trial (Heathgate 2010c).

As the proposed action is a "controlled action" under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval for the project was also required from the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities. Conditional approval was granted on 6 December 2010.

Since the mine involves the mining of radioactive ore (uranium), licensing under the *Radiation Protection and Control Act 1982* (RPC Act) also applies, and the appropriate licence(s) have been obtained. Heathgate's EPA licence 12918, held in accordance with Section 36 of the *Environment Protection Act 1993* (EP Act), licensing for conduct of *prescribed activities of environmental significance* is also required and has been obtained.

1.2.2 Approvals Background

An Environmental Impact Statement (EIS) was prepared in 1998 (Heathgate 1998a, b) to satisfy both Commonwealth and South Australian Government requirements, resulting in approval of the Beverley project, an Export Permit and other related approvals. In 2008 Heathgate was granted approval for an extension of the previously approved mining area. The approval resulted in replacement of the previous ML 6036 with the larger ML 6321, comprising part of the previous EL 3251 (now EL 4387) and subsuming the former ML 6036 and three Miscellaneous Purposes Licences (MPLs 57, 58 and 59).

The extended ML 6321 includes the pre-existing camps, airstrip, Four Mile Bore for water supply, and associated internal access roads as well as the pre-existing Beverley processing plant and wellfields on former ML 6036. There were no changes to the operations at the Beverley processing plant and no increased production as a result of the extension of the mining area.

In 2009, the Commonwealth government approved an ISR operation for the Beverley Four Mile Project, which is adjacent to ML 6321. In April 2010, a MLP/PER was submitted for the newly discovered deposits (Pepegoona East & West, Pannikan) at Beverley North project (Heathgate 2010a, 2010b), and a Retention Lease (RL) application for an FLT at Beverley North was applied for in April 2010 (Heathgate 2010c). Approvals for the Beverley North FLT (on RL124) testing the Pepegoona deposit were completed on 16 July 2010. A second stage of the FLT to incorporate testing of the Pepegoona West deposit was approved in December 2010.

This PEPR relates only to those activities associated with a Beverley North Mine, incorporating but extending beyond the previous Beverley North FLT infrastructure and activities.

The Beverley project completed a comprehensive approval process for both the extension of the Beverley mine and the Beverley Four Mile project, each of which involved a MLP/PER (Heathgate 2007, 2008a, 2009a,b) and a MARP[2] (Heathgate 2008b).

A copy of the main text of the current Beverley PEPR is available on the DSD website. Specifically, descriptions of activities addressed in the Beverley PEPR that are relevant to the Beverley North Mine are given in Table1-1.

The Adnyamathanha community is the Native Title Holder for the Beverley North area and the surrounding region. As part of the 1998 Beverley EIS process, anthropological and archaeological investigations in conjunction with the Native Title Holder were undertaken in 1997 within the original Beverley ML and MPL areas. No sites were identified as requiring entry on the South Australia Register of Aboriginal Sites.

Since that initial investigation, numerous heritage surveys (Work Area Clearance inspections) have been conducted over the Four Mile MLA area, the extended Beverley ML and the Beverley North areas. Maps have been produced in association with the researchers, which detail areas where approval has been granted for exploration, mining and related activities. The surveys are undertaken by Adnyamathanha representatives who have been selected by Native Title Holders. The survey team members are generally considered by their peers to be most closely associated with the Beverley and Beverley North project areas, and knowledgeable about its cultural amenity. This is the preferred approach of the body representing the Native Title Holders.

Heathgate also had approval to install a Field Leach Trial at Pepegoona and Pepegoona West, including test wellfield patterns, to undertake trial mining to understand the hydraulic, leaching and extraction characteristics of typical Beverley North ore. The infrastructure of the FLT was incorporated into routine mining described here.

[2] Now termed a PEPR

Table 1-1 Cross References to Documentation in Beverley PEPR

Aspect	Reference in Beverley PEPR	Notes
Description of the environment of Beverley ML 6321	3 Description of the Environment	Other than slightly lower elevation and rainfall and details of hydrogeology, the environment is very similar to that at Beverley North.
Beverley accommodation camp, airstrip and utilities	4.5 Supporting Infrastructure	This infrastructure will be used to support mining at Beverley North.
Waste disposal arrangements	Section 4.4 Wastes	The liquid and solid waste disposal facilities at Beverley will be used for wastes arising from Beverley North, with the exception of grey and black water which will be treated at Beverley North.
Resource inputs	Section 4.6 Resource Inputs	Water, diesel fuel, lubricants and reagents (sulphuric acid and hydrogen peroxide) are required for the Beverley North Mine.
Environmental, Social and Economic aspects	Section 6 Environmental, Social and Economic aspects	This considers context and stakeholder views, potential impacts, control and management strategies, risks and consequences, specific outcomes, outcome measurement criteria, leading indicator criteria and company compliance monitoring plans for soil, vegetation, surface water, hydrogeology, fauna, air quality and heritage. The environmental aspects of the Beverley North Mine are similar to those of Beverley.
Mine closure and rehabilitation	Section 7 Mine Closure and Rehabilitation Plan	This gives a timeframe for the closure, decommissioning and rehabilitation of all surface facilities at Beverley. The Beverley North Mine may be completed prior to the end of mining at Beverley (as the facilities are likely to be used for other satellite mining projects), and any Beverley North Mine facilities no longer required would be progressively rehabilitated. The Beverley closure plan includes general and specific outcomes and a residual risk assessment.

1.2.3 Project location

Figure 1-2 shows the location of the Beverley North ML relative to the Beverley Mine (ML 6321).

The Beverley North ML is located approximately 10 km north of the existing Beverley deposits. It was subject to an FLT that commenced in August 2010 at Pepegoona (and later included Pepegoona West). The location of the currently known Beverley North deposits is shown in Figure 1-2.

1.3 Summary of the Land and Environment Description

The Beverley North Mine is located in an arid region of South Australia, on the western boundary of a broad plain approximately 45 km wide lying between the eastern margin of the Flinders Ranges and Lake Frome. The area is characterised by low average, but highly variable rainfall.

A series of water courses, rising in the Flinders Ranges, flow in a generally easterly direction, eventually discharging into Lake Frome.

Between the Ranges and the Lake, many small flow channels are cut into the topography, starting in the low foothills of the area, at about elevation 130 m Australian Height Datum (AHD), and which also flow in an easterly direction toward Lake Frome.

Swainsona oligophylla, which is listed as rare under the National Parks and Wildlife Act, 1972 (NPWA), is known to occur at Beverley. Two previously reported rare or threatened species, *Frankenia subteres* and *Swainsona murrayana*, are now considered to be based on misidentifications. Most of the threatened species that are known to occur in the general area are restricted to the Flinders Ranges and are not known to exist on the plains.

One proclaimed plant, *Tribulus terrestris*, has been recorded at Beverley and Beverley North. It is fairly common in the general area but is not recorded in all years. Twenty alien plant species have been recorded at Beverley and a further 10 are known to occur in the general area. None of these occurrences can be directly attributed to exploration or mining activities.

The dominant habitat types within the project area are a mixture of gibber plains, very open eucalyptus woodland, tall shrubland and tall shrubland over chenopods (mostly found in minor and major drainage lines). Fauna surveys conducted as part of the Beverley Mine EIS in 1998, baseline surveys for the Beverley Extension and Beverley Four Mile, and specific Beverley North studies (Badman 2010; Appendix E of Heathgate 2010aand EBS 2010 (Appendix B here)), identified no species of state or national conservation significance. Since the 1998 EIS, one notable capture at Beverley was a *Pseudomys hermannsburgensis* (Sandy Inland Mouse), which is listed as rare in the NPWA. This represented a range extension for this species of over 80 km.

The annual fauna monitoring survey that occurs at the Beverley Mine site has recorded two additional bird and three additional reptile species, none which are considered to be of conservation significance. In 2007, the first recording of the Dusky Hopping Mouse, *Notomys fuscus*, was made during the routine annual fauna survey (Waudby & Howe 2008). This native mouse has a national and state conservation rating of Vulnerable. It has not been found to date at Beverley North but may occur in the area in favourable years.

In terms of its hydrogeology, the formations in the Beverley North area are part of the Frome Embayment, although the hydrogeological regime is somewhat different to Beverley. The Pepegoona and Pannikan deposits are located in the Eyre Formation, with possible extensions into the overlying Namba Formation.

At Pepegoona and Pannikan themselves where mining is commencing, no sandy aquifer lenses have been found in the Namba Formation (as was the case at Four Mile East), however, as at Four Mile East but unlike at Beverley no groundwater has been found in the overlying Willawortina Formation. The Great Artesian Basin (GAB) does not extend into that part of the Beverley North area hosting the Pepegoona and Pannikan deposits, although it is present further east.

In the Beverley North area groundwater in the Eyre and Namba Formation aquifers is brackish to saline, with Total Dissolved Solids up to 15,000 mg/L, and frequently contains naturally occurring radioactive uranium and radium and also fluoride at many times drinking water limits; this is certainly the case in and usually close to uranium orebodies. It is therefore entirely unsuitable as potable water, and the radioactivity and fluoride content renders much of it unsuitable, now and in the future, for agriculture or stock watering purposes. Water quality in the underlying Fractured Rock Aquifer, where it has been found, is of similar salinity and high fluoride content.

Higher quality groundwater is found in both the underlying GAB and in part of the overlying Willawortina Formation (where they are present), which are and will remain both suitable and available for stock and other uses.

Water use for the Beverley mine comes from two sources: groundwater from the Namba Formation aquifer in the area of the Beverley mine, which is largely recycled throughout the ISR process; and groundwater from the GAB, which is utilised for potable, plant and camp use. Non-potable water for the Beverley North Mine is sourced from the Eyre Formation, whilst potable water requirements are trucked in from Beverley.

1.4 Summary of Existing Operations

1.4.1 Exploration and Other Activities

The previous (and current) operations at the Beverley North Mine site mainly comprise exploration activities. Exploration on the broader Beverley North area and nearby Exploration Leases is ongoing. As at June 2010, approximately 500 exploration holes had been drilled on EL 4387.

In 2010 Heathgate conducted an FLT at Pepegoona and Pepegoona West (Section 1.2.2) to understand hydraulic, leaching and ore-recovery characteristics within typical Beverley North ore horizons. In total approximately 28 test wellfield patterns were installed, each comprising a central extractor well and up to six injector wells, connected to two wellhouses. The locations have differing stratigraphy; some include a silcrete zone, and others do not. Wellfield patterns were not all contiguous.

Work Area Clearance inspections were conducted to ensure that any environmental and heritage concerns were addressed. Maps have been produced in association with the researchers, which detail areas where approval has been granted for exploration and related activities. The Work Area Clearance methodology adopted by the company in association with the Native Title Holders has been developed to minimise potential deleterious impact upon Aboriginal cultural values at all stages of exploration and development within the area.

1.4.2 Beverley Operations

The Beverley Uranium Mine is capable of producing approximately 1,500 t/a uranium by the ISR method, although recent production has been less.

ISR is a mining method that is applicable to uranium orebodies that present in aquifers and have suitable geological and other conditions. ISR mining removes uranium from the host ore without the physical removal of ore and covering soils and rocks. It requires installation of multiple close-spaced wells into the uraniferous aquifer, pipelines to and from the wells and a surface treatment plant, and does not require either underground mine workings or open cut pits.

In the ISR process, natural groundwater from the mineralised zone of the aquifer is extracted and conditioned by adding an oxidant (hydrogen peroxide is used at Beverley and Beverley North) and dilute sulphuric acid, which after conditioning is called mining solution or lixiviant (“lix”).

This mining solution is then pumped via multiple injection wells back into the aquifer, where it dissolves the uranium contained in the aquifer. The resulting uranium-rich solution is drawn back to the surface via multiple extraction wells and pumped to a uranium recovery plant.

Figure 1-3 shows the general arrangement of the Beverley North operations in the Eyre Formation, such as at Pepegoona and Pannikan deposits. This has been adapted from Beverley, but the principles are the same. The exact arrangement may vary at other orebodies in Beverley North which may occur in the Eyre or Namba formations, or both. The general principles will remain.

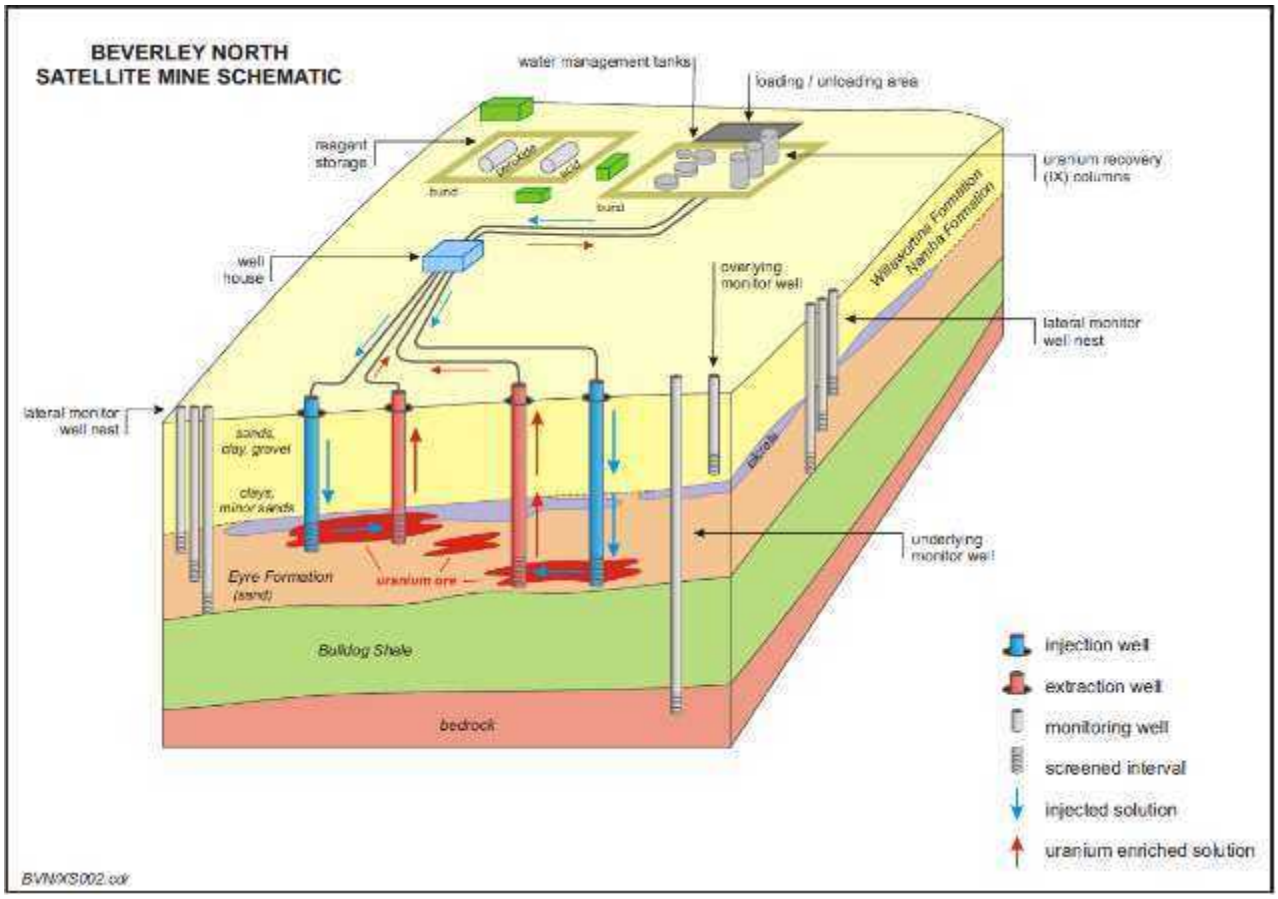

Figure 1-3 General Arrangement of Beverley North Operations (Eyre Formation Example at Pepegoona and Pannikan Deposits)

At the processing plant, uranium is stripped from the uranium-rich mining solution using ion exchange resin beads and held for later elution, precipitation, drying and packaging. The barren solution is reconditioned (back to mining solution specification) and recycled back to the injection wells. A group of multiple injection and extraction wells is called a wellfield. Within any given wellfield area, this cycle continues until the uranium remaining in the aquifer is depleted to uneconomic levels. At Beverley, mining solution is typically circulated between 50 and 100 times through a specific mined area.

Control of the flow of mining solution through the aquifer is maintained through careful design and operation of the wellfield, adjusting the pressures in each extraction well to direct the fluid to required areas. This ensures continuous recycling within the active mining area and minimises the potential for migration of mining solutions outside the active mining area (excursions).

A small amount of liquid waste is produced through this process, which is partially evaporated to reduce volume and then reinjected in unused or mined out sections of the Namba Formation aquifer at Beverley. A small amount of solid waste (radioactive and non-radioactive) is also produced and is buried in purpose-built near-surface facilities that meet the requirements of the *Radiation Protection and Control Act* 1982 (SA), and the ARPANSA *Code of Practice and Safety Guide*, and *Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (ARPANSA 2005). Other relevant legislation and Codes of Practice are listed in Table 6-1.

Extraction of uranium may be conducted over a number of phases to maximise the total amount extracted (typically about 60-80% is extracted in the first phase). After the final phase has been completed, the wellfield is closed and rehabilitated.

ISR mining is a relatively low impact mining method, since ore is not mined in the conventional sense. There is minimal surface disturbance, no overburden removal, no ore treatment facility, no tailings generation or tailings disposal requirements. It requires a simple processing plant that can be removed on completion of mining and simple surface rehabilitation once a wellfield has completed its final operational phase. Because of the low impact of ISR mining, however, the final rehabilitation of wellfields is not a major exercise, compared with other forms of mining.

The mine is operated 24 hours per day, 365 days per year on a fly in-fly out basis. There is a camp at Beverley that accommodates about 180 people, an airstrip and other associated infrastructure to the west of the mine (refer Figure 1-2).

1.5 Summary of Proposed Operations

The Beverley North Mine entails installation of satellite resin capture plants close to the individual uranium deposits and construction of ISR wellfields of the same basic design (but deeper) as currently used on the Beverley Mining Lease. The Beverley North Mine will also process mining solution used at the Four Mile East wellfields.

The satellite plants remove uranium from the ISR liquor by ion exchange, producing uranium-bearing resin, which is trucked to the Beverley processing plant. The resin is then stripped of uranium, regenerated, and trucked back to the pilot plant. A summary flowsheet of the operations is shown in Figure 1-4.

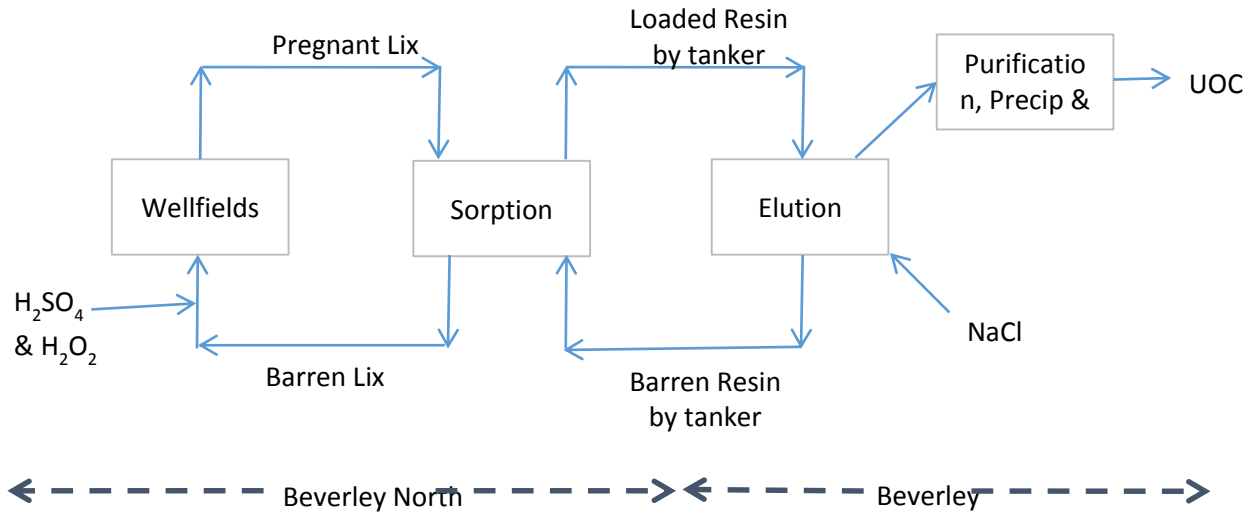

Figure 1-4 Beverley North– Summary Flowsheet

Note: Wellfields and sorption (in IX columns in a Satellite Plant) occur at Beverley North and elution and further processing at Beverley.)

Minor modifications to the Beverley processing plant were required to accept the Beverley North uranium-bearing resin, although there is no net increase in uranium processing capacity. The uranium stripped from the resin is processed at Beverley using existing processing facilities, and the small quantity of liquid waste arising is disposed of at Beverley.

It is noted that some of the required minor modifications at the Beverley processing plant were approved as part of the approval process for the Beverley Four Mile project (Heathgate 2009a,b), for which construction is presently delayed. Other minor changes were made following appropriate notification to the EPA and DSD, with appropriate adjustments to the Beverley Radiation Management Plan and Radioactive Waste Management Plan.

No changes are required to the existing Beverley camps, airstrip and camp water supply bores. Currently an existing pastoral track has been improved between the Beverley processing plant and the Pepegoona Satellite Plant, and to the site of the Pannikan Satellite Plant. Some

additional internal tracks are necessary within the Beverley North ML to access the wellfields. In addition fencing is installed around satellite plant sites for security purposes. Figure 1-5 shows the location of the ML, satellite plants and wellfields and a possible future, more direct access road included in the existing approvals but not yet constructed (as at November 2010).

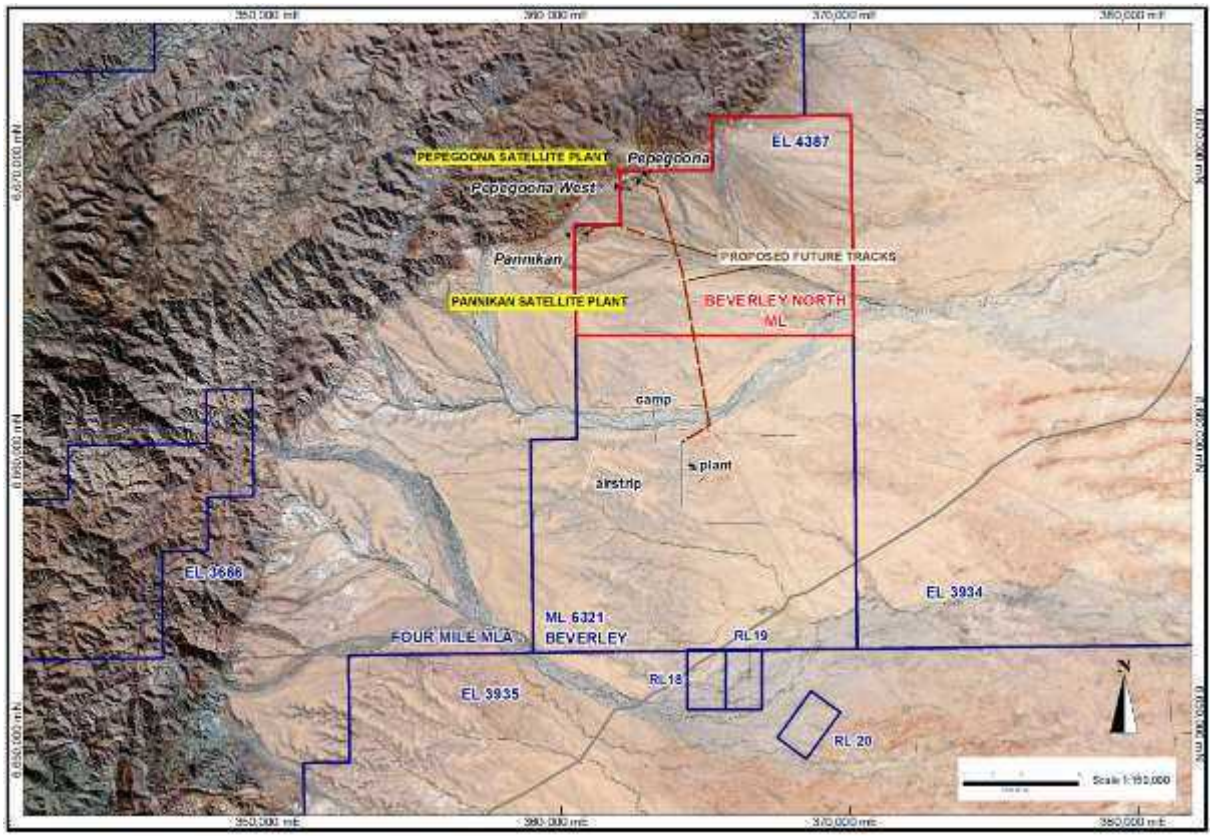

Figure 1-5 Key Elements of the Beverley North Mine

1.6 Key Environment Impacts and Management Strategies

The following environmental topics have been identified as requiring consideration with respect to the Beverley North Mine:

1. Surface hydrology
2. Hydrogeology
3. Landscape (soil and vegetation)
4. Landscape (amenity)
5. Flora, including weeds and plant pathogens
6. Fauna
7. Radiation management
8. Non-radioactive waste
9. Chemical management
10. Heritage management and community liaison
11. Rehabilitation
12. Air quality
13. Third party property issues.

The risk assessment criteria outlined in the DSD (PIRSA ,2009) Guidelines have been applied to these activities.

A description of this risk assessment methodology and the proposed control and management strategies to reduce the potential identified environmental impact events, has been set out in Section 6. The strategies for managing issues involve the implementation of technically and economically achievable best practice environmental management techniques, including progressive rehabilitation where applicable and practicable.

Control and management strategies detail one or more of the following:

- A change in design or procedures to avoid or reduce the likelihood of the impact occurring
- A change in design or procedure(s) to avoid or reduce the consequences of an environmental impact event, should such an event happen.

1.7 Proposed Post Mine Land Use

The long-term objective for rehabilitation of the Beverley North ML, for the majority of the area that is on Wooltana Station, is the return of the landscape to its pre-mining use (pastoral activity). Mining-associated disturbance that extends onto the Arkaroola pastoral lease (Arkaroola Wilderness Sanctuary[3]) will also be eventually returned to it pre-mining use (conservation).

1.8 Mine Closure and Rehabilitation Strategies

The long-term objective for closure and rehabilitation of the Beverley and Beverley North operations is the return of the landscape to a moderately stable soil surface carrying a self-maintaining set of plant communities dominated by grasslands/chenopods, with no major surface hydrological alterations and minimal acceleration of natural erosion processes and which is suitable for pre-mining use.

The primary activities for the closure and rehabilitation of the ML under current assumptions are:

- Flush one pore volume of native groundwater through active mining areas when in a flow-through aquifer
- Closure of wells
- Removal/disposal of trunklines and associated pipelines and supporting infrastructure such as fences and tracks
- Removal/disposal of the satellite plants and associated facilities
- Return of the landscape as described above.

Heathgate intends to undertake the decommissioning and rehabilitation of the Beverley North Mine. As surety, a bond that is adequate to cover the cost of decommissioning and rehabilitation will be provided to the South Australian government, and this bond will be maintained in accordance with DSD requirements.

The extraction of uranium at Beverley North may be conducted over a number of ISR phases to maximise the total amount extracted. After the final phase has been completed, each wellfield will be closed and rehabilitated. The timing of future phases is subject to the price of uranium and to meet operational needs.

When ISR mining has been completed in a flow-through aquifer (such as the Eyre Formation), a ‘groundwater sweep’ of one pore volume of water drawn from outside the active areas will be

[3] Arkaroola Station is a declared Sanctuary under the SA National Parks and Wildlife Act 1972 (the Arkaroola Wilderness Sanctuary)

drawn through the active areas to accelerate natural attenuation ('enhanced natural attenuation'). This will be done progressively where possible. Geochemical modelling for Pepegoona with protectively-conservative assumptions indicates that with this groundwater sweep, water quality will improve within a few hundred metres of movement through the down-gradient aquifer, once the natural groundwater flow regime has re-established.

As such there will be no impact on the water quality category of use outside the mining areas and their immediate surrounds. This modelling, whilst applicable to the Pepegoona West and Pannikan deposits that are of a similar size and geological setting to Pepegoona, may need to be redone for other deposits that are proposed for mining in the future. If the deposits are in essentially stagnant 'bathtub' aquifers such as at Beverley, the possible requirement for a groundwater sweep, which is more difficult in such circumstances and may not be required to meet appropriate environmental outcomes, would be reassessed using the risk assessment approach.

At the conclusion of mining operations at an individual mining site, any remaining stored process solutions at the satellite plant would be treated and disposed of in accordance with the relevant regulations. Once this is accomplished, all remaining wells (not required for environmental monitoring purposes) and the satellite plant will be decommissioned, ready for relocation or storage or reusable components and decommissioning of the remaining components. It is possible, subject to appropriate approvals and handover arrangements, that some general infrastructure such as some internal access roads, wells and water tanks may be retained for the future land use.

Heathgate proposes an initial period of five years from the conclusion of commercial operations to complete the decommissioning of facilities at an individual mining site. A monitoring and maintenance program is proposed to run for a further two years, for a total of seven years from the final conclusion of mining activities at that site. The total monitoring period will be reviewed with the regulatory authorities and may be extended.

Facilities at an individual mining site will therefore be fully decommissioned within seven years from the conclusion of the commercial operation at that particular location. This period includes a post-completion monitoring period for vegetation maintenance, groundwater sampling, drainage repairs and other activities to ensure the long-term permanent rehabilitation of the site.

Rehabilitation of temporary access tracks and other temporary infrastructure will be completed as soon as possible after the conclusion of mining operations. Details of the rehabilitation requirements in these instances are included as part of the environmental clearance permits issued prior to commencement of activities in undisturbed areas or areas under rehabilitation.

APPENDIX E Groundwater Flush

E1 Aquifer Remediation through Enhanced Natural Attenuation

For the proposed Beverley North Mine, the mine closure groundwater remediation plan comprises a staged approach where the lowest impact methods are used in preference to higher impact methods. The staged approach employs monitored enhanced natural attenuation within an attenuation zone as the preferred method to achieve aquifer rehabilitation. A mechanism to decide if additional remediation is required in the future, to achieve the required environmental outcome, is currently being prepared for discussion.

E2 Groundwater Flush

The process of natural attenuation will be enhanced or "kick started" through an active remediation step called 'groundwater flush". This entails drawing in clean groundwater for approximately one pore volume exchange at the closure of each wellfield. This will be an efficient way of immediately improving groundwater quality in mined out wellfields while new wellfields are still being established.

For the case of the Pepegoona deposit, the withdrawn groundwater will either be trucked back to Beverley and put through the remaining processing there, or if the opportunity exists pumped to a possible future nearby deposit as part of mining there.

E3 Outcomes

Groundwater quality following flush will be affected by several factors:

- The efficiency of the flushing process
- The ratio of open pore to stagnant pores in the aquifer
- The groundwater quality at the end of mining before flushing
- The ion exchange (there is some acidity which 'sticks' to clay minerals)

This means the groundwater quality after flush cannot be predicted with certainty, but estimates of pH moving from pH 1.7 to pH 2.0 - 2.2 are reasonable, whilst other mining fluid constituents such as uranium may be immediately diluted by up to a factor of 3. This estimate is based on a stagnant porosity in the aquifer of 0.15, a total porosity of 0.45 and assumes complete flushing of the active pores.