BEVERLEY NORTH MINE

PROGRAM FOR ENVIRONMENT PROTECTION AND REHABILITATION

16 December 2015

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Tenement details	**ML 6387**
Name of mining operation	**Beverley North Project**
Commodity to be mined	**Uranium**
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Senior Executive Declaration

I, Craig Bartels, being President of Heathgate Resources Pty Ltd in its capacity as leaseholder of ML6387, declare that I have reviewed the program contained in this document and I can verify its accuracy.

Craig S Bartels
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ACRONYMS AND ABBREVIATIONS

AGSO	Australian Geological Survey Organisation
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	Annual Rainfall Index
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASNO	Australian Safeguards and Non-Proliferation Office
BGL	Below Ground Level
CASA	Civil Aviation Safety Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEST	Department of Education, Science and Training
DEWHA	Department of Environment, Water, Heritage and the Arts (now DSEWPC)
DITR	Department of Industry, Tourism and Resources (now DRET)
DEWNR	Department for Water and Natural Resources
DRET	Department of Resources, Energy and Tourism
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
DWLBC	Department of Water, Land, Biodiversity and Conservation (now DEWNR)
ECP	Environmental Clearance Permit
ECL	Excursion Control Limit
EFA	Ecosystem Function Analysis
EIS	Environmental Impact Statement
EL	Exploration Lease
EMS	Environmental Management System
EPA	Environment Protection Authority
EPBC	Environmental Protection and Biodiversity Conservation
ERT	Emergency Response Team
GAB	Great Artesian Basin
HDPE	High Density Polyethylene
Heathgate	Heathgate Resources Pty Ltd
HEPA	High Efficiency Particulate Air
ISR	In-situ recovery
IX	Ion exchange
JORC	Joint Ore Reserves Committee
LFA	Landscape Function Analysis
LLRW	Low Level Radioactive Waste
MARCR	Mining and Rehabilitation Compliance Report
MARP	Mining and Rehabilitation Program
ML	Mineral/Mining Lease
MLA	Mining Lease Application
MPL	Miscellaneous Purposes Licence

NEPM	National Environmental Protection Measure
NL	No Liability
NHMRC	National Health and Medical Research Council
NOHSC	National Occupational Health and Safety Commission
NPWA	National Parks and Wildlife Act
NVC	Native Vegetation Council
ORP	Oxidation/Reduction Potential
PER	Public Environment Report
PEPR	Program for Environment Protection and Rehabilitation
PFN	Prompt Fission Neutron
PIRSA	Primary Industry and Resources of South Australia
Quasar	Quasar Resources Pty Ltd
RPB	Radiation Protection Branch
RPC	Radiation Protection and Control
RPD	Radiation Protection Division (now RPB)
RL	Retention Lease
RMP	Radiation Management Plan
RWMP	Radioactive Waste Management Plan
SEB	Significant Environmental Benefit
SO_4	Sulphate
TALR	Target Action Leakage Rate
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
UOC	Uranium Oxide Concentrate
4WD	Four-wheel-drive

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

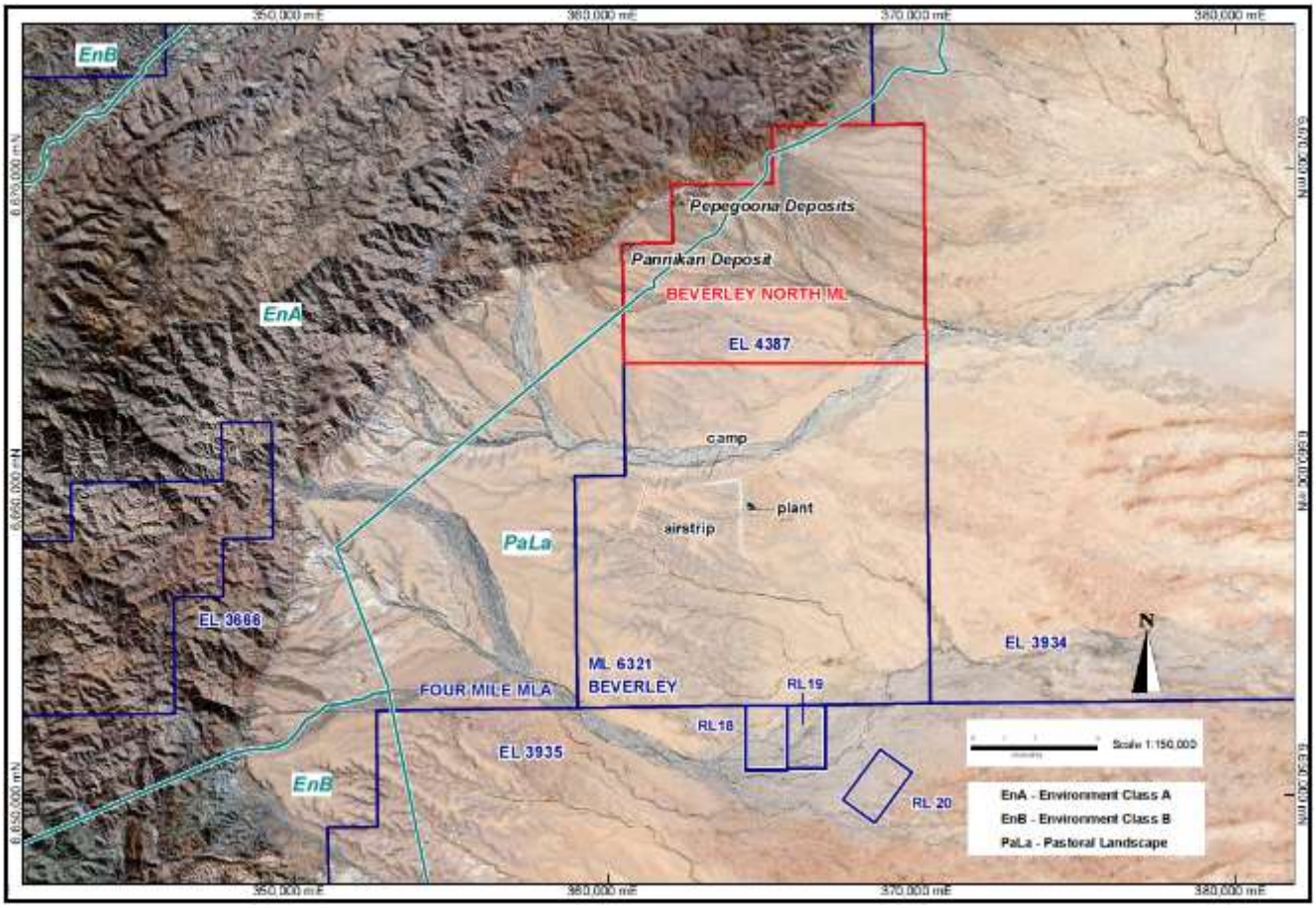

Figure 1-2 Beverley North ML and Existing Beverley Mine

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.

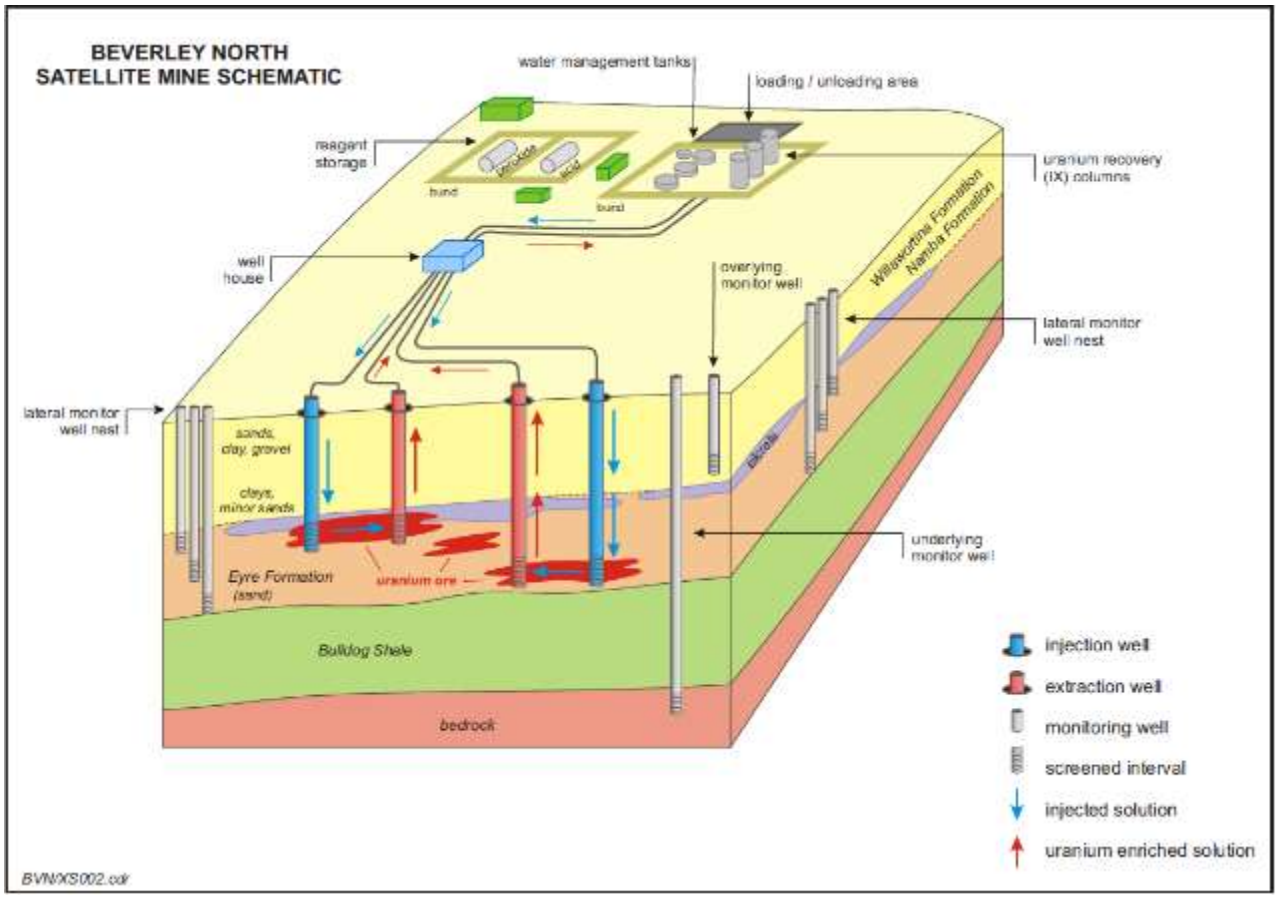

Figure 1-3 General Arrangement of Beverley North Operations (Eyre Formation Example at Pepegoona and Pannikan Deposits)

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.

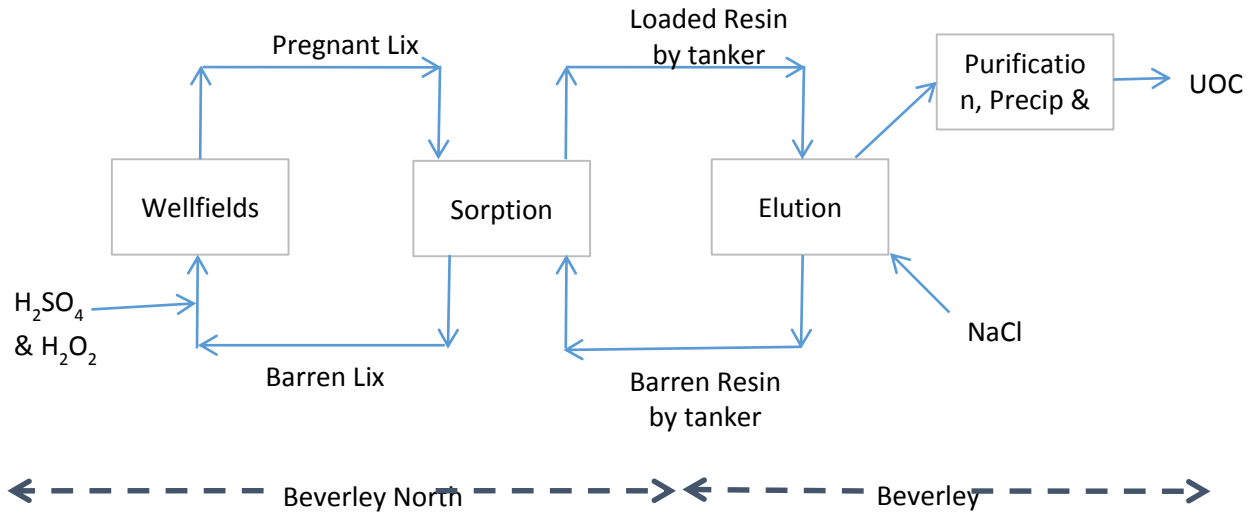

Figure 1-4 Beverley North– Summary Flowsheet

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).

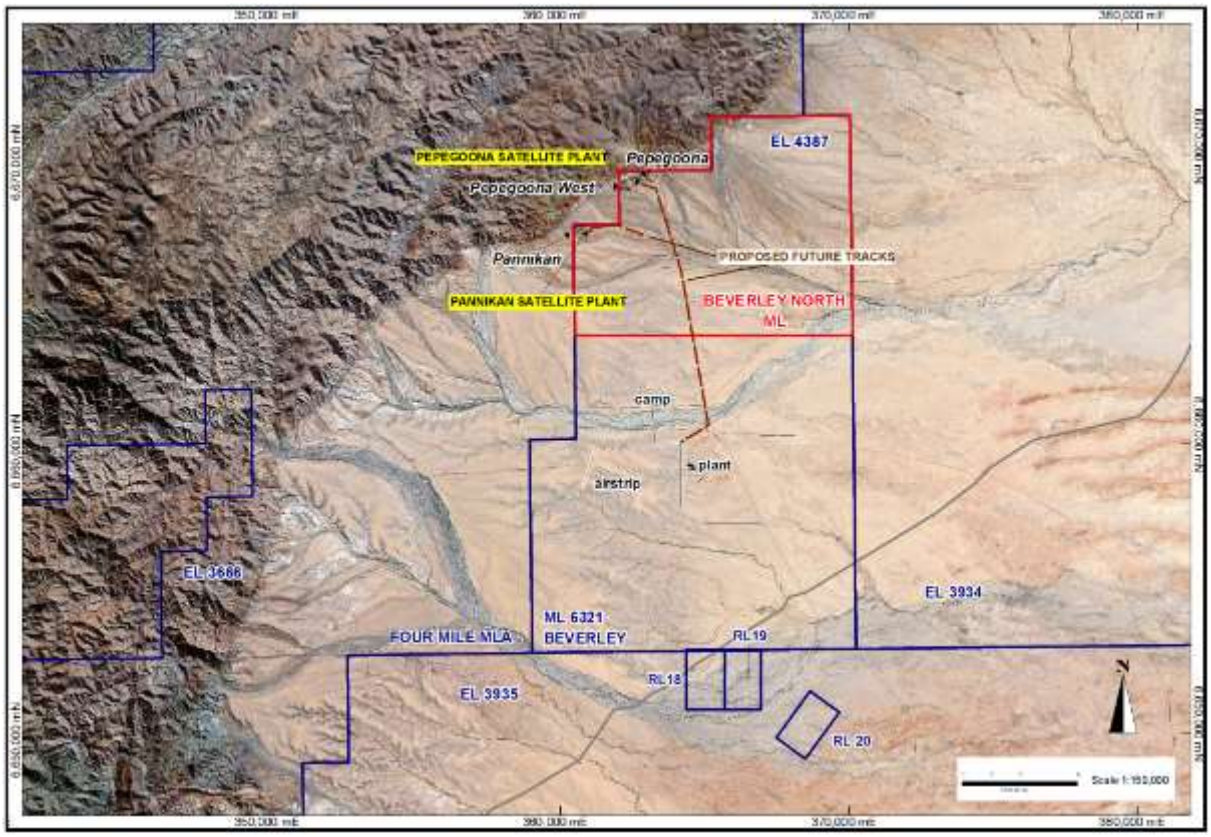

Figure 1-5 Key Elements of the Beverley North Mine

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.

2 MINE DETAILS

2.1 Mine Name, Tenement Information and Commodity

The name of the mining operation is the Beverley North Mine.

The Beverley North ML lies within the boundaries of Exploration Lease EL 4387 (Figure 1-2). Heathgate is the owner of the lease. Mineral Claim applications on EL 4387 were lodged with DSD[4] by Heathgate on 29 March 2010. The Mineral Claims were granted on 6 April 2010 and are numbered 4203 to 4233.

ML 6387 incorporates former Retention Lease RL124, which itself covered the Pepegoona deposits. The Beverley North Mine wellfield patterns, not all contiguous, each comprising a central injector well and up to six extractor wells, are sited within the deposit areas, grouped into a smaller number of wellfields.

The relocatable satellite plants are located close to the Pepegoona and Pannikan deposits in the first instance (Figures 1-5, 2-1, 2-2). The Pepegoona Satellite Plant was developed directly using (and adding to) infrastructure installed for its FLT. Locations of future satellite plants will depend on future discoveries and requirements.

The commodity to be mined is uranium. Heathgate will keep accurate records of the quantity, value and manner of disposition of all minerals recovered and, whenever required to do so by the Director of Mines or a delegate authorised by the Director of Mines, will submit the records for inspection by the person so authorised.

2.2 Location of the Operation - Direction and Distance from the Nearest Town

The Beverley North ML is located between the Northern Flinders Ranges and Lake Frome, approximately 550 km north of Adelaide and 300 km north-east of Port Augusta. The closest communities include the tourist resort at Arkaroola (some 25 km to the south west) and the Aboriginal community at Nepabunna (approximately 75 km south-west – see Figure 1-1).

2.3 Land Tenure

Most of the Beverley North ML is on the Wooltana pastoral lease, although small areas in the north-west corner are on the Arkaroola pastoral lease (see Figures 2-1 and 2-2). Arkaroola Station is a declared Sanctuary under the *SA National Parks and Wildlife Act 1972*, and is referred to as the Arkaroola Wilderness Sanctuary.

The Wooltana pastoral lease is owned by Heathgate, the owners and operators of the Beverley Uranium Mine. The Arkaroola Wilderness Sanctuary is owned by the Sprigg family. The title details are:

- Wooltana Pastoral Lease Parcel/Plan D42204/A34 Pastoral Lease No 2293 Crown Leasehold Volume 1289 Folio 38
- Arkaroola Pastoral Lease Hundred 833900 Pastoral Block 1108 Pastoral Lease No 2240, Crown Leasehold Volume 1278 Folio 43.

The Adnyamathanha people are the Native Title Holders for the Beverley region. As noted in Section 1.2.2, surveys of cultural heritage matters pertaining to the Beverley and Beverley North project areas are undertaken by Adnyamathanha representatives who have been selected by named Native Title Holders. The representatives are generally considered by their peers to be

[4] Then PIRSA

most closely associated with the Beverley and Beverley North project areas and knowledgeable about its cultural amenity.

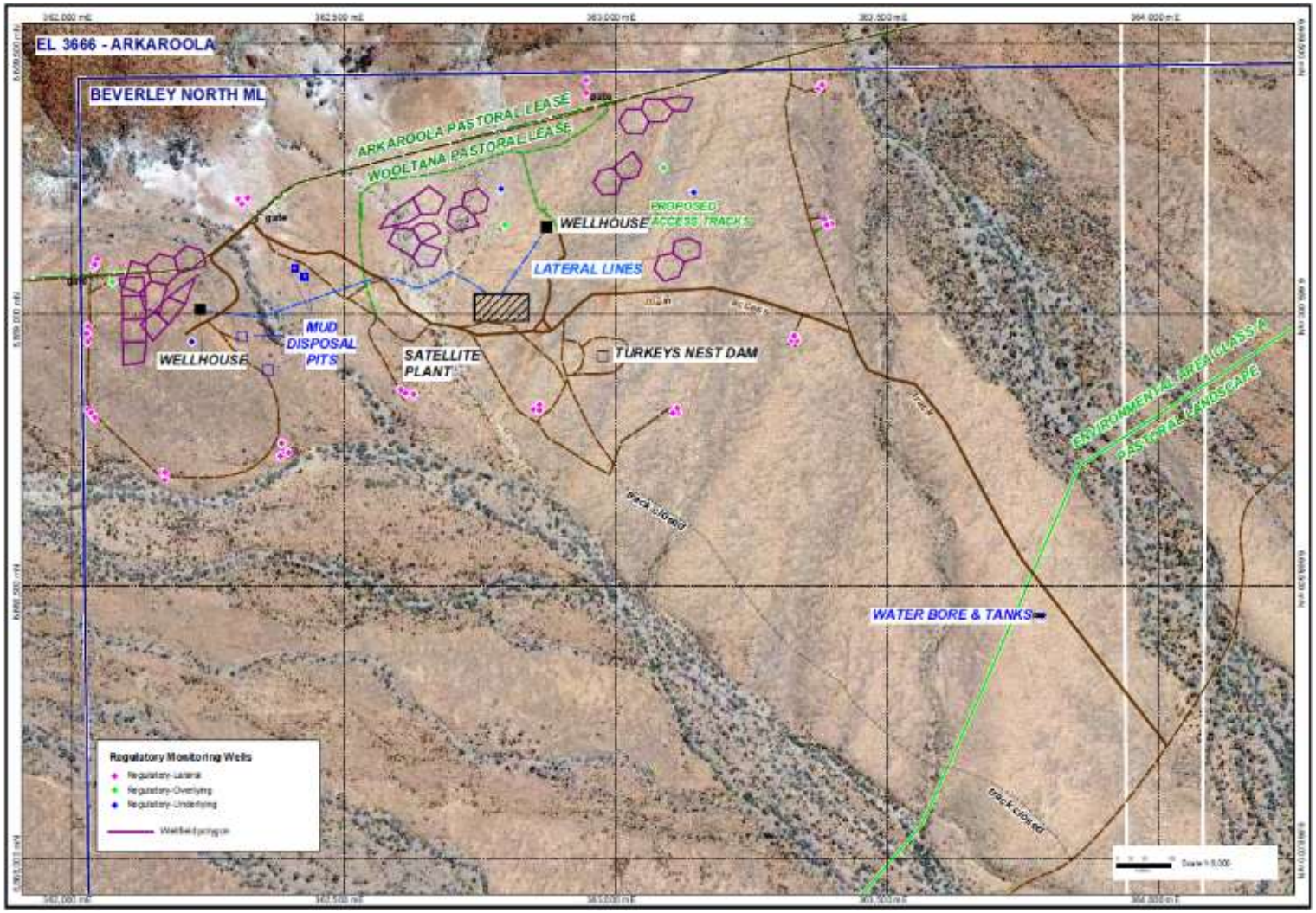

Figure 2-1 Pastoral Lease, Zoning Boundaries and Initial Beverley North Infrastructure – Pepegoona Deposits

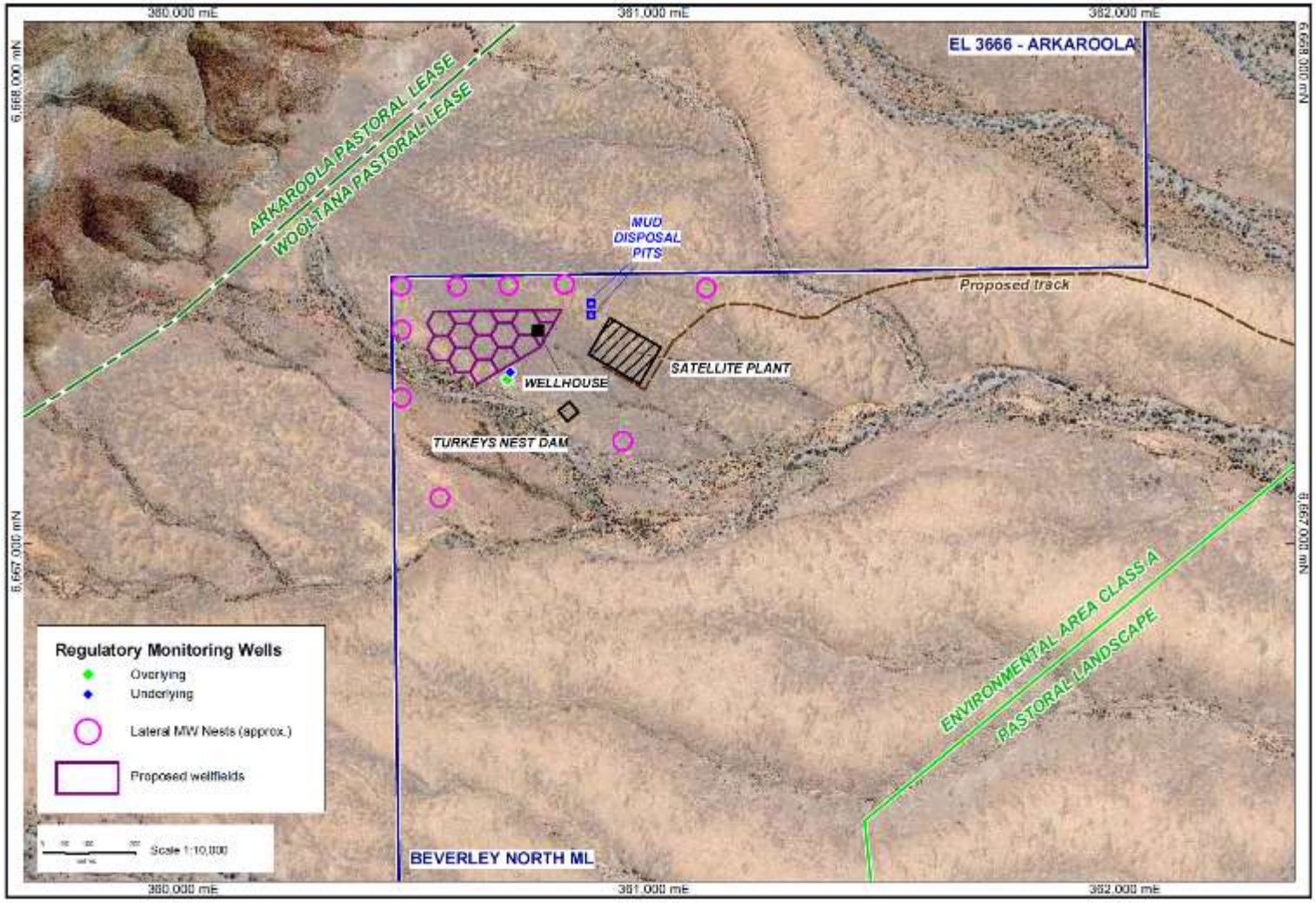

Figure 2-2 Pastoral Lease, Zoning Boundaries and Initial Beverley North Infrastructure – Pannikan

Note: Wellfields will be within the indicated lateral monitor well nests.

2.4 District Council or Corporation

The Wooltana and Arkaroola pastoral leases are out of Hundreds, and are not within a District Council or Corporation area. The land is within the Development Plan 'Land not within a Council Area (Flinders) (Consolidated 25 September 2003)'.

The north-west part of EL 4387, including the Pepegoona and Pannikan deposits, is zoned EnA (Environmental Class A). The remainder of EL 4387 and the Beverley ML 6321, is zoned PaLa (Pastoral Landscape) (Figures 1-2, 2-1 and 2-2).

The Outback Areas Community Development Trust provides many of the services to the region that may otherwise be undertaken by a Council.

2.5 Contact Details of Mine Owner and Operator

Heathgate is the owner and operator of ML 6387 upon which mining is conducted. The contact details are:

Mine Owner and Operator:	Heathgate Resources Pty Ltd
Address:	Suite 1, Level 4, 25 Grenfell Street, Adelaide SA 5000
Contact person:	Richard Phillips – Vice President, Operations
Telephone:	(08) 8110 0500
Facsimile:	(08) 8212 5559
Mobile:	0419 866 862.

3 DESCRIPTION OF THE ENVIRONMENT

3.1 Local Community

The closest communities include the tourist resort at Arkaroola Village and the Aboriginal community at Nepabunna/Iga Warta (Figure 3-1). A total of some 50 permanent residents live within a 50 km radius of the Beverley Uranium Mine site. This number includes staff at the Arkaroola tourist facilities and Wooltana Station, each some 30 km distant. The population at Arkaroola varies with tourist demand. The North Mulga outstation of Wooltana Station is located 15 km south-east of the satellite plant and this is only occupied for approximately 6 months per year.

Small numbers of people reside at the former homestead of Balcanoona that is now the Vulkathunha-Gammon Ranges National Park headquarters (45 km south-west).

The Aboriginal communities of Nepabunna and Iga Warta are approximately 75 km from the Beverley North ML, on the western side of the Gammon Ranges (Figure 3-1). These communities are within Aboriginal Lands and operate as self-contained settlements. The population is currently estimated to be about 120 persons but it fluctuates with the movement of residents to and from the townships.

Leigh Creek, some 150 km to the west, is the nearest significant township and service centre.

Beverley employees, including those who would undertake Beverley North, are mostly flown to and from the mine site out of Adelaide and Port Augusta on a regular roster. A few drive in and out from more local communities. All employees are housed at the camp on the Beverley Mine site. Emphasis is placed on hiring local personnel, with most operational staff coming from Nepabunna, Iga Warta, the Iron Triangle region and Adelaide.

Heathgate's Beverley mine has typically contributed over $1.5 million/year in Aboriginal Royalties, Administration and Community payments, $2.2 million/year in State Royalties, Taxes, Fees and Licenses and about $25 million/year to regional and state businesses/suppliers.

Heathgate strives to achieve 20% Aboriginal employment at the mine site by providing employment opportunities for Aboriginal people living in or with links to the Flinders Ranges. This has been achieved for several years, although the exact percentage may vary from month to month.

3.2 Land Use and Development Plan

3.2.1 Existing Land Uses

The majority of the Beverley North ML is on the Wooltana pastoral lease, but a small portion of the Beverley North ML extends on to the Arkaroola pastoral lease (Figure 3-1 and earlier figures). Most of the initial mining would be undertaken wholly within the Wooltana pastoral lease (Section 2.3), with the initial exception of some well patterns at the Pepegoona West orebody, some groundwater monitoring locations and one background fauna monitoring location, which are on Arkaroola. Mining will not extend into the Flinders Ranges proper for which Arkaroola is famous.

The primary land use of the Wooltana lease is pastoral, currently cattle grazing for beef production but previously sheep grazing for wool production. The Wooltana pastoral lease has been used for pastoral purposes continuously since the 1870s.

Key areas of the existing Beverley operations have been fenced to prevent access by stock to processing areas, and the same approach is used for the satellite plant. Wooltana lease areas that are not involved with Beverley or Beverley North operations are sub-leased to another party for pastoral use. Issues related to water supply, fencing, stock control and roads are discussed with the sublessees on a co-operative and ongoing basis.

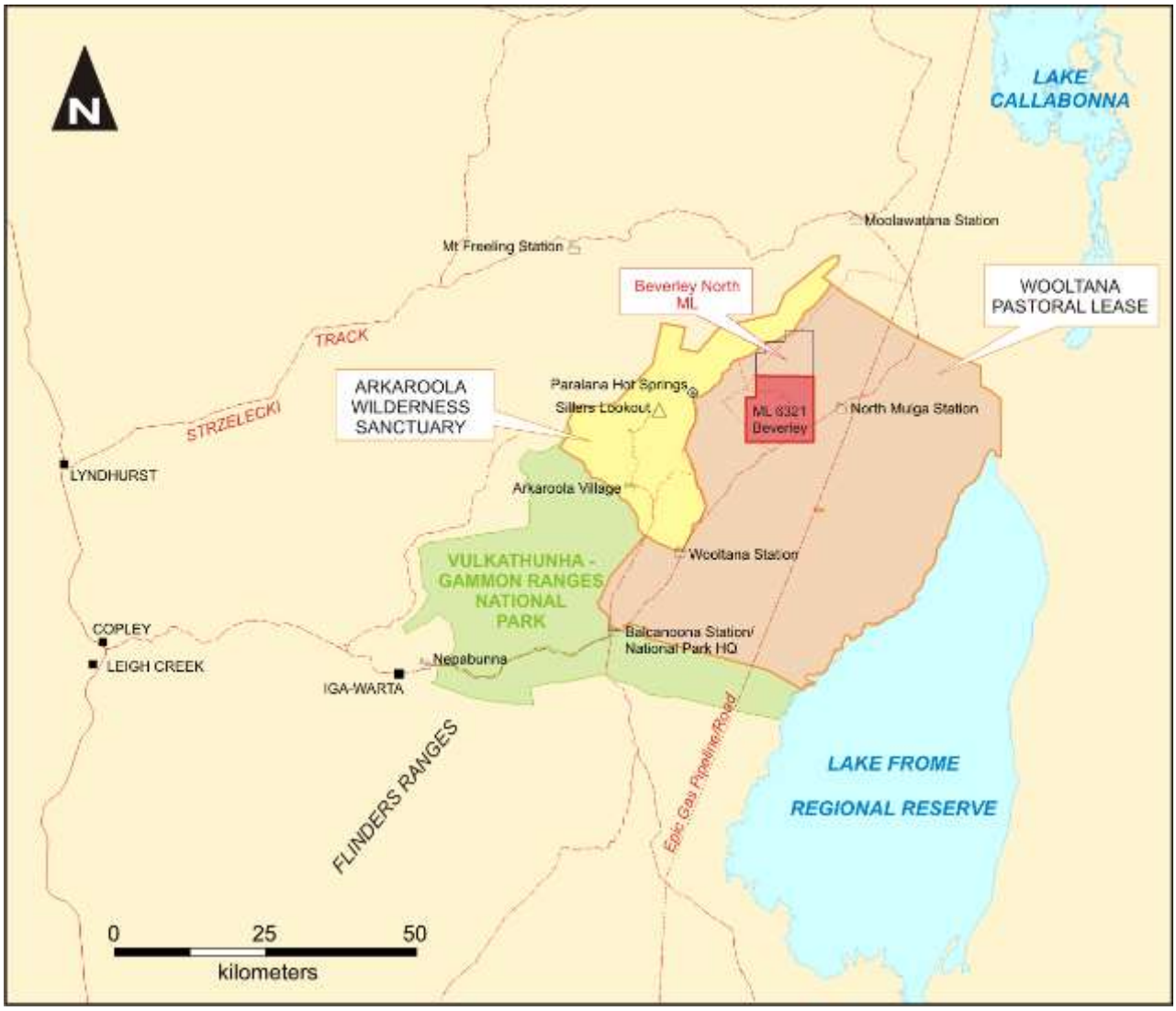

Figure 3-1 Beverley North ML and Surrounds

As noted above some well patterns and environmental monitoring sites for Beverley North lie within the Arkaroola pastoral lease (Section 2.3). Arkaroola Station is a declared Sanctuary under the SA National Parks and Wildlife Act 1972 (the Arkaroola Wilderness Sanctuary). The primary use of the Arkaroola Wilderness Sanctuary is as a wildlife sanctuary and for tourism. Arkaroola has been destocked for more than 35 years, and has been managed as a controlled tourism and conservation enterprise for 40 years. Originally called the Arkaroola Mt Painter Sanctuary, the name Arkaroola Wilderness Sanctuary was adopted in 1995 (Arkaroola Wilderness Sanctuary 2008).

Adjoining the south-western boundary of the Arkaroola Wilderness Sanctuary and Wooltana Station is the Vulkathunha - Gammon Ranges National Park (Figure 3-1). The Department of Environment and Heritage website describes the Park as comprising arid wilderness with rugged, spectacular scenery, interesting wildlife and a wealth of Adnyamathanha Aboriginal culture and European heritage, with challenging bushwalking experiences and cottage accommodation (refer to DEH website: http://www.environment.sa.gov.au/parks/sanpr/vulkathunha_gammonranges/index.html).

The Flinders and Outback Region is a key tourist area within South Australia with potential to expand its tourism industry. A significant element in tourist attraction to the Flinders Region is the

sense of wilderness conveyed by open and largely uninhabited spaces. Mining at Beverley North will have negligible impact on tourism. The Beverley North operations are similar to those being undertaken at Beverley, but at a smaller scale.

In regard to tourism, fencing is installed around the satellite plants for security purposes. Overall, the mining is on the plains area abutting the Flinders Range, and would not affect the wildlife sanctuary and tourism activities at the Arkaroola Wilderness Sanctuary.

It is anticipated that the future land use (post-rehabilitation) of the mining lease will be for its pre-mining use, i.e. pastoral activity, in particular cattle grazing on Wooltana Station, and on-going conservation activities on Arkaroola Wilderness Sanctuary (for any activities that extend onto Arkaroola).

3.2.2 Development Plan

The Beverley North ML is located in the Land not within a Council Area (Flinders) Development Plan, consolidated 25 September 2003. This Plan was current (according to the Planning SA website) on 12 May 2010: http://www.planning.sa.gov.au/go/development-plans/development-plans-online/country-plans.

The zoning boundaries in the Beverley North ML area are shown in Figure 1-2. The west of the ML, including the Pepegoona and Pannikan wellfield patterns and satellite plant sites, is within the Environment Zone A (EnA). Support infrastructure such as the water supply wells and tanks, and most of the access track to the satellite plant sites from the Beverley plant is in the Pastoral Landscape Zone (PaLa).

The Development Plan objective in relation to mining is:

> ***Objective 16:*** *The protection of the landscape from undue damage from prospecting, mining, quarrying, and similar extractive and associated manufacturing industries.*

In relation to this objective, the Plan states that:

> *The permanent effect of mining operations on the appearance of the landscape should be considered before operations begin. It is important that prospecting, and mining and quarrying operations, be carefully planned to avoid unnecessary impairment of the landscape. Structures should be removed and the natural cover of land restored so far as possible after workings are finished.*
>
> *At Leigh Creek the massive disturbance of the earth by open-cut mining will preclude the restoration of the land to its original state when mining operations are completed. However an attractive artificial landscape should be created using the cuts and dumps in conjunction with the diversion of streams and planting of vegetation to the best advantage.*

In relation to this objective, the nature of the ISR mining undertaken at Beverley means its surface impact is small during operations and, unlike Leigh Creek, when structures are removed the natural cover of land will be able to be restored to very close to original. Exceptions may be if parts of the infrastructure, such as some roads, are retained long term. However, any of the infrastructure that might be retained is typical of a pastoral landscape (although on a larger scale) and is not considered to detract from the landscape.

The Development Plan also includes additional objectives for the zones within the Plan. These are listed below:

Pastoral Zone (PaLa)

> *Objective 1: The preservation of the environmental and scenic qualities of the foreground of the most prominent ranges.*

Environment Zone A (EnA)

> *Objective 1: The conservation of the natural character and environment of the area.*

Objective 2: The protection of the landscape from damage by mining operations and exploring for new resources.

Objective 3: Roads which do not unduly disturb the natural character and beauty of the area.

In relation to Objective 2 for Environment Zone A, the Development Plan states that:

Mining operations should not take place in the Environmental Class A Zone unless the deposits are of such paramount importance and their exploitation is in the highest national or State interest that all other environment, heritage or conservation considerations may be overridden. Deposits which may potentially have the required degree of significance have been identified in the following localities only:

the western face of the Heysen Ranges; portion of the Moralana Valley; portion of the Mount Hack and Mount Uro areas; portion of the Stirrup Iron Range; portion of the east Gammons and the Mount Painter-Freeling Heights area.

In addition, in relation to mining the Principles of Development Control for Environment Zone A state:

4. No mining operations should take place in the Environmental Class A Zone except where:

(a) the deposits are of such paramount significance that all other environment, heritage or conservation considerations may be overridden;

(b) the exploitation of the deposits is in the National or State interest;

(c) investigations have shown that alternative deposits are not available on other land in the locality outside the zone; and

(d) the operations are subject to stringent safeguards to protect the landscape and natural environment.

Mining is a permitted use in both the PaLa and EnA zones, subject to the considerations above. It is considered that the development of Beverley North Mine is in conformance with the objectives; in particular the Beverley North Project, which is in the EnA zone, conforms to item 4 of the principles of development for the EnA zone.

3.3 Proximity to Infrastructure and Housing

The area is remote and sparsely populated. Section 3.1 describes the nearest communities, and Figure 3-1 shows the principal access routes to the area. The Epic Energy gas pipeline runs nearby and a 15 km long spur line provides gas to Beverley for power generation.

Due to the small scale of the satellite plants and associated wellfields relative to the Beverley uranium mine, the impact of which is very low, it is anticipated that the Beverley North Mine will have negligible social impact in terms of dust and noise or damage to infrastructure of other parties.

3.4 Amenity

The main opportunities for viewing the Beverley mine site by tourists and visitors to the region arises when travelling the Balcanoona-Moolawatana Road, which is some 5 km distant at the closest point (Figure 3-1). This is also the case for Beverley North (Figure 3-1).

Despite the small probability of adverse visual impact, the existing Beverley buildings and infrastructure are designed to blend in with the surrounding landscape. From the Flinders Ranges (Siller's Lookout), the mine is barely detectable to the naked eye (Plate 3-1). From the north, some roads are visible depending on the angle of the view. This situation will be little changed with Beverley North, the satellite plant of which is very much smaller than the Beverley processing plant, and some 20 km away from Siller's Lookout.

At night, at present the Beverley processing plant lights can be seen from both the Balcanoona-Moolawatana Road and Siller's Lookout. The Beverley North operations would be additional lit-up areas. Given that the beauty of the Flinders Ranges is appreciated during daylight hours, the use of lights at night at Beverley North is not regarded as a significant negative impact. In any event, the overall visual impact would be no more significant than structures normally associated with a pastoral station. It is anticipated that the Beverley North Mine will have negligible additional impact on the visual aesthetics of the area.

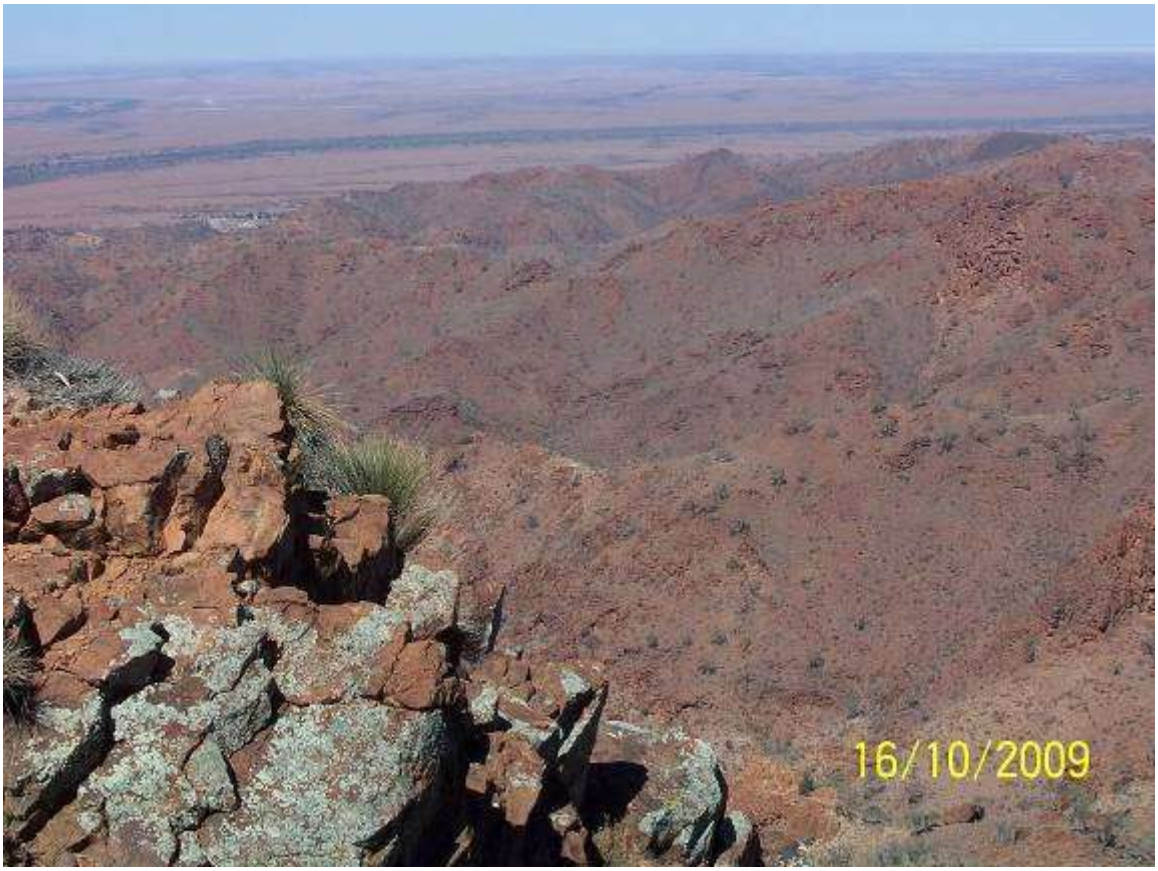

Plate 3-1 Looking towards Beverley from the Flinders Ranges (Siller's Lookout)

3.5 Noise, Dust and Air Quality

No specific noise monitoring has been collected for the Beverley North Mine area. The nearest sensitive noise receptors to the Beverley North operations are North Mulga outstation which is located some 15 km south-east of the Beverley North satellite plant, and the Beverley accommodation camp approximately 10 km south. The outstation is occupied approximately six months per year whilst the Beverley camp is occupied year-round.

Particulate matter (dust), as the result of wind is likely to be the most significant natural impact on air quality. For example, Oodnadatta, an arid site north-west of Beverley, experiences on average five dust storms annually (Arid Areas Catchment Water Management Board 2006). This frequency is related to the lack of ground cover and major dust storms have been recorded after periods of drought. High wind levels are likely to exacerbate dust generation and lead to an increase in the concentration of airborne dust. An example of a dust storm at Beverley is shown in Plate 3-2.

Dust deposition has been measured at four compass points near the boundary of the previous Beverley ML 6036 since 2005. Similar results would be expected for the adjacent Beverley North area. The average, maximum and minimum daily dust deposition rates (from quarterly composites) are 118, 319 and 22 mg/m²/d respectively. These compare to rates of 49 mg/m²/d

and 46 mg/m²/d attributed to background measurements near Olympic Dam during the 1 January to 31 December 2004 reporting period by Termite Resources (2007).

Vehicles and the existing Beverley operations are the only anthropological sources of other existing emissions to air in the area. There would be some minor additional emissions of nitrogen oxides, carbon monoxide and particulates associated with vehicle movements to and from the satellite plant, and operation of diesel generators at the Beverley North site.

Plate 3-2 Dust Storm at Beverley

3.6 Topography and Landscape

The Beverley North ML is on the western boundary of a broad plain approximately 45 km wide lying between the eastern margin of the Northern Flinders Ranges and Lake Frome. The Ranges rise abruptly on the western margin of the plain to about 600 m above sea level, falling to between 100 m to 60 m over the ML, then to the lowest elevation of +0.5 to -3.0 m above sea level at Lake Frome some 35 km south east.

The terrain consists of four main landforms:

- level to moderately steeply sloping stream channels rising on the High Plain and discharging on to the Low Plain
- flat to very gently sloping slightly elevated areas adjacent to drainage
- gently to steeply sloping dissection slopes of the High Plain
- gently sloping, broadly rounded foot slopes and interfluves of the second-order and streams forming the lower margins of the High Plain.

Additional information on topography and landscape is provided in the Beverley North ML Application (Appendix B [Soils Baseline Report] and Appendix C [Hydrology Baseline Report] of Heathgate 2010a) the Four Mile MLP/PER (Appendix B [Soils Baseline Report] and Appendix C [Hydrology Baseline Reports] of Heathgate 2009a) and also the Beverley EIS (Heathgate 1998a,b).

3.7 Climate

3.7.1 Regional Recording Stations

Beverley and Beverley North are located in an arid region of South Australia, adjacent to the Northern Flinders Ranges and in their rain shadow. The area is characterised by low but highly variable, average rainfall. Meteorological data has been collected continuously at the Beverley weather tower since December 1999, from Four Mile since April 2007 and from near Pepegoona since late 2009. The Beverley North Mine is well represented by data from these recording stations.

A meteorological station was installed at Beverley North near the Pepegoona deposit in late 2009 (location GDAe 363860 GDAn 6668048), thus no meaningful data are yet available. This data will be reported in future Beverley Annual Compliance Reports (ACRs) or the equivalent Beverley North ACR.

Wooltana Station homestead and Arkaroola are the closest Bureau of Meteorology rainfall recording stations to the Beverley site (Figure 3-1). The mean annual rainfall at Wooltana at the foot of the Ranges is 192 mm (median 164 mm) (www.bom.gov.au accessed 2007) and at Arkaroola within the Ranges the mean and median rainfall are 248.6 mm and 211 mm respectively (www.bom.gov.au accessed 2009). There is a one-year-in-ten expectation of an annual total less than 80 mm.

Average annual pan evaporation for the region ranges from around 2,500 mm near Yunta to the south, to over 3,700 mm to the north-east at Moomba.

3.7.2 Beverley and Beverley North Data

A moderate period of meteorological data is available for Beverley, a distance of only some 10-15 km from the Beverley North Project, and so a summary of the Beverley data is provided below. Overall the Pepegoona and Four Mile data (to date) are consistent with the longer climatic records at Beverley and elsewhere in the district.

Wind speed and wind direction are collected at the height of 3 m and are recorded every 10 minutes using a continuous data logging system. Data from the weather station at Beverley shows the most common winds in the area are from the south-south west and the south. These two directions account for nearly 31% of wind direction time. The predominance of southerly and south westerly winds persist though-out the year, regardless of season.

Rainfall data is collected using a tipping bucket and recorded every hour. The Beverley average of the 10 years 2000 – 2009 was 111 mm; however, the length of record is not sufficient to consider this is the long-tem average rainfall of the site. Based on its location in the rain shadow of the Ranges the average rainfall of the Beverley – Beverley North area is estimated at approximately 150 – 200 mm/yr.

Evaporation is measured at Beverley using a standard above-ground Class A evaporation pan located adjacent to the weather tower, with a precision level meter linked to the weather station that logs every 24 hours. The ten-year average (2000-2009) is 3,402 mm/yr but this has occurred during below-average rainfall. The estimated long-term average pan evaporation for the Beverley – Beverley North area, based on regional trends, is likely to be between 3,000 and 3,500 mm. The available annual evaporation and rainfall data for Beverley is shown in Figure 3-2.

For November to March, mean maximum temperatures exceed 30°C and daily temperatures may exceed 40°C. Summer mean minima are around 20°C. Mean maximum temperatures are lowest for June and July, around 15°C. Mean minimum temperatures are <10°C, with <0°C daily minima recorded. Frosts are frequent, although actual white frosts appear less frequently because of the dryness of the air. The mean and maximum temperatures on a quarterly basis for Beverley are shown in Figure 3-3.

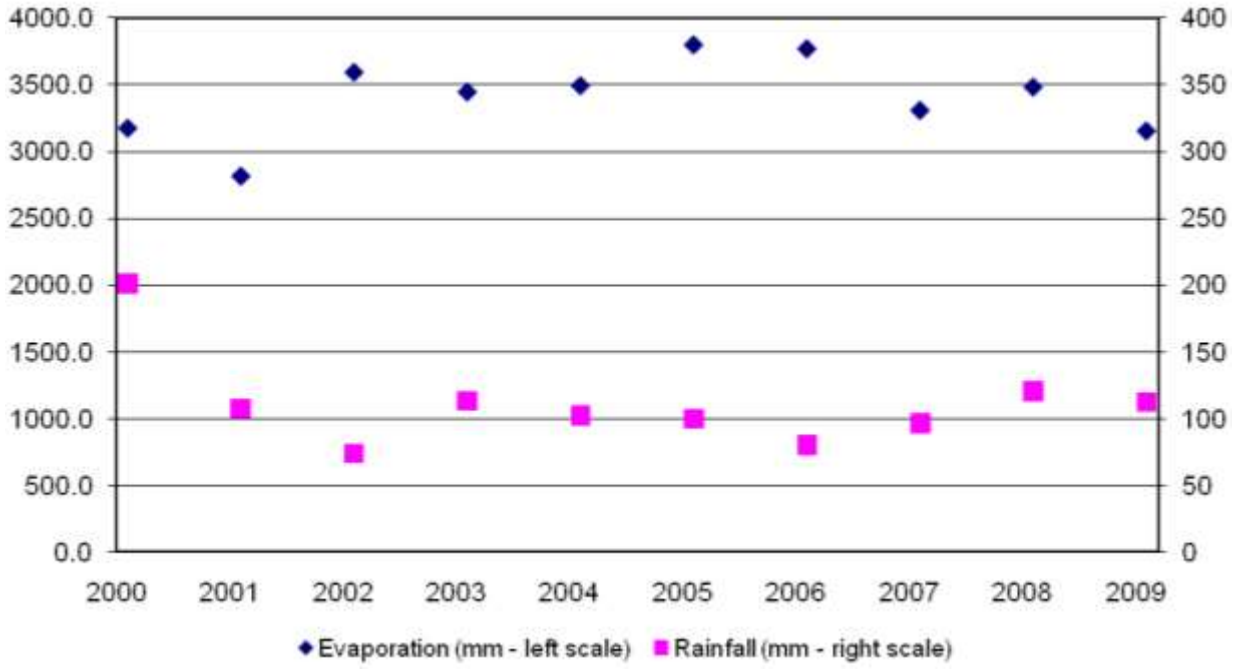

Figure 3-2 Annual Pan Evaporation and Rainfall, Beverley

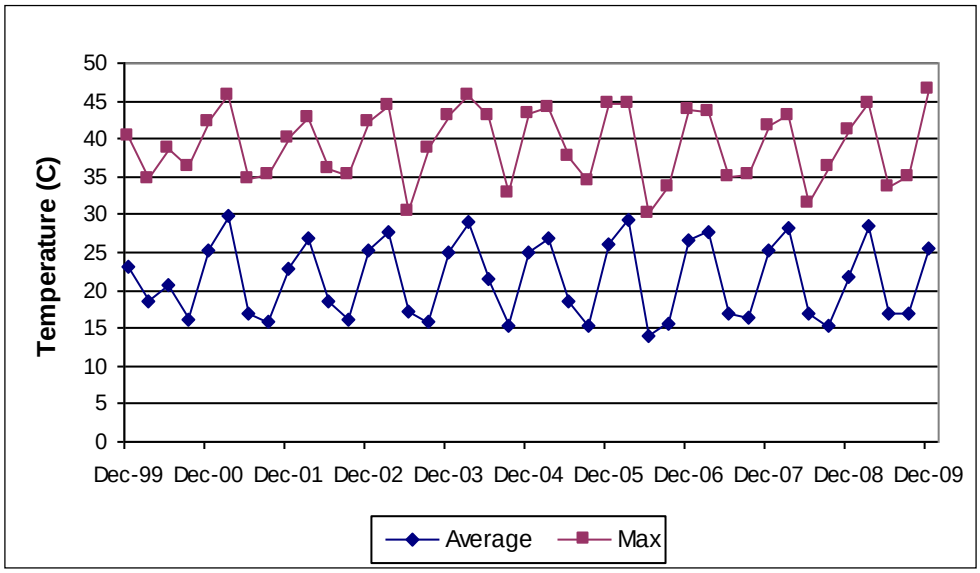

Figure 3-3 Quarterly Temperatures, Beverley

3.8 Geohazards

URS (2009) undertook a study of earthquake ground motion parameters for use in any design aspects of the Beverley North operations. A full copy of the report is provided at Beverley North ML Application (Appendix D [Seismicity Report] of Heathgate 2010a,).

The Beverley North site is located close to active faults of the Northern Flinders Ranges. Two categories of earthquake sources were used to represent the seismic hazard in the region. The first consists of active faults, and uses estimates of fault slip rate to quantify the seismic activity rate on the faults. The second earthquake source category consists of distributed seismicity.

URS commissioned a review by Professor Mike Sandiford of active faults in the north-eastern corner of the Northern Flinders Ranges. He identified a system of faults, shown in Figure 3-4, which include (clockwise from west) the Buxton, Paralana, Four Mile, Adams, Parabarana, Poontana, Wooltana, and Wooltana Range Front faults. The Beverley North Pepegoona and Pannikan deposits, where early satellite plants and mining areas are located, are at the head of the black arrows in Figure 3-4. Various minor faults more recently identified by detailed drilling are not included. These minor faults are not considered to change the findings of this section. For the remainder of this section, only the major faults shown in Figure 3-4 are discussed.

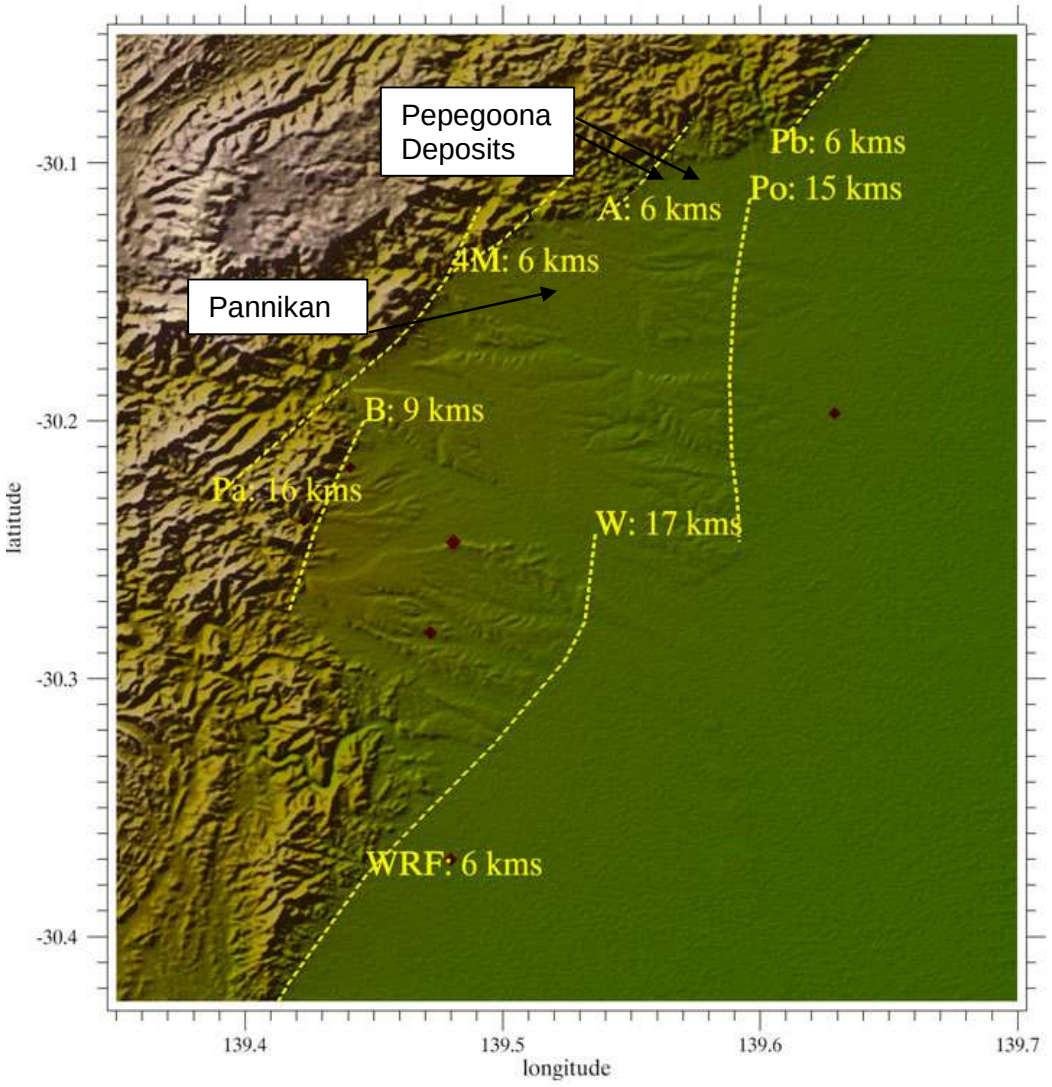

Figure 3-4 Major Faults in the Northern Flinders Ranges near Beverley North

These faults are all west-dipping reverse faults, and earthquakes on them cause the Flinders Ranges to rise in elevation above the adjacent Paralana High Plains. The Pontoona – Parabarana fault dips down to the west of the Beverley North Pepegoona deposit site. The Pepegoona deposits are fairly close to the Adams fault, whilst the Pannikan deposit and most of the rest of the ML are more distant from faults.

Although the Pepegoona deposits and satellite plant site are located close to active faults, there is no indication that active faults intersect the site. Conclusions made regarding the Pepegoona deposit location are protectively conservative for the rest of the area where Pannikan is found and further deposits may be found for later mining.

Two alternative spatially distributed earthquake source models were used in this study. Both the AUS5 source model and the Risk Frontiers source model assume a maximum earthquake magnitude (Mw) of 7.5 throughout Australia. It is considered that these models are equally viable alternative models of spatially distributed earthquake activity, so both were used in order to represent uncertainty in earthquake occurrence in the site region

It is considered that the ground motion characteristics at the Beverley North site are intermediate between those for stable tectonic regions and those for more tectonically active regions. Accordingly, equal weight has been given to ground motion models that represent each of those two conditions.

As described by Heathgate (2008), the ground surface at the Beverley North site consists of about 30 m of gravels of the Tertiary Willawortina Formation, overlying the sands of the Tertiary Upper Eyre Formation. The economic mineralisation at Pepegoona and Pannikan deposits occurs within the Tertiary Eyre Formation at depths between 190 and 220 m.

In the ground motion models used, ground motion amplification in the near surfaces is estimated based on the average shear wave velocity in the top 30 m of the soil profile (Vs30). The estimated Vs30 at the site is 540 m/sec.

Several effects cause the ground motions at depth to be generally lower than those at the ground surface. Data from downhole ground motion recordings at other locations were used to make very conservative estimates of the reduction factors at a depth of 220 m. The surface ground motion levels were multiplied by a period dependent scaling factor ranging from 0.6 for peak acceleration and short periods to 0.9 for a period of 2 seconds.

The ground motion parameters are provided in the form of uniform hazard response spectra for a series of return periods ranging from 475 years to 50,000 years. The response spectra for the ground surface are shown in Figure 3-5, and spectra for a depth of 220 m below the ground surface are shown in Figure 3-6.

The estimated peak acceleration values at the ground surface are listed in Table 3-1 for the Beverley North site, for both ground surface level and a depth of 220 m below the ground surface. The peak acceleration values for return periods of 475, 1,000 and 10,000 years at the ground surface at the site, listed in Table 3-1, are 0.039g, 0.063g, and 0.335g respectively. The corresponding values at a depth of 220 m below the ground surface, listed in Table 3-1, are 0.023g, 0.038g, and 0.201g respectively.

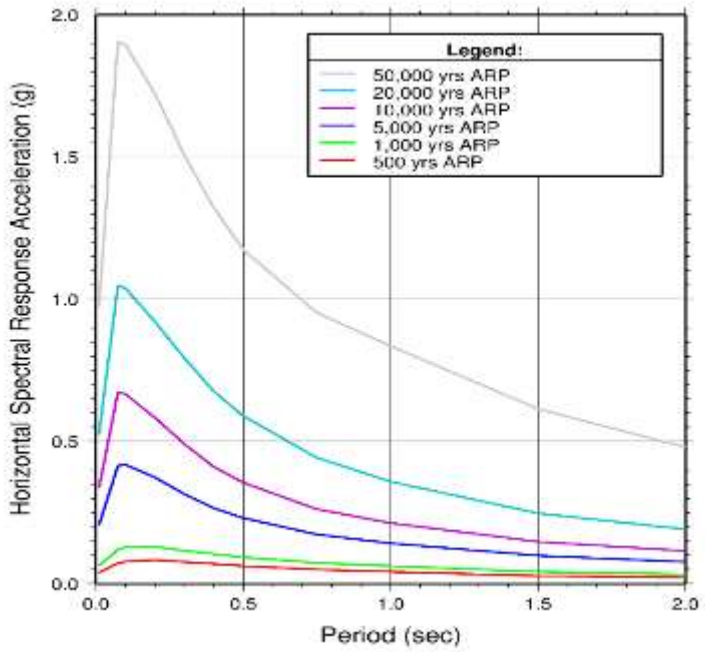

Figure 3-5 Probabilistic Ground Motion Response Spectra at Surface at Beverley North

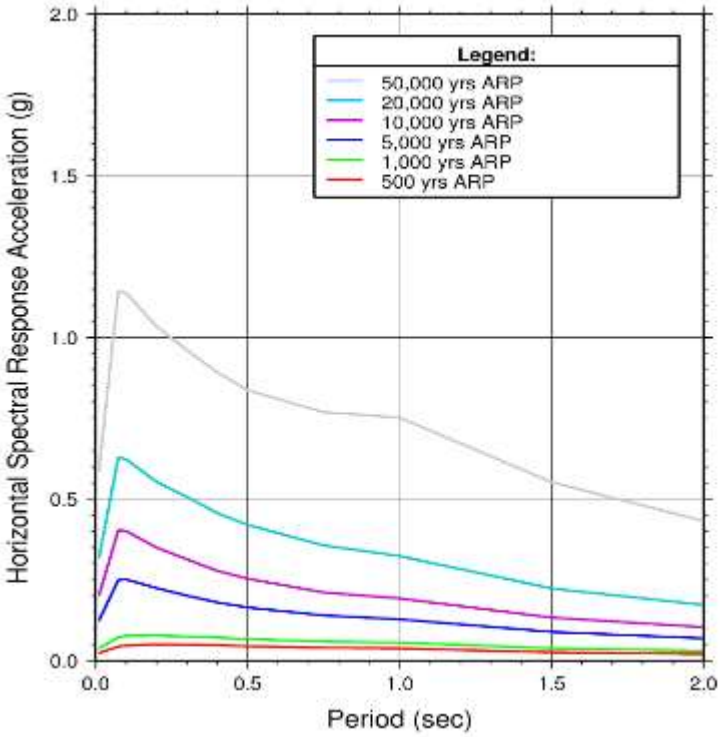

Figure 3-6 Probabilistic Ground Motion Response Spectra at 220 m Depth at Beverley North

Table 3-1 Peak Acceleration for Various Return Periods

Location	Peak Acceleration (g) at for various return periods					
	475 yrs	1,000 yrs	5,000 yrs	10,000 yrs	20,000 yrs	50,000 yrs
Beverley North, ground surface	0.039	0.063	0.206	0.335	0.526	0.975
Beverley North, 220 m BGL	0.023	0.038	0.124	0.201	0.316	0.585

The URS (2009) ground motion report focussed on the Pepegoona deposit area as this is the location of the first satellite plant and early mining. It is conservatively protective for the rest of the ML which is further from the main faults.

The original Beverley EIS (Heathgate 1998a) included assessment of seismic risk in ML 6321. Cornell-McGuire and Seismic Moment hazard assessment (Love 1996) indicated that the Beverley project site has a 30-40 mm/sec acceleration event risk of once in 500 years. This level of risk corresponds to a Mercalli Magnitude level VI to VII seismic event with a 400-1000 year recurrence interval.

Heathgate (1998a) reported that the confined aquifers in the ore zone are fully saturated and not likely to respond by liquefaction under the substantial confining pressure. Damage to wells, pumping equipment, and pipelines would not be likely to be sustained other than in a Mercalli Level VII or higher earthquake, an unlikely occurrence given the 400 year to 1000 year recurrence interval.

Infrastructure will be designed to withstand an acceleration coefficient of 0.09-1.0 in accordance with the requirements of AS 2121-1979 and AS 1170.4-1993. This level of risk and design compliance requirements is normal for Australia.

3.9 Hydrology

The main creek system on the Beverley North ML is Pepegoona Creek. URS (2010a; Appendix C of Heathgate 2010a) investigated the surface hydrology associated with Pepegoona Creek system. Its catchment lies primarily north and west of the Beverley North Mine, with an upstream catchment area of nearly 120 km^2. The upper reaches of the catchment drain the north-eastern slopes of the Gammon Ranges, and the creek flows in a generally easterly direction, discharging to the northern part of Lake Frome, east of Beverley.

The south-east corner of the Beverley North ML area is traversed by a segment of Four Mile Creek. The hydrology of Four Mile Creek was investigated as part of the Four Mile Creek Public Environment Report (URS 2008, Appendix C1 of Heathgate 2008a).

Whilst Pepegoona and Four Mile Creeks, and other smaller creeks, consist of dry creek beds for most of the year, they are subject to occasional flood flows. The upper reaches of the catchments are relatively steep, becoming less steep to the east. Correspondingly, flow decreases in velocity, but increases in depth and lateral extent. The creek beds in the lower reaches of Pepegoona and Four Mile Creeks are typically highly braided, characterised by multiple channels, and lined with small rocks or cobbles.

The 10 and 100 year average return interval (ARI) flood depths for the Pepegoona Creek catchment are shown at Figure 3 7 (URS 2010a). Any regions within braided sections of Pepegoona creek are potentially subject to risk of flooding, and any infrastructure developed within these sections would be engineered and constructed accordingly.

The locations of surface water (stock) dams on and near the Beverley North project area are shown in Figure 3-8. The nearest stock dam downstream, Dam 1, is on the opposite side of Four Mile Creek after Pepegoona Creek has joined it, out of the main channel. The Bank is on the ML

however this is not downstream of any known prospects and hence will not be affected (Figure 3-8).

3.10 Groundwater

The regional hydrogeological setting is important in understanding the potential downstream impacts of Beverley North mining on the groundwater system over the longer term. This section presents the current conceptual understanding of the surface and groundwater systems that summarizes the aspects of groundwater movement, interactions between aquifer systems and groundwater quality. For the northern Beverley North area this section is based on a comprehensive description of the regional and local hydrogeology given in the Beverley North ML Application (Heathgate 2010a), and information gained during the Pepegoona FLT and investigations at Pannikan. A minor update of the SKM report is included here as Appendix A (SKM 2010).

The regional setting information draws on a wide range of available data sources including:

- Geological information from over 1000 exploration drillholes drilled by Quasar and Heathgate
- Geological drillhole data sourced from DSD's SARIG Database
- Airborne and surface acquired geophysical data sets sourced from Quasar Resources and DSD
- Aquifer pressure and water quality data from over 60 observation wells installed by Quasar and Heathgate
- Well information sourced from DEWNR's Drillhole Enquiry System
- Heathgate survey of over 50 pastoral wells recorded in the DEWNR's Drillhole Enquiry System
- Published hydrogeological reports including DSD reports (Ker 1965; Draper & Jensen 1974), BRS reports (Radke *et al*. 2000), Heathgate hydrogeological reports associated with the Beverley Mine (Heathgate 1998, 2007a, 2009, 2010a, 2010c, Armstrong & Jeuken 2009), and published geological papers (e.g. Callen & Tedford 1976).

The Pepegoona and Pannikan deposits are hosted in the Eyre Formation aquifer (with minor mineralisation, currently considered uneconomic, in the Namba Formation), in common with the Four Mile East orebody (Heathgate 2009a). The ore zones are located on the edge of the large sedimentary Lake Frome Embayment, which is part of the Callabonna Sub-basin of the Eyre Basin. This overlies the Eromanga Basin that includes the GAB aquifers (where present) and extends across three states and the Northern Territory. The rest of the Beverley North project area is likewise part of the Lake Frome Embayment.

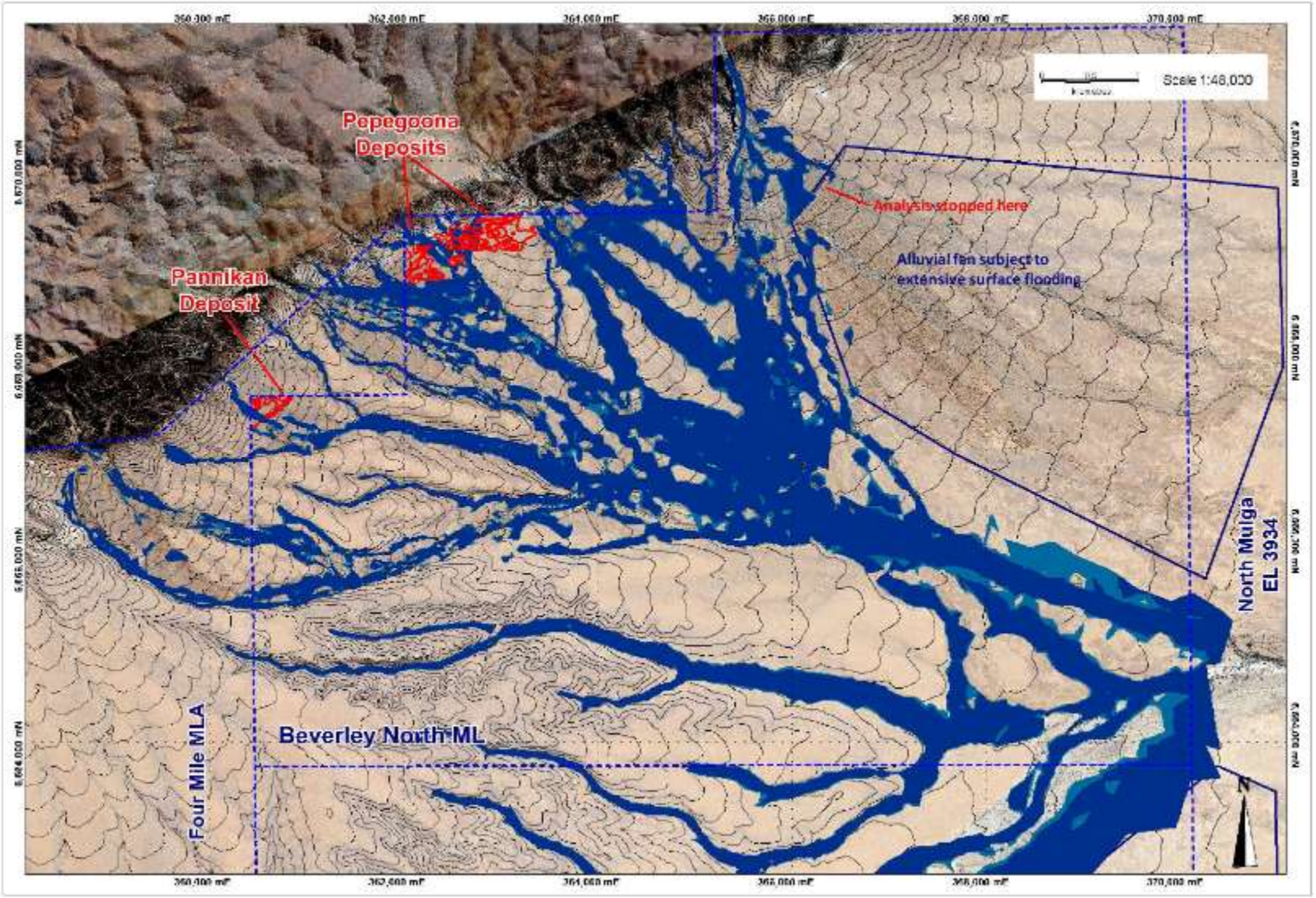

Figure 3-7 Pepegoona Creek Floodplain - 10 and 100 Year Interval Flooding Depth

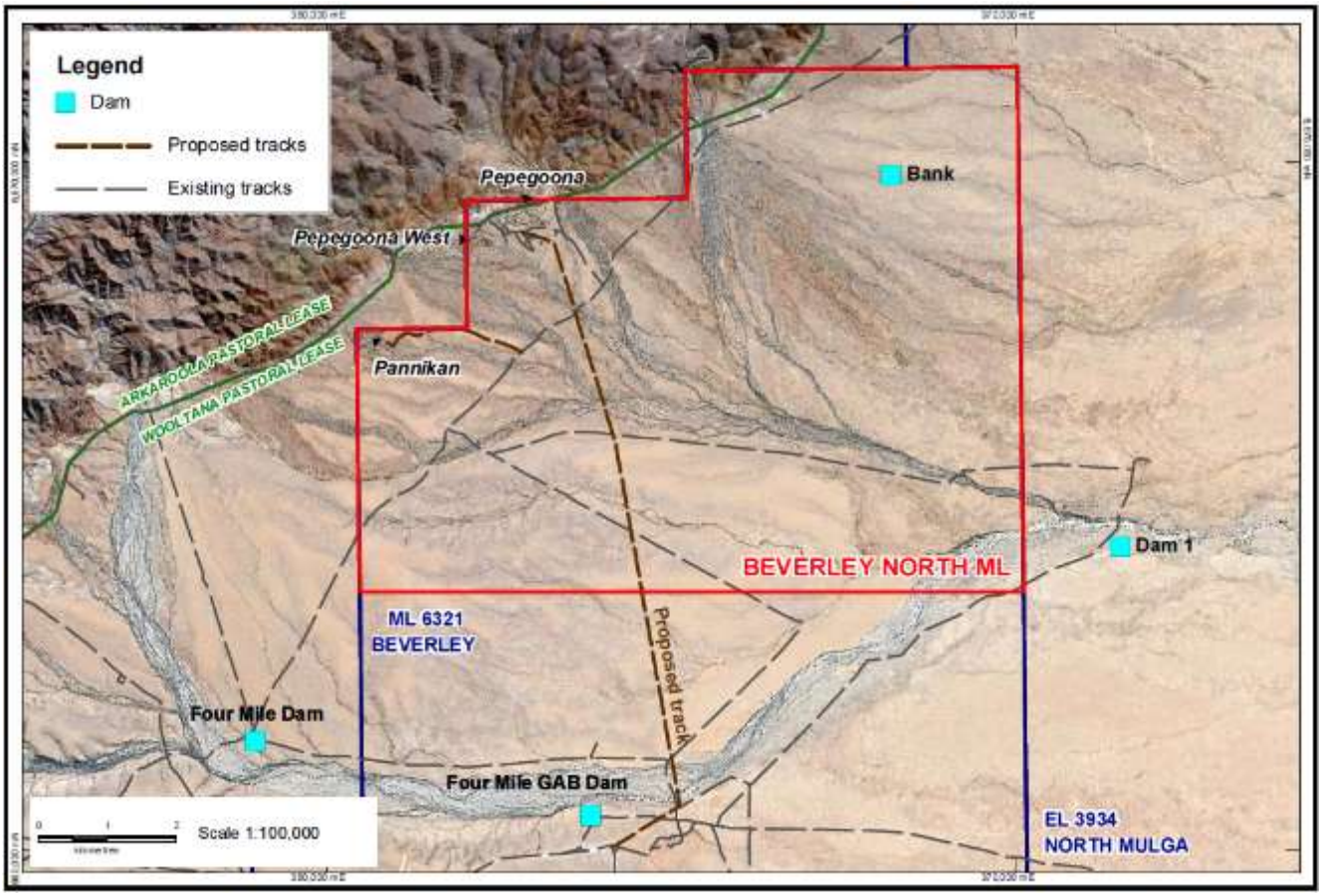

Figure 3-8 Location of Surface Water Dams

3.10.1 Recharge and Discharge Zones

Regional recharge is considered to occur mainly via direct infiltration into the fractured rock aquifers of the Northern Flinders Ranges and through streambed infiltration in ephemeral streams of the Flinders Ranges and on the plains of the Lake Frome Embayment. This is consistent with the general understanding of recharge mechanisms in arid zones (Gee & Hillel 1988). In the deeper GAB aquifer, which is present only to the east of the Poontana Fault Zone, groundwater inflow to the region occurs through lateral flow from the north and north east (Radke *et al*. 2000), and also via inferred leakage from basement along the Flinders Ranges escarpment, creating a local flow from west to east towards Lake Frome.

In general terms, groundwater flows towards the regional groundwater sink of Lake Frome (Ker 1965; Draper and Jensen 1974). The lake surface exhibits an elevation that ranges from -2 to 4 mAHD and is the lowest point in the Lake Frome Embayment. Discharge is via diffuse upward vertical leakage, and also via upward flow along more conductive pathways associated with faulting.

3.10.2 Structural Controls

Structural features associated with faulting have a significant impact on groundwater flow paths within the Four Mile Embayment and the adjacent Frome Embayment proper.

The Beverley Four Mile East and Pannikan ore bodies are hosted in the Eyre Formation within the Four Mile Embayment. This embayment is formed between the Paralana Fault, which defines basement uplift to the surface along the eastern edge of the Northern Flinders Ranges, and the Poontana and Wooltana Fault Zone where basement is uplifted (though not to the surface) in a Horst structure forming a hydraulic barrier between the Four Mile East and Beverley

area aquifers. This is referred to as the Poontana Inlier, although basement rocks are not exposed at the surface.

The Four Mile Embayment becomes deeper to the north east, parallel to the range front. This structure is shown in Figure 4-9 of Appendix A. This basement structure has resulted in the situation where older sediments within the Four Mile Embayment are uplifted and positioned at a higher elevation than younger sediments east of the Wooltana Poontana Fault Zone in the main part of the Lake Frome Basin.

The Pepegoona deposits of the Beverley North project are just outside the 'exit point' of the Four Mile Embayment and close to the range front. At this site mineralisation is also found largely in the Eyre Formation. Hydrogeologically the Pepegoona deposits site is part of the Frome Embayment proper. At Pannikan and the Pepegoona deposits a thick stratum of clayey Bulldog Shale underlies the deposits overlying bedrock. Whilst the Namba and Willawortina Formations are present the former is clayey and the latter dry at all these sites.

The groundwater gradient in the Eyre Formation ranges from north-east at Pannikan, within the Four Mile Embayment, to the south-east at the Pepegoona deposits, towards Lake Frome. Moving east of the Pepegoona and Pannikan deposits, the Cadna-Owie Formation (a major GAB aquifer) is again present and groundwater occurs in the Willawortina Formation, as at Beverley.

The southern part of the Beverley North project area is likewise within the Frome Embayment proper, east of the influence of the Poontana Inlier. The full hydrogeological sequence of the Beverley deposit area is present.

A generalised regional stratigraphic section is shown in Figure 3-9.

3.10.3 Hydrogeology

Figure 3-10 reproduced from Appendix A (SKM 2010) shows the location of a series of hydrogeological cross sections used to describe the hydrogeology of the northern part of the Beverley North project area. To illustrate the hydrogeological setting; Figure 3-11 (ibid.) shows a section from the Flinders Ranges into the central part of the Frome Embayment, whilst Figure 3-12 shows a generalised section parallel to the Flinders Ranges from the Four Mile East deposit to the Pepegoona deposits, essentially (but not exactly) along a groundwater flow path. Note that the minor faults close to the orebodies are indicative only

Figure 3-13 (ibid.) is a block diagram showing the three-dimensional relationships between aquifers and aquitards in the Beverley North area. Drilling to date at Beverley North has corroborated the conceptual model of the area's hydrogeology documented earlier by SKM (2008). The minor refinement is the presence of a thick stratum of Bulldog Shale directly overlying bedrock at the Pepegoona and Pannikan deposits, rather than overlying Cadna-Owie Formation as it does further from the Flinders Ranges.

3.10.3.1 Overview

This section describes the current understanding of the hydrogeological structure and properties of the Beverley North project area. The source of this information is primarily derived from extensive geological drilling, monitoring well installation, and aquifer testing.

High density drilling data provides very good geological control over the Pepegoona and Pannikan deposits and the overlying and underlying formations. To early 2010, Heathgate had drilled several hundred exploration holes on the Beverley North Project area using mud rotary and coring methods. This includes a significant number of exploration holes in other parts of the lease, as well as the detailed work at the currently identified orebodies.

Aquifer pressure and groundwater quality data was initially obtained from nine observation wells and one drilling water supply well completed in the Eyre Formation and one in the underlying formation (bedrock) at Pepegoona. Details of early testing are given in Appendix A. Over forty

Eyre Formation production wells, approved for the first stage of the FLT at Pepegoona, have since been drilled, together with a number of wells at Pepegoona West (FLT Stage 2).

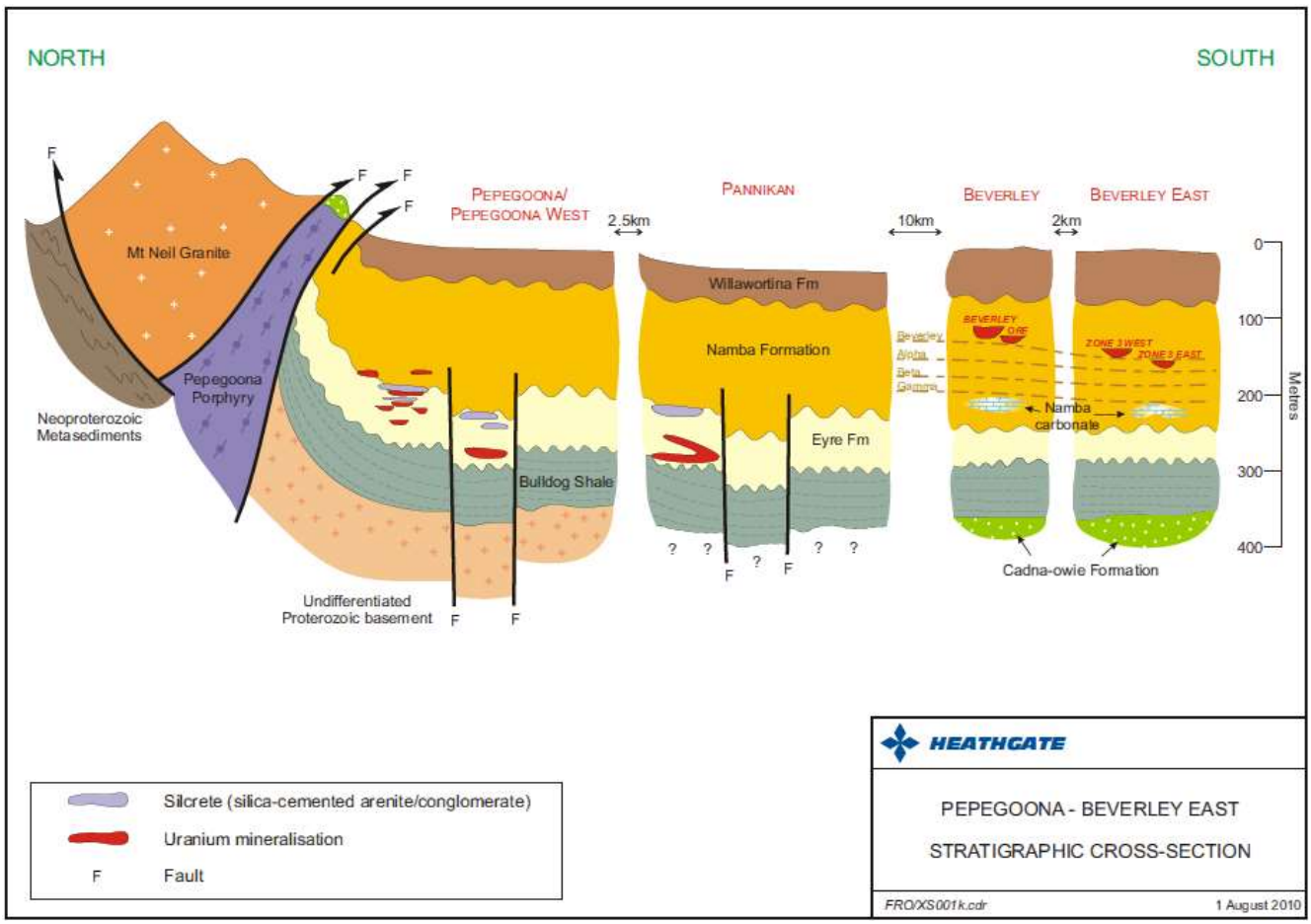

Figure 3-9 Regional Stratigraphic Cross-Section (Diagrammatic)

Two shallow wells have since been installed in the overlying Namba Formation at Pepegoona, one at Pepegoona West and one scheduled at Pannikan, and as at early November there were two underlying monitor wells at Pepegoona, one under construction at Pannikan and another scheduled for Pepegoona West.

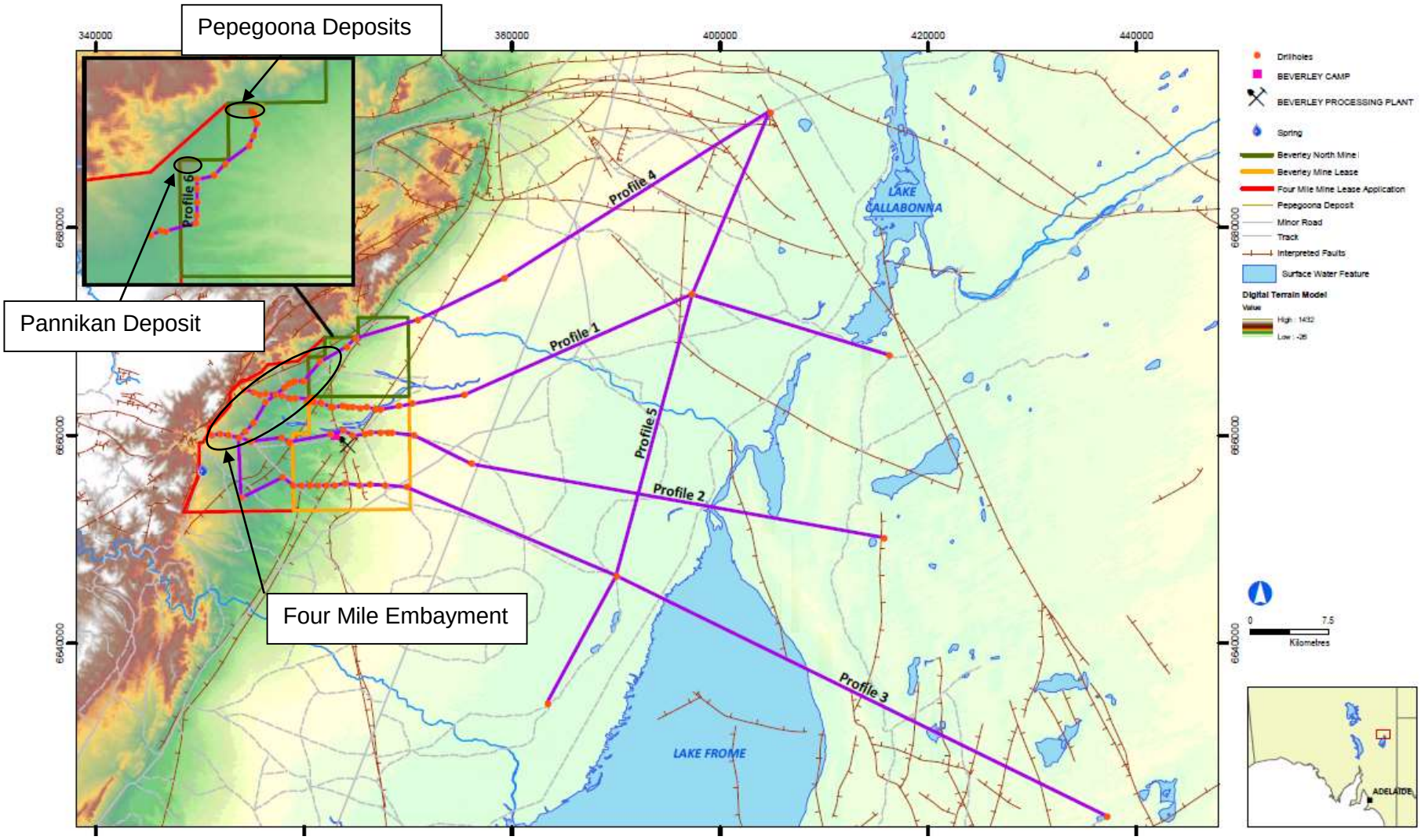

Figure 3-10 Beverley North – Locations of Hydrogeological Profiles

See Appendix A for all cross and long sections

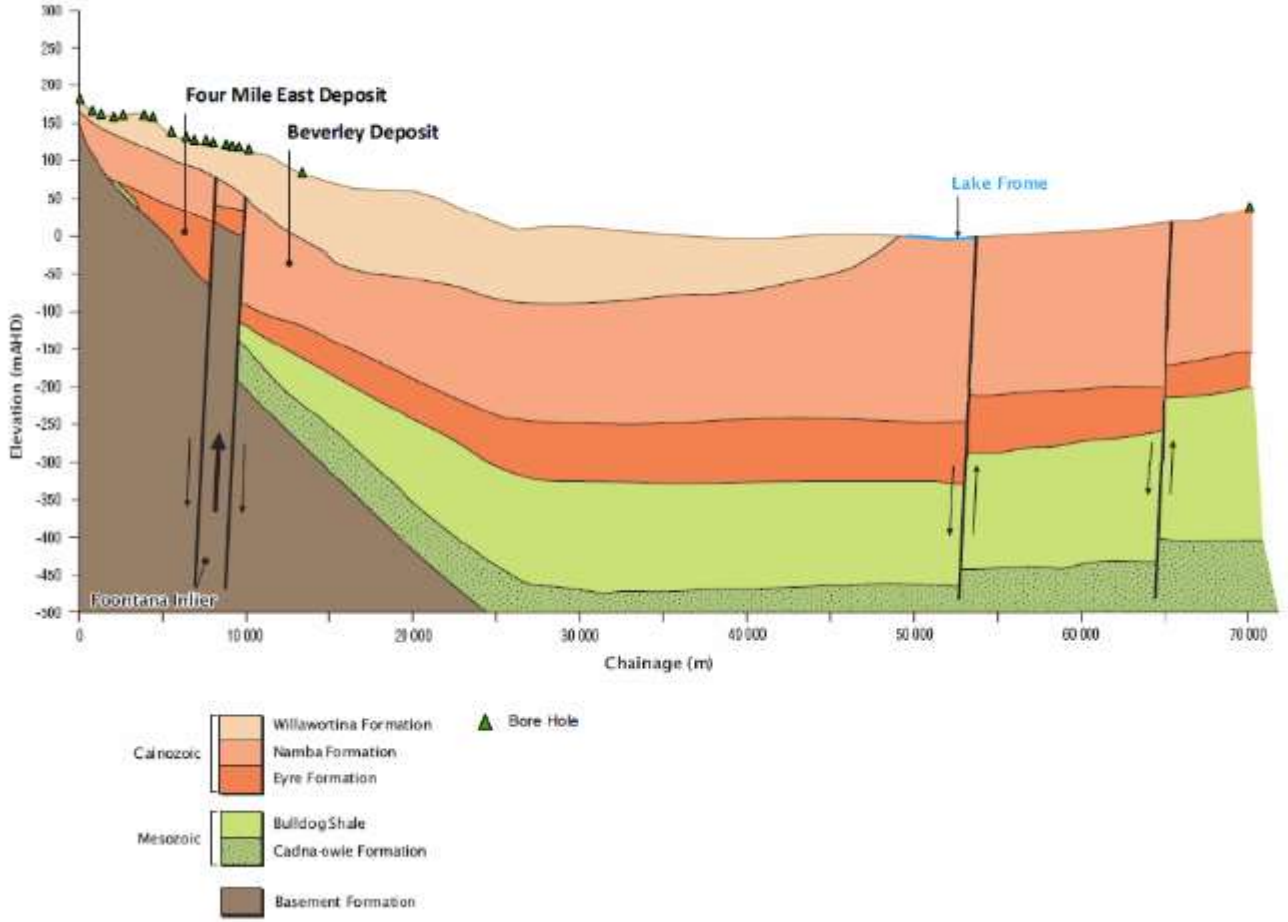

Figure 3-11 Beverley North – Hydrogeological Profile 2

Note: the Four Mile East Deposit is in the Four Mile Embayment, west of the Poontana Inlier

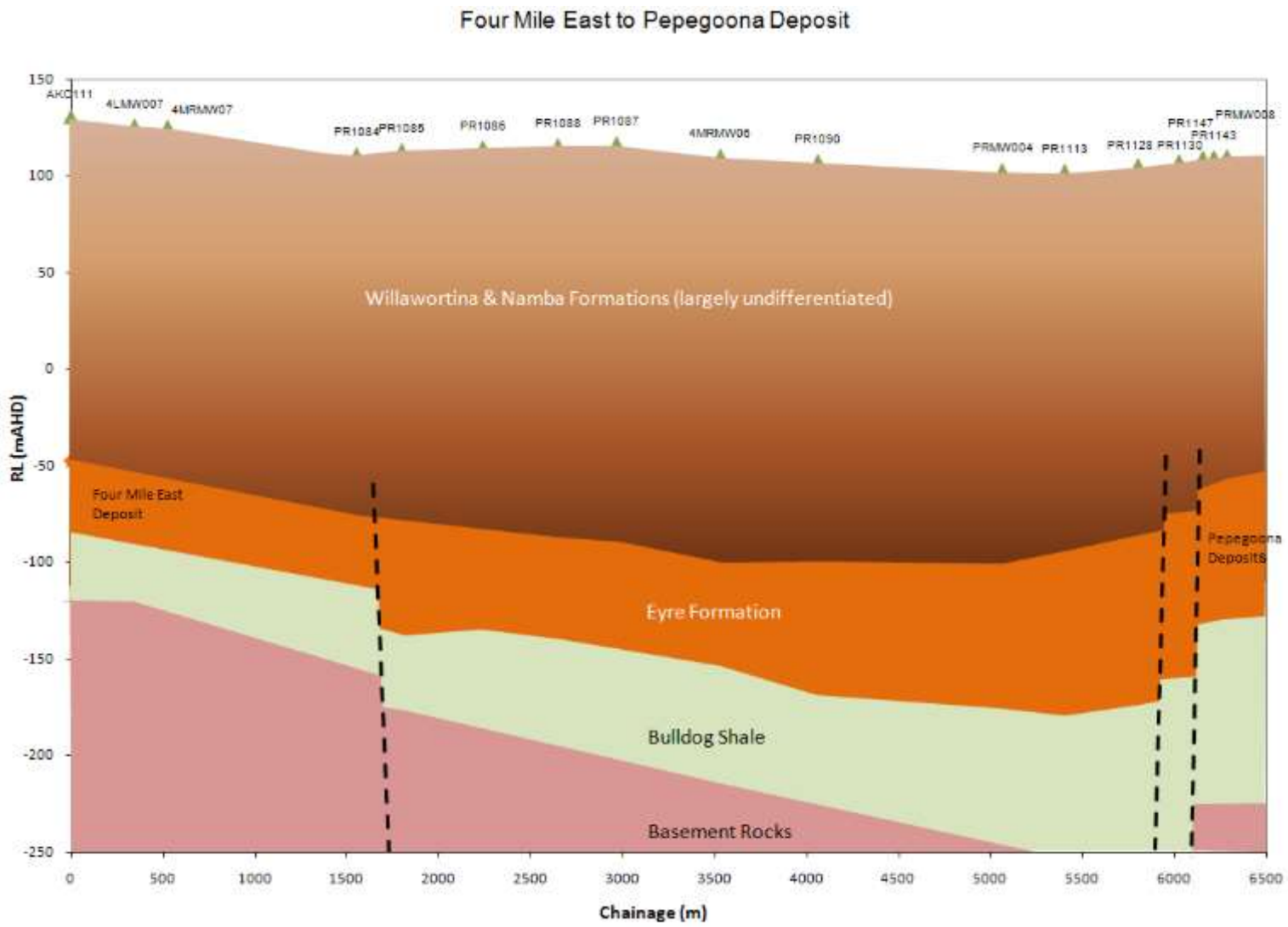

Figure 3-12 Inferred Regional Cross Section South-West to North-East

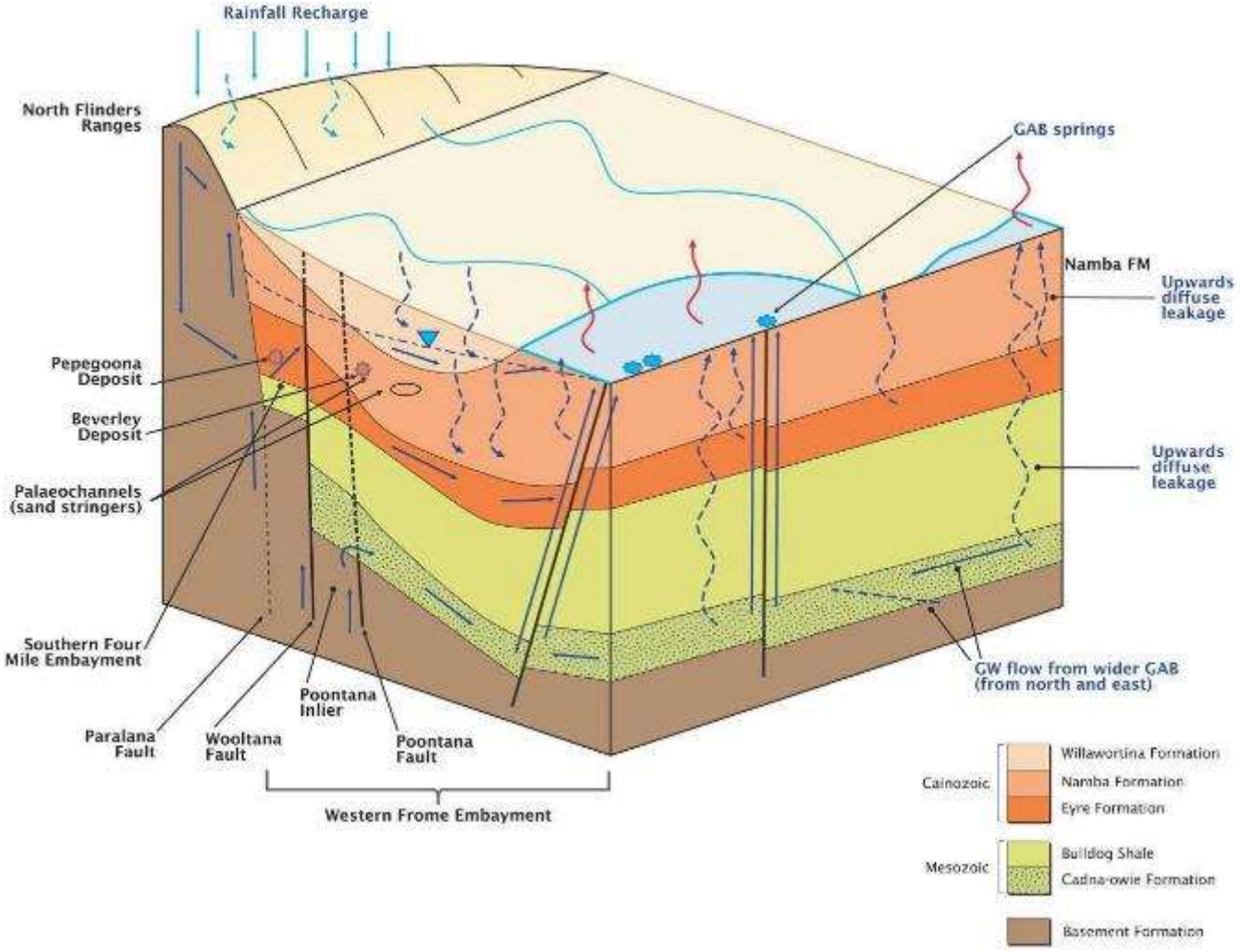

Figure 3-13 Beverley North – Hydrogeological Block Diagram

3.10.3.2 Hydrostratigraphy

The hydrogeology in the Beverley North project area, east of the Flinders Ranges, consists of up to five main aquifers, in order of depth:

- Willawortina Formation
- Beverley Sands and other minor sands in the Namba Formation
- Eyre Formation Sands
- GAB – Cadna-Owie Formation
- Fractured Rock.

Aquitards generally separate the various mined aquifers, which are not all present at all locations within the Beverley North project area.

Mineralisation at the Pepegoona and Pannikan ore zones is largely hosted within the permeable mostly unconsolidated sandstone sediments of the Tertiary age Eyre Formation at a depth of around 210-250 m. Minor mineralisation, currently considered uneconomic, is found in the Namba Formation. The Eyre Formation comprises a relatively thick aquifer of approximately 70 m thickness. The Eyre formation is overlain by the low permeability, predominately mudstone and siltstone of the Tertiary Namba Formation which forms an effective upper hydraulic confining bed. This is in turn overlaid by the Quaternary age Willawortina Formation.

The Eyre Formation is deposited unconformably on the Cretaceous Bulldog Shale which comprises a lower hydraulic confining unit. This confining unit, in turn, overlies the Proterozoic basement rocks which comprise a moderately low permeability Fractured Rock Aquifer at the Pepegoona deposits and Pannikan, and the Cadna-Owie Formation further east.

Each hydrostratigraphic unit is described in detail below.

Willawortina Formation

The Quaternary age Willawortina Formation is present from surface to a depth of approximately 30 m at the Pepegoona deposits. There are no thin sandy beds forming minor local aquifers in this formation at the Pepegoona deposits, in contrast to Beverley. This formation appears to be dry in the Four Mile Embayment and at the Pepegoona deposits (close to the Flinders Ranges). At the Pepegoona and Pannikan deposits it is difficult to pick the Willawortina-Namba boundary using geophysical and geological logs, such that the exact depth of the transition there is uncertain.

East of the Pepegoona and Pannikan deposits the Willawortina formation is at least in part saturated and forms a regional aquifer, albeit of highly variable character. Previous investigations summarised by Flow (2007), using data from Ker (1965), the government database and further backed by additional data from Beverley and unpublished regional pastoral and geothermal investigation water supply drilling, show a north-west to south-east potentiometric gradient towards Lake Frome (Figure 3-14).

Groundwater quality data show that the salinity within the Willawortina aquifer, where groundwater is present, is highly variable, but in general increases away from major creeklines. At the Beverley mine, the salinity of Willawortina aquifer water ranges from 1600 to 12,000 mg/L TDS; pH varied from 6.9 to 8.0 pH units (Heathgate 2007). Only some Willawortina Formation groundwater is suitable for stock. Individual sandy lenses with the Willawortina are generally of limited extent, although at Beverley a more widespread sandy layer occurs at the base of the formation immediately above the Beverley Clay, locally the uppermost member of the Namba Formation.

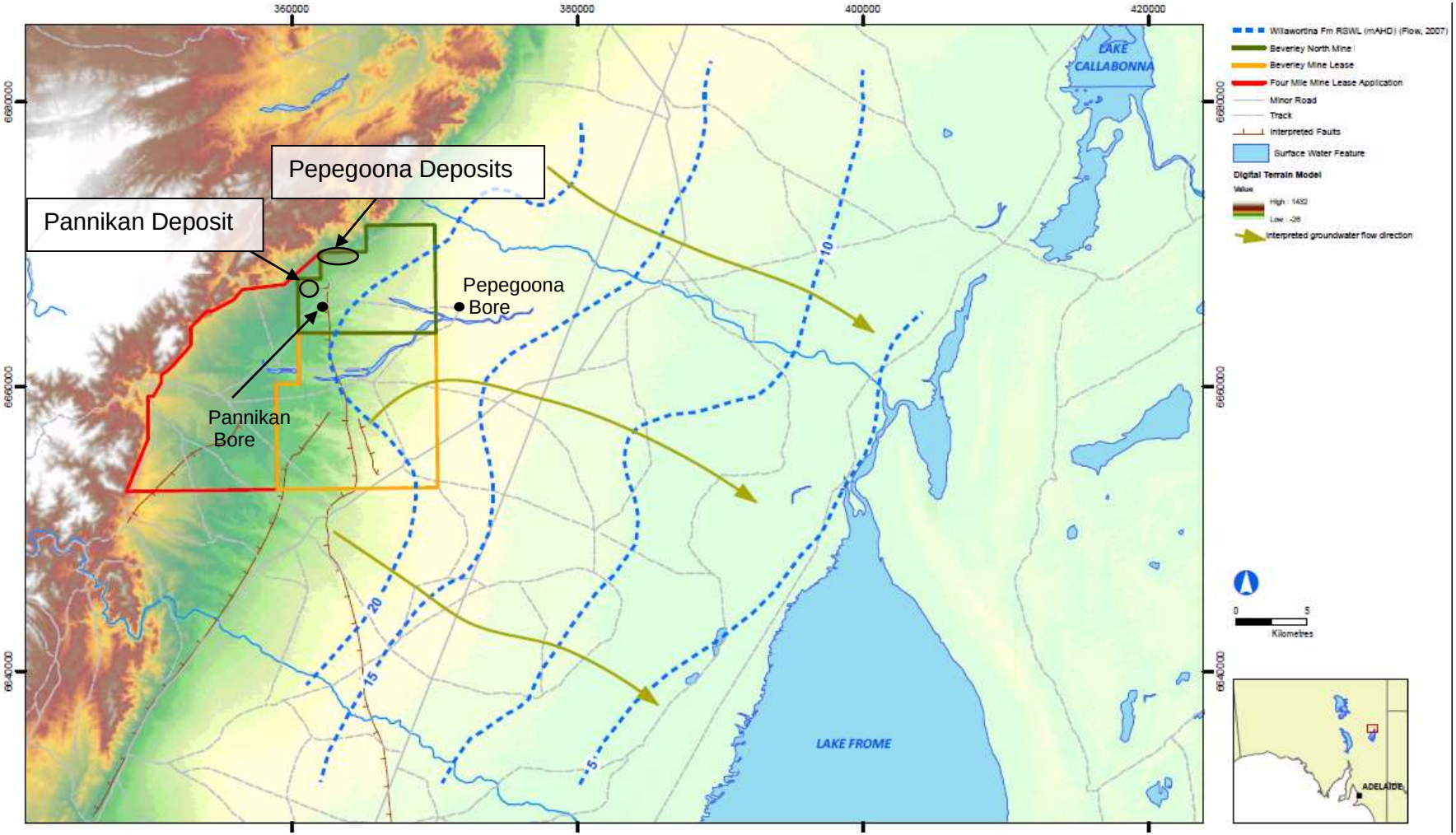

Figure 3-14 Regional Potentiometric Gradient, Willawortina Aquifer

Namba Formation

The Namba Formation is present from approximately 30 m to 175 m depth at the Pepegoona deposits and extends to 200 m at Pannikan, although as discussed above the upper boundary can be hard to discern. The formation here comprises mainly low permeability siltstones and mudstones; to date no significant thin sand units have been identified. Here and elsewhere in the project area the formation acts mainly as an aquitard and a hydraulic confining layer to the Eyre Formation below. Exploration wells (now used as Monitoring Wells) were installed into the Namba Formation at Pepegoona and Pepegoona West in thin, isolated lenses of slightly more permeable material, allowing the sampling of groundwater from this formation.

Further east of the Pepegoona and Pannikan deposits and in the southern part of the project area sandy lenses similar to the Beverley Sands (the main uranium-bearing unit at Beverley, within the upper part of the Namba Formation) have been encountered in some locations. In these parts of the Beverley North project area the Namba Formation is considered prospective for further ISR-amenable uranium deposits. Minor uranium mineralisation has been identified in the Namba Formation at Pepegoona but is not considered economic at this stage.

Groundwater in the Namba Formation at Beverley is essentially stagnant, bounded within discontinuous palaeochannel structures (Armstrong & Jeuken 2009). Whilst data from the Beverley project area (ML 6321) is discussed in Appendix A, as there are no pastoral or exploration wells in this formation in the Beverley North project area, no hydraulic or water quality information is currently available for this mostly clayey formation.

Eyre Formation

The Eyre Formation, which is host to most mineralisation at the Pepegoona and Pannikan deposits, is present from approximately 175 m to 250 m depth. The formation comprises fine to coarse mostly unconsolidated sand, with some variably silica-cemented layers. Mineralisation is hosted from approximately 190 to 220 m depth in a number of discrete thin zones. Aquifer testing at the Pepegoona ore zone indicates a transmissivity of 120 m^2/day, from a four-metre screen. The silica-cemented horizons are expected to have lower permeability; this was tested as part of the Pepegoona FLT but results are still being interpreted.

Water Quality

The salinity of this aquifer at the Pepegoona deposits ranges from 2600 to 3070 mg/L (within the range of the larger Four Mile East area). Natural uranium concentrations are relatively high, ranging from 0.004 to 0.097 mg/L (similar range to Four Mile East). Radium concentrations can be high, ranging from 0.4 to 36.5 Bq/L (mostly within the range of the larger Four Mile East area of 1.5 to 90.4 Bq/L). Natural fluoride concentrations are also high ranging from 4 to 4.8 mg/L (similar range to Four Mile East). Because of the regional, flow-through nature of the aquifer, and its location between Four Mile East and Pepegoona, water quality at Pannikan can be also expected to be in this range.

Pressure

Aquifer pressure in the Eyre Formation at the Pepegoona ore zones ranges from 23 to 27 mAHD and at Pannikan is interpolated to be approximately 50 mAHD. In the broader area hydraulic pressures are shown in Figure 3-15.

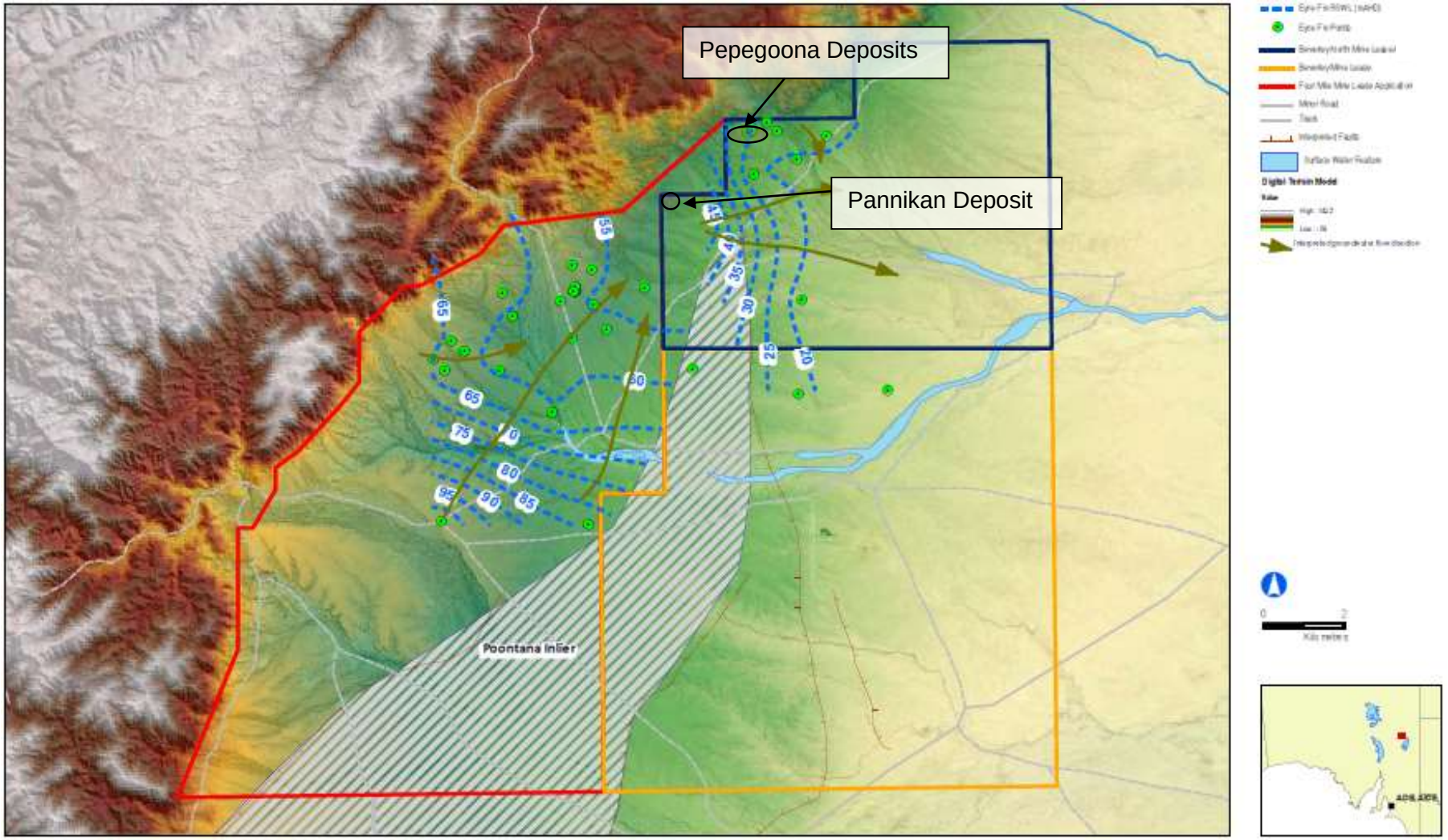

Figure 3-15 Eyre Formation Aquifer Pressure (mAHD) across the Beverley North Area

Note: Eyre Formation contours are unlikely to extend over the northern extent of the Poontana Inlier, but are left on the diagram to allow the labelling of the contours to be shown.

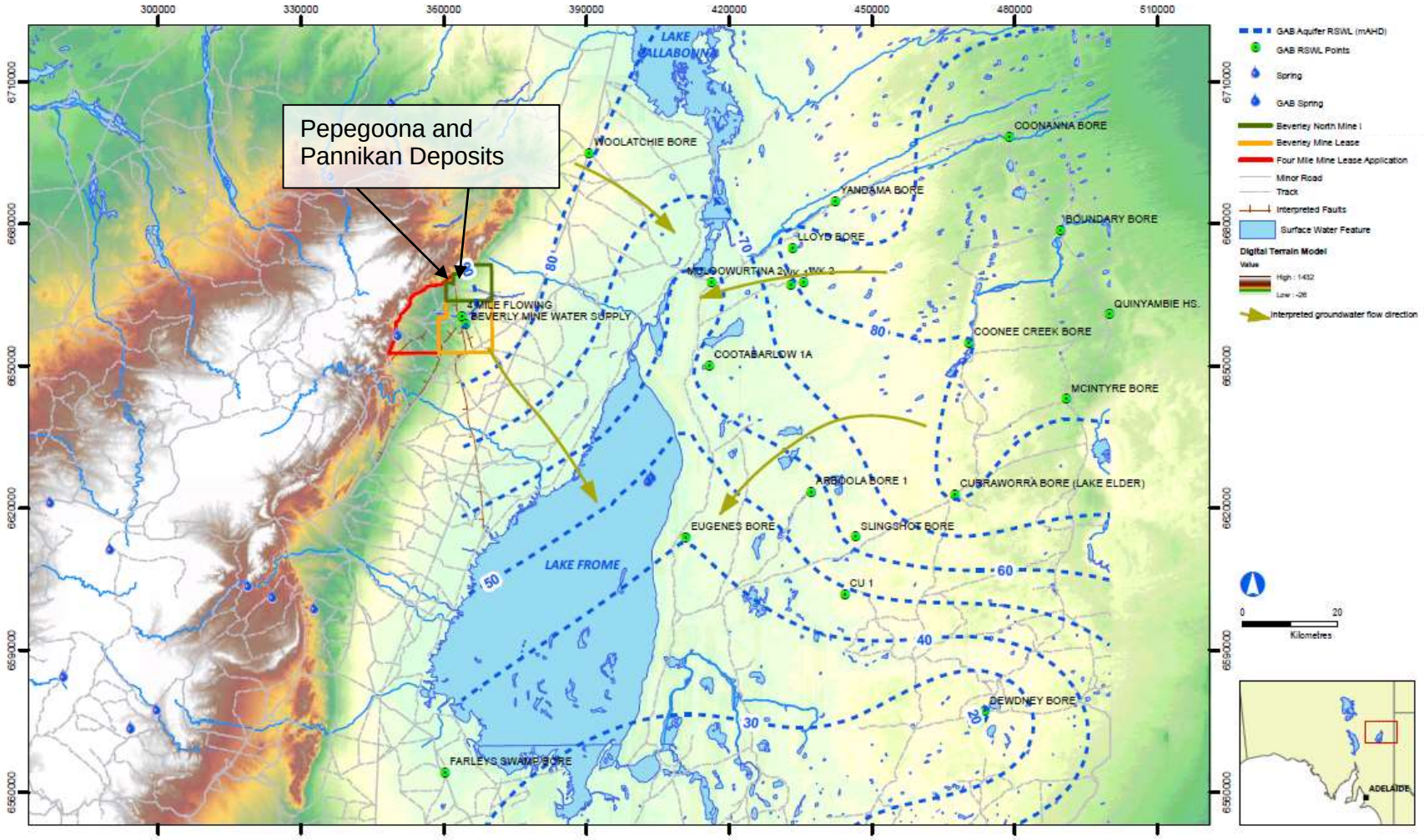

Figure 3-16 GAB Aquifer Pressure (mAHD) across the Beverley North Region

Hydraulic Gradient

Eyre Formation aquifer pressure gradient ranges from 0.01 at the southern end of the Four Mile Embayment, reducing to around 0.0025 across the Pepegoona deposits area and reducing further east of the Poontana fault in the broader Lake Frome Embayment to 0.0007 (see Figure 3-15).

Bulldog Shale

The Bulldog Shale underlying the Eyre Formation serves as a lower hydraulic confining unit. The unit comprises a thick sequence of clays and silts between depths of approximately 250 to 335 m at the Pepegoona deposits and 200 to 330 m at Pannikan (compared to 220 to 330 m at Beverley). The permeability of this unit is very low.

Great Artesian Basin (Cadna-Owie Formation)

The Cadna-Owie Formation is the only GAB aquifer present in the area to the west of Lake Frome. The Cadna-Owie Formation is capped regionally by the Bulldog Shale. It appears to be absent in the Four Mile Embayment (SKM 2008), which includes Pannikan, and at the Pepegoona deposits.

Further east of the Pepegoona and Pannikan deposits and in the southern part of the project area Cadna-Owie formation is present, and is used for pastoral and the Beverley mine water supplies. The regional disposition of water pressure in the GAB aquifer is shown in Figure 3-16. This shows a broad groundwater depression existing in the vicinity of the eastern shores of Lake Frome, with groundwater flow towards the saline lake systems from the west, north and east.

The depression results in a head change of up to 40 m between the western margin of the GAB aquifer beneath the Beverley mine and the eastern shore of Lake Frome. Similar groundwater pressures are inferred for the GAB elsewhere on its western extent, approaching the Northern Flinders Ranges, although it does not reach all the way to the ranges as noted above.

Where present, there is good hydraulic isolation from the uranium bearing Namba Formation sands at Beverley and the GAB aquifer, with thick fine grained sediments of the lower parts of the Namba Formation and the Bulldog Shale. The Bulldog Shale also isolates the Eyre Formation sands from the GAB aquifer, which is present in the eastern part of the northern Beverley North area and the Beverley ML. Previous assessments have found no credible threat of ISR mining to the GAB at Beverley (CSIRO 2004) and the GAB is absent at the Four Mile, Pepegoona and Pannikan deposits.

Fractured Rock Aquifer (Bedrock)

The Proterozoic basement rocks most likely of the Mount Painter Group underlie the sedimentary package in the Pepegoona and Pannikan deposits. These rocks comprise a fractured rock aquifer where groundwater is hosted mainly in fractures in the hard rock. The bulk permeability calculated from aquifer testing of this formation in the nearby Four Mile East area is low at 0.05 m/day.

Hydraulic testing has not been undertaken elsewhere. However, deep monitor wells at the Pannikan and Pepegoona deposits indicate water pressure conditions consistent with expectations by the extrapolation of fractured rock aquifer water levels in the Flinders Ranges and beneath Four Mile East (Figure 3-17).

Elsewhere in the project area bedrock – not necessarily the Mt Painter Group – is inferred to be present at greater depths. East of Beverley, outside the Beverley mine lease and the current application, the Petratherm joint venture geothermal exploration well was terminated at 4012 m in non-crystalline Cambrian to Adelaidean aged rocks, equivalent to rocks of the Flinders Ranges and stratigraphically above the Mt Painter group (Reid 2009).

Water Quality

Water quality measurements from deep wells at Pepegoona show the salinity of this aquifer is 2900 to 3700 mg/L TDS, whilst radionuclide concentrations are 0.002 to 0.003 mg/L uranium and 3.7 to 17 Bq/L radium 226. Fluoride concentrations are high at 6-9 mg/L. This groundwater is more saline than that encountered in the fractured rock wells at Four Mile East, but by nature this sort of variability in a fractured rock system is not unusual.

Pressure

Aquifer pressure measured in the wells at Pannikan and Pepegoona interpreted to intercept the FRA is approximately 94 m and 108 mAHD respectively, higher than the 59 mAHD at Four Mile East. These deep wells are closer to the escarpment of the Northern Flinders Ranges, and gave aquifer pressures consistent with the sub-regional hydrogeological conceptual model.

Hydraulic Gradient

The hydraulic gradient in the FRA towards and extending under the Beverley North area is 0.005 orientated from north-west to south-east. Aquifer pressure data points are shown in Figure 3-17. This orientation is consistent with the regional gradient in this aquifer that indicates groundwater recharge in the Northern Flinders Ranges, and groundwater discharge to the overlying sedimentary aquifers in the Frome Basin (Figure 3-14).

The aquifer structure at the Pepegoona and Pannikan deposits is presented in Tables 3-2 and 3-3. The Eyre Formation comprises the most permeable aquifer unit in this system. It exhibits an aquifer pressure which is much lower than underlying Fractured Rock Aquifer indicating that the potential for natural vertical groundwater flow is towards the Eyre Formation aquifer.

However, whilst at Four Mile East the aquitard between the Eyre Formation and the FRA was of modest thickness (several metres) and leakage may be of some relevance to the water balance of the Eyre Formation there, at the Pepegoona and Pannikan deposits the situation is more like that at Beverley, where a very significant aquitard is present.

This suggests any leakage from the FRA is negligible in timeframes of decades to centuries. Aquifer testing indicates that the Eyre Formation at Pepegoona (and, by the similarity of stratigraphy, Pepegoona West, Pannikan and all nearby areas) is effectively vertically confined by the low permeability of the overlying Namba Formation and the underlying Bulldog Shale unit.

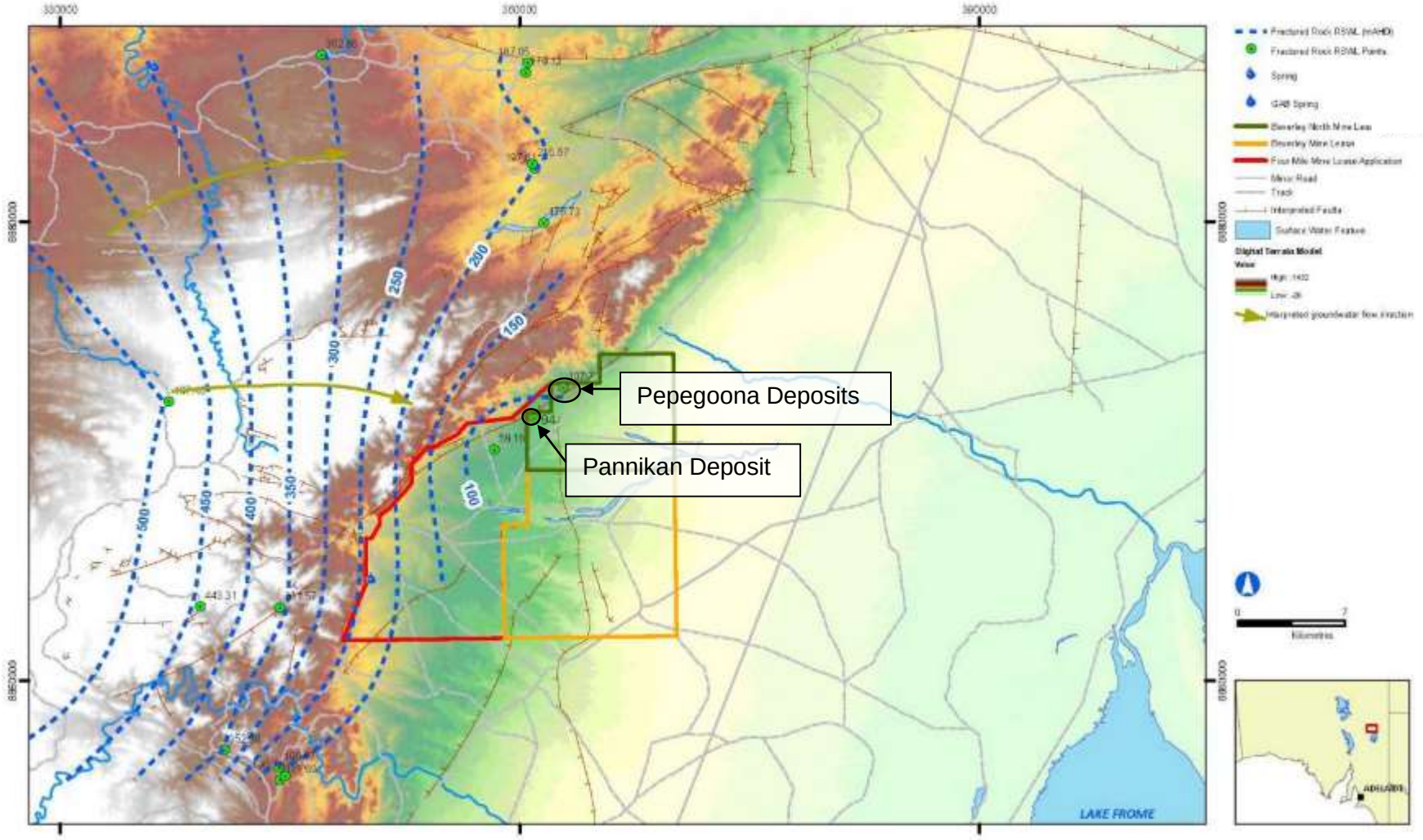

Figure 3-17 Regional Gradient in the Fractured Rock Aquifer

Table 3-2 Hydrostratigraphy of Beverley North at the Pepegoona Deposits

Formation	Hydrogeological status	Depth range (m below ground level)
Willawortina/Namba Formation	Dry or aquitard	Near surface to ~175
Eyre Formation	Regional aquifer	~175 to ~ 250
Bulldog Shale	Regional aquitard	~ 250 to ~ 335
Fractured Rock (Basement)	Regional Fractured Rock Aquifer	From ~ 335

A lateral aquifer pressure gradient across the ore zone indicates that lateral groundwater migration in the Eyre Formation aquifer is from the west to the east (Figure 3-16). Lateral groundwater migration is estimated as relatively slow at approximately 15-25 m/year near the Pepegoona deposits, slowing to approximately 7 m/yr further east. The gradient is a little higher at Pannikan, about 30-35 m/year, also slowing to the east.

Table 3-3 Hydrostratigraphy of Beverley North at Pannikan

Formation	Hydrogeological status	Depth range (m below ground level)
Willawortina/Namba Formation	Dry or aquitard	Near surface to ~200
Eyre Formation	Regional aquifer	~200 to ~ 265
Bulldog Shale	Regional aquitard	~ 265 to ~ 330
Fractured Rock (Basement)	Regional Fractured Rock Aquifer	From ~ 330

3.10.3.3 Key Values for Each Aquifer

The key values for each aquifer are defined by the current and potential use by third parties. These third parties include pastoralists, other mining companies, the government, and the environment. An assessment of the current or potential third party use follows.

Current Third Party Users

Pastoral Use

A field survey was undertaken of all the water bores within the sedimentary Frome Embayment within 30 km of the Four Mile East orebody recorded in the South Australian Government DEWNR Drillhole Enquiry system database. The full report is presented in the Beverley Four Mile MLP/PER (Appendix K of Heathgate 2009a). The examined area is also relevant to the Beverley North ML.

This survey showed that, of the 57 bores recorded in the database, 22 bores are in use by third party groundwater users for stock and domestic use. The remainder are either non-existent, in disrepair, or are used by the Beverley Mine.

There are no bores that use groundwater from the Eyre Formation aquifer within the Beverley North ML (nor within 25 km of the Pepegoona and Pannikan ore zones). All third-party bores access the Willawortina Formation aquifer. Salinity ranges from 1,500 mg/L to 10,000 mg/L.

The closest third party well to the Pepegoona deposits is Pepegoona Bore, located approximately 10 km south-east of the Pepegoona deposits. The location of Pepegoona Bore is shown in Figure 3-14. This was in use when checked in 2008 and had a salinity of 1664 mg/L and pH of 8.3. The now-broken Pannikan Bore is a similar distance and direction from Pannikan (both

deposits were named after these bores). These wells access or accessed the Willawortina formation aquifer and are or were used for stock water supplies.

Springs and Groundwater Dependent Ecosystems

There are no springs recorded within the Beverley North ML (nor within 20 km down-gradient, for all aquifers, of the known ore zones). The closest down-gradient springs are on Lake Frome some 70 km to the south-east. Research into these springs concluded that the springs are fed by groundwater discharge from the deeper GAB aquifer (Draper & Jensen 1974). There is no credible potential for impact on these springs.

There are several springs recorded within 20 km of Beverley North (Figure 3-18) (GA data downloaded 2010). The only nearby springs (e.g. Mount Fitton, Brindana and Tee Junction) are all located within the Northern Flinders Ranges and are fed via groundwater flow from local fractured rock aquifers of the Flinders Ranges. These springs are located more than 10 km up gradient from the Frome Embayment hence no adverse impact on these springs is possible as a result of mining at the Pepegoona or Pannikan ore zones (or future mining elsewhere in the Beverley North ML).

Paralana Hot Springs (PHS) is located approximately 20 km and 15 km south west of the Pepegoona and Pannikan deposits respectively. A detailed study of the hydrogeochemistry of these springs (Brugger *et al*. 2005) concluded that the water source of these springs is the fractured rock aquifers of the Mount Painter Inlier, not the sedimentary aquifers of the Frome Embayment which are the target for mining. This indicates that any impact on PHS from the Beverley North Mine is very unlikely. Modelling of drawdown from the Four Mile mining project which is closer to these springs than the Beverley North ML showed negligible effect on PHS.

Further, aquifer pressure in the target aquifer is approximately 20 mAHD. This aquifer pressure is much lower than the ground surface at PHS, which is approximately 190 mAHD. Hence the aquifer feeding PHS exhibits at least 170 m H_2O higher pressure than the target aquifer and, even if a hydraulic connection were to exist, there is no potential for adverse impacts on these springs due to flow from the Eyre Formation (or other sedimentary aquifers) on the Beverley North ML to PHS as this flow would have to be against a significant pressure gradient.

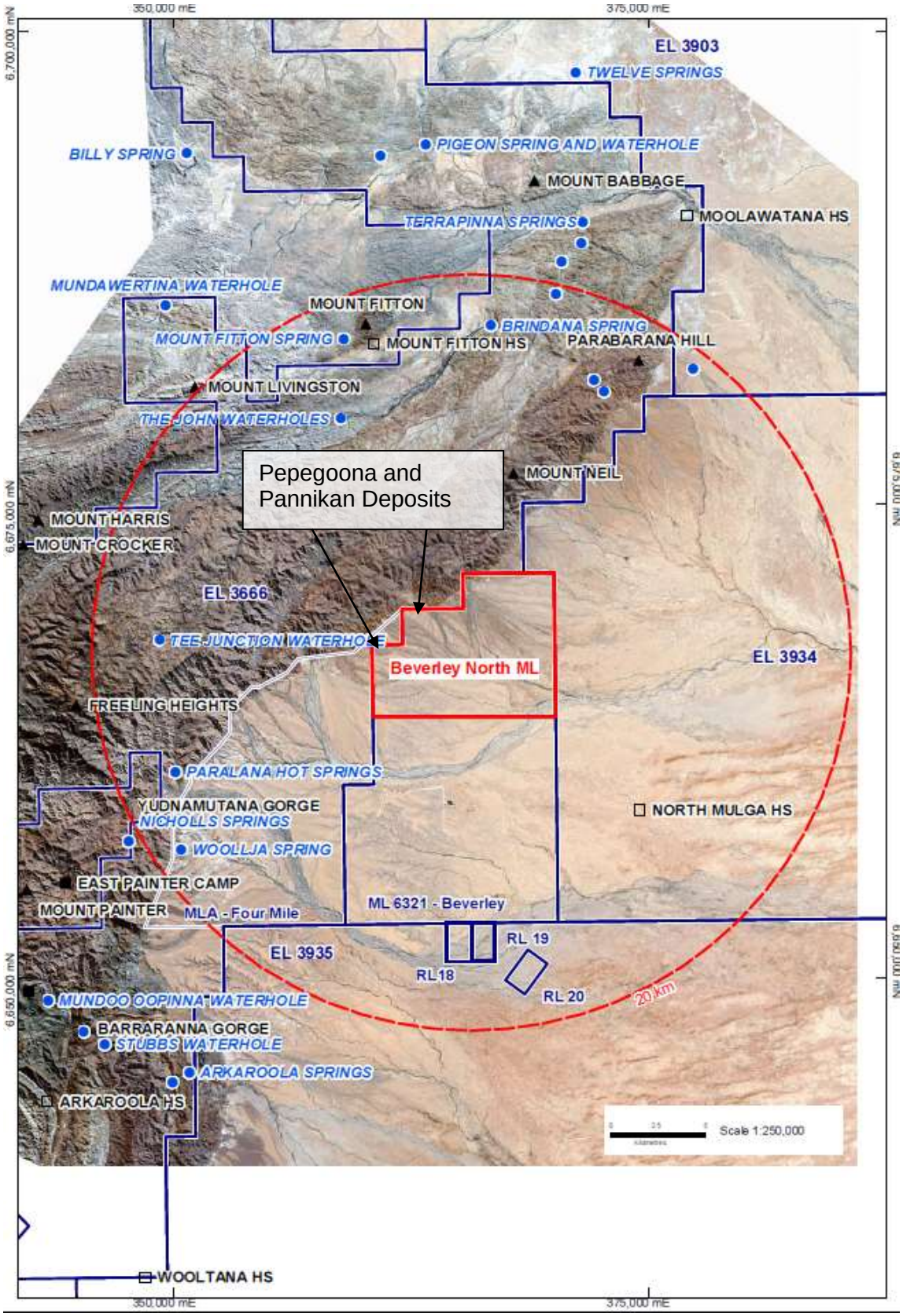

Figure 3-18 Springs within 20 km of the Centre of the Beverley North Area

(Data sourced from GA database. 5km grid)

The Fractured Rock Aquifer at Pepegoona and Pannikan has aquifer pressures of approximately 108 mAHD and 94 mAHD respectively, which are well below the pressure at PHS, so it cannot possibly be a source of water to those springs. Groundwater abstraction due to the Beverley North Mine will not impact on spring flows through de-pressurising of source aquifers. This is because the Beverley North mine will have a negligible effect on the aquifer water balance. The Beverley North Mine will operate at a near neutral water balance, with only a small net extraction ('bleed').

Potential Third Party Users

There are a number of factors which impact upon potential third party groundwater use, including the location/remoteness of the water source, the suitability of the environment for alternative land use, the availability of other services and the groundwater quality.

This assessment of potential third party use will focus only on groundwater quality since the other factors are beyond the scope of this assessment. It is note-worthy that the other factors, such as remoteness, adverse climate and environment, and a lack of services, will all act to constrain other potential groundwater use in this area.

The assessment compares the measured groundwater quality of samples taken from monitoring bores against the ANZECC water quality guidelines for potable, irrigation and stock water use. The Four Mile MLP/PER (Appendix J of Heathgate 2009a) presents the full groundwater chemical dataset.

Table 3-4 summarises the water quality constraints for third party use of groundwater from the different aquifer systems in the Beverley North area. All groundwater is of poor quality and is unsuitable for potable or irrigation use without treatment. The water table aquifer (the Willawortina Formation east of the Poontana Fault Zone) is sometimes suitable for use as stock water supplies. The GAB aquifer is also suitable for use as a stock water supply.

Table 3-4 Potential Groundwater Use Water Quality Constraints

Aquifer	Location	Potable Constraints	Irrigation Constraints	Stock Water Constraints
Willawortina Formation	Lake Frome Embayment	Salinity	Salinity	None
Namba Formation	Four Mile Embayment	Salinity, U, Ra, F	Salinity, U	None
	Lake Frome Embayment	Salinity, U, Ra	Salinity, U, Ra	Salinity, U, Ra
Eyre Formation	Four Mile Embayment	Salinity, U, Ra, F	U, Ra, F	Ra, F
	Lake Frome Embayment	Salinity, U, Ra, F	U, Ra, F	F
	Pepegoona	Salinity, U, Ra, F	Ra, F	F
Fractured Rock	Four Mile Embayment	Salinity, Ra, F	U, F	F
Great Artesian Basin	Lake Frome Embayment	Salinity	Salinity	None

Highlight colours: yellow, at least one constraint; green, no constraints

3.10.3.4 Water Protection Area

The Beverley North ML is located within the Far Northern Prescribed Wells Area. Because groundwater in the area is a prescribed water resource under the Natural Resources Management Act 2004 (SA), a water allocation and licence will be required for the net extraction of water from the Eyre Formation. When the licence is issued Heathgate will abide by its conditions.

No additional GAB water supply will be needed for the conduct of the Beverley North Mine.

3.10.4 Hydrogeochemical Modelling

3.10.4.1 Overview

In the context of ISR mining at Beverley North, an understanding of the hydrogeochemical fate of mining lixiviant is a key component of predicting the impacts of mining upon the aquifer system. This is particularly important in the Pepegoona and Pannikan deposits since these ore zones are hosted within an aquifer which does not exhibit lateral boundaries in the same way as the 'bathtub' Namba Formation aquifers at Beverley. After mine closure, remnant mining solution is expected to migrate very slowly down the natural hydraulic gradient.

It is expected that this remnant mining solution will be modified during its travel through the aquifer material due to chemical reactions and physical mixing and dilution of the lixiviant with natural groundwater. The following comments are relevant (quoted from CSIRO 2004):

> *The process where groundwater, which has been altered through the addition of leach solution or liquid waste, reverts through reaction to its surrounding aquifer matrix and pre-existing groundwater over a period of time to or towards its pre-contaminated state, without additional attenuating treatment is termed natural attenuation.*
>
> *Data from overseas operation indicates that natural attenuation does occur over time. At Beverley there is emerging evidence based on available data that natural attenuation has indeed reduced the impact from acid ISL on groundwater and limited the movement of leach liquor from the well-fields, and that eventual return approaching pre-mining conditions is likely.*

Natural attenuation is acknowledged as an appropriate control measure for ISR mines to avoid impact on aquifer environmental values.

A comprehensive work program has been undertaken by Heathgate to demonstrate that this will occur in the Pepegoona ore zone aquifer with some certainty and in an appropriate timeframe. This work program includes:

- Groundwater flow modelling
- Laboratory geochemical test work
- Geochemical modelling
- Ongoing, iterative natural attenuation modelling validation and assessment.

This section outlines the methodology and outcomes of this work. Full detail of the groundwater flow modelling and the geochemical modelling for the preparation of this document is provided in Appendix I of Heathgate 2010a. The work can also be applied to other Eyre Formation orebodies of similar size in similar hydrogeological settings, i.e. Pepegoona West and Pannikan.

3.10.4.2 Groundwater Flow Modelling.

The aim of this work is to develop a model that can predict the expected down-gradient flow paths and flow velocity of groundwater and mining fluids which flow through the Beverley North area.

The modelling approach is to develop a simple, two dimensional model of the regional groundwater system which hosts the Beverley North deposits using known aquifer properties and boundary conditions. The intention is that the model be fit for purpose, and reflect the currently available information with minimal uncertainty, or non-uniqueness. To this end, the model set-up comprises very simple boundary conditions which reflect measured data, and a simple, two dimensional, transmissivity-based, approach to aquifer property setup and calibration.

Model setup, calibration and reporting have been undertaken in accordance with the current industry standard guidelines for numerical groundwater modelling (MDBC 2000). The modelling serves three purposes:

- Firstly, to confirm that the conceptual model is hydraulically feasible, i.e. that the model can be calibrated to measured water levels using realistic aquifer properties and boundary conditions which are supported by real data.
- Secondly, to predict flow paths and flow velocities which can be used as inputs into geochemical modelling of natural attenuation. The geochemical modelling considers water – rock reactions in two dimensions along these flow paths.
- Thirdly, to estimate long term three dimensional mixing and dispersion of mining lixiviant constituents down-gradient of the ore zone.

The steady-state flow model was well calibrated with a RMS error of 4.6%, well within industry guidelines. This indicates that the conceptual hydrogeological model is a plausible, simplification of the real system. The flow model was used to predict flow paths and flow velocities for a range of aquifer porosity values. Predicted flow paths from the three deposits to be mined in the first instance are shown in Figure 3-19. Flow paths based on fluid velocity calculated by the modelling is shown in Figure 3-20. In this figure, the smooth curve was given by the numerical flow model; a step-wise approximation was used in the geochemical modelling (Figure 3-21).

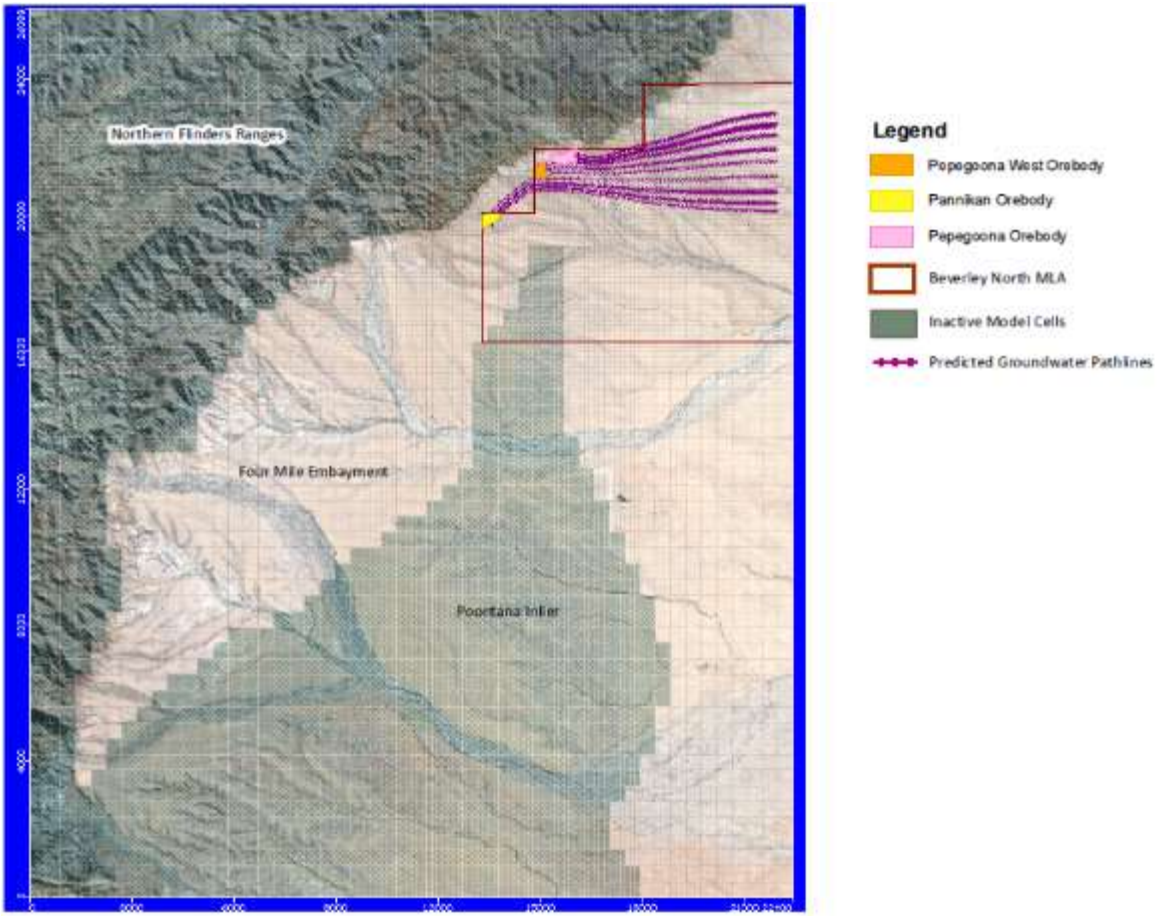

Figure 3-19 Flow Paths

(Time markers at 10 year intervals)

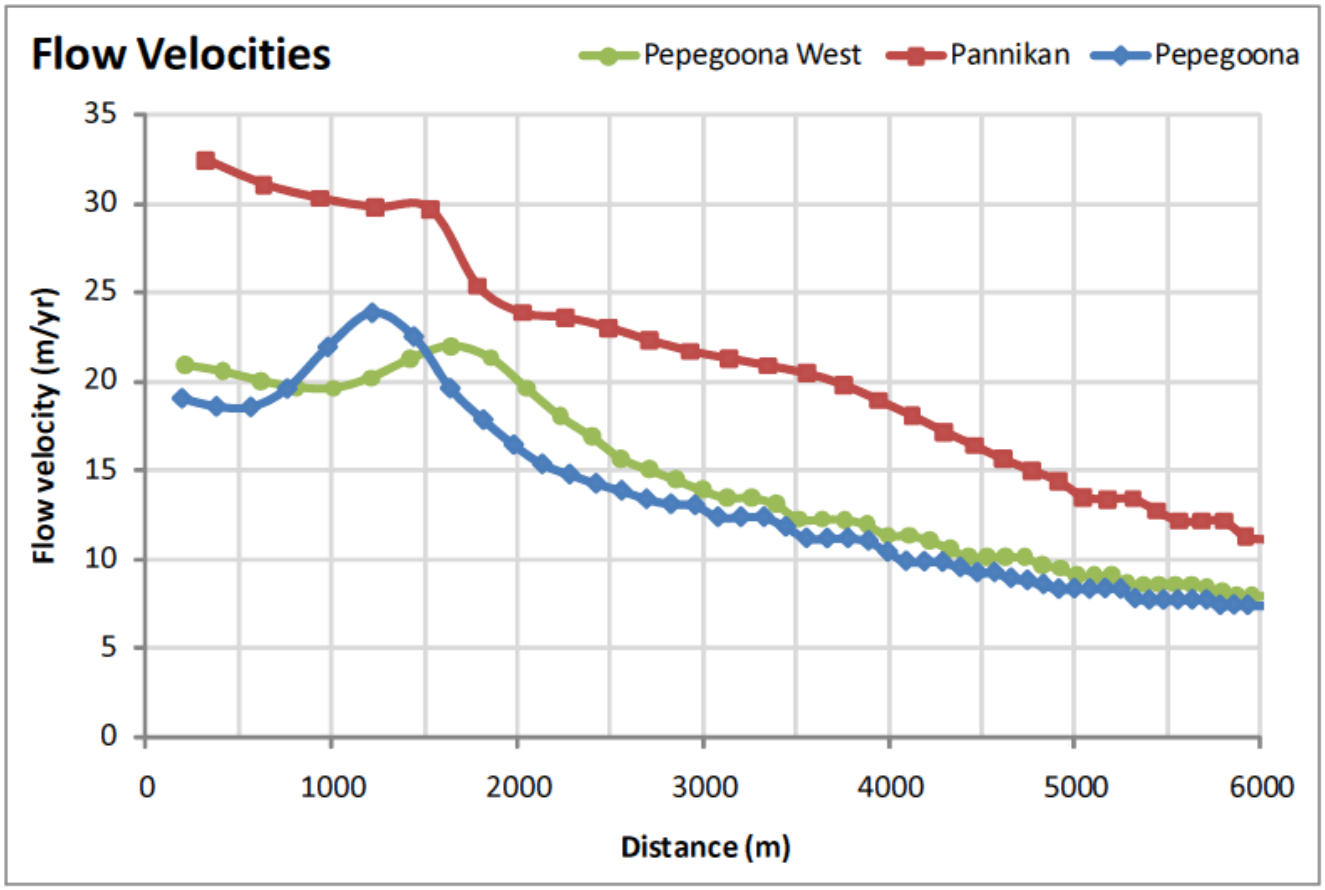

Figure 3-20 Eyre Formation Groundwater Velocity Down Gradient of Pepegoona, Pepegoona West and Pannikan

This simplified flow line conceptual model for Pepegoona was used for the geochemical transport modelling.

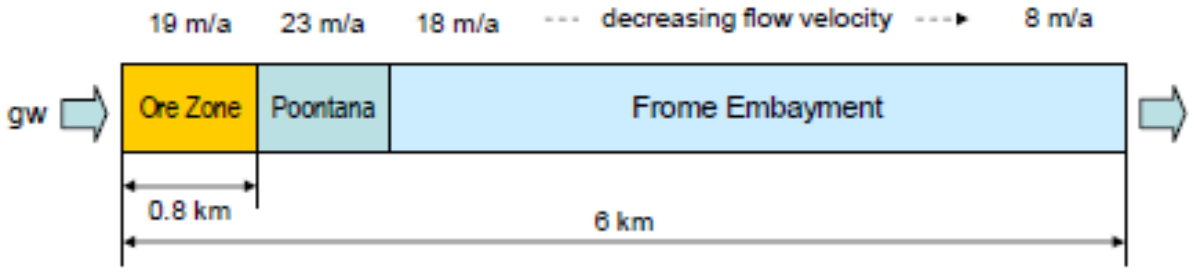

Figure 3-21 Flow Path Conceptual Model

Three dimensional solute transport modelling demonstrated that dilution of mining lixiviant is anticipated down gradient of the mining zone due to dispersion of the mining solution plume. This mechanism results in a more extensive and less concentrated plume as it moves down gradient.

3.10.4.3 Geochemical Modelling

Geochemical modelling (Appendix I of Heathgate 2010b) was undertaken by UIT in Dresden, Germany. UIT are specialists in uranium mine rehabilitation and also undertook the geochemical modelling for the Four Mile MLP/PER (Appendix M of Heathgate 2009a). The model was modified for the situation at Pepegoona.

Because the Pepegoona deposit is in the same formation as Four Mile East, the interpretation of column and batch tests for Four Mile East were used as a basis of this model. This was adjusted based on geological observations and geochemical analyses of core from Pepegoona as required. This provides an understanding of the principal geochemical processes that determine the fate of uranium and other lixiviant constituents. For example, at Pepegoona calcite content is slightly lower, kaolinite considerably lower and pyrite higher, compared to the averages used for modelling at Four Mile.

A reactive transport model (TRN) was provided by UIT to describe the geochemistry in the Eyre Formation aquifer at and near Pepegoona. Its main goal is to understand the principal geochemical processes that determine the fate of uranium and other lixiviant constituents. It combines transport (advection and dispersion) with geochemistry (thermodynamics and kinetics). The chemical equilibrium module is based on PHREEQC. PHREEQC is an industry standard geochemical modelling package.

The main geochemical transformations within the aquifer material can be summarized as follows (Figure 3-22). The lixiviant enters the stagnant water zone and dissolves the reductive minerals pyrite and coffinite. Due to the contact with the O_2-rich mobile phase the released Fe(II) and U(IV) species oxidize and precipitate as Fe(III) and U(VI) minerals. As a result Fe and U are immobilized. The immobilization occurs as far as pH > 3 - 4.

If the pH drops below 3 (due to the ongoing lixiviant inflow), the precipitation stops and all accumulated Fe(III) and U(VI) minerals re-dissolve. The greater the pH buffer the more the peaks are retarded. The pH buffer is determined by both ion exchange and the amount of dissolved calcite (and clay minerals).

The laboratory tests show explicitly a retardation of pH and uranium. Uranium retardation / immobilisation is caused by:

- precipitation of U(VI) minerals
- uranyl ion exchange at clay minerals
- a combination of both processes.

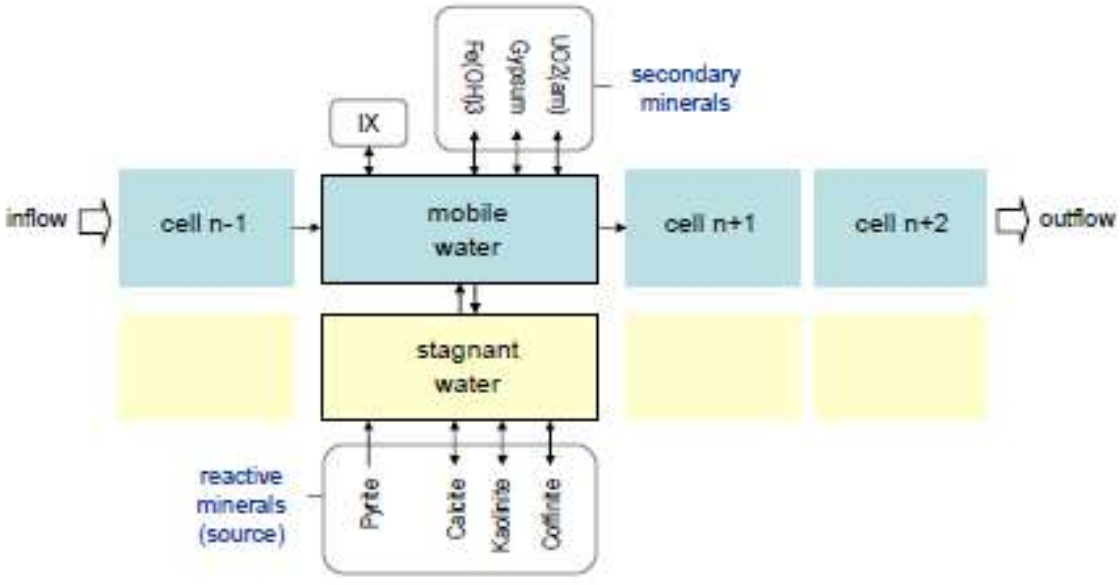

Figure 3-22 Main Geochemical Processes within the Dual Porosity Approach
(Double arrows symbolize reversible processes)

The geochemical modelling framework developed and calibrated using previous laboratory test data was utilized to simulate the fate of mining lixiviant over a longer time frame and at a field scale. The aquifer simulations rest on two pillars:

1. the hydraulic parameters taken from the hydrogeological model
2. the geochemical data taken from the column and batch tests.

The up scaling procedure is described in detail in Section 4.3, Appendix M of the Four Mile MLP/PER (Heathgate 2009a).

The study of post-mining scenarios represents the central part of the natural attenuation studies. The model configuration is as follows: after mining/leaching, groundwater flows into the ore zone and pushes the dissolved lixiviant from the ore zone into the down gradient Eyre Formation aquifer. At the beginning (initial state t = 0), mobile and stagnant pores of the ore zone are filled either with:

- aggressive lixiviant (pH = 1.7, U = 50 ppm) 'Worst Case'; or
- diluted lixiviant (pH = 2.0, U = 25 ppm) 'Real Case'.

In addition, there is an ongoing dilution along the flow path caused by transversal dispersion. Based on these assumptions four calculations are performed:

1. WORST - Worst Case without transverse dilution
2. W_DILU - Worst Case with transverse dilution
3. POST - Post-Mining (Real) Case without transverse dilution
4. P_DILU Post-Mining (Real) Case with transverse dilution (i.e. with the one-pore volume flush Heathgate commits to undertake).

These are set out diagrammatically in Figure 3-23. Cases 3 and 4 are with the one-pore volume flush Heathgate commits to undertake.

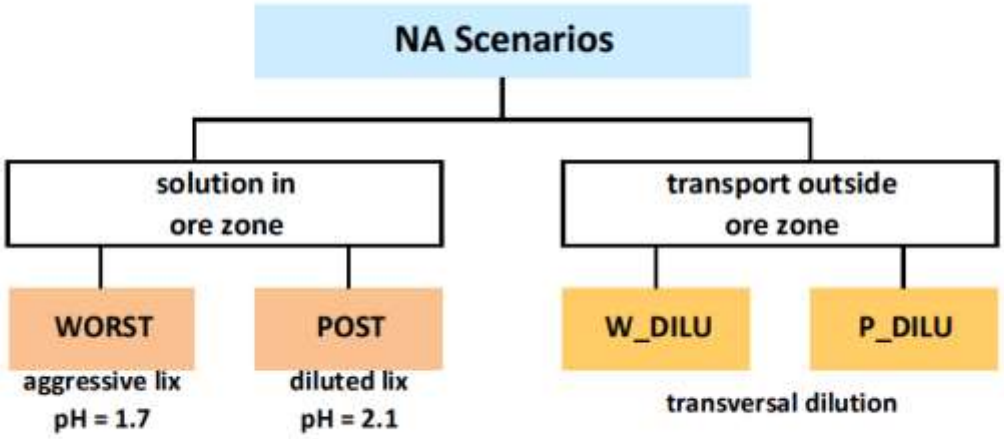

Figure 3-23 Natural Attenuation Cases Modelled

(Note: Heathgate commits to undertake dilution of 'lix' (lixiviant or mining solution))

Thereby WORST represents the most improbable and P_DILU the most probable case.

Plots of predicted pH, and uranium concentration profiles along the flow path for time steps up to 800 years are presented in Figure 3-24 and Figure 3-25. In all cases, the acid front (with pH < 5)

as well as uranium move only a short distance; their influence is confined within a maximum range of 3 to 5 km away from the ore zone.

The uranium geochemistry strongly depends on ORP. In contrast to the lab tests, which have been performed under non-reducing conditions (pe = 5), reducing conditions definitely exist in the aquifer (pe < 1). Thus, the aquifer simulations are performed at lower pe values. In particular, due to the dissolution of reducing minerals (pyrite and coffinite) pe drops below zero.

The impact of a potential uncontrolled flow through fractured rocks is discussed in Appendix M of Heathgate 2009a. This impact is small and does not comprise a significant potential pathway for impact at Four Mile East. With the very thick Bulldog Shale present at the Pepegoona and Pannikan deposits, this aspect is not considered further.

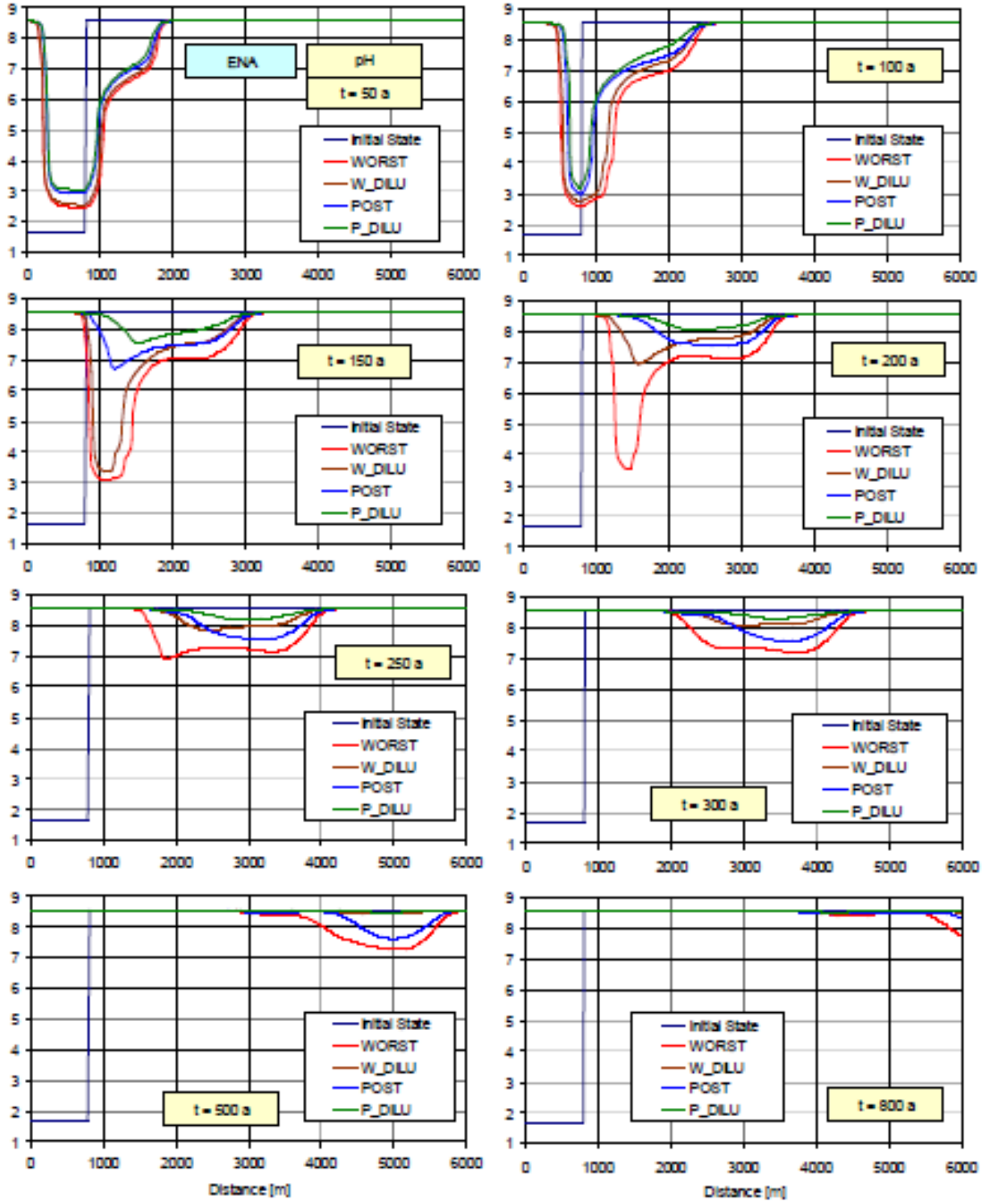

Figure 3-24 Predicted pH Profiles (Eyre Formation) Downgradient of Pepegoona

Note: all Y-axes represent pH.

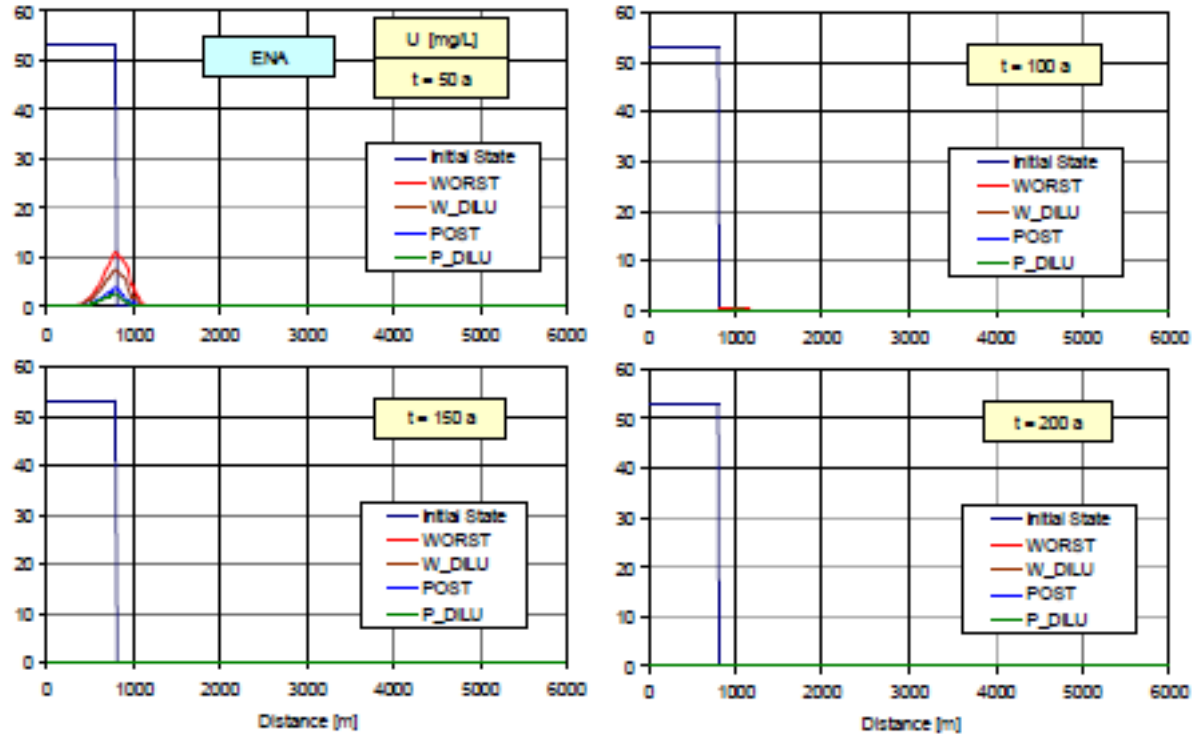

Figure 3-25 Predicted Uranium Profiles (Eyre Formation) Downgradient of Pepegoona

(For time steps up to 800 years)

Comparison to USGS Approach

The United States Geological Survey (U.S.G.S.) performed a similar study (Davis & Curtis 2007) for groundwater restoration after uranium leaching. The current study is based on this reported methodology; the current study refines the USGS model and applies it to a real case. A comparison of both approaches is given in Table 3-5.

Table 3-5 Model Comparison with the USGS Study

	USGS report	UIT report
ISR chemistry	alkaline leaching	acid leaching
Model	1D reactive transport	1D reactive transport
Program	PHREEQC	TRN (incl. PHREEQC)
Approach	thermodynamic	thermodynamic + kinetic
Dual Porosity	yes	Yes
Scenarios	post mining	post mining
Model Space	ore zone (100 m)	ore zone (800 m) plus embayment (6000 m)
Number of Cells	5	583
Time step	20 years	0.8 years
Forecast	400 years	800 years
Lab Tests	none	batch and column tests, whole-rock analyses

The geochemical model and methodology developed in this study enables a description of geochemical processes in the Eyre Formation aquifer. On this foundation in combination with extended knowledge about the real aquifer conditions (observations, experimental data) new investigations can be done easily and the forecast can be refined as described below.

3.10.4.4 Ongoing Natural Attenuation Modelling Validation and Assessment

The geochemical modelling predictions will be assessed and refined following commencement of mining. This is an important step which will allow validation of the modelled outcomes, and further refinement of the modelling methodology. This iterative approach to the prediction of mining solution evolution in the Eyre Formation aquifer comprises three steps (Figure 3-26):

1. Calibration of a geochemical model using laboratory data (current step)
2. Validation / recalibration of the geochemical model using mining data.
3. Validation / recalibration of the geochemical model using post-mining data.

This iterative approach to understanding and predicting impacts on the aquifer is essential to provide confidence in the predicted outcomes, and to allow accurate and appropriate planning of mine closure strategies.

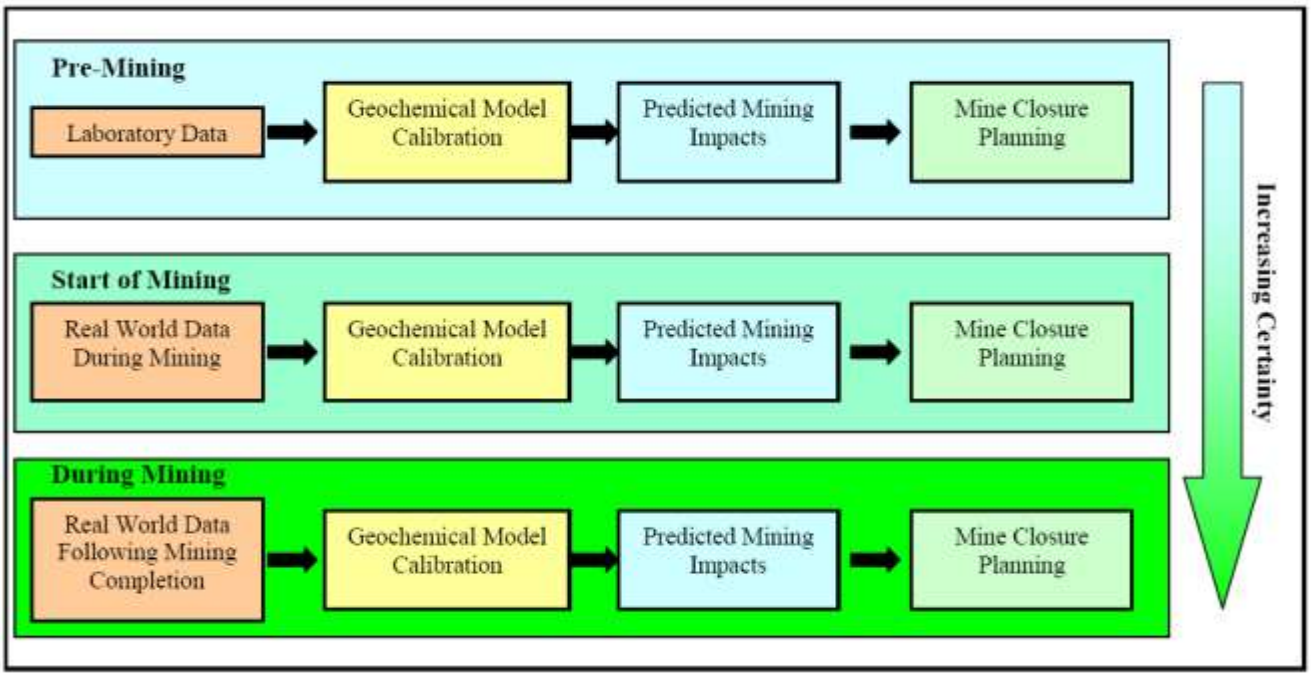

Figure 3-26 Iterative Approach to Prediction of Chemical Evolution of Mining Solutions

The methodology for natural attenuation modelling validation and assessment will be to model real - world mining and post-mining scenarios, and compare the modelled outcomes with measured outcomes. Three examples of this approach are:

- To examine chemical breakthrough data from active well fields. This will entail collecting samples immediately following the start up of new wellfield patterns and comparing the measured chemical composition of lixiviant that has travelled 30 m through the aquifer, to the predicted chemical composition of lixiviant in this scenario.
- To examine chemical breakthrough data from observation wells placed within the zone of "flare" of an active wellfield. In this scenario, lixiviant will travel some 20 m through the aquifer at a lower velocity than the scenario above.

- To examine the chemical evolution of groundwater in inactive well fields following the completion of mining, and comparing modelled against actual results.

The refined and validated geochemical model will be used to confirm, or refine the predicted impacts of mining, and this information will be used to inform mine closure planning.

Further information on the implementation of this approach during the rehabilitation of the mine is given in Section 7.6.2.

3.11 Vegetation, Weeds and Plant Pathogens

A baseline survey of vegetation in the Beverley North area was carried out by Badman Environmental in September and December 2009 (Badman 2010) (Appendix E of Heathgate 2010b). Although the latter part of the survey was interrupted by heavy rainfall, conditions were generally a continuation of the dry situation experienced in this area over the past several years. None of the effects on vegetation of the November / December 2009 rainfall were recorded during the Badman (2010) survey.

Badman (2010) collected data from one hectare quadrats using the methodology of the State Biological Survey. These data were analysed by means of ordination using the PC-Ord computer package. Results of the ordination were similar to those obtained from similar surveys for the Beverley Expansion and for Beverley Four Mile.

Three vegetation groups were described from the ordination: low woodland and tall shrubland in major watercourses; shrubland in minor watercourses; and low herbland on the plains. When data from the three different local surveys (Beverley North, Beverley Four Mile and Beverley Extension area) were compared, there was also a slight separation of sites within the three groups which can be attributed to slightly different seasonal conditions during the different surveys. Badman (2010) therefore considered vegetation to be little different from that of the surrounding plains and watercourses.

An air-photograph interpretation of vegetation into these three vegetation groups is shown in Figure 3-27.

No threatened species or communities were identified during the present survey.

Only two alien species were found during the present survey, a reflection of the hot and dry conditions experienced prior to the November/December 2009 rainfall.

In addition to the one hectare quadrats, a 5 x 2 m quadrat was set up and read at each site. These quadrats will allow future direct comparison with other vegetation monitoring sites in the Beverley area. This was not possible for the Badman (2010) investigation as the 2009 Beverley and Four Mile vegetation reports had not been completed.

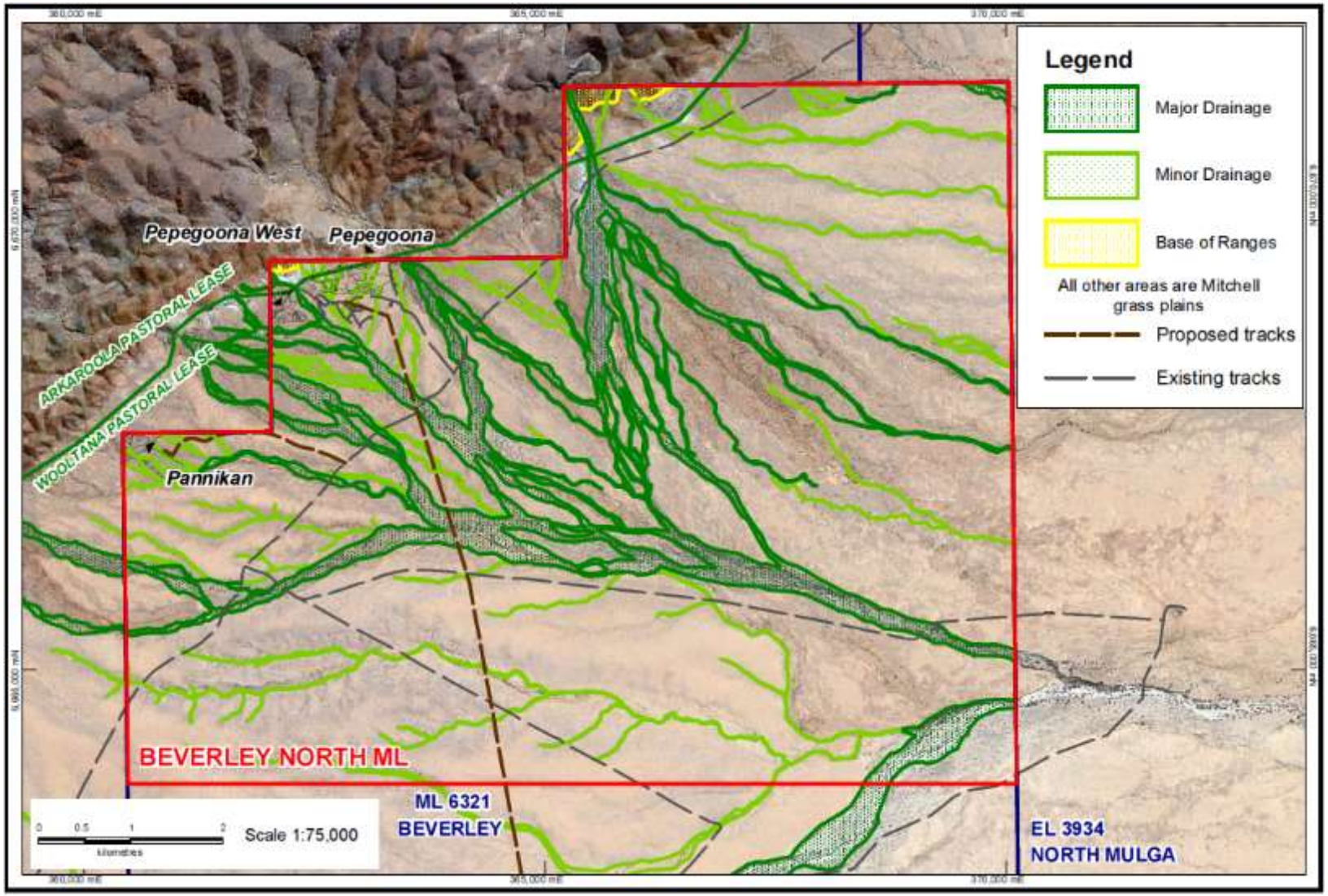

Figure 3-27 Vegetation Associations

3.12 Fauna

A desktop fauna assessment of the Beverley North area was undertaken by EBS (2009) (Appendix F of Heathgate 2010b) to identify fauna species and fauna habitat likely to be present in the Beverley North area or adjacent areas that may be potentially impacted by any future developments. The objectives of the EBS (2009) study were to:

- Identify Matters of National Significance protected under the EPBC Act, and State significant species protected under the National Parks and Wildlife Act 1972 (NPW Act), including threatened fauna that may occur within the project boundaries, or immediately adjacent
- Identify fauna species likely to occur within the project area by identifying the main fauna habitats present
- Make appropriate recommendations for future survey work.

Information was gathered by EBS (2009) and collated to generate a list of species potentially occurring within the Beverley North region based on the previous records and the presence of known preferred and suitable habitats.

All mammal, bird and reptile species recorded to date were expected to be present amongst similar habitats at Beverley North. The one frog species recorded as part of Beverley fauna monitoring, the Desert Trilling Frog (*Neobatrachus centralis*), is expected to be present at Beverley North amongst major creekline habitat (Table 13 of Appendix F of Heathgate 2010b).

Three of the four Nationally conservation significant species identified by EBS (2009) are considered unlikely to occur in the Beverley North area. This assessment is based on rationale of no Biological Database Records of South Australia (BDBSA) records in the defined area search, no observations during the Beverley, Beverley Extension, Four Mile and Control sites, and no suitable habitat (Slender-billed Thornbill, *Acanthiza iredalei iredalei*; Thick-billed Grasswren, *Amytornis textilis modestus*; Australian Painted Snipe, *Rostratula australis*). Despite recent records of the Yellow-footed Rock-wallaby (*Petrogale xanthopus xanthopus*) in the broader area, the species is also considered unlikely to occur in the Beverley North region due to lack of suitable rocky hill habitat.

One Nationally conservation significant species, the Dusky Hopping-mouse (*Notomys fuscus*), is considered likely to occur in the Beverley North area due to recent records during the Beverley fauna monitoring and the presence of suitable habitat (Waudby & How 2008).

The following recommendations were made by EBS (2009) based on the outcomes of the desktop study:

- Conduct a baseline fauna survey of Beverley North using standardised DEH Biological Survey methodology.
- Re-survey Control Sites 4, 5 and 8, to further add to the existing data-set of these recently established sites.

It was recommended that the field survey work be conducted in March – April 2010, and this was done (EBS, 2010; Appendix B here).

3.13 Topsoil and Subsoil

A soil survey was undertaken by URS (2010b) in the Beverley North area with the following objectives:

- Summarise the available descriptive information on soils with reference to the landforms
- Provide indicative baseline chemical and physical data of soil across various landforms.

The scope of the URS (2010b; Appendix B of Heathgate 2010b) soil survey included:

- Review of available published material and aerial photographs to determine the major landform and soil types in the vicinity of the site
- Excavation of 10 test pits to an approximate depth of 2.0 m, logging of soils according to Australian Standards (AS1726-1993) and collection of samples for analysis for soil physical and chemical characterisation
- Preparation of a report summarising the existing soils and terrain information, describing soils encountered in the test pits, and presenting and discussing soil analytical results with reference to the soil properties.

3.13.1 Desktop Study

3.13.1.1 Surficial Geology

The oldest sediments influencing the land surface characteristics are the relatively thick deposits of the Willawortina Formation. These comprise extremely to very poorly sorted brown, bouldery to pebbly, silty or sandy clays with some carbonate nodules. Close to the Ranges the sediments are coarser with cobbles and large boulders. This unit underlies the High Plains, west of the Poontana Fault, and crops out towards the base of some of the dissection slopes (Heathgate Resources 1998a).

The presence of extremely poor sorting, numerous channels with medium scale cross bedding, and laminated calcareous silts with red-mottling and carbonate concretions typical of flood plain deposits, indicate deposition in an alluvial fan environment.

The thin late Pleistocene Eurinalla Formation[5] overlies the Willawortina Formation both conformably and unconformably. The Eurinalla Formation comprises clayey fine to medium grained, poorly sorted orange brown sands, impregnated with gypsum at the base. The sands are interbedded with grey-green brown sandy and silty clays (Woodburn Associates 1997).

The Eurinalla Formation is indicated as the parent material of the soils of the more elevated areas. On the Low Plains, east of the Poontana Fault, there are extensive fluvial sediments forming very low angle fan and sheet deposits overlying the Eurinalla Formation. At the land surface, the sediments of the Coonarbine Formation consist of a thin veneer of reddish brown sands and silty and clayey sands (Heathgate 1998a).

3.13.1.2 Soil Types

Broadscale mapping across the study area in the Atlas of Australian Soils identified the soils as Sodosols. These soils are typically deep, have a strong texture contrast between the surface and subsoil horizons and have accumulation of exchangeable sodium in the subsoil that makes them highly dispersive and erodible by water. Consequently, once the surface is disturbed the erosion risk is high.

3.13.2 Field Survey

The URS (2010b) sampling plan is outlined in Table 3-6 and the test pit locations are shown at Figure 3-28.

[5] This formation is thin and never contains groundwater so was not specifically described in the geology and groundwater sections; it is only of relevance to soil studies.

Table 3-6 Baseline Test Pitting

Test Pit	Physiography/ Terrain
TP01	Gibber plains (150 m north of major drainage line)
TP02	Gibber plains
TP03	Minor drainage line
TP04	Major drainage line
TP05	Minor drainage line
TP06	High Gibber plains
TP07	Major drainage line
TP08	Minor drainage line
TP09	Major drainage line
TP10	Gibber plains

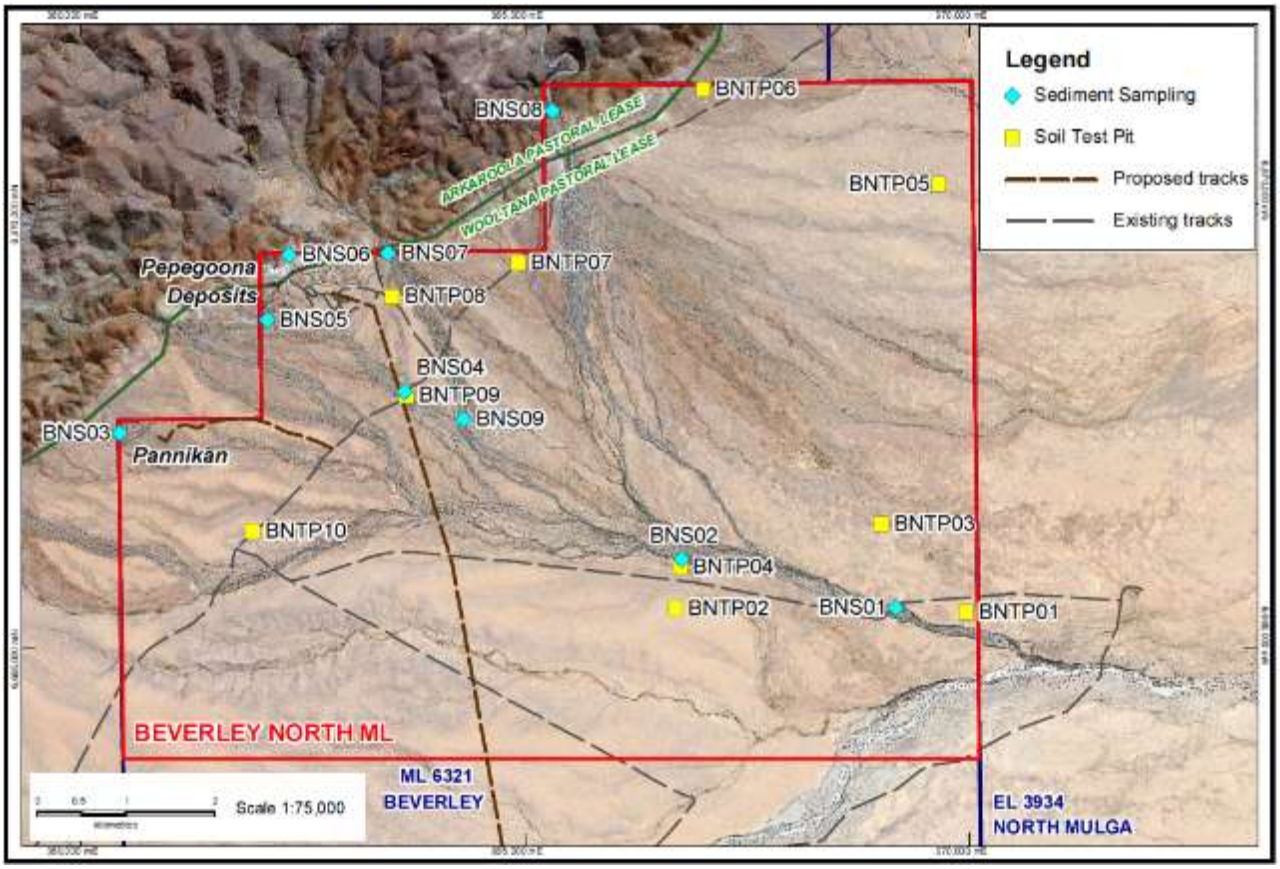

Figure 3-28 Beverley North Baseline Soil Sampling Locations

URS (2010b) concluded that soils in the Beverley North area can be generally classified as silts and clays on the upper profiles underlain by sandy gravel profiles in the lower soil profiles.

The topography of the majority of the site is relatively flat or gently sloping and as such the risk of significant rill erosion and runoff was considered likely to be low where the natural soil surface is protected from channelled overland flow. Gibbers were observed to be present on the surface of much of the plains of the site; the resulting surface has a low permeability but is generally considered quite resistant to water erosion when the surface is intact. A generalised soil profile is set out in Table 3-7.

Table 3-7 Generalised Sub Surface Soil Conditions

Depth	Description
0 – 0.1	Silty Sandy CLAY; low to medium plasticity, brown to orange brown, fine sand, minor quartz gravels, occasional minor gibber gravel and cobbles at surface
0.1 – 1.0	Silty Sandy CLAY; medium to high plasticity, brown, fine sand, inferred calcareous, blocky. Gravel and boulders near the foot of the Northern Flinders Ranges
1.0 – 2.0	Silty Clayey GRAVEL; fine to coarse, brown with occasional white staining, calcareous silt, with some mixed cobbles, gravels and cobbles comprising mix of one or more of schist, quartzite, gneiss, pegmatite and granite, more prevalent near the foot of the Northern Flinders Ranges

Surficial soils were found to be saline (low to moderately low salinity) and non-sodic while subsoils are saline (high salinity) and sodic (URS 2010b). Variations in this pattern were associated with enhanced leaching along major creek lines. Soils across the site have low wet strength, slaking when wet, which limits trafficability when wet. This is consistent with Heathgate's experience in the district.

The URS (2010b) baseline soil data also established background soil chemical conditions (primarily pH, electrical conductivity and major ion chemistry) in the event of an unexpected chemical release such as saline extraction solutions.

3.14 Heritage

3.14.1 Aboriginal Heritage

As part of the 1998 Beverley EIS process, anthropological and archaeological investigations in conjunction with the (then) Native Title claimants 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 time, numerous Work Area Clearance surveys have been conducted over the Four Mile MLA area, the present 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 Work Area Clearance methodology adopted by the company in association with the now 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 (refer Section 6.10.9).

3.14.2 European Heritage

The Flinders Ranges are of significance to European heritage. From the start of European use of the Flinders Ranges and immediate surrounds in the 1850s, the historical land use of the region has been primarily pastoral. Mining has been historically a secondary land use. Apart from coal mining post-World War Two at Leigh Creek, other minerals have been mined with variable success, particularly copper, gold, talc, and barite.

The Beverley North ML contains no artefacts of European occupation of historical value. The operation of the existing Beverley mine and its associated facilities has had no impact upon the European heritage of the area, and the Beverley North Mine will also have no impact.

3.14.3 Heritage Management

Inspections have been conducted using the Heathgate Work Area Clearance methodology to minimise potential deleterious impact upon Aboriginal cultural values at all stages of exploration and development within the mining leases and licences held. This methodology and the inspections it has generated, have resulted in detailed and in many cases, on-foot investigation, of the Beverley North ML.

The Work Area Clearance methodology was originally developed in the Northern Territory to permit Aboriginal Native Title Holders, in company with cultural heritage professionals or advisors, (but not those professionals or advisors alone), to assess activities proposed on Aboriginal land, without the necessity for them to divulge information on the cultural amenity of the area within which work is proposed.

The survey team members are generally considered by their peers to be most closely associated with the Wooltana Pastoral Lease and surrounding areas, and are knowledgeable about its cultural amenity. This is the preferred approach of the body representing the Native Title Holders, and the one that most closely replicates the traditional decision-making responsibilities that previously applied in this area.

Such an approach is recommended as one most likely to ensure continuing protection for the cultural heritage values and places associated with the areas under consideration. It is also considered to have the benefit of promising opportunity for Heathgate to negotiate reasonable and speedy resolution of matters essential for future mine development within such tenements as they may be granted in this location.

3.14.4 National Estate Listings

The Beverley North ML is not subject to any National Estate or similar listings.

3.15 Proximity to Conservation Areas

The nearest conservation areas are the Vulkathunha-Gammon Ranges National Park and the Arkaroola Wilderness Sanctuary (a declared Sanctuary under the *SA National Parks and Wildlife Act 1972*) (Figure 3-1). The Vulkathunha–Gammon Ranges National Park includes a section of plain between the Northern Flinders Ranges and Lake Frome of similar character to the Beverley North ML (refer also to Section 3.2).

The following description of Arkaroola is largely taken from the sanctuary's website www.arkaroola.com.au. The Arkaroola Pastoral Lease was purchased by Mr Reg Sprigg in 1967 for wildlife preservations and conservation of the environment, and the accommodation village was commenced in the following year. At Sprigg family request property gazetted as a private wildlife sanctuary under the Fauna Conservation Act (1964-65) in 1969 and sheep were removed the following year. The Wilderness Sanctuary has won numerous awards in the fields of ecotourism, and a Bronze Award for Festivals and Events for its "Star Party DownUnder", an astronomical observation event. Whilst mainly known as a tourist destination and nature conservation advocate it hosts a number of scientific endeavours in the astronomical, geological and biological sciences.

Paralana Hot Springs (Figure 3-1) is simultaneously of major significance to Aboriginal people, a tourist attraction, a site of particular geological interest and, albeit radioactive, the closest permanent natural surface water to the site. The springs are located on Wooltana Station adjacent to the Arkaroola Wilderness Sanctuary. The Beverley North ML is over 10 km downstream and will not impinge on the springs.

Lake Frome was proclaimed a Regional Reserve on 19 December 1991 and comprises 259,615 ha. The reserve was proclaimed to extend the conservation management of the adjoining Vulkathunha-Gammon Ranges National Park. It conserves a large arid salt lake system that is of regional geological significance. The dominant land use of the reserve is

biological and cultural conservation. It is located south-east of the Beverley North ML, and at its closest is some 30 km distant.

There are some areas within the Beverley North ML that are considered environmentally sensitive for reasons such as unusual vegetation, good faunal habitat, gibber/gilgai landforms posing erosion hazards or because they are flood prone areas; thus care and environmental sensitivity is taken in surface activities throughout the mining process. The clearance of native vegetation is subject to the issuing of individual clearance permits under Heathgate's Environment Management System (see Section 8.2).

3.16 Pre-existing Site Contamination and Disturbance

No mining-related site disturbance (other than exploration) or pre-existing contamination is known to exist on the Beverley North ML.

The Lake Frome Plains area has, however, been subject to some mining and pastoral activity since European settlement. This is evident by ruins in the vicinity of the Beverley North, such as the old Paralana Homestead and a number of small mines and associated structures. Pastoral activity in the region since the late 1850s has also resulted in substantial modification to natural vegetation. There has been considerable exploration for uranium in the area for the last five years, with a legacy of exploration tracks and rehabilitated drill sites.

3.17 Natural Radioactivity

3.17.1 Context

Radiation is a part of the universe and our life and was present on earth even before the evolution of human kind. The radiation that we receive from nature is called natural radiation or natural background radiation. The sources of natural background radiation are cosmic radiation and terrestrial radiation. Radiation that has enough energy to cause ionisation of molecules or atoms that it collides with is called ionising radiation. Lower energy radiation such as infra-red or microwaves do not cause ionisation of molecules or atoms but can have effects on living tissue by other means.

Radioactivity is the term used to describe the breakdown of unstable atoms and the associated release of energy, which is in the form of subatomic particles or electromagnetic waves. Over time radioactive material is completely broken down (this is called radioactive decay), stable atoms are formed and there is no further release of energy or radiation. Intermediate atoms that decay further and stable atoms resulting from the decay of the initial atom are called decay (or daughter) products. In natural settings uranium is accompanied by 13 radioactive decay products as well as the ultimate stable decay product the lead isotope Pb-206.

During the decay process radioactive atoms mainly emit three different types of ionising radiation, alpha, beta and gamma. Radiation when it passes through matter dissipates its energy, and the released energy is absorbed in the medium; this is termed as Radiation Dose. The unit that quantifies radiation dose is Sievert (Sv). The Sievert is a large unit and so the milliSievert or microSievert is usually used to describe occupational radiation dose.

Different types of radiation have different energies and hence varying penetrating powers in human tissue. The radiation dose absorbed in tissue depends on the type of radiation and its penetrating power. The sensitivity of different types of tissues or organs to radiation in human body is different, and hence some organs are more susceptible to the effects of ionising radiation.

Radiation exposure to the human body can take place either from external exposure to radiation sources or through inhalation and ingestion of radioactive materials. The biological effects of exposure to ionising radiation depend on the amount of radiation received and the rate at which it is received.

When people are exposed to very low levels of ionising radiation the damage that it causes to the body is practically negligible, because of the ability of living cells to repair any minor damage that it may sustain from the exposure. Serious damage to the body or future generations is possible only when people are exposed to high amounts of radiation dose.

Uranium is an unstable atom that emits radiation during its decay process. As a result occupational exposure to very low levels of radiation is expected during mining operations. Radiation exposure to employees and members of public are minimised using various engineering and administrative controls.

The National Occupational Health and Safety Commission's (NOHSC*) National Standard for Limiting Occupational Exposure to Ionising Radiation* (NOHSC: 1013 (1995)) set the annual dose limits for radiation workers and members of the public.

For workers who are occupationally exposed to radiation, the dose limit is 20 mSv per annum averaged over a five year period. For members of the public the dose limit set in this national standard is an annual effective dose of 1 mSv above the ambient background dose rate, excluding exposure from medical procedures.

The ISR process to recover uranium from its ore significantly reduces the occupational exposure to workers. Table 3-8 gives the average and maximum radiation doses received by the employees during the operation of Beverley Uranium Mine over the past seven years. The occupational radiation dose received by Heathgate workers is much lower than the annual limit set in the national standard.

Table 3-8 Occupational Dose Received at Beverley

Year	Occupational Dose (mSv)	
	Avg	Max
2001	0.63	4.37
2002	0.74	3.35
2003	0.68	3.33
2004	0.89	4.53
2005	0.48	3.84
2006	0.45	7.59
2007	0.28	3.46
2008	0.27	2.66
2009	0.22	2.98

3.17.2 Beverley North Background Radiation Levels

Gamma surveys were undertaken in the Beverley North ML prior to the commencement of exploration drilling activities. The average gamma radiation field in the area is approximately 0.20 µSv/h, with a maximum reading measured up to 0.28 µSv/h (Figure 3-1).

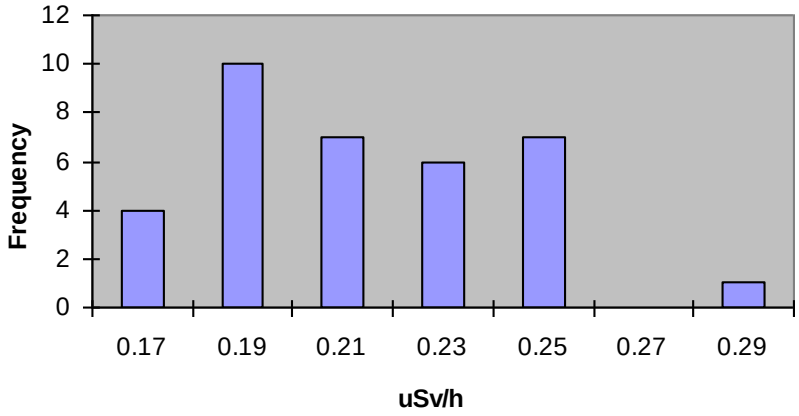

Figure 3-1 Beverley North Gamma Dose Rate

A low level airborne radiometric survey done in May 2008 by UTS Geophysics using an Exploranium GR-820 gamma ray spectrometer mapped the natural background dose rate as well as the ground concentrations of uranium, thorium and potassium in the project area.

Figure 3-29 to Figure 3-32 show the results of this survey as the finely detailed information over most of the Beverley North ML. Other, coarser data is available publically from the SA Government. Note that Beverley mining operations are visible in some of these images. These 'hotspots' are operational only and will not be a permanent feature.

Uranium concentrations at the soil surface determined by the airborne spectrometry in the Beverley North ML mostly vary from 0.6 to 6.5 ppm. Creek beds show elevated concentrations in the range 8.4 to 12.3 ppm. Thorium concentrations at the soil surface in the project area vary from 14.9 to 44.2 ppm and in the creek beds it is in the range 55 to 73.5 ppm. The percentage of potassium in the project area is in the range 1.1% to 2% and that in the creek beds vary from 2.5% to 3%.

The dose rate from the natural background terrestrial radiation in the project area varies from 60 to 300 nGy/h, equivalent to 0.06 to 0.30 uSv/hr.

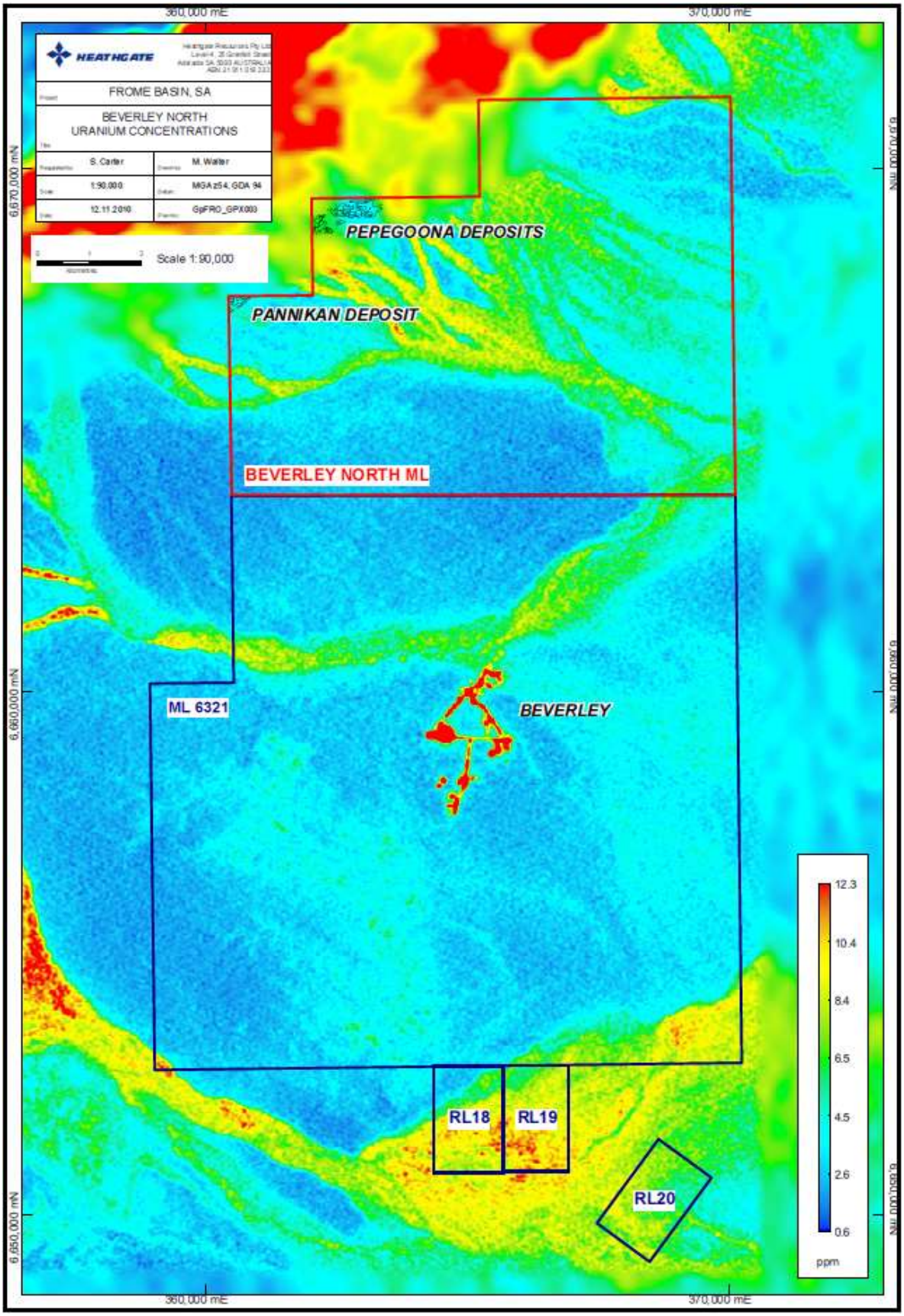

Figure 3-29 Beverley North Surface Uranium Concentrations

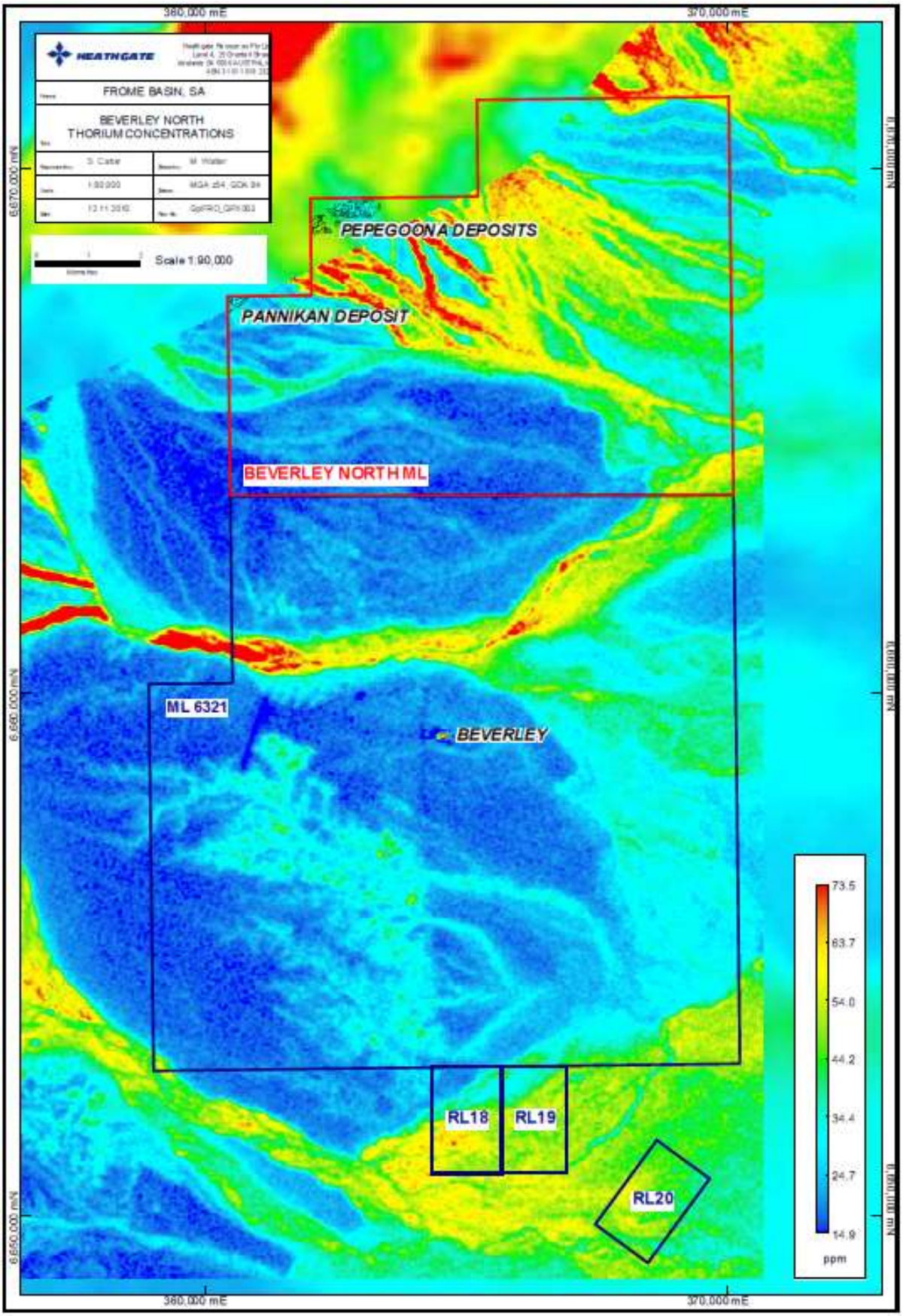

Figure 3-30 Beverley North Surface Thorium Concentrations

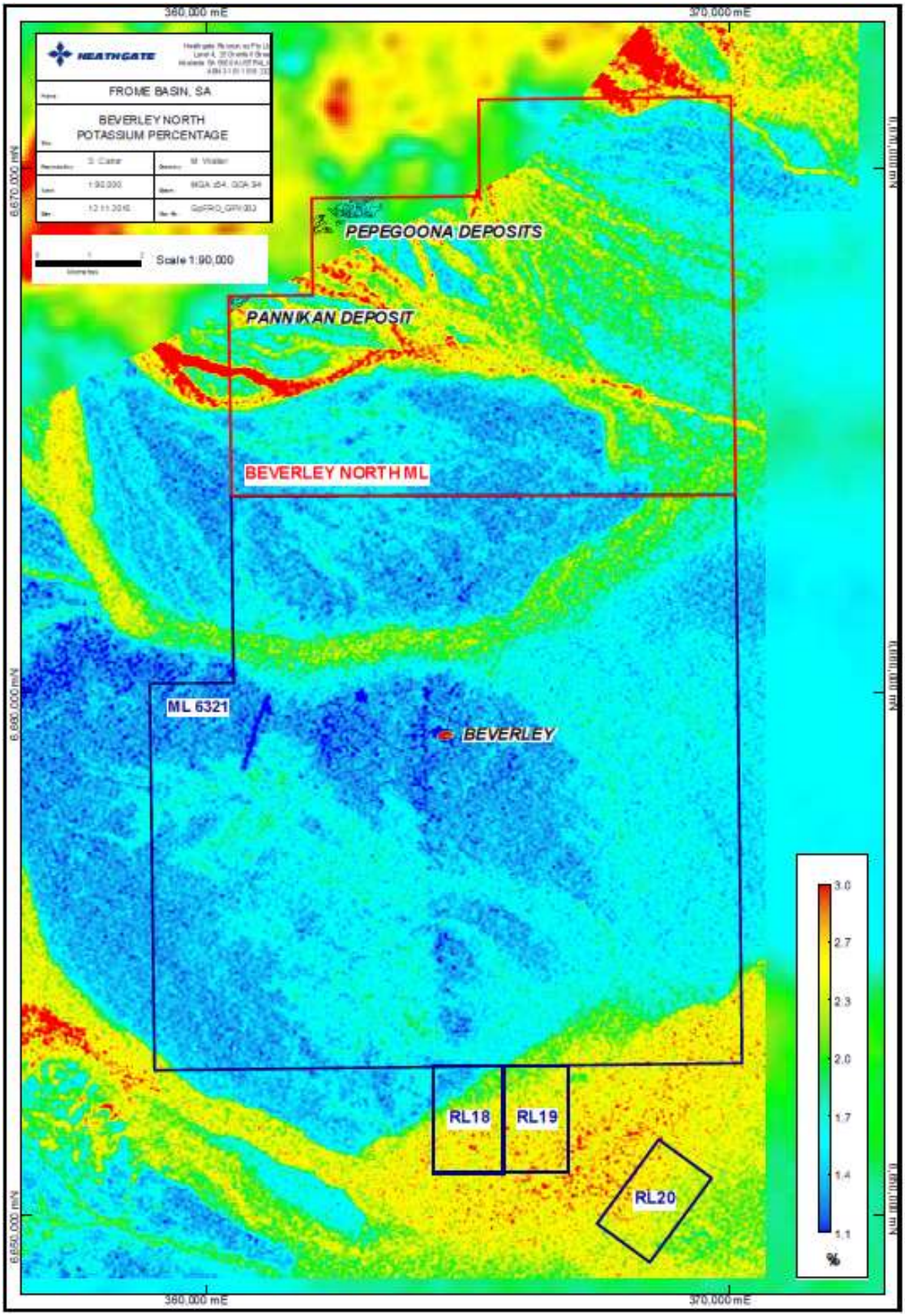

Figure 3-31 Beverley North Surface Potassium Concentrations

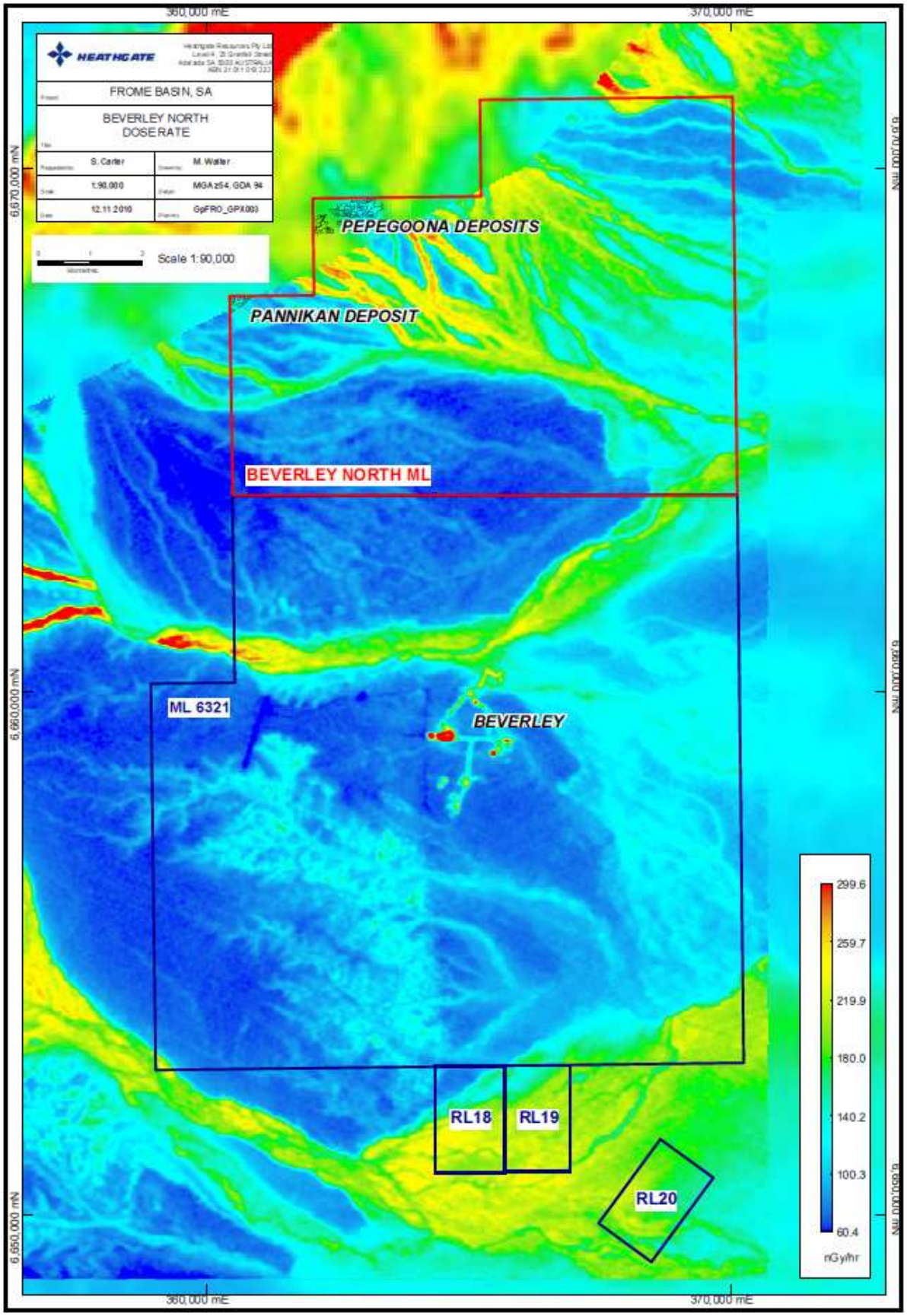

Figure 3-32 Beverley North Surface Background Dose Rate

4 DESCRIPTION OF THE OPERATION

4.1 General Description

The Beverley North Mine includes ISR wellfields and wellhouses connected by pipelines to satellite plants each comprising IX resin columns, diesel powered electricity generators, fuel storage, control room, small office facility and a small on-site laboratory. Note that the wellfields connected to wellhouses consist of up to 14 'patterns', each which are not necessarily contiguous. Drillers' laydown areas are also required.

The IX columns remove the uranium from the ISR liquor by ion exchange, producing uranium-bearing resin, which is trucked to the Beverley processing plant. The resin is stripped of uranium and regenerated, and the regenerated resin trucked back to the satellite facility.

The uranium is concentrated, dried and packed, and stored at Beverley in accordance with requirements of the Australian Safeguards and Non-Proliferation Office (ASNO).

Minor modifications have been made at the Beverley processing plant to accept the uranium-bearing resin, although there is no net increase in uranium processing capacity at this stage. 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 have previously been approved as part of the approval process for the Beverley Four Mile project (Heathgate 2009a), for which construction is presently delayed. Other minor alterations were notified to the regulators as required and constructed to service the preceding FLT.

Key elements of the Beverley North ML relative to Beverley were shown in Figure 1-5, including the proposed future access track from the Beverley Uranium Mine (existing tracks are currently used), and the location of the currently defined deposits and the satellite plants. More detail is given in Figure 4-1, showing the general layout at the Pepegoona deposits, and Figure 4-2 showing the general layout at the Pannikan deposit.

The existing Beverley camps and airstrip will be utilised for the additional personnel required for the Beverley North Mine; however, there are no changes to the existing Beverley camp, airstrip and camp water supply bore.

Other minor infrastructure includes some unsealed internal roads within the Beverley North ML to access the Beverley North wellfields. Fencing is provided for security purposes around the satellite plants.

4.2 Ore Reserves and Market

4.2.1 Geological Environment

A stratigraphic cross-section of the region, showing known and potential uranium deposits, is shown in Figure 4-3.

The geological setting of the deposit is in Tertiary sediments of the Frome Embayment of the Callabonna sub-basin of the Lake Eyre Basin. These sediments cover an area of approximately 25,000 km^2 between the Mount Painter Inlier in the north-west, the Olary block to the south and Broken Hill block to the east. Basement to this sub basin may be variably Cretaceous Palaeozoic, Adelaidean or Mid to Lower Proterozoic, generally following that progression from north-west to south-east. The sub basin comprises an almost flat lying sequence reaching 300 m maximum thickness.

In its southern part, Lower Tertiary (Eocene) Eyre formation sediments are restricted to incised palaeovalley infill. Overall gentle palaeovalley gradients are to the north where skeletal valley fill sediments grade into widespread blanket sands overlying the Cretaceous Frome Embayment.

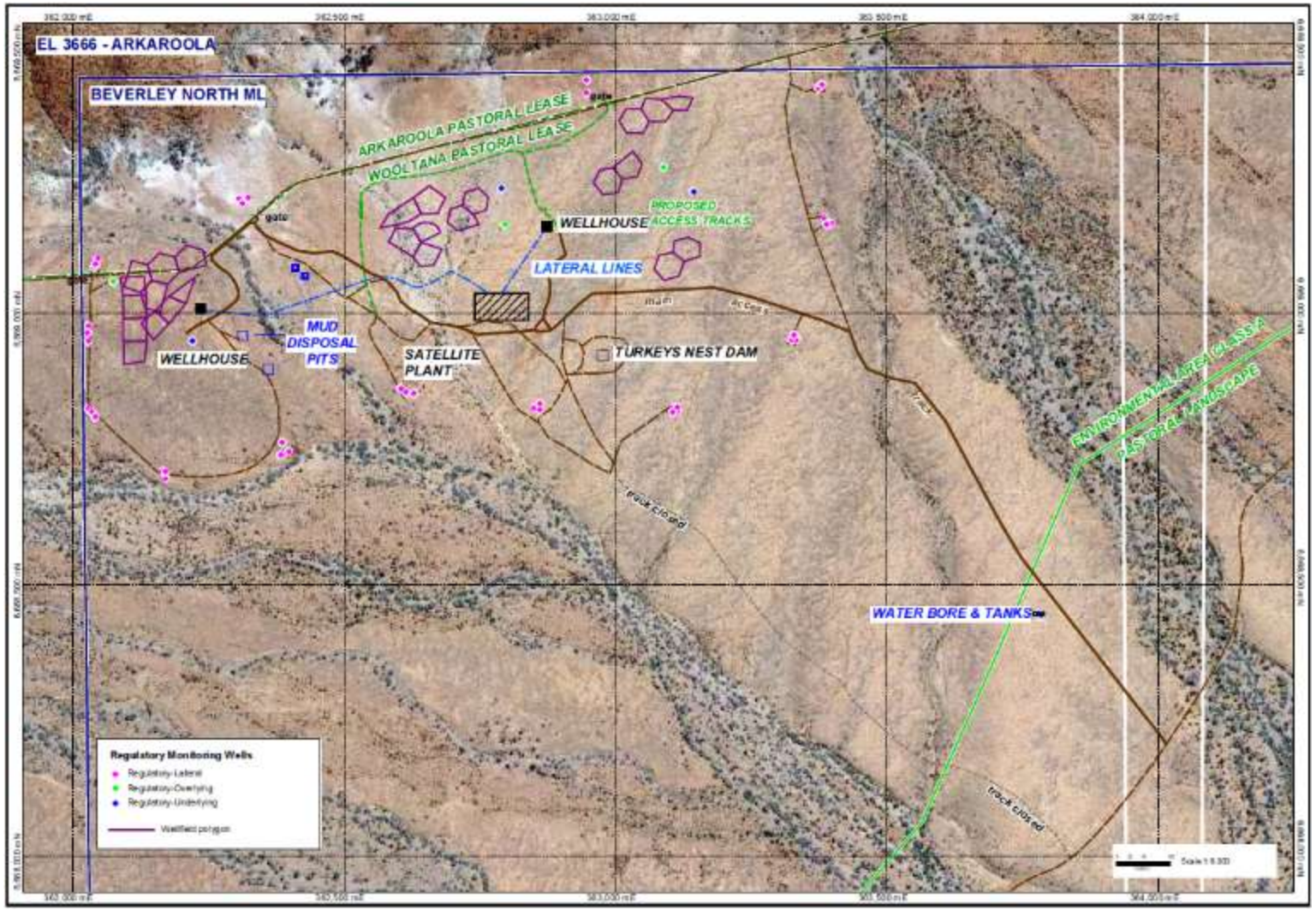

Figure 4-1 Beverley North ML Facilities – Pepegoona Deposits

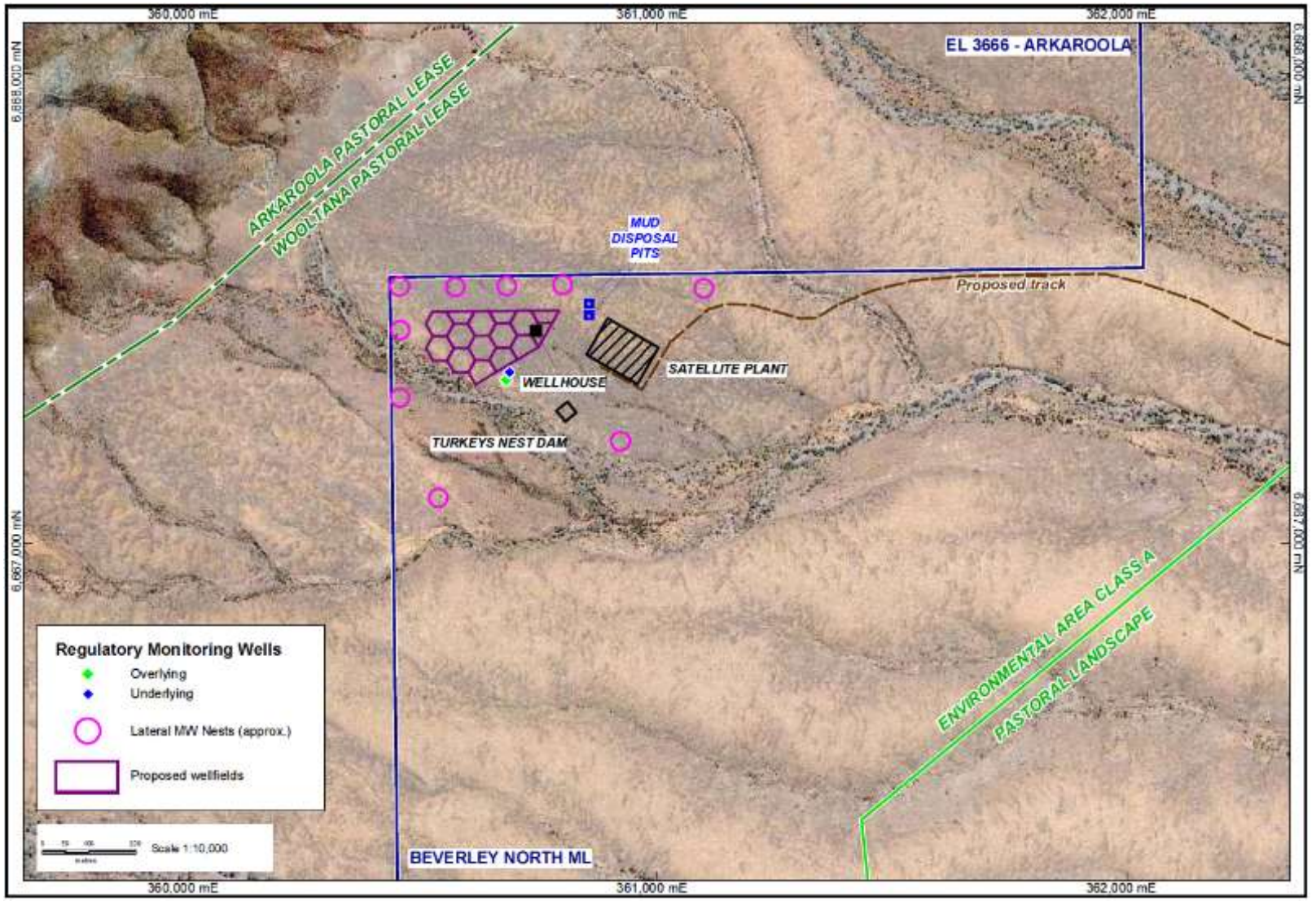

Figure 4-2 Beverley North ML Facilities – Pannikan

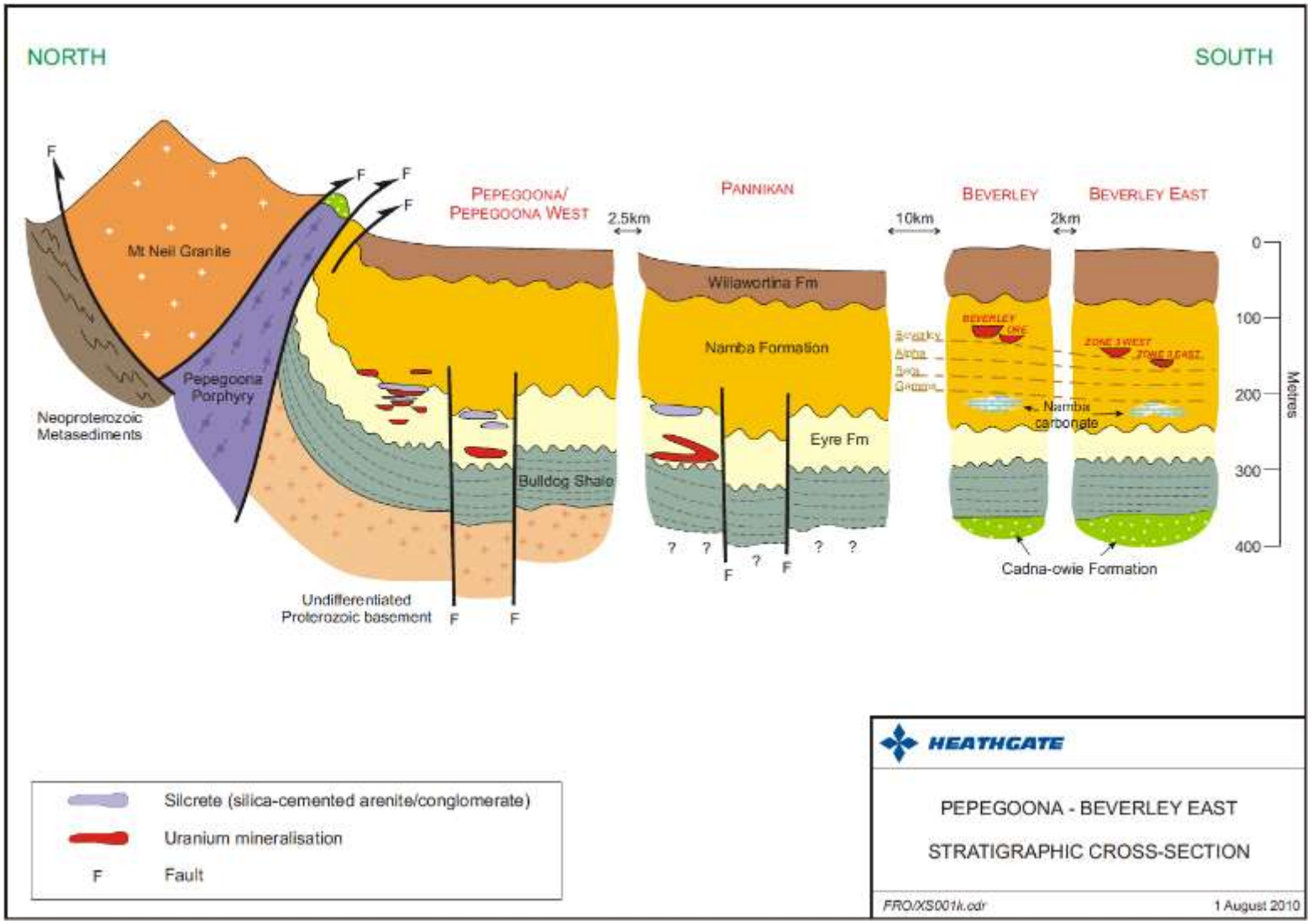

Figure 4-3 Regional Stratigraphic Cross-Section

Mesoproterozoic, uranium rich granites within infringing or underlying terranes are considered the source for the uranium mineralisation.

Other sedimentary uranium deposits occur within the Tertiary units of the Callabonna and Birdsville Basins of the Frome Region. This uranium province was recognised some years ago as having the potential for additional discoveries of uranium resources.

Interpretation of seismic data has previously identified the major faults as west-dipping structures that extend well down into Proterozoic basement rocks and show west over east compression. The structural regime was established in the early Palaeozoic and has periodically re-activated (Heathgate, 2006). The faults generally extend steeply to within 100 m of surface; some are expressed at the surface.

Following an assessment of a high resolution gravity survey for the region, the tectonics and stratigraphy in the region have been reassessed. It is now believed that fault locations are known with improved precision.

4.2.2 Reserves and Resources

The resource estimate for the Pepegoona deposit given here is based on 168 rotary mud drill holes, 7 core drill holes and 8 exploration monitor wells and using information up to mid February 2010. Resource estimation was undertaken utilising two 3-D block model methods, inverse distance (ID) and ordinary kriged (OK).

The mineral resource estimate at Pepegoona is 0.9 Mt at 0.13% U_3O_8, containing 1.1 kt (2.4 M lb) U_3O_8 (0.15m% GT cut-off). Mineralisation is hosted in two different horizons and can be associated with silcrete in the upper horizon. Mineralisation extents have been defined by drilling in most directions.

The mineral resource estimate at Pepegoona West is 1.3 Mt at 0.22% U_3O_8, containing 2.9 kt (6.3 M lb) U3O8 (0.15m% GT cut-off). Mineralisation is hosted in several horizons. Mineralisation remains open to the north and west.

The mineral resource estimate at Pannikan is 1.1 Mt at 0.20% U_3O_8, containing 2.1 kt (4.6 M lb) U_3O_8 (0.15m% GT cut-off). Mineralisation is hosted in two different horizons and can be associated with silcrete in the upper horizon. Mineralisation remains open to the north and west.

4.3 Radioactive Substances and Ores

Where radioactive ores are to be mined, preoperational monitoring is required to determine background radiation levels in the environment. These measurements are required to ensure that the mining operation does not significantly increase exposure of the environment to radiation as a result of mining activities.

Heathgate has provided an updated RMP (Radiation Management Plan) and an updated RWMP (Radioactive Waste Management Plan) to satisfy the monitoring and reporting requirements under relevant regulations and Codes of Practice (particularly the ARPANSA (2005) Code *Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing*).

These plans, adapted from those recently updated for Beverley ML 6321 operations, were approved by the SA EPA RPB (SA Environment Protection Authority Radiation Protection Branch) prior to construction and operation of the FLT. Consolidated documents were provided for combined Beverley ML 6321 and the Beverley North ML operations (on Wooltana Station), as both are or will be undertaken under EPA RPB licence LM4[6].

[6] EPA have advised a separate licence or a further licence endorsement is required for mining not on the Wooltana pastoral lease as licences apply to formal parcels of land. This will be arranged before any mining is extended off Wooltana Station.

Heathgate conducts all operations in a safe and responsible manner, and places the safety of workforce (employees and contractors) and protection of the environment ahead of commercial considerations.

The Beverley RMP and the RWMP are designed to enable Heathgate to critically review the radiological impact of the Beverley ML 6321 processing plant and associated wellfields, and provide details of the issues related to the occupational and environmental radiation at the Beverley operations. Only minor updates of the RMP and RWMP were required to accommodate activities for the Beverley North ML.

ISR mining is a relatively low impact mining method for extraction of uranium, 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 disposal requirements, and rehabilitation is relatively simple.

4.4 Exploration Activities

Heathgate will undertake ongoing exploration activities in the Beverley North ML. These are required to discover and delineate additional resources and aquifer and metallurgical testing.

Exploration activities may include:

- Remote sensing surveys such as airborne radiometric, electromagnetic or gravitational surveys using fixed wing or rotary wing aircraft
- Non-invasive ground based exploration including rock chip, vegetation, soil and sediment sampling
- Heritage surveys using light vehicles
- Ground-based geophysical surveys including electromagnetic, gravity and seismic techniques
- Drilling using auger, aircore, mud-rotary, rotary air blast and diamond coring or similar techniques, with associated mud pits where applicable
- Down-hole geophysical logging with a broad suite of techniques
- Groundwater exploration wells
- Groundwater pumping tests including the construction of ‘turkeys nest’ dams to hold pumping test water.

Whilst existing Beverley and Beverley North mine infrastructure will be used wherever possible, support activities for this may include:

- Small-scale drillers’ laydown areas including loading/unloading ramp(s)
- Portable offices, crib rooms/caravans and toilets
- Improvement of existing pastoral tracks for improved access.

Much of the support equipment will be provided by mining operations, but depending on individual requirements the following additional equipment may be used to support exploration activities:

- Drilling rigs
- Water tankers
- Support trucks (rod carriers etc)
- Light 4WD vehicles
- All-terrain light vehicles such as quad bikes
- Seismic trucks, vibrosis buggies, support trucks.

Closure of exploration drillholes will be in accord with DSD’s Minerals and Energy Information Sheet M21 ‘Mineral Exploration Drillholes – General Specifications for Construction and

Backfilling' or its successor, This will include drillhole completion reports in accordance with the specifications.

The general environmental risk management measures for exploration will be as per Chapter 6. Clearing and rehabilitation techniques are as described for production drilling in Chapter 6. Any clearance of native vegetation resulting from exploration activities not rehabilitated within six months will be included within SEB (Significant Environmental Benefit) arrangements – see Section 6.5.

4.5 Mining Operations

4.5.1 Type of Operations to be Carried Out

Due to the depth of cover and other factors, ISR is the preferred mining method over open cut or underground methods. ISR mining is a relatively low impact mining method, since ore is not mined in the conventional sense. As noted above there is minimal surface disturbance, no overburden removal, no ore treatment facility, no tailings generation nor any tailings or waste rock disposal requirements. It requires simple processing plants that can be removed on completion of mining and simple surface rehabilitation once a wellfield has completed its final operational phase.

The operation of the Beverley North Mine would be very similar to that at Beverley. The main components of the operation are:

- Wellfields (not necessarily contiguous)
- Wellhouses
- Bunded satellite plant areas containing;
    - Ion exchange columns
    - A barren lixiviant surge tank(s)
    - A resin transport tanker and reagent loading/unloading area
    - A bleed water storage tank(s)

The associated facilities will include:

- Potable water tanks
- Generators and switch rooms
- Control rooms
- Reagents storage tanks on separately bunded areas
- Offices and crib rooms
- Change rooms
- Small laboratory facilities
- Communal mud pits
- Drillers' laydowns
- Water supply wells and water storage tanks
- Turkey nest dams
- Unloading ramps.

Works associated with the Beverley North Mine include the utilisation of the wellfields and wellhouses at the Pepegoona deposits FLT, augmented for routine production, and the

establishment of additional satellite plants at other deposits. The first of these is the Pannikan Satellite Plant and wellfields. It is possible that the initial satellite plant at other future deposits may begin as small-scale test plants, or built directly for routine mining, depending on the nature of the future deposits that are expected to be found. A photograph of the Pepegoona Satellite Plant (during construction) is shown in Plate 4-1.

Plate 4-1 Satellite Plant at Pepegoona (under construction)

IX columns from the existing IX trains at Beverley Plant were moved to the Beverley North FLT (now the Pepegoona Satellite Plant) for resin capture, A similar approach will be undertaken for the Pannikan Satellite Plant, although for this and possible future satellite plants custom-built or modified IX columns may be used. IX columns and associated supporting pipework, pumps and ancillary tanks are placed on prepared lined pads meeting EPA requirements. The loaded lixiviant from wellfields passes through the IX columns and in that process the uranium is captured on the resin. The barren lixiviant which passes through the barren lixiviant tank is then refortified with reagents before sending it back to the orebodies through the injection wells.

The loaded resin is then transferred into a resin transport tanker which carries loaded resin to the Beverley plant for further processing. At the Beverley plant the loaded resin from the tanker is transferred to the elution circuit for eluting uranium from the resin. The uranium then goes through precipitation, dewatering and drying. After drying the final product will be drummed for storage.

Once the elution is complete the barren resin is transferred to the resin transport tanker for transporting back to the satellite plants.

Minor modifications have been made at the Beverley processing plant to accept the uranium-bearing resin, although there is no net increase in uranium processing capacity. 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 have previously been 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 have been notified to the regulatory authorities as required. No changes are required to the existing Beverley camps, airstrip and camp water supply bore.

4.5.2 Sequence of Operation

Heathgate anticipates commencing the Beverley North Mine as soon as possible after necessary approvals. The main development would be: conversion of the FLT plant at the Pepegoona deposits for routine mining as a satellite plant; installation of additional wellfield patterns; construction then operation of the Pannikan satellite plant and its associated wellfields and wellhouse(s) will commence soon after the receipt of suitable approvals. The timing of future activities beyond this is uncertain, as which of the several uranium occurrences found on the ML will prove appropriate to mine next is not yet known.

As noted in earlier, the various minor modifications at the Beverley processing plant to accept resin from satellite plants have been previously approved as part of the approval process for the Beverley Four Mile project (Heathgate 2009a,b) or separately approved in 2010. Construction of the relevant modifications was completed in August 2010 in order to be ready to accept resin from the FLT that preceded routine mining.

4.5.3 Modes and Hours of Operation - Mining

The Beverley North Mine will operate on a 24 hours a day, 7 days a week basis.

4.5.4 Type of Field Equipment - Mining

The field activities at the Beverley North Mine comprise wellfield and satellite plant operation, maintenance, monitoring, and rehabilitation following closure. All production drilling would be undertaken using wet mud-rotary techniques. The same field equipment used at Beverley would also be used at Beverley North. No additional field equipment is expected to be required.

The current list of field equipment in use at Beverley ML 6321, which would be shared with work on the Beverley North ML, is given below. Some of this equipment would remain based at the Beverley processing plant and office complex:

- Drill rigs and support vehicles including water tankers
- Geophysical logging vans
- Airlift truck(s)
- Water recovery truck(s)
- Water sampling truck(s)
- Backhoe(s)
- Low-loader and prime mover(s)
- Crane(s)
- Grader(s)
- Forklift truck(s)
- Water trucks
- 4WD ambulance
- Fire truck
- Assorted light vehicles (4WD utilities and wagons).

4.5.5 Well Construction

Delineation drilling and geophysical logging results are used to design the wellfield layouts. Typically, 7 or 5 spot wellfield patterns (i.e. each extractor well is surrounded by 6 or 4 injector wells) are used, although other patterns can be used to optimise environment protection around creeks and drainage lines and to match the geometry of the deposit. Injection and extraction wells are typically spaced between 25 m to 40 m apart.

Well construction methods would be designed to achieve minimal surface impact, and to maintain the integrity of aquifer-confining layers. Plate 4-2 shows a typical wellfield at Beverley in a vegetated area, and Plate 4-3 a typical wellfield in a non-vegetated area at Pepegoona.

Plate 4-2 Wellfield at Beverley (vegetated area)

Plate 4-3 Wellfield at Pepegoona (non-vegetated area)

Wellfield construction outcomes are achieved through the following measures:

- Surface Impacts;
  - Mud pits are excavated in such a way that surface soil is stockpiled and re-used to rehabilitate the site
  - Drill cuttings are stored in the mud pit and are buried by at least 1 m of soil during rehabilitation
- Maintain the integrity of aquifer confining layers;
  - Wells are constructed in accordance with the Minimum Construction Requirements for Water Bores in Australia Edition 2, Land and Water Biodiversity Committee 2003
  - Wells are cased with appropriately pressure rated PVC and the annulus is pressure grouted with sulphate resistant cement to the surface
  - Well casing is integrity tested to 1000 kPa after installation
  - Wells which fail integrity test are repaired and retested or abandoned by pressure grouting with sulphate resistant cement to the water table or the surface.
  - Exploration drillholes are pressure grouted with sulphate resistant cement to the position of the water table or the surface after the drillhole is logged.

4.5.6 Wellhouses

Wellhouses are small sheds of about the same size as a domestic single garage, which contain all the plumbing and control devices to facilitate the movement of fluids from the trunklines to and from the wellfields. Plate 4-4 shows the internals of a wellhouse at Pepegoona; similar controls would be used for other Beverley North wellhouses.

Plate 4-4 Flow Monitoring and Control in a Wellhouse at Pepegoona

4.5.7 Pipelines

The Beverley North wellfields would be connected to the satellite plants by a series of pipelines of similar design to those used at the Beverley operation. The pipelines are constructed of poly pipe of the appropriate pressure rating for the proposed use, as used at the Beverley operation. The Pannikan satellite plant will also be connected to the Four Mile East wellfields via pipelines as shown in Figure 4-4.

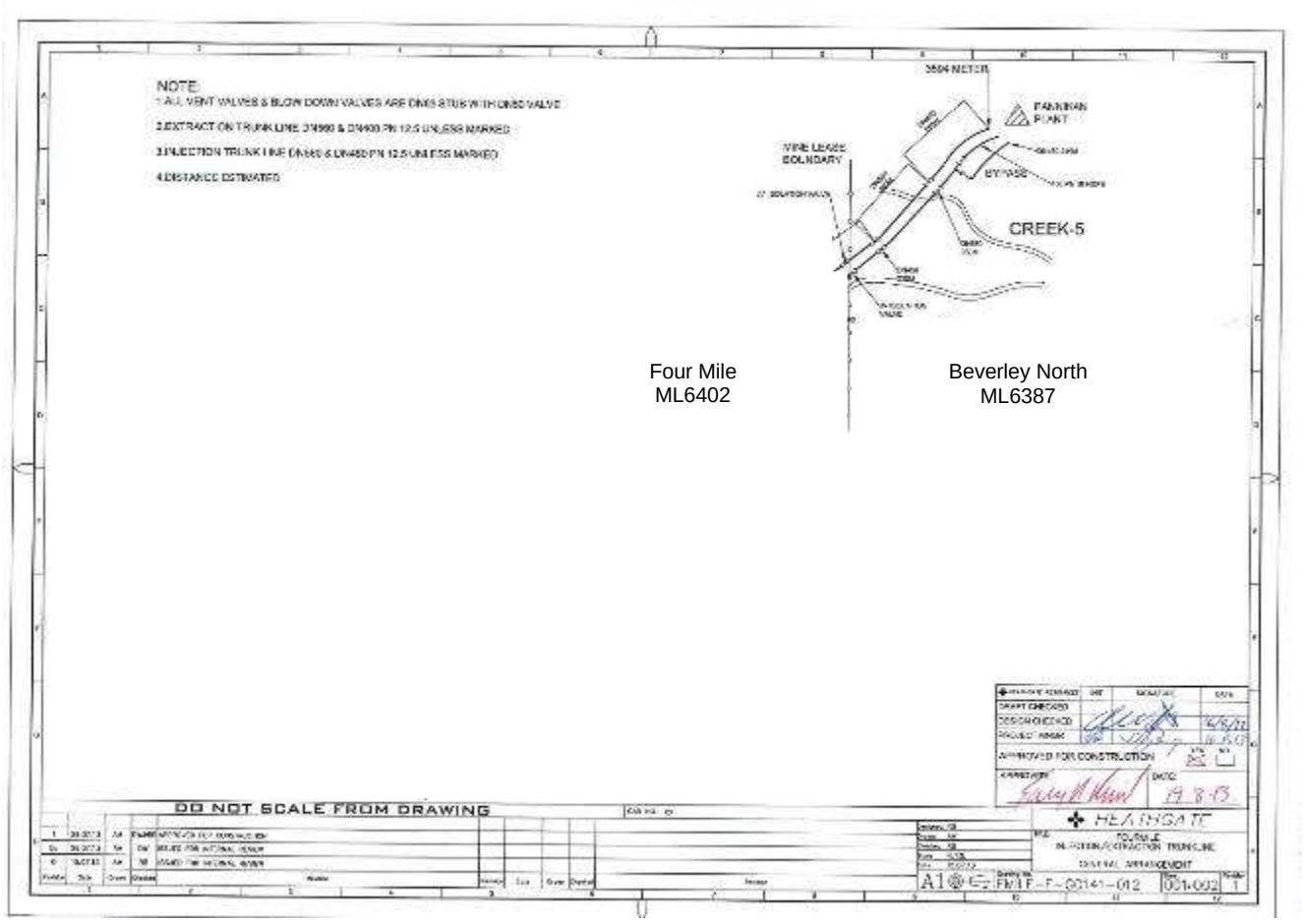

Figure 4-4 Pipelines to Four Mile East

4.5.8 Procedure for Mining of Later Deposits

The Beverley North ML is host to three known ISR-mineable deposit (the Pepegoona deposits and the Pannikan deposit), and several uranium mineralisation occurrences (prospects). Heathgate is confident that other prospects will prove sufficiently economic to mine in the near future and that these first wellfields and satellite plants may be the first of several, dependent on ongoing exploration success.

Heathgate anticipates that the mining of future deposits other than the Pepegoona and Pannikan deposits will be authorised by way of PEPR amendments under the South Australian Mining Act 1971, with subsidiary approvals under the other relevant acts and agreements including:

- Agreements with the Native Title holders using established clearance mechanisms
- *Radiation Protection and Control Act 1982* via Licence to Mine LM4 (or other equivalent licence(s) if off Wooltana Station) and the Radiation Management and Radioactive Waste Management Plans

- *Environment Protection Act 1993* via Licence 12918 (or other equivalent licence(s) if off Wooltana Station)

If required under EPBC Act approval of the Beverley North Project, amendments to the monitoring, mine closure and completion and community engagement plans or other relevant approval conditions.

Most baseline studies presented here and in the appendices cover the entire Beverley North MLA. The geological formation containing mineable uranium and details of the hydrogeology can, however, vary. Thus additional hydrogeological studies would be reviewed and if required additional investigations undertaken and presented as part of the application. If the future deposit is in a flow-through aquifer such as the Eyre Formation, the fate and transport of residual mining solution after mining will need careful consideration which may include hydrogeological and geochemical modelling. Potential cumulative effects will also be considered.

4.5.9 Haulage

It is noted that there is no rock haulage as such in an ISR project. The only change to the existing Beverley operations in regard to haulage would be trucking of resin and bleed water between the satellite plants and the Beverley processing plant.

The truck used for transport of resin to and from the satellite plant to Beverley would operate as required, depending on test requirements, but may be expected to run once or twice a day per satellite plant during operation of the satellite plant.

The resin is transported in a tanker truck (Plate 4-5) hauled by a prime mover. This can also be used for bleed water, or a separate tanker truck of tanker tailer used.

Plate 4-5 Resin Tanker

4.5.10 Cross-boundary Protocol

An injection and an extraction trunkline, located together, will cross the Four Mile/Beverley North ML boundary. The tenements are held by two different entities (the Four Mile JV parties, and

Heathgate) with Heathgate being the operator of both projects. To address issues relating to cross-boundary risks, the following will guide actions:

1. The JV is responsible and liable for any leaks or spills that originate on the Four Mile ML irrespective of the cause of the leaks or spills;
2. Heathgate is responsible and liable for any leaks or spills that originate on the Beverley North ML irrespective of the cause of the leaks or spills; and
3. Heathgate will conduct all works associated with repairing and cleaning up the results of any unplanned events on the Four Mile and Beverley North MLs.

The philosophy noted above will also apply to power lines and any other infrastructure that crosses the ML boundary.

It is likely the orebodies at Beverley North extend into the Four Mile ML, and future agreements between the parties will allow an application to amend the PEPR to permit mining across the boundary.

4.6 Processing

4.6.1 Processing Equipment

As described earlier, the Beverley North Mine comprises satellite processing plants adjacent to the wellfields, together with some minor modifications to the existing Beverley plant. The satellite plants are IX operations where uranium is adsorbed onto resin in IX columns. Once fully loaded with uranium, resin is transported to the Beverley plant. Uranium loading is calculated from liquor analyses and flow rates.

The resin will be stripped of uranium and regenerated, and the regenerated resin would be trucked back to the satellite plant.

The overall processing arrangements are shown in Figure 4-5. The operations on the Beverley North ML area are shown on light blue background. The existing Beverley operations are shown on green background. The operations in pale yellow are the existing product area; no changes would be required for this area.

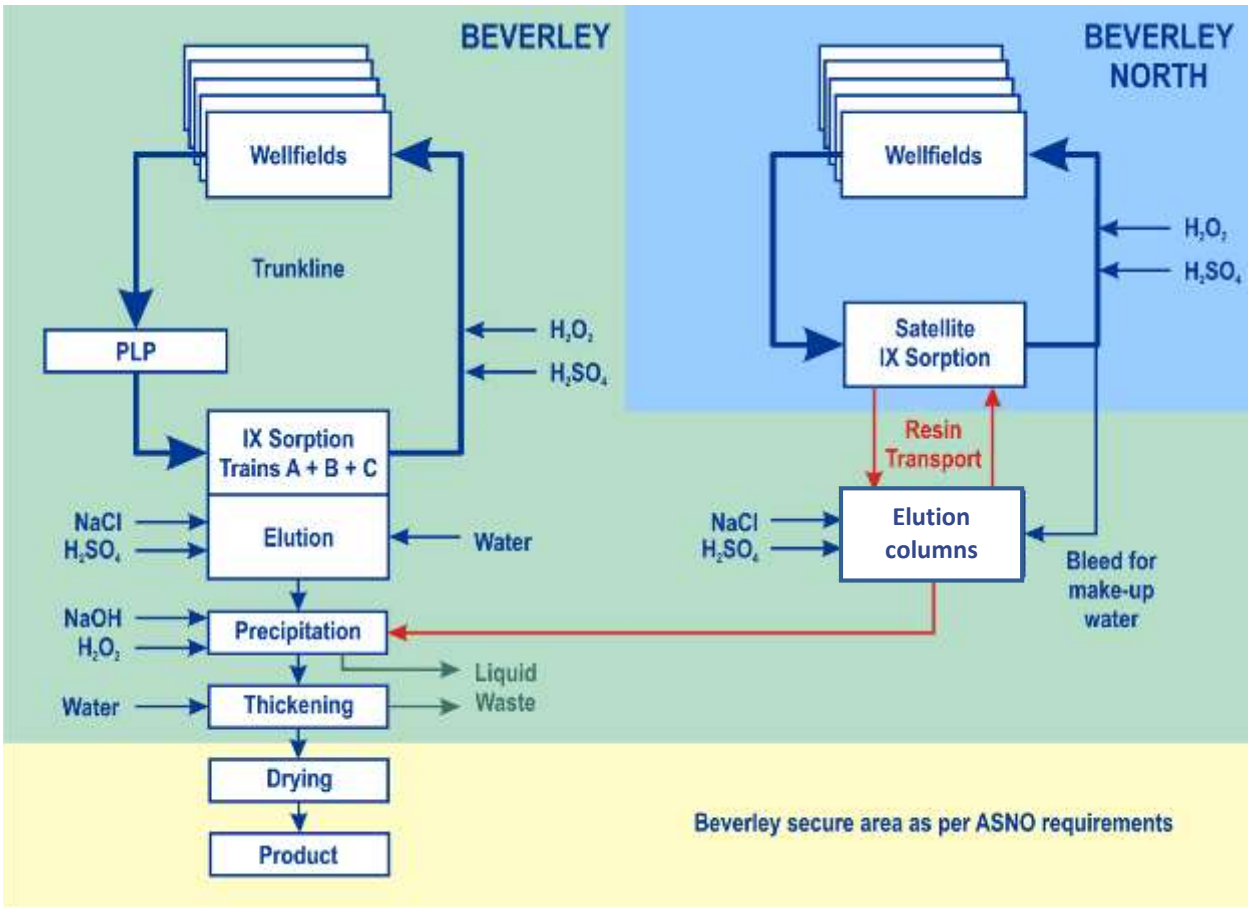

Figure 4-5 Overall Processing Arrangement

Note: The blue (Beverley North) part of the processing will be repeated for each satellite plant.

The satellite plants are similar, although on a smaller scale, to that approved for the Beverley Four Mile project (Heathgate 2009a,b). As noted above the required minor modifications to the Beverley processing plant were previously approved and are in place. For completeness, however, the description provided below covers both the satellite plants and the Beverley modifications.

The operation of a satellite plant and wellfields is essentially similar to the existing Beverley operation, but at a smaller scale. Mining solution is injected into the permeable mineralized regions of the orebody for dissolution of deposited uranium. The loaded liquor is then pumped into one of a group of IX vessels containing resin.

Barren solution then flows from the base of the final IX column into a barren lixiviant tank. The barren solution is then re-dosed with sulphuric acid and hydrogen peroxide (as is currently done at Beverley) and reinjected into the wellfields.

It is necessary to 'bleed' a small amount of barren liquor from the circuit to ensure control of solution in the aquifer. This bleed solution would be stored in a barren liquor tank and transported back to Beverley in water tankers or a resin tanker and used in the elution process, reducing the water consumption at Beverley.

Only minor modifications were required at the Beverley plant to elute the Beverley North resin. Beverley has three IX 'trains' of (until recently) five vessels each. Previously obsolete tanks have been reconfigured to accept resin and act as elution tanks. In these tanks uranium is stripped from the resin to create a concentrated uranium solution, referred to as eluant.

The existing trains continue to process liquor from the Beverley wellfields, although with a reduced capacity due to the relocation of IX columns to the Beverley North satellite plants.

After the completion of test analyses, which allows the production from Beverley North to be quantified, eluant from Beverley and from Beverley North are mixed together and the uranium is then precipitated, dewatered and dried to produce UOC.

4.6.2 Uranium Ore Concentrate Accounting and Storage

A mass balance will be produced that uses rich liquor grade, barren liquor grade and flow-rate information at the satellite plant to fully account for uranium produced by Beverley North.

UOC product will be packed at Beverley and stored in 205 L steel drums within the secure area at Beverley to meet all regulatory requirements including those of ASNO and the SA EPA RPB. The stored drums and records demonstrating the mass balance will be retained for inspection by the appropriate Government regulators.

4.6.3 Modes and Hours of Operation - Processing

The Beverley North Mine operates on a 24-hour basis.

4.6.4 Types of Equipment - Processing

The principal equipment for the Beverley North Mine Satellite Plants comprises:

- At each of the Beverley North satellite plant sites (refer to plant layout in Figure 4-6a, b and c and Figure 4-7 for the Pepegoona and Pannikan layouts):
    - Bunded processing equipped with pumps, tanks and three to five IX columns containing resin
    - Separate bunded areas for hydrogen peroxide and sulphuric acid
    - Office/Crib Room (together or separate)
    - Generator(s) (with a fuel tank within a suitable bund)
    - Switch-room
    - Compressor
    - Small laboratory
    - Control room
    - Change room
    - Bunded truck loading/unloading area
    - Wellfield injection pumping system and associated wellhouse, pumps, pipes and control systems.
- At the Beverley plant:
    - The existing main equipment components would remain (columns other than those moved to Beverley North, eluant tanks)
    - Reconfiguration of previously obsolete tanks to accept Beverley North resin and act as elution tanks.
    - Minor pipework changes and an update of the process control system.
    - An existing truck loading/unloading bay within the existing Beverley bunded area will be used for resin transfer.

All bunded areas will be designed to hold the relevant minimum volumes in accordance with EPA requirements. Any spills of liquid will enter the existing waste water system and any spills of resin

will be recovered by mechanical or manual methods and put through the resin cleaning facilities for re-use.

4.7 Wastes

4.7.1 Drilling Wastes

Mud pits are excavated adjacent to the rig at each drill hole collar, to allow the circulation of drilling fluid and for capture of drill cuttings. At the completion of the drill hole or well development, the mud pits are rehabilitated as follows:

- The mud pit is allowed to dry out, either naturally or after being pumped out
- Drill cuttings are returned to the pit after which the pit is in-filled with the excavated material
- The surface is compacted to ensure that the surface of the capping is approximately levelled with the surrounding terrain.

Radiation monitoring and modelling of the above procedure has been undertaken and has demonstrated that the method conforms with best practice and ensures that radiation doses to employees and members of the public are below applicable limits and as low as reasonably achievable.

Note that this applies to exploration and production drilling.

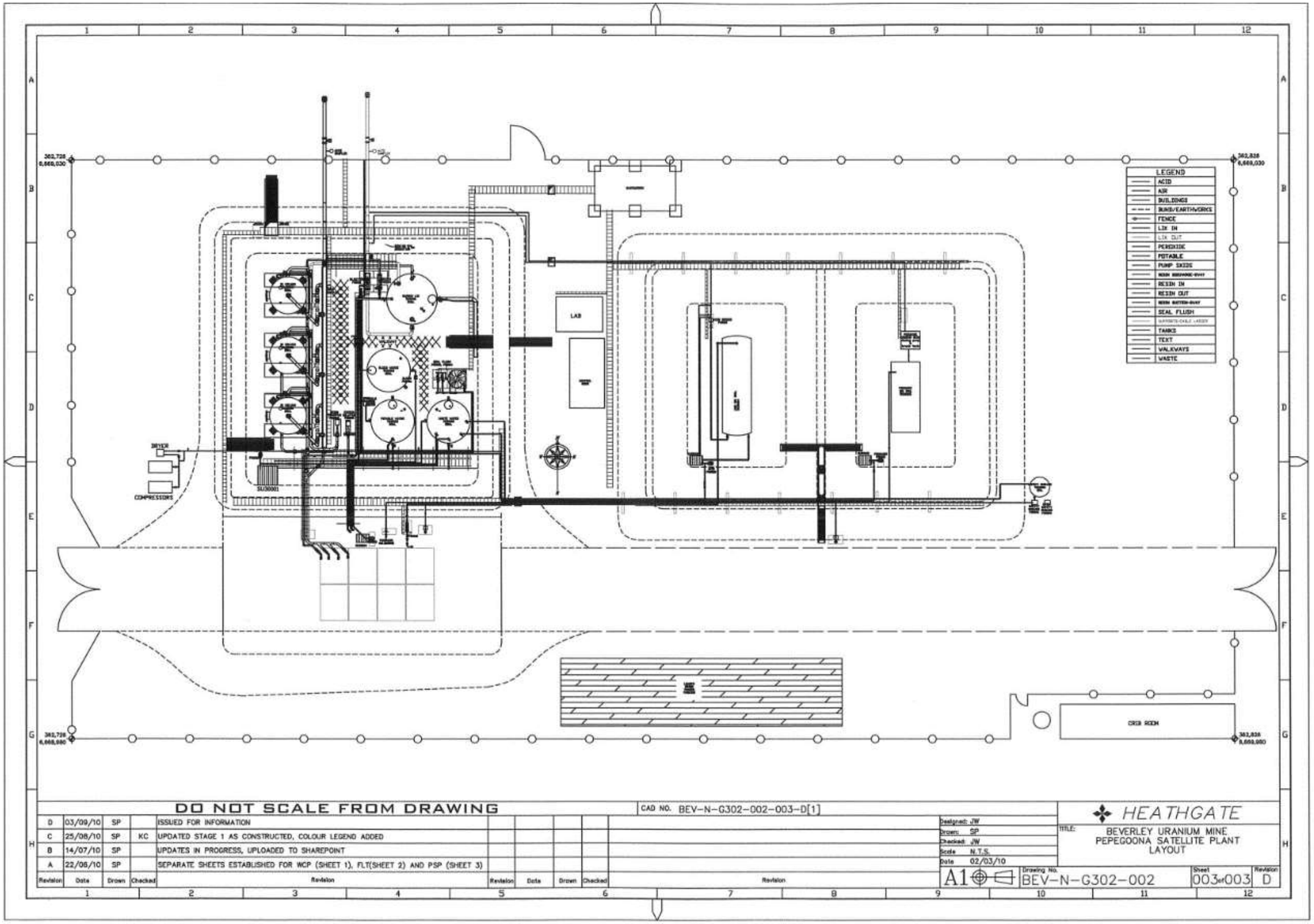

Figure 4-6a Pepegoona Satellite Plant Site Layout – complete layout area

Note: exact location of components may be moved in final construction. Outer line is fence.

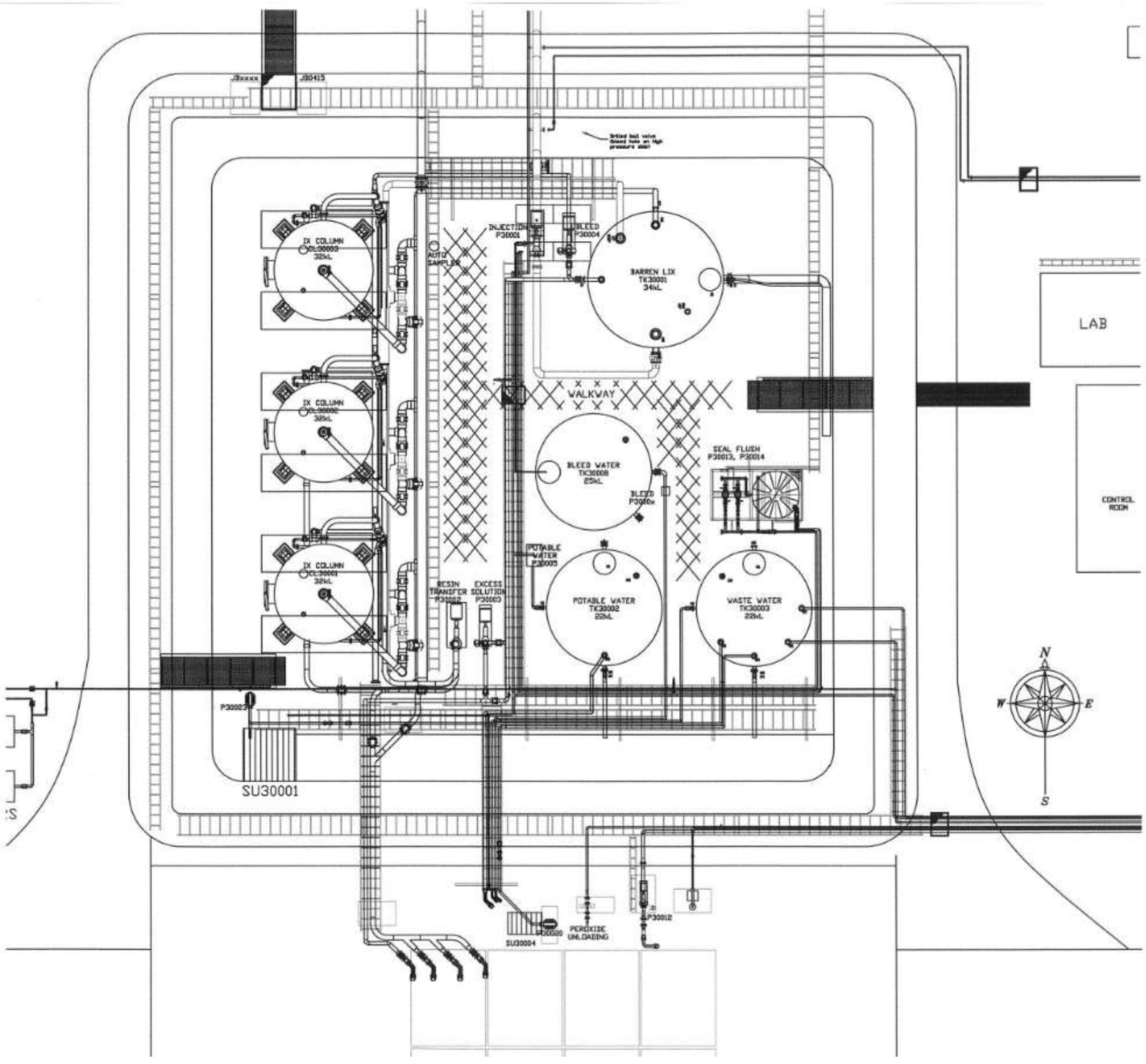

Figure 4-6b Pepegoona Satellite Plant Site Layout – bunded plant area

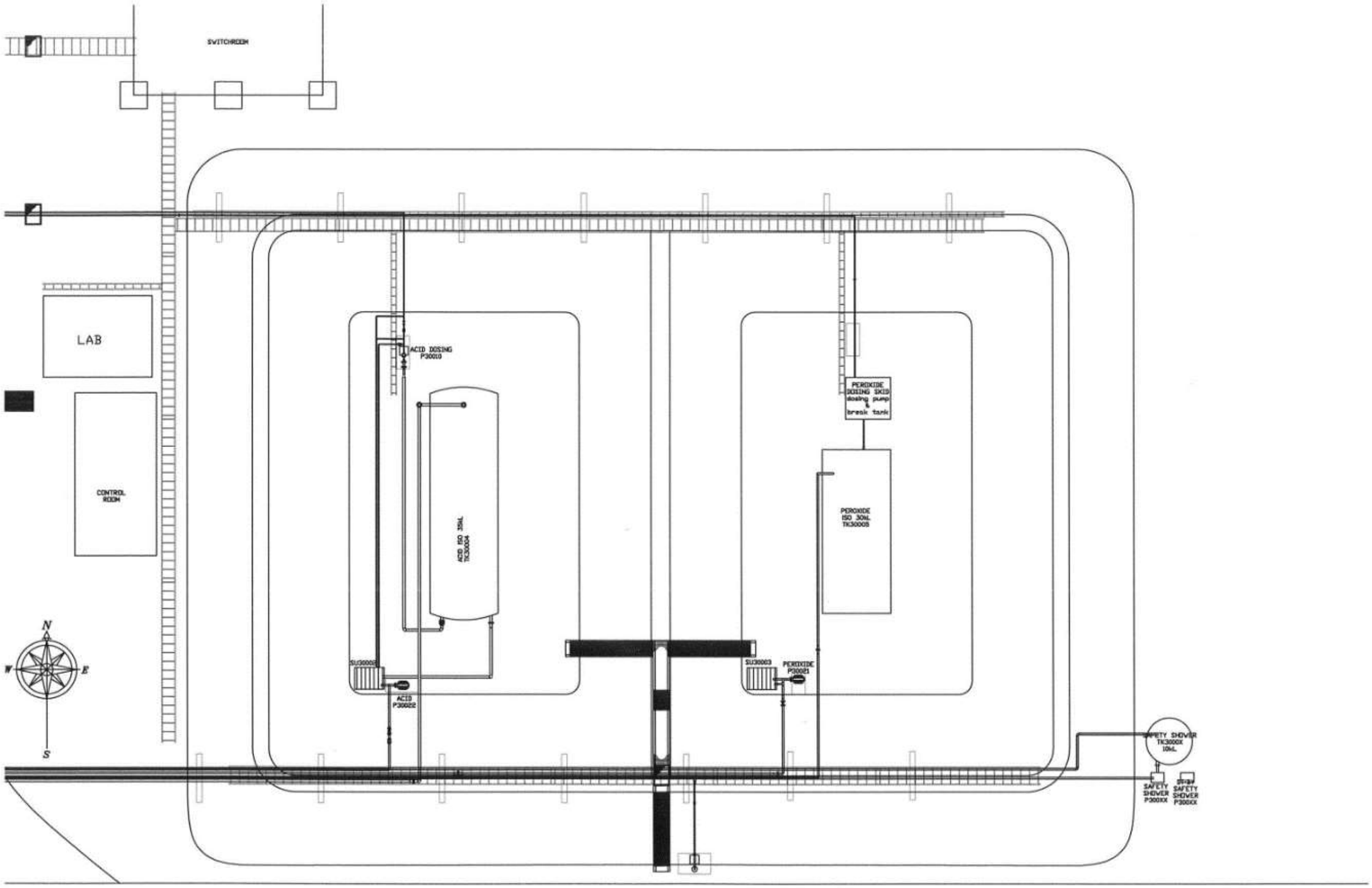

Figure 4-6c Pepegoona Satellite Plant Site Layout – bunded reagent area

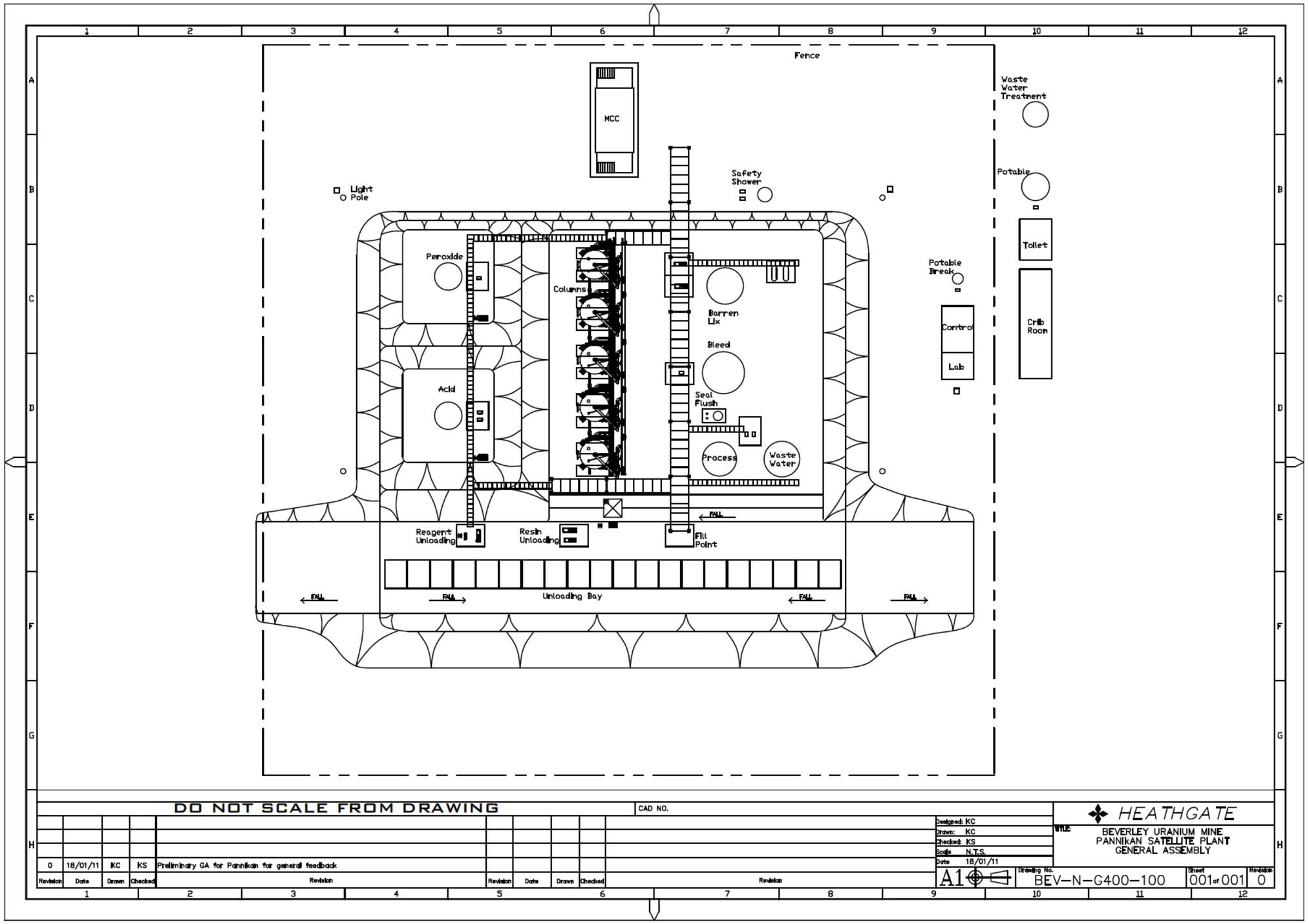

Figure 4-7 Pannikan Satellite Plant Site Layout

Notes: All areas are bunded excluding control and MCC rooms. Exact location of components may be moved in final construction. Fence not shown but will enclose the plant.

4.7.2 Surplus (Communal) Drilling Mud Pits

A second communal drilling mud disposal pit was constructed for the conduct of the FLT stage 1 and two more for FLT stage 2 (for locations see Figure 4-1). Additional pits will be required from time to time at Beverley North, depending on the rate of drilling. The size of the communal mud pits are approximately 300 m^2 x 3-6 m each. The pits are used to accept mud pumped from individual drill pits (exploration and production) to allow their rapid re-use, and to allow rapid refilling for rehabilitation purposes. The walls of the pits self-seal with the mud and the water component of the mud evaporates. Cuttings from the wells, including those from the ore zone, would remain in the original drill pits for local burial as per current practice.

Management of these pits is also part of the RWMP authorised by the SA EPA RPB. The chosen locations are in stable areas with no incompatible future use and that is not subject to flooding or erosion[7]. On drying and prior to burial, the surplus mud pit will be sampled for analysis to ascertain its radiological status.

In the unlikely event that the residual material is more radiologically significant than drill cuttings, the base of the pit will be scraped for disposal at the Beverley Low Level Radioactive Waste Repository. The more likely scenario will see the remnants within the pit covered with a minimum of 2 m of clean material and progressively rehabilitated.

As per the RWMP, after the backfilling of each pit or group of pits, a pit closure report will be submitted to the regulatory authorities with the following information contained in the report:

- The location, GPS coordinates and dimensions of the pit(s)
- A list of contents in the pit(s)
- Photographic confirmation of construction of the pit(s)
- Photographic confirmation of the pre closure waste location within the pit indicating depth
- Measured gamma dose rates before construction and after closure.

A photograph of one of the communal mud pits constructed for the FLT at Pepegoona is shown in Plate 4-6.

[7] Other than normal erosion typical of areas away from defined drainage channels.

Plate 4-6 Communal Mud Pit

4.7.3 Liquid Processing Wastes

No liquid waste will be generated at the Beverley North wellfields, and minimal quantities at the satellite plants. Any liquid waste from Beverley North will be transported to the main Beverley plant, either specifically or as part of the bleed water stream that will be regularly transported by tanker. This includes a small amount of waste water from the small on-site laboratory/ies.

The volume of bleed water generated by the Beverley North wellfields will depend on flow rates, and as this water will be added to the process at Beverley (partially replacing an existing water source) it will have negligible impact on the water balance at Beverley. It will be used in the process at Beverley displacing some water currently taken from the Beverley aquifers

As a result of processing uranium from Beverley North, 2-5 L/s of saline wastewater will eventuate at Beverley for disposal into the mined-out Beverley Sands aquifer. In 2009 the liquid waste capacity of the previously mined aquifer units within the Beverley system was estimated to be sufficient to accept a disposal rate of 5 L/s for approximately 20 years, being:

- 8 years in Central-South, currently approved
- North-East (3.3 yrs)
- East (8.0 yrs)
- Deep South (1.1 yr)

A mechanism for approval of the additional areas, if they are required, is in place in the Beverley PEPR. Pending the discovery of additional minable resources on the Beverley ML 6321, mining at Beverley itself wound down over the second half of 2010 and relatively small amounts are expected to be mined in 2011. Further, the average disposal rate at Beverley over 2009 and 2010 has been significantly less than 5 L/s, meaning that at the end of 2010 approximately 7 years' liquid waste capacity remains at Beverley. Current resources in Beverley North (to the end of 2010) were equivalent to 3-5 years full production at Beverley and are expected to produce similar amounts of saline waste water for disposal. Saline liquid waste arising from remaining Beverley and currently known Beverley North production is therefore expected to be accommodated in the Central-South area. There is sufficient capacity in the other Beverley system areas (subject to approvals) to accommodate considerable additional production through the Beverley treatment plant.

4.7.4 Low-Level Radioactive (LLR) Solid Wastes

Small amounts of low level radioactive waste will be generated from Beverley North. The appropriately designed and approved disposal method and facilities at Beverley will be used, as described in detail in the Beverley PEPR and RWMP (which covers operations at both Beverley and Beverley North).

There is sufficient suitable terrain at Beverley to install many additional LLR waste cells. There is also suitable terrain to install land fill cells at Beverley North, although approval for this is not sought at this time.

4.7.5 Industrial and Domestic Wastes

Solid Wastes

The Beverley North Mine will produce a certain amount of non-radioactive solid waste associated with both its mining operation and staffing facilities, including:

- 'Household' type wastes (food scraps, plastic wrapping, etc)
- Packaging and containers (cans, bottles, etc)
- Commercial wastes (papers, documents, etc)
- Industrial wastes (oils, chemicals, etc).

All wastes that are deemed to have no further use are disposed of in an approved landfill facility at the Beverley ML 6321 site. The objectives for managing the landfill comprise:

- Minimising waste requiring disposal in approved refuse facility
- Maximising recycling and reuse
- Minimising the impact on the environment by waste handling and disposal methods
- Ensuring that the integrity of the waste management facilities is maintained.

The strategies for managing the landfill operations are:

- Identification of waste streams
- Segregation of radioactive wastes from the general waste stream Beverley PEPR and RWMP.
- Implementation of management systems to minimise waste generation, including:
    - Recycling and re-use
    - Shredding
    - Baling or other form of compaction

- Periodic review of waste management technology with a view to adoption of cost-effective waste management methods
- Fencing and locking of refuse facilities to prevent inappropriate use (and potential access by large animals)
- Waste facilities are constructed according to engineering specifications.

The location of the landfill on Beverley ML 6321 is shown in Figure 4-4 in Section 4.5 of the Beverley MARP[2] (Heathgate 2008b). There is sufficient suitable terrain at Beverley to install many additional landfill cells. There is also suitable terrain to install land fill cells at Beverley North, although approval for this is not sought at this time.

Domestic type wastewater

Domestic type wastewater will arise from the offices, toilets and crib rooms. The wastewater will be treated in local septic systems; approval for the system design and operation is obtained from the SA Health Department. Portable toilets are used in the interim and some may remain on site for ongoing use.

4.7.6 Silt Control and Drainage

Operations in drainage channels and creeks are avoided wherever possible. However, some silt control measures would be employed on roads, particularly creek crossings, as is presently done at Beverley.

4.8 Supporting Surface Infrastructure

4.8.1 Access

There is no change to the external access requirements to service the Beverley North Mine. Access is via the Beverley Uranium Mine.

The unsealed access track would be upgraded between the Beverley camp and the satellite plants, which would continue on to the wellfield areas. Some additional internal roads would be necessary within the lease to access wellfields. There is additional fencing around the satellite plants for security purposes. A separate road may be constructed in the future as shown in Figure 1-5.

Figure 1-5 and Figure 4-1 and 4-2 show the access tracks and other infrastructure related to the Beverley North Mine.

4.8.2 Accommodation and Offices

A small site office will be used at each satellite plant site. All employees would be accommodated in the Beverley camp, where there is sufficient accommodation for the project personnel. Utilities would be provided by local diesel-powered electricity generation and local non-potable supply water wells. Potable water will be trucked in from Beverley.

4.8.3 Public Roads, Services and Utilities

There would be no change to the use of public roads, services and utilities from that at present for the Beverley operations.

4.8.4 Visual Screening and Site Security

Visual Screening

The nearest viewing point for the Beverley operations from the Flinders Ranges is Siller's Lookout, from which Beverley is barely detectable to the naked eye (Figure 3-1). This situation will be little changed with the Beverley North Mine, with the satellite plant being much smaller than the Beverley processing plant, and significantly further away from Siller's Lookout.

At night, at present the Beverley processing plant lights can be seen from both the Balcanoona-Moolawatana Road and Siller's Lookout. The satellite plant is an additional lit-up area. Given that the beauty of the Flinders Ranges is appreciated during daylight hours, the use of lights at night at the satellite plant is not regarded as a significant negative impact. In any event, the overall visual impact would be no more significant than structures normally associated with a pastoral station.

Site Security

The main access to the Beverley North Mine would continue to be through the existing Beverley main gate, which has an electronic pass system. As noted previously, there is some additional fencing around the satellite plants themselves for security purposes.

4.9 Resource Inputs

4.9.1 Workforce

Each satellite plant and its associated wellfields will be manned by up to two people at any time. The positions required to run the Beverley North Mine such as wellfield, maintenance and Environment, Safety and Health staff will be made up of existing Beverley employees. All employees will be based in the Beverley camp.

4.9.2 Energy Sources

Power will be supplied to the satellite plants and wellfields from diesel generators. However, in the future the reticulation of electricity from Beverley's gas-powered generators is under consideration.

4.9.3 Water Sources

The current GAB water source to the Beverley camp and extraction plant will remain and local Eyre Formation non-potable water supplies of up to 5 L/s (average) provided at Beverley North, one water supply well each near Pepegoona and Pannikan, each with a small diesel power supply and set of tanks and a water loading area. This will mostly be used for dust control on roads.

Drinking water will be imported to Beverley North from Beverley.

5 RESULTS OF STAKEHOLDER CONSULTATION

5.1 Identification of Stakeholders and their Views

An ISR development at Beverley North could impact stakeholders, and Heathgate initiated stakeholder consultation to inform stakeholders of the possibility of development at Beverley North and seek feedback early in the development application process. The Beverley North Mine is expected to have minimal impact on stakeholders due to the small scale of the project relative to the existing Beverley operations.

The Beverley North satellite plants and wellfields, and any potential future development at Beverley North, will be located well away from any populated centre, too far for noise, dust or any nuisance created at the site to affect a community. Unlike some mining projects where there are communities located within a few kilometres of the site, there is no local community for Beverley North.

There is potential, however, for some regional communities to be impacted by the project, such as by disruptions to families because of fly-in, fly-out employment, or Aboriginal cultural disruptions. In light of this, the key stakeholders were identified as follows:

- The Adnyamathanha community – the mine is located on their Native Title area, production payments are received, some members are employed at Beverley;
- The Port Augusta region – most employees live in either Adelaide or the Port Augusta region;
- Arkaroola – a wilderness sanctuary and tourist venture (Beverley North will be visible from some lookouts at Arkaroola)
- The regulators – who represent the whole community.

In addition to numerous consultation meetings with the Commonwealth and SA regulators, public consultation sessions on the Beverley North MLA were held in Port Augusta and Arkaroola on 3 March 2010 and received no adverse feedback. Several meeting with the regulators, Native Title Holders and the owners of Arkaroola have been held since that time.

5.2 Stakeholder Consultation Process and Results

For the Adnyamathanha community, a specific meeting was held on 29 March 2010 to discuss a new Native Title Mining Agreement that would cover both the FLT and the Beverley North ML. The Beverley North Mine was also discussed at the Beverley Advisory Committee meeting on 31 March 2010 and on 30 June 2010.

At a community meeting held on 1 May 2010, the Adnyamathanha community approved a new Native Title Mining Agreement which was subsequently signed and submitted to DSD[8] on 12 May 2010. That agreement was subsequently registered.

Heathgate has participated in a number of meetings with South Australian and Commonwealth Government Departments regarding the Beverley North Project. These have not been listed separately.

5.3 Details of Consultation

The issues raised and responses were provided in Tables 2-1 to 2-10 of the Response Document to the PER/MP (Heathgate 2010b). Since that time Heathgate has undertaken a number of meetings, formal and informal, with State and Commonwealth regulators, local station holders and owners of Arkaroola, and the Adnyamathanha people. Feedback from regulators on the FLT

[8] Then PIRSA

MARP and early drafts of the Beverley North PEPR have also been taken into account and resulted in a number of amendments (e.g. the format of presentation of the groundwater monitoring program). The ongoing community consultation plan is given in Section 6.13.

6 ENVIRONMENTAL, SOCIAL AND ECONOMIC ASPECTS

6.1 Overview

The Beverley North and Beverley Mines are located in a remote part of the State, between the eastern edge of the Northern Flinders Ranges and Lake Frome. There are few communities within proximity of the mine, notably:

- Arkaroola
- Nepabunna
- Iga Warta.

Heathgate recognises the importance of information regarding the environment, heritage management and Aboriginal issues in the region. In order to aid in community liaison a Visitor and Heritage Centre has been constructed at the mine site. The mine furthermore has an extensive OH and S system and risk assessment process which addresses the risks associated with environment and heritage issues.

Different community groups require different specific mechanisms for consultation. The level and type of consultation varies between these groups, as described in Section 5 and later discussed at Section 6.13.

6.2 Applicable Legislation and Standards

A listing of legislation and standards relevant to the Beverley North Mine is provided in Table 6-1.

6.3 Impact Event Analysis

6.3.1 Potential Impact Events

A listing of all credible potential impact events associated with activities relating to the project, including construction and operational activities, has been developed. This includes any potential impacts relating to the following:

- Natural environment (including air quality, surface and underground water supplies, flora, fauna, landform stability, etc.)
- Social environment (including public health, amenity, nuisance, fires, heritage, use of public resources, etc.)
- Economic environment (including regional economy, individual landholder incomes, land values, etc.).

The basis for identifying these issues involves application of a risk assessment methodology, which is set out in Section 6.3.5 and in Table 6-2 to Table 6-5. The potential impact events include any major negative public perceptions (even if not technically justified). Such events will be considered as a social impact event and appropriately managed.

A discussion of potential impact events is also provided. In particular, Table 6-6 in this section includes a reference number, the aspects, the assigned inherent risk levels, the control and management strategies leading to revised risk levels, outcomes to be achieved and outcome measurement criteria. More details are given below.

Table 6-1 Relevant State and Commonwealth Legislation and Codes of Practice

State Legislation	Commonwealth Legislation	Commonwealth Codes of Practice	SA State Codes of Practice
Aboriginal Heritage Act 1988 Controlled Substances Act 1984 Country Fires Act 1989 Dangerous Substances Act 1979 Development Act 1993 Environment Protection Act 1993 and Regulations Heritage Act 1993 Mines and Works Inspection Act 1920 and Regulations Mining Act 1971 and Regulations National Parks and Wildlife Act 1972 Native Vegetation Act 1991 Natural Resources Management Act 2004 Occupational Health Safety and Welfare Act 1986 and Regulations Pastoral Land Management and Conservation Act 1989 Public and Environmental Health Act 1987 Radiation Protection and Control Act 1982 and Regulations	Aboriginal and Torrens Strait Islander Commission Act 1989 Aboriginal and Torrens Strait Island Heritage Act 1984 Civil Aviation Act 1988 and Regulations Customs Tariff (Uranium Concentrate Export Duty) Act 1980 Customs (Prohibited Exports) Amendment Regulations 2000 (No. 1), under the Customs (Prohibited Exports) Act 1901 Environment Protection & Biodiversity Conservation Act 1999 Environment Protection (Nuclear Codes) Act 1978 Foreign Acquisitions and Takeovers Act 1975 Industrial Chemicals (Notification and Assessment) Act 1989 Native Title Act 1993 Nuclear Non-Proliferation (Safeguards) Act 1987 Nuclear Safeguards (Producers of Uranium Ore Concentrates) Charge Act 1993	Australian Code for the Transport of Dangerous Goods by Road and Rail 1993 Code of Practice and Safety Guide, Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing, ARPANSA, 2005 Code of Practice, Safe Transport of Radioactive Material, ARPANSA, 2001 Department of Industry Tourism and Resources documents Mine Closure and Completion (2006a) and Mine Rehabilitation (2006b) National Health and Medical Research Council (NHMRC) and National Occupational Health and Safety Commission (NOHSC) National standard for limiting occupational exposure to ionizing radiation 1995 (reprinted by ARPANSA 2002) Commonwealth of Australia, 2010, Australia's In Situ Recovery Uranium Mining Best Practice Guide. Canberra	Assessment of Underground Storage Systems (EPA Guidelines, Feb 2005) EPA Guideline 080107 Bunding and Spill Management (June 2007) Compliance and Enforcement (EPA Guidelines, 2005) Disposal of Used Hydrocarbon Absorbent Materials (EPA Guidelines, March 2004) Site Contamination Provisions of the Environment Protection Act 1993 (Part 10A) Environment Protection Authority Guidelines for Responsible Pesticide Use, 2004 Environment Protection (Noise) Policy 2007 DSD Minerals and Energy Information Sheet M21 'Mineral Exploration Drillholes – General Specifications for Construction and Backfilling 'Environment Protection (Waste Management) Policy 1994 Environment Protection (Water Quality) Policy 2003 EPA Compliance and Enforcement Regulatory Options and Tools (November 2009) Environment Protection Act 1993 (including the Environment Protection (Miscellaneous) Amendment Bill 2005) Environmental Noise (EPA Information, Oct 2004) Fire protection services pipework systems (EPA Guidelines, Re-issued Sept 2003) Waste tracking form (EPA Guidelines, 2003) Waste transport certificate (EPA Guidelines, Re-issued Sept 2003)

Note: Environment Protection Policies are issued under the Environment Protection Act 1993

6.3.2 Likelihood and Severity of Consequence, Risk

The risk assessment has been carried out based on Heathgate's Risk Management System, which in turn is based on Australian Standard AS/NZS 4360:2004 Risk Management. The methodology conforms generally with the criteria outlined in DSD's Guidelines for preparation of a mining PEPR. The assessment was been prepared by taking into account the history of environmental management, regulation and reporting undertaken including during and since the production of the Beverley EIS in 1998.

The Heathgate Risk Management System differs slightly from the Australian Standard in that it applies risk classifications that are more in keeping with the common-use meaning of terms such as "low", "medium" and "high". This difference in terminology does not have any impact on the management of risks. The Heathgate Risk Management System also covers risks outside the traditional health, safety and environment fields.

For clarification, the definitions and risk assessment matrix as used in the risk assessment are outlined in Table 6-2 to Table 6-5.

6.3.3 Control and Management Strategies

Table 6-6 includes a brief description of the control and management strategies to reduce the environmental impacts associated with mining at Beverley North. These strategies are set out opposite the corresponding potential impact event, with some repetition as a strategy may be relevant to more than one impact event. The strategies for managing issues involve the implementation of technically and economically achievable best practice mining and environmental management techniques, including progressive rehabilitation where applicable and practicable.

In general, the hierarchy of controls are applied:

1. Elimination – if possible a procedure will be modified to eliminate the need for exposure to the risk
2. Substitution – if possible a procedure will be modified to substitute a less hazardous alternative
3. Engineering controls – engineering barriers to reduce risk
4. Administrative controls – operating procedures that reduce likelihood or consequences
5. Personal Protective Equipment – hard hats etc that reduce consequences
6. Transfer – suitable mainly for business risks (e.g. insurance).

Specifically, the 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 procedures to avoid or reduce the consequences of an event, should it happen.

Table 6-2 Definitions of Severity and Consequence

S Safety & Health		A Assets: Plant/ Equipment Damage	F Finance: Business Interruption and Corrective costs	E Environment: Land, Air, Flora, Fauna and Authorisations	R Reputation: Media, Community
Catastrophic Severe injury/illness resulting in irreversible damage or fatality. Indefinite rehabilitation	Life threatening or disabling illness e.g.: cancer (quartz, radon, ionising radiation) reproductive hazards	>$10M	Ongoing production operations severely compromised. Immediate corrective action required. Loss of production > 6 months. >$10M remediation costs.	Widespread severe and permanent Environmental damage. Could lead to closure. Prosecution very likely.	Severe national public and media negative opinion. National denouncement of operations by key stakeholders. Prosecution very likely.
Major Injury/illness resulting in extended lost time and admission to medical facilities for corrective procedures. Rehabilitation required to effect full recovery.	Irreversible health effects of concern e.g.: noise induced hearing loss, lung disease from dust occupational asthma	$1M – 10M	Major impact on production. Significant action required to correct situation. Loss of Production 1 week to 6 months. $1M-$10M remediation costs.	Substantial or permanent damage, prosecution likely. Major stakeholder concerns	Widespread national public attention and media scrutiny. Serious key stakeholder concern. Damage to HGR's corporate image.
Intermediate Short term admission to medical facility resulting in treatment or lost time. Rehabilitation achieves complete recovery.	Severe reversible health effects of concern e.g.: breathing SO_2, solvents, musculoskeletal	$100k – 1M	Moderate impact to operations. Loss of production <1 week. Corrective actions require immediate planning. $100,000 - $1M remediation costs.	Substantial temporary or permanent minor damage. Possible breach of authorization and prosecution. Stakeholder enquires.	Attention from SA public and media services. Public complaints from key stakeholders.
Minor Low-level physical injury resulting in onsite first aid treatment.	Reversible health effects of concern e.g.: jetlag, stress, sunstroke	<$100k	Minor damage that requires no resulting production loss. Corrective action requires short plan time. $10,000 - $100,000 remediation costs.	Temporary impact – minor effect. No publicity likely and with no stakeholder concerns.	Minor localised public scrutiny and minimal media attention.
Insignificant No identified effects with no First Aid required. Information only.	Reversible health effects of little concern e.g.: offensive odours, minor throat irritation	Minor Damage	Insignificant damage to operation resulting in low level planned action to rectify. <$10,000 remediation costs	No measurable impact on the environment. Non-reportable with no publicity.	No public interest in incident.

Table 6-3 Probability Chart

(The probability that the consequence will occur again if no additional controls are put in place)

Almost Certain:	Common or repeating occurrence (weekly).
Likely:	Known to occur (it has happened several times a year).
Possible:	Could occur or have heard of it happening.
Unlikely:	Not likely to occur (once in 20 years).
Rare:	Practically impossible (once in 200 years).

Table 6-4 Risk Assessment Matrix

	Consequence				
Probability	**Insignificant**	**Minor**	**Intermediate**	**Major**	**Catastrophic**
Almost Certain	**M**	**H**	**H**	**C**	**C**
Likely	**L**	**M**	**H**	**H**	**C**
Possible	**L**	**L**	**M**	**H**	**H**
Unlikely	**L**	**L**	**L**	**M**	**H**
Rare	**L**	**L**	**L**	**L**	**M**

Table 6-5 Risk Classification

C: Critical risk	Requires immediate senior management intervention to reduce risk to a lower level.
H: High risk	Requires senior management intervention to reduce risk to a lower level.
M: Moderate risk	Requires corrective action or continuous monitoring to reduce risk. Management accountability must be specified.
L: Low risk	Routine operations will generally control the risk. No specific management attention required unless a reality check determines that such attention is advisable.

6.3.4 Outcome Overview

The desired overall environmental outcome for the Beverley North Mine is expressed in the Heathgate Environment Policy (which will apply to Beverley North), and which states that integral to the policy are goals focused on:

- Waste minimisation
- Zero pollution events
- Compliance with all applicable laws and regulations concerning the environment
- Environmental awareness training
- Minimum site disturbance.

Detailed outcomes were developed during the Beverley North ML approval process (Heathgate 2010a,b) and also the earlier Beverley Extension PER/MARP process (refer Heathgate 2007, 2008a,b). Further details are given below.

6.3.5 Risks to Achieving Outcomes

The main risks associated with potentially not meeting the desired outcomes are discussed below and are later summarised in Table 6-6 and discussed further in Sections 6.4 to 6.11. The identified nine key risk areas are:

1. Soils
2. Vegetation

3. Surface water
4. Hydrogeology
5. Fauna
6. Air quality
7. Heritage
8. Third party issues
9. Radiological aspects.

Identifiers corresponding to these numbers have been assigned to allow easy identification of these aspects in Table 6-6. Note, however, that radiological aspects are considered as part of the other key risk areas and do not have a separate section in the table.

The control and management strategies are devised to ensure that the risks (after control measures have been implemented) are managed to "As Low As Reasonably Achievable" (ALARA) levels. In accordance with DSD Guidelines for preparation of a PEPR the discussion for each of the key risk areas includes consideration of:

- Risk acceptance
- Outcomes
- Outcome measurement criteria
- Leading indicator criteria
- Compliance monitoring plan.

There are instances where control and management strategies, outcomes and outcome measurement criteria for an event are not set out in this section where:

- The risk level for an event is deemed so low, that further specific control measures are not warranted. If this is the case, no outcome, criteria or further monitoring may be warranted;
- The risk is considered acceptable in the context of the mining industry and surrounding environment such that there are no control measures available;
- The cost of implementing further control measures is grossly excessive compared to the benefit obtained; or
- The risk is acceptable, given the other benefits that will arise from the mining operation, which will outweigh the impact that will or may arise.

It is noted that radiological issues relevant to the various categories of aspect (surface water, air quality etc) are covered in Table 6-6 within the key risk area where radiological issues are considered.

It is noted also that the risks addressed in Table 6-6 are those relevant to the Beverley North Mine only; the risks specific to the Beverley operations only are addressed in the approved Beverley PEPR.

It is noted also that the risks addressed in this document apply to the whole of the Beverley North ML including exploration activities.

Further, to meet DSD requirements the future land use of the ML is referred to in terms of returning to pre-mining use. It remains Heathgate's contention that it would be more appropriate to refer to 'agreed future land use', which may well be the pre-mining land use but could, with agreement, be an alternative use.

Table 6-6 Potential Impact Events, Risks, Management, Outcomes and Measurement – Mining

ID	Potential Impact Event	Inherent Risk Level	Design Control Measure(s)	Operational Management Measure(s)	Residual Risk Level	Outcome(s)	Outcome Measurement Criteria
	SOILS						
1.1	Chemical and radiological contamination of soil and watercourse sediments that would prevent its return to pre-mining use arising from: a. Seepage from water management tanks through construction defects, wear and tear and accidental damage. b. Tank or bund overflows of mining solution from high rainfall events or control system failure. c. Escape of mining solution due to accidental breakages of piping from poor welds, vehicle damage or pipe defects.	Likelihood: Possible Consequence: Intermediate Risk: **MODERATE**	Pressure testing of all pipework prior to commissioning. Leak detection system beneath tanks. Wellhead drip trays. Bunds around processing plant and operational mining areas. Protection of piping from traffic in key areas. Refer RWMP.	Wellfields are continually checked by Wellfield Operators and Maintenance personnel. Soils that are radiologically affected above the operational contamination criteria will be buried according to the RWMP. Leaks in tanks will be repaired. Continuous pressure monitoring of trunklines. Continuous flow monitoring of wellhouses. Monitoring of wellhead drip trays.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**	Soil affected by mining activities is suitable for return to pre-mining use.	For: a: Only rehabilitation criteria apply (see text). b, c: All sites subject to spills meet radiological criteria as defined in the RWMP.

ID	Potential Impact Event	Inherent Risk Level	Design Control Measure(s)	Operational Management Measure(s)	Residual Risk Level	Outcome(s)	Outcome Measurement Criteria
1.2	Spillage of hazardous substances during transport, storage and handling resulting in contamination of soil that would prevent its return to pre-mining use.	Likelihood: Possible Consequence: Minor Risk: **LOW**	Hazardous materials and fuel stored in bunded areas.	Undertake routine inspection of tanks and equipment used to store and transfer chemicals and process materials. Any deficiencies in the integrity of any equipment discovered by the inspection will be brought to the attention of senior site management for appropriate corrective action. Implement and regularly update spill and emergency response procedures, maintain spill kits and train Emergency Response Team (ERT) personnel. Implement and regularly update standard operating procedures for handling of chemicals. Fuel-affected soil removed for landfarming and later disposal (if required). Acid or alkali spills remediated (if required).	Likelihood: Rare Consequence: Minor Risk: **LOW**	Soil affected by mining activities is suitable for return to pre-mining use.	Spills of hazardous materials are assessed as soon as practicable[9] and if so determined cleaned up: a) Diesel spills to site-specific criteria to be established using National Environmental Protection Measure (NEPM) Risk Assessment methodology as recommended by the SA EPA. b) Acid or alkali spill sites returned to within local background range of pH.
1.3	Soil disturbance due to excessive off-road vehicle movement which may compromise rehabilitation for pre-mining use resulting from: • compaction of soil • exacerbated erosion.	Likelihood: Possible Consequence: Minor Risk: **LOW**	Provide stabilised tracks or roads for areas with frequent traffic. Provide fencing in key areas to keep vehicles on tracks.	Educate all site employees and contractors on the importance of remaining on existing tracks. Personnel to drive only on existing tracks, unless permitted otherwise via Environmental Clearance Permit. Additional fencing in areas with repeated unauthorised off-road tracks. Progressive closure and rehabilitation of obsolete formed tracks and unauthorised off-road tracks. Ripping of compacted areas and soil when replaced.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**	Soil affected by mining activities is suitable for return to pre-mining use.	Off-road vehicle movements not approved via an Heathgate's Environmental Clearance Permit (ECP) are investigated, reported and one of the following actions are taken: • fenced off to prevent reuse and rehabilitated, or • converted to an authorised road subject to Significant Environmental Benefit (SEB).

[9] Assessment will be risk-based and specify the timeframe for remediation (if remediation is required).

ID	Potential Impact Event	Inherent Risk Level	Design Control Measure(s)	Operational Management Measure(s)	Residual Risk Level	Outcome(s)	Outcome Measurement Criteria
1.4	Spillage of resin, chemicals or bleed stream solution during transport, storage and handling resulting in contamination of soil that would prevent its return to pre-mining use.	Likelihood: Rare Consequence: Intermediate Risk: **LOW**	Resin stored in bunded areas. Resin, chemicals and bleed stream solution transported in suitably designed containers, to withstand spillage in event of an incident.	Transportation across creeks will cease if flood risk is present. Resin, chemicals or bleed stream solution spills are cleaned up within 24 hours. Undertake routine inspection of tanks and equipment used to store and transfer resin, chemicals or bleed stream solution. Any deficiencies in the integrity of any equipment discovered by the inspection will be brought to the attention of senior site management for appropriate corrective action. Implement and regularly update spill and emergency response procedures, maintain spill kits and train ERT personnel. Implement and regularly update standard operating procedures for handling resin, chemicals or bleed stream solution. Resin spills would be recovered should they occur.	Likelihood: Rare Consequence: Intermediate Risk: **LOW**	Soil affected by mining activities is suitable for return to pre-mining use.	All sites subject to spills meet radiological criteria as defined in the RWMP.
	VEGETATION						
2.1	Reduction in regional native vegetation species density and diversity due to mining operations.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**	Minimise perennial vegetation clearing by design: • Fencing patches of vegetation and soaks to protect seed stock and habitat. • Run pipeline on surface. • Wellfield and projects planning.	Enforcement of Environmental Clearance Permit system. Establishment of approved SEB compensation where due. Weed control.	Likelihood: Rare Consequence: Minor Risk: **LOW**	No loss of abundance or diversity on or off the Beverley North mining lease to native vegetation through clearance or any other damage unless prior approval under the relevant legislation is obtained.	Demonstrate that all clearing is undertaken within the maximum area approved in the Native Vegetation Management Plan.

ID	Potential Impact Event	Inherent Risk Level	Design Control Measure(s)	Operational Management Measure(s)	Residual Risk Level	Outcome(s)	Outcome Measurement Criteria
2.2	Loss of local native vegetation (habitat) due to clearance for mining operations.	Likelihood: Almost Certain Consequence: Minor Risk: **HIGH**	Minimise perennial vegetation clearing by wellfield layout design.	Enforcement of Heathgate's ECP system. Establishment of approved SEB compensation where due. Progressive and final revegetation.	Likelihood: Rare Consequence: Minor Risk: **LOW**	No loss of abundance or diversity on or off the Beverley North mining lease to native vegetation through clearance or any other damage unless prior approval under the relevant legislation is obtained.	Demonstrate that all clearing is undertaken within the maximum area approved in the Native Vegetation Management Plan.
2.3	Introduction of new or increase in abundance of existing weeds and pests (feral animals).	Likelihood: Possible Consequence: Minor Risk: **LOW**	'	Flora and fauna surveys to identify trends. Weed control. No pets on Mine Lease. Feral animal control.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**	No introduction of new weeds, plant pathogens or pests (including feral animals), nor increase in number or abundance of existing weed or pest species in the lease area compared to adjoining pastoral areas.	Flora and fauna surveys demonstrate no new weeds or feral animals (due to mining activities) nor statistically significant[10] increase in number or abundance of existing weed or pest species in the lease area compared to adjoining pastoral areas.

[10] Where such statistical measures are valid. Qualitative assessment by independent specialists is considered more appropriate in some cases.

ID	Potential Impact Event	Inherent Risk Level	Design Control Measure(s)	Operational Management Measure(s)	Residual Risk Level	Outcome(s)	Outcome Measurement Criteria
2.4	Loss of local native vegetation (habitat) due to mining-related fires.	Likelihood: Possible Consequence: Minor Risk: **LOW**	Fire fighting equipment. Roads/tracks act as fire breaks.	Fire-fighting exercises undertaken. Design control measures to be implemented should fuel loads become significant.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**	No loss of abundance or diversity on or off the Beverley North mining lease to native vegetation through fire damage unless prior approval under the relevant legislation is obtained.	Any fires caused by mining operations are controlled within the ML boundary.
	SURFACE WATER						
3.1	Watercourse contamination (including radiological) arising from release of mining solution due to flood damage to pipes, bunds and infrastructure or from high rainfall causing overflow of bunds.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**	Engineered creek crossings where high opportunity for flood damage is present. Wellhouses and processing plant located on high ground above 1-in-100 year Average Recurrence Interval (ARI) flood level. Use of 1-in-100 year ARI flood level map in design of pipe routes and flood protection to minimise creek crossings. Minimise production well installation in flood-prone areas.	Visual Inspection around site and review of Flood Management Plan as appropriate. Visual assessment of infrastructure as part of routine maintenance and following all major rainfall events of greater than 1-in-10 year ARI. Compliance with the RWMP.	Likelihood: Rare Consequence: Minor Risk: **LOW**	No compromise of pastoral use of downstream surface water bodies.	Water quality in downstream water storages (within 5 km of an individual mining/spill site, or the closest accessible significant temporary creek waterhole if there is no water storage within 5 km), will be measured as soon as it is safe to do so following surface water flow, if there has been any immediately reportable[11] release of mining solution. This must show no compromise of pastoral use that is attributable to mine operations. Applicable ANZECC/ARMCANZ stock water guidelines are: • salinity (EC) – 4,000 mg/L (6,000 uS/cm) • sulphate (SO_4)– 1,000 mg/L • uranium – 0.2 mg/L.

[11] Under the Bachmann criteria (Bachmann 2003).

ID	Potential Impact Event	Inherent Risk Level	Design Control Measure(s)	Operational Management Measure(s)	Residual Risk Level	Outcome(s)	Outcome Measurement Criteria
3.2	Watercourse contamination (including radiological) arising during transport of resin or chemicals, resulting from an accidents and release of materials into a creek.	Likelihood: Rare Consequence: Intermediate Risk: **LOW**	Engineered creek crossings where high opportunity for flood damage is present. The access track follows high ground wherever possible, and creek crossings were chosen for minimum likelihood of damage during flood events.	Satellite mining would be closed down when rain is significant imminent, and field staff would return to Beverley. Also access tracks are closed at the onset of significant rain. There are no truck movements of resin, chemicals or bleed streams during significant rainfall events. Compliance with the RWMP.	Likelihood: Rare Consequence: Intermediate Risk: **LOW**	No compromise of pastoral use of downstream surface water bodies.	Water quality in downstream water storages (within 5 km of an individual mining/spill site, or the closest accessible significant temporary creek waterhole if there is no water storage within 5 km), will be measured as soon as it is safe to do so following surface water flow, if there has been any unremediated release of resin or chemicals. This must show no compromise of pastoral use that is attributable to mine operations. Applicable ANZECC/ARMCANZ stock water guidelines are: • salinity (EC) – 4,000 mg/L (6,000 uS/cm) • sulphate (SO_4)– 1,000 mg/L • uranium – 0.2 mg/L.
	HYDROGEOLOGY						
4.1	Groundwater contamination of target aquifer(s) outside ML preventing stock watering	Likelihood: Possible Consequence: Minor Risk: **LOW**	Pumping infrastructure in place to actively control fluids	Monitoring network sampled during operations and fluids actively controlled. Post rehabilitation, natural attenuation studies will have been used to design treatment options if necessary.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**	No compromise to the environmental values of the target aquifers (Eyre or Namba Formations) outside the ML.	No migration of mining solution in the Eyre or Namba Formation aquifers outside the ML (except for areas where a Cross Boundary Agreement applies that has been accepted by the Director of Mines) as demonstrated by Excursion Control Limit (ECL) and EC monitoring and response Compliance with the Eyre and Namba Formation outcome will be demonstrated by either no exceedence of ECLs at lateral monitor wells or by demonstration of compliance with the contingency measures described in Section 6.7.8.2

ID	Potential Impact Event	Inherent Risk Level	Design Control Measure(s)	Operational Management Measure(s)	Residual Risk Level	Outcome(s)	Outcome Measurement Criteria
4.2	Contamination (including radiological) of non-target overlying aquifer(s) (if locally existing) units near mined Beverley North deposits arising from mining activities.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**	Exploration holes cement grouted. Production and monitor wells cement grouted and integrity tested. Wells that do not pass integrity tests are cemented up and abandoned. Refer to RWMP.	Monitor non-target overlying aquifer(s) (if locally existing) water levels and quality. Adjust injection and extraction balances in mined areas to maintain control of mining solution. Adjust pressure in mining aquifer at end of mining to restore pre-mining pressure gradient or a gradient towards mined area. Refer to RWMP.	Likelihood: Rare Consequence: Minor Risk: **LOW**	No compromise to the environmental values of the overlying aquifer (Willawortina Formation).	Monitoring of ECL parameters and EC demonstrates no compromise of the environmental values of the overlying aquifer(s), should either be present and saturated, as a result of mining operations.
4.3	Contamination (including radiological) of underlying aquifer units underlying mined Beverley North deposits arising from mining activities.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**	Exploration holes cement grouted. Production and monitor wells cement grouted and integrity tested. Wells that do not pass integrity tests are repaired or cemented up and abandoned. Refer to RWMP.	Monitor the first underlying aquifer water levels and quality. Adjust injection and extraction balances in mined areas to maintain control of mining solution. Adjust pressure in mined aquifer(s) at end of mining to restore pre-mining pressure gradient or a gradient towards mined area. Refer to RWMP.	Likelihood: Rare Consequence: Minor Risk: **LOW**	No compromise to the environmental values of the underlying aquifers (Fractured Rock or GAB Aquifers).	Monitoring of ECL parameters and EC demonstrates no compromise of the environmental values of the underlying aquifer, as a result of mining activities.

ID	Potential Impact Event	Inherent Risk Level	Design Control Measure(s)	Operational Management Measure(s)	Residual Risk Level	Outcome(s)	Outcome Measurement Criteria
	FAUNA						
5.1	Reduction in native vertebrate species density and diversity caused by wellfield development, access road construction and operations.	Likelihood: Possible Consequence: Minor Risk: **LOW**	Minimise perennial vegetation clearing by design: Fencing patches of vegetation and soaks to protect seed stock and habitat. Run pipeline on surface. Wellfield and projects planning.	Enforcement of Heathgate's ECP system. Enforce speed limits within Mining Lease. Rapid backfilling and rehabilitation of mud pits. Presence of drilling crews (discouraging fauna near pits and operations). Rescue of trapped fauna. Backfilling of exploration and delineation drill holes. Placing stockpiled vegetation as habitat. Recreational hunting prohibited within the lease area.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**	No net adverse impacts from the site operations on native fauna abundance or diversity in the lease area and in adjacent areas.	Results of monitoring program show no reduction of native vertebrate density and diversity compared with local area background.
5.2	Reduction in native vertebrate species density and diversity resulting from an increase in feral animals caused by creation of food sources, modified habitat and waste management operations.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**	All putrescible waste disposed of at Beverley.	Covering of putrescible waste. Increase personnel awareness via inductions and notices.	Likelihood: Rare Consequence: Minor Risk: **LOW**	No net adverse impacts from the site operations on native fauna abundance or diversity in the lease area and in adjacent areas.	Results of monitoring program show no reduction of native vertebrate density and diversity compared with local area background. Results of monitoring program show no increase in feral vertebrates, compared with local area background[12].

[12] based on assessment by the appropriately qualified and experienced specialists engaged to undertake and assess the monitoring program.

ID	Potential Impact Event	Inherent Risk Level	Design Control Measure(s)	Operational Management Measure(s)	Residual Risk Level	Outcome(s)	Outcome Measurement Criteria
5.3	Reduction in adjacent pastoralist viability due to increase in feral animals due to mining operations.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**		Prohibition on pets within the lease area. Trap and destroy feral species. Recreational hunting prohibited within the lease area.	Likelihood: Rare Consequence: Minor Risk: **LOW**	No introduction of new weeds, plant pathogens or pests (including feral animals), nor increase in abundance of feral animals in the lease area compared to adjoining pastoral areas.	Results of monitoring program show no increase in feral vertebrates, compared with local area background[13].
	AIR QUALITY						
6.1	Radon and uranium-bearing dust release increasing radiation doses to the environment or the public.	Likelihood: Rare Consequence: Minor Risk: **LOW**	Tank ventilation at appropriate height. Refer RWMP and RMP.	Radon and radon progeny monitoring and review. Regular maintenance of valves, process equipment etc including clean up of any minor seepage or spills that may occur within the plant bunded area and regular removal of any scale that may possibly include uranium. Refer RWMP and RMP.	Likelihood: Rare Consequence: Minor Risk: **LOW**	No adverse impacts to workers, public or the environment due to radon release, nor radiological aspects of seepages and spills.	Estimated radiation doses to the public (and workers) within applicable limits as defined under the Radiation Protection and Control (RPC) Act.
	HERITAGE						
7.1	Impacts on Aboriginal heritage as a result of mine activity.	Likelihood: Rare Consequence: Major Risk: **HIGH**		Maintain and improve the use of Aboriginal Heritage Clearance surveys. Protection of heritage sites in accordance with State and Commonwealth legislation (there are currently no listed heritage sites within the RL). Check flagged areas for disturbance.	Likelihood: Rare Consequence: Intermediate Risk: **LOW**	No disturbance to Aboriginal artefacts or sites of significance unless prior approval under the relevant legislation.	Demonstration that documented Aboriginal Heritage Clearance surveys of all operational areas. Audits show flagged areas are not disturbed.

[13] based on assessment by the appropriately qualified and experienced specialists engaged to undertake and assess the monitoring program.

ID	Potential Impact Event	Inherent Risk Level	Design Control Measure(s)	Operational Management Measure(s)	Residual Risk Level	Outcome(s)	Outcome Measurement Criteria
	THIRD PARTY ISSUES						
8.1	Damage to adjacent public or private property and infrastructure, including that caused by fire, as a result of mine activity.	Likelihood: Unlikely Consequence: Minor Risk: **LOW**	Separation of pastoral, touristic and mine traffic where possible Installation of gates in fence lines. Fire fighting equipment. Roads/tracks act as fire breaks.	Fencing maintenance or replacement on a new, agreed alignment. Maintenance of gates. Obtain authorisation for any necessary changes to third-party property Repair of any accidental damage to third party property Fire-fighting exercises undertaken. Design control measures to be implemented should fuel loads become significant.	Likelihood: Rare Consequence: Minor Risk: **LOW**	No unauthorised damage to adjacent public or private property and infrastructure, including that caused by fire, as a result of mine activity	Any fires caused by mining operations are controlled within the ML boundary. Any accidental damage to infrastructure is made good as soon as practicable.

6.4 Soil Aspects

6.4.1 Context and Stakeholder Views - Soil

The nature of ISR mining requires some disturbance and in some cases removal and stockpiling of soil. It is not the disturbance of soil*, per se*, that could cause environmental impacts at Beverley North; rather, it is the potential for soil disturbance to lead to other problems. Nevertheless, as the measures to avoid or minimise these effects are to do with soil stabilisation and the like, soil is considered an aspect with risks to be assessed and ameliorated.

The conservation of soil, in the context of its ability to support appropriate vegetation, is of importance to stakeholders in the area. Soil conservation is considered in pastoral leases, conservation interests including Vulkathunha-Gammon Ranges National Park and the private Arkaroola Wilderness Sanctuary and the Traditional Owners. It is of interest to DSD principally with respect to potential compromise of rehabilitation.

6.4.2 Potential Impacts - Soil

Mine operations may degrade soil or allow additional erosion that could affect infrastructure (e.g. road washouts), cause vegetation death by exacerbated dust deposition, or delay final revegetation of the site and the return to pastoral or conservation use, e.g. by compaction or other degradation including spills of solution, fuel or chemicals.

The potential impact events considered in Table 6-6 are:

1.1. Chemical and radiological contamination[14] of soil and watercourse sediments that would prevent its return to pre-mining[15] use arising from;

   a. Seepage from water management bunds through construction defects, wear and tear and accidental damage

   b. Bund or tank overflows of mining solutions due to high rainfall events or control systems failure

   c. Escape of mining solutions due to breakages of piping from poor welds, vehicle damage or pipe defects.

1.2. Spillage of hazardous substances during transport, storage and handling resulting in contamination of soil that would prevent its return to pastoral use.

1.3. Soil disturbance due to excessive off-road vehicle movement which may compromise rehabilitation for later pastoral use resulting from compaction of soil or exacerbated erosion.

1.4. Spillage of resin during transport, storage and handling resulting in contamination of soil that would prevent its return to pastoral use.

Potential Impact Event 1.1 has three parts - parts ‘a’ and ‘b’ apply to bund and tank water management while part ‘c’ is mainly relevant across the mine site.

6.4.3 Control and Management Strategies - Soil

The management strategies to minimise the risks of soil degradation and erosion have been used and progressively reviewed and improved at Beverley since 2000. These strategies will be applied at Beverley North. Those most directly related to the identified potential impact events are given in Table 6-6. A fuller list is given below, and reference should also be made to the

[14] Chemical and radiological contamination are intrinsically linked and radiological is the primary indicator.

[15] Heathgate would prefer ‘agreed future land use’, to cover the possibility of a different land use being agreed by the relevant parties and accepted by DSD, but pre-mining use is used in this document to match the lease conditions.

RWMP, which details controls and management strategies related to radiological impacts that will apply at Beverley North:

Design Measures

- Pressure testing of pipework prior to commissioning
- Wellhead drip trays
- Bunds around plant and operational mining areas
- Protection of piping from traffic in key areas
- Storage of hazardous materials and fuel in bunded areas or self-bunded tanks
- Provision of stabilised tracks or roads for areas with frequent traffic
- Provision of fencing in key areas to keep vehicles on tracks
- Stripping of soil and gibber from processing plant and similar areas is stockpiled for later re spreading
- Creation of soil stockpiles generally less than 2 m high
- Surface running of trunklines, lateral lines and spider lines (i.e. not buried).

Management Measures

- Continual checking of wellfields by Wellfield Operators and maintenance personnel
- Burial of soils that are radiologically affected above the operational contamination criteria according to the RWMP
- Repair of leaks in bunds and tanks
- Continuous pressure monitoring of trunklines
- Continuous flow monitoring of wellhouses
- Monitoring of drip trays
- Undertaking of routine inspection of tanks and equipment used to store and transfer chemicals and process materials - any deficiency in the integrity of any equipment discovered by the inspection is brought to the attention of the Senior Site Supervisor for appropriate corrective action
- Implementation and regular updating of standard operating procedures for handling of chemicals
- Implementation and regular updating of spill and emergency response procedures
- Removal of fuel-affected soil for land farming and later disposal (if required)
- Remediation of acid or alkali affected soils, if required
- Regular training of emergency response personnel
- Education of all site employees and contractors on the importance of remaining on existing tracks

- Personnel driving on existing tracks, unless permitted otherwise via Environmental Clearance Permit
- Additional fencing in areas with repeated unauthorised off-road tracks
- Progressive closure and rehabilitation of obsolete formed tracks and unauthorised off-road tracks
- Ripping of compacted areas and replacement of stockpiled soil when available
- Issuing of Environmental Clearance Permits prior to any planned disturbance and documenting any expected disturbance
- Actively managing activities to minimise disturbance areas
- Measuring actual disturbance at completion of planned activity
- Rehabilitation of disturbed areas post closure for suitability for later pastoral use
- Maintenance of stabilised tracks for areas with frequent traffic to reduce potential erosion, runoff and sedimentation issues
- Provision of regular stormwater turn-outs along roadways to reduce water velocities
- Use of stone (gibber) or environmental matting cover to protect cut slopes from erosion during major rainfall events
- Restriction of down slope movement of soil from bared ground by stabilising soil surfaces
- Establishment of silt fences or similar management tools to minimise the amounts of sediment entering creeks
- Installation processing plant and wellhouses above the known 1 in 100 year ARI flood level to protect from possible flood damage
- Visual assessment of infrastructure as part of routine maintenance and following all major rainfall events of greater than 1-in-10 year ARI
- Protection for piping that crosses creeks where flood damage is credible
- Provision of wellfield and trunkline shut down procedures for significant rainfall events
- Provision of a no reversing (without a spotter) rule in wellfields areas to avoid damage to wellfield infrastructure
- Appropriate bunding of chemicals storage and processing areas to contain potential spills
- Removal of hazardous material-affected soil for burial, neutralisation or dilution.

6.4.4 Likelihood and Severity of Consequence, Risk and Risk Acceptance - Soil

The inherent risks for soil aspect 1.1 were **moderate**, whilst those for 1.2 to 1.4 were **low**. However, with the design and operational measures (based on those in use at Beverley in 2010), all residual risks were reduced to **low**, which are considered acceptable.

6.4.5 Specific Outcome - Soil

The specific outcome to be achieved for soil is that:

- Soil affected by mining activities is suitable for a return to pre-mining use.

6.4.6 Outcome Measurement Criteria – Soil

- All sites subject to solution spills meet the radiological criteria as defined in the RWMP
- Spills of hazardous materials are assessed as soon as practicable[16] and if so determined cleaned up;
    - Diesel spills to site-specific criteria to be established using NEPM Risk Assessment methodology as recommended by EPA
    - Acid and Alkali: spill sites returned to within local background range of pH
- Off-road vehicle movements not subject to Heathgate's Environmental Clearance Permit (ECP) system are investigated, reported and one of the following undertaken;
    - fenced off to prevent re-use and rehabilitated, or
    - converted to an authorised road subject to SEB.

6.4.7 Leading Indicator Criteria – Soil

Leading indicator criteria in relation to the risks are:

- Water levels in bunds and sumps are checked at least weekly and after >10 mm of rainfall in a day and maintained at least 0.20 m below lowest level of rim
- Any leaks detected by automatic systems or visual observation are logged as events and rectified
- Number and nature of spills and cleanups and time taken to complete
- Number of non-compliant ECPs involving off-road incidents.

6.4.8 Company Compliance Monitoring Plan - Soil

Table 6-7 gives the soil monitoring program directly related to soil outcome criteria (even though they may not be soil measurements). Soil sampling locations are given in Figure 3-28. If mining later extends to the southern part of the project area, additional sites will be established.

Ecosystem Function Analysis (EFA) monitoring, much of which is related to soil but includes additional vegetation measurements, will also be applied to Beverley North.

Table 6-7 Company Compliance Monitoring Plan – Soil

Location	Method	Parameter	Frequency
Bunded areas of Beverley North satellite plants	Manual with electronic alarms	Water Level	Weekly manual, continual electronic
Site-wide	Manual area and affected depth or thickness measurements of spills of hazardous substances	Spill dimensions, diesel concentration (if not all removed)	When required
Site-wide	Surface sediment grab up and downstream of local creeks	Chemical parameters including radionuclides	Following rainfall events of >10 year ARI or at least once per year

[16] Assessment will be risk-based and specify the timeframe for remediation (if remediation is required).

6.5 Vegetation Aspects

6.5.1 Context and Stakeholder Views – Vegetation

The nature of an ISR mine requires some disturbance and removal of vegetation. The vegetation associations affected are widespread in the area and the proportion of vegetation removal is very small compared to the surrounding area, such that no species or vegetation associations are threatened by the Beverley North operations.

The conservation of vegetation and its diversity is of importance to stakeholders in the area. Vegetation conservation is considered in pastoral leases (fodder, shelter, soil conservation) and is intrinsic to the State Government's Native Vegetation Council (NCV) and Department of Environment and Heritage (DEH) and to local conservation interests including Vulkathunha-Gammon Ranges National Park and the private Arkaroola Wilderness Sanctuary and the Traditional Owners. It is of interest to DSD, principally for rehabilitation reasons and the Commonwealth, with respect to the protection of rare or endangered species and biodiversity conservation.

Although vegetation removal at the Beverley North Mine will be small by mining standards, due to the arid climate the establishment and growth of native vegetation after clearing are slow, so it is important to minimise the removal of vegetation. This is the aim of the management strategies described below.

A Native Vegetation Management Plan has been prepared to determine the Significant Environmental Benefit (SEB) ratio for the Beverley North wellfields and infrastructure development areas, and this is attached at Appendix C.

6.5.2 Potential Impacts - Vegetation

Disturbance and clearing of vegetation closely mirrors that of soil described above. The proportion of vegetation removal is very small compared to the surrounding area, such that no species or vegetation associations are threatened by the Beverley North operations. However, locally the removal or degradation of vegetation has follow-on effects by the local temporary reduction in habitat for fauna and can exacerbate erosion discussed above.

The potential impacts considered in Table 6-6 are:

2.1 Reduction in regional native vegetation species density and diversity due to mining operations
2.2 Loss of local native vegetation (habitat) due to clearance for mining operations
2.3 Introduction of new or increase in abundance of existing weeds and pests (feral animals)[17]
2.4 Loss of local native vegetation (habitat) due to mining-related fires.

6.5.3 Control and Management Strategies - Vegetation

The management strategies to minimise the risks to vegetation have been used and progressively reviewed and improved at Beverley since 2000. These strategies will be applied at Beverley North. Those most directly related to the identified potential impact events are given in Table 6-6. A fuller list is given below:

Design Measures

- Minimisation of perennial vegetation clearing by design (wellfield and projects planning)
- Fencing of patches of vegetation and soaks to protect seed stock and habitat

[17] Feral animals are included here to match condition 5 of the Second Schedule of the lease conditions. They influence vegetation outcomes. Weeds are defined in this condition as any invasive plant that threatens native vegetation in the local area or any species recognised as invasive in South Australia

- Running pipelines on the surface
- Planning of wellfield and projects
- Provision of fire-fighting equipment
- Use of road/tracks as fire breaks

Management Measures

- Identification and protection (fencing off), prior to planned vegetation clearance, of any vulnerable vegetation via the Environmental Clearance Permit system
- Enforcement of Environmental Clearance Permit system
- Examination of actual vegetation clearance at completion of activity
- Establishment of approved SEB compensation
- Use of EFA on progressive rehabilitation areas to refine techniques
- Undertaking annual flora and fauna surveys to identify trends
- Commissioning periodic aerial photography – comparisons with previous photographs to assess site wide vegetation cover changes
- Control of weed and feral animal
- Training of personnel to identify and report any alien species
- Training of all site employees and contractors on the importance of remaining on existing tracks
- Requiring personnel to drive only on existing tracks, unless permitted otherwise via Environmental Clearance Permit
- Providing additional fencing in areas with repeated unauthorised off-road tracks
- Progressive closure and rehabilitation of obsolete formed tracks and unauthorised off-road tracks
- Progressive and final revegetation
- Requiring no pets on Mine Lease
- Undertaking fire-fighting exercises
- Implementation of additional control measures to be implemented should fuel loads become significant.

6.5.4 Likelihood and Severity of Consequence, Risk and Risk Acceptance - Vegetation

The inherent risk for vegetation aspects 2.1, 2.3 and 2.4 was **low**, and for 2.2 was **high**. However, with the design and operational measures (which are based on those in use at Beverley in 2010), all residual risks were reduced to **low**, which are considered acceptable.

6.5.5 Specific Outcomes - Vegetation

All of the soil protection management strategies also apply to vegetation. Additional specific outcomes to be achieved by the combined soil and vegetation management measures are:

- No loss of abundance or diversity on or off the Beverley North ML to native vegetation through clearance or any other damage unless prior approval under the relevant legislation is obtained
- No introduction of new weeds, plant pathogens or pests (including feral animals), nor increase in abundance of existing weed or pest species in the lease area compared to adjoining pastoral areas.
- No loss of abundance or diversity on or off the Beverley North ML to native vegetation through fire damage unless prior approval under the relevant legislation is obtained

6.5.6 Outcome Measurement Criteria – Vegetation

The specific outcomes to be achieved for vegetation at Beverley North are:

- Demonstrate that all clearing is undertaken within the maximum area approved in the Native Vegetation Management Plan.
- Flora and fauna surveys demonstrate no new weeds or feral animals (due to mining activities), nor statistically significant[18] increase in abundance of existing weed or pest species in the lease area, compared to adjoining pastoral areas
- Any fires caused by mining operations are controlled within the ML boundary.

Control sites are chosen by appropriately qualified and experienced specialists. In general terms:

- Control sites are planned approximately 5 km away from planned disturbance areas
- Confirmation is received from Beverley staff of the absence of known mineralisation.

6.5.7 Leading Indicator Criteria – Vegetation

Leading indicator criteria for vegetation are:

- Progressive SEB accounting in the ACR.
- Trends noted in annual vegetation and fauna surveys.

6.5.8 Company Compliance Monitoring Plan - Vegetation

General Vegetation Monitoring

The vegetation monitoring program at Beverley has been developed using the years of experience at the site, and it will be extended to include Beverley North. The program set out below (Table 6-8) is largely based on that established in the Beverley PEPR, taking into account the risk assessment and criteria developed above.

EFA monitoring includes a vegetation component that contributes to the specialised vegetation monitoring described in Table 6-8. The locations of Beverley North vegetation survey quadrats are shown in Figure 6-1.

Reporting of the surveys will include the appropriate statistical comparison of mining-affected and control areas with respect to no statistically significant increase in abundance of existing weed or pest species in the ML area compared to adjoining pastoral areas. Other measures are more appropriately assessed qualitatively by the appropriately qualified and experienced specialists undertaking and interpreting the results of the annual vegetation surveys.

The sites shown in Figure 6-1 were located for general mining on the Beverley North ML.

Table 6-8 Company Compliance Monitoring Plan - Vegetation

[18] Where such statistical measures are valid. Qualitative assessment by independent specialists is considered more appropriate in some cases (see text this section).

Location	Method	Parameter	Frequency
ML and Local Area	Survey 5 m x 2 m vegetation quadrats	Species richness and total cover for all plant species and perennials only	Annually
ML	Opportunistic watch –look for and record any alien species.	Number of species and their density	Following rainfall and during Annual Survey
	Aerial photograph – comparisons with previous photographs to assess site wide vegetation cover changes	Vegetation cover	Biannually (odd-numbered years)
	Prior to any planned disturbance issue Environmental Clearance Permit and document expected disturbance. Measure actual disturbance at completion of year by GPS.	Percent Actual vs Expected Disturbance Area	Annual (December)
	Map extent of any fire should one occur	Area burned and distance from boundary	If required

Significant Environmental Benefit

As noted in Section 6.5.1, a plan has been prepared to determine the SEB ratio for the Beverley North wellfields and infrastructure development areas, and this is attached at Appendix C.

In summary the SEB concept for Beverley includes ample excess area to cover the Beverley North Mine, and progressive accounting of SEB for both projects will be provided in their respective ACR. A detailed formal proposal to establish the Beverley SEB compensation area on the Arkaroola Wilderness Sanctuary was provided to DSD[19] in September 2010. Modifications were required, and formal acceptance anticipated prior to 31 December 2010.

The SEB liable area for Beverley North Mine operations is approximately 32 hectares. As set out in Appendix C, using a multiplier of four to account for the state of the native vegetation being cleared and a discount of 50% as all of the area will be rehabilitated in a reasonable timeframe, the SEB compensation due is 64 ha (monetary equivalent $25,770). At the end of 2009 the SEB compensation area due to Beverley mine was 152 ha compared to an available 520 ha, with a further 20 ha of compensation area expected to be required by the end of 2010 (Heathgate 2010c).

In the event the SEB project is not accepted, Heathgate will endeavor to establish an equivalent project in the Northern Flinders/Lake Frome area within a timeframe acceptable to DSD. As a final option the appropriate monetary amount would be confirmed and paid into the Native Vegetation Fund.

Ecosystem Function Analysis

In 2006 Heathgate introduced an integrated monitoring technique (EFA) in a response to the CSIRO review (CSIRO 2004), the recommendations of which were required to be implemented by the State government (EPA 2007). This technique (Tongway and Hindley 2004) is primarily a tool for examining surface rehabilitation at the mine, both of progressive and final rehabilitation.

As an integrated technique it includes both soil and vegetation measurements that contribute to the operational monitoring that is required to measure soil and vegetation leading indicators and outcome measurement criteria. In recent decades rangelands monitoring had been based on plant cover and biomass, which are time-consuming and subject to high variation between observers.

[19] Then PIRSA

This noisy plant cover and biomass data have made interpretation difficult and prediction almost impossible. The location of monitoring sites often ignores biophysical landscape function.

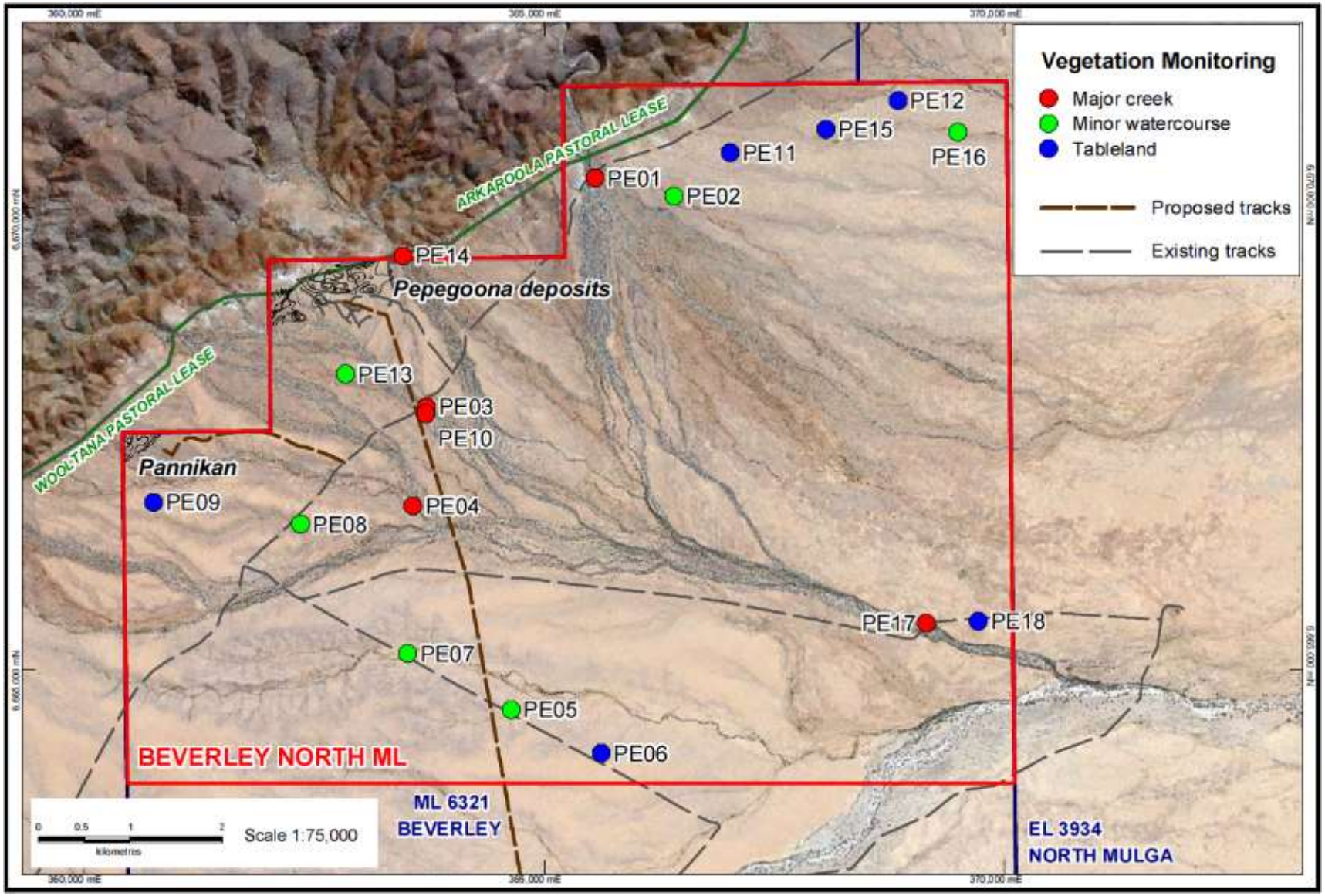

Figure 6-1 Vegetation Quadrat Monitoring Sites

CSIRO was sponsored by the mining industry to develop a monitoring technique that not only provides a quantitative analysis of a number of indicators to assess the functional status of landscapes but also provides vectors to indicate rehabilitation success (Tongway and Hindley, 1999).

The indices measured as part of EFA are:

- Landscape integrity reflecting overall resource "economy"
- Soil surface considerations, comprising
    - Stability (resistance to erosion)
    - Infiltration (capacity to absorb rain and run-off water)
    - Nutrient cycling (organic matter decomposition and cycling)
- Vegetation dynamics
- Habitat complexity (a measure of development of mammalian habitat niches).

Thus, this system of EFA not only provides a quantitative analysis of the landscape but also provides vectors which indicate whether the landscape is moving to sustainability (Tongway and Hindley 2003). This system of monitoring is particularly useful for assessing the rehabilitation of disturbed areas, but as stated above, contributes to operational monitoring and hence is introduced here.

The vegetation aspects of EFA complement the specialised vegetation monitoring described above. The full EFA monitoring program is set out in Table 6-9. The detailed locations will be finalised in consultation with the specialist consultant during the first survey.

Table 6-9 Company Supplementary Monitoring Plan – Ecosystem Function Analysis

Location	Method	Parameter	Frequency
Ecosystem Function Analysis (EFA) transects at both analogue (control, near PE13-see Figure 6-1) and a disturbed area (former drill pit) at Pepegoona	Landscape Function Analysis: Description and organisation of landscape units (e.g. bare ground, stony surfaces, litter, grass, 'crabhole' depressions).	Proportional cover and quality of resource-accumulating 'patch' zones.	Annually
	Landscape Function Analysis: Soil surface assessment of transect units (rain splash protection, perennial vegetation cover, litter, cryptogram cover, crust brokenness, soil erosion, deposited materials, surface roughness, surface nature, slake test and texture).	Indices for stability, infiltration and nutrient cycling.	Annually
	Lower storey plant assessment, distinguishing between annual and perennial species and identifying contribution of alien species.	Plant cover, density and diversity.	Annually
	Upper storey plant assessment, for vegetation exceeding 2 m in height.	Plant cover, density and diversity.	Annually

6.6 Surface Water Aspects

6.6.1 Context and Stakeholder Views – Surface Water

The nature of mining at Beverley North requires very little disturbance to the hydrology of the area, as there are no creek diversions or significant catchment area reductions or alterations required.

However, roads, tracks and pipelines do cross creeks of various sizes and flow potential and the protection of these creeks and their associated ecology needs to be considered. These have parallels to soil protection discussed above.

The protection of surface water is of importance to stakeholders in the area. Surface water dams (and to a lesser extent temporary water holes in creek beds) are used by pastoralists as (often intermittent) stock water supplies. Protection of surface water and associated ecosystems is intrinsic to conservation interests including Vulkathunha-Gammon Ranges National Park, Lake Frome Regional Reserve, the private Arkaroola Wilderness Sanctuary and the Traditional Owners. Surface water also helps recharge the surficial aquifer (Willawortina Formation) which is used in some areas for stock water.

The ANZECC/ARMCANZ guidelines (2000) give the following advice:

> *No adverse effects to stock are expected if the concentration of sulphate (SO_4) in drinking water does not exceed 1,000 mg/L. Adverse effects may occur at sulphate concentrations between 1,000 and 2,000 mg/L, especially in young or lactating animals or in dry, hot weather when water intake is high. These effects may be temporary and may cease once stock become accustomed to the water. Levels of sulphate greater than 2,000 mg/L may cause chronic or acute health problems in stock.*

With respect to salinity, the tolerance of different animals varies. Tolerances of the three possible stock types (beef cattle, sheep and horses) are reproduced below (Table 6-10).

Table 6-10 Tolerances of Livestock to Salinity (TDS mg/L)

Livestock Type	No adverse effects on animals expected	Animals may have initial reluctance to drink or there may be some scouring but stock should adapt without loss of production	Loss of production and a decline in animal condition and health would be expected. Stock may tolerate these levels for short periods if introduced gradually
Beef Cattle	0–4,000	4,000–5,000	5,000–10,000
Sheep	0–4,000	4,000–10,000	10,000–13,000
Horses	0–4,000	4,000–6,000	6,000–7,000

(ANZECC/ARMCANZ 2000)

Concentrations of uranium less than 0.2 mg/L in livestock drinking water are considered unlikely to be harmful to animal health.

No specific guidelines are given for pH, which is low in mining solutions and loaded resin. However, as there would be both neutralisation and very significant dilution from natural runoff should solutions enter a flowing creek, pH is not a credible risk to downstream water bodies.

The locations of surface water (stock) dams on and near the Beverley North project area are shown in Figure 6-2. The nearest stock dam downstream of the satellite plant and wellfields at Pepegoona is a full 10 km away on EL 3934 (Dam 1), and is on the opposite side of Four Mile Creek after Pepegoona Creek has joined it, out of the main channel. The 'Bank' dam on the ML is in a different catchment to currently proposed mining. It is not proposed to routinely monitor these dams.

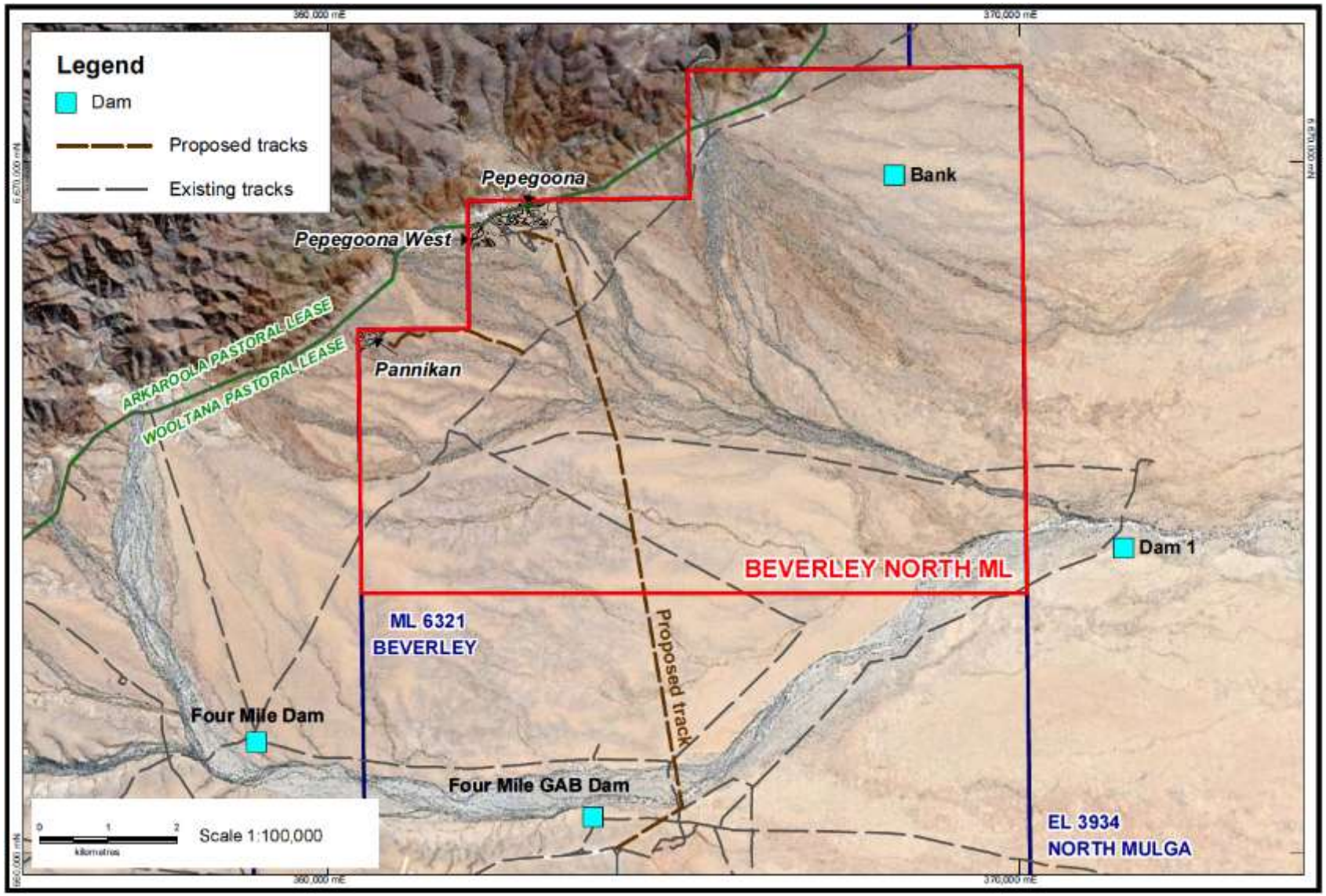

Figure 6-2 Location of Surface Water Dams

6.6.2 Potential Impacts – Surface Water

The potential impact considered in Table 6-6 is:

3.1 Watercourse contamination (including radiological) arising from release of mining solution due to flood damage to pipes, bunds and infrastructure, or from high rainfall causing overflow of bunds

3.2 Watercourse contamination (including radiological) arising during transport of resin or chemicals, resulting from an accident and release of materials into a creek.

Note that this concerns impacts to surface water itself. The indirect impact on creek sediments that might arise by contact with contaminated water is addressed under Soil Aspects.

6.6.3 Control and Management Strategies – Surface Water

The management strategies to minimise the risks to surface water have been used and progressively reviewed and improved at Beverley since 2000. These strategies will be applied at Beverley North. Those most directly related to the identified potential impact events are given in Table 6-6. A fuller list is given below:

Design Measures

- Engineered creek crossings where high opportunity for flood damage is present
- Wellhouses and processing plant located on high ground above 1-in-100 year ARI flood areas
- Use of 1-in-100 year ARI flood level map in design of pipe routes and flood protection to minimise creek crossings
- Minimising production well installation in flood-prone areas.

Management Measures

- Visual Inspection around site and review of Flood Management Plan as appropriate
- Visual assessment of infrastructure as part of routine maintenance and following all major rainfall events of greater than 1-in-10 year ARI
- Sufficient freeboard in bunded areas to ensure that a high rainfall event does not result in over-topping
- No reversing in wellfields rule to avoid damage to wellfield infrastructure
- Mining would be closed down when significant rain is imminent, and field staff would return to Beverley. Also access tracks are closed at the onset of significant rain
- There are no truck movements of resin, chemicals or bleed streams during significant rainfall events.
- Compliance with the RWMP.

6.6.4 Likelihood and Severity of Consequence, Risk and Risk Acceptance – Surface Water

The inherent risk for surface water aspect 3.1 was **low**. With the design and operational measures (which are based on those in use at Beverley in 2010), the residual likelihood was reduced from **unlikely** to **rare**, and the risk was **low**, which is considered acceptable.

6.6.5 Specific Outcomes – Surface Water

The specific outcome to be achieved by the above management measures is:

- No compromise of pastoral use of downstream surface water bodies.

6.6.6 Outcome Measurement Criterion – Surface Water

Water quality in downstream water storages (within 5 km of an individual mining/spill site, or the closest accessible significant temporary creek waterhole if there is no water storage within 5 km), will be measured as soon as it is safe to do so following surface water flow, if there has been any immediately reportable release[20] of mining solution or any unremediated spill of resin or chemicals[21].

Applicable ANZECC/ARMCANZ stock water guidelines are:

- salinity (EC) – 4,000 mg/L (6,000 uS/cm)
- sulphate (SO_4)– 1,000 mg/L
- uranium – 0.2 mg/L.

Note that a mass balance calculation using estimated spill volume and chemical quality and estimated stream flow will be undertaken, or another investigation acceptable to the Chief Inspector of Mines, to ascertain if any compromise is plausibly due to the mine operations.

6.6.7 Leading Indicator Criteria – Surface Water

No specific leading indicator criteria apply to surface water.

6.6.8 Company Compliance Monitoring Plan – Surface Water

The surface water monitoring plan is set out in Table 6-11 below.

Table 6-11 Company Compliance Monitoring Plan – Surface Water

Locations	Method	Parameters	Frequency
First significant temporary waterhole or water storage in a creekline affected by a spill within 5 km of the spill	Surface water grab sample (mass balance calculation to be undertaken after analysis if required)	pH, EC, SO_4, U	As soon it is possible to safely drive a vehicle to the site after a mining solution or resin spill that requires such sampling

Surface water sampling - discussion

The locations of surface water (stock) dams on and near the Beverley North project area are shown in Figure 6-2. The nearest stock dam downstream of the satellite plant and wellfields as currently defined, Dam 1, is a full 10 km away on EL 3934, and is on the opposite side of Four Mile Creek after Pepegoona Creek has joined it, out of the main channel. It is not proposed to routinely monitor this dam. However, if there were a spill of resin or chemicals on the road between Beverley and the Beverley North satellite plant, this dam might be the relevant monitoring point.

Should a release of mining solution, chemicals or resin occur requiring surface water sampling, as per Section 6.6.6, as soon as it is safe to do so the creeklines downstream of the mine or other spill site will be examined for temporary water holes unless, in the possible case of chemical or resin spill, a stock dam within 5 km). If a stock dam is relevant or if a significant temporary waterhole is found within 5 km, that dam or closest significant temporary waterhole (as relevant) would be sampled for the following minimum parameters:

[20] Under the Bachmann criteria, Bachmann (2003).

[21] i.e. if a spill has been assessed and remediated prior to creek water flow, sampling of surface water is not required. If the spill occurred during creek flow or has not been cleaned up prior to creek flow, surface water sampling is required as there may have been contamination washed into a creek.

- salinity (via its surrogate Electrical Conductivity)
- pH
- sulphate
- uranium (detection limit 0.05 mg/L or better).

Note that other than salinity, these are the same parameters as those included for groundwater ECLs.

Surface water contingency plan

In the remote possibility that the water quality in the waterhole or pastoral dam is compromised due to mining, the waterhole or pastoral dam will be fenced off. A plan to treat or dispose of water above the trigger values will be agreed to the satisfaction of the Director of Mines before it is implemented.

6.7 Hydrogeological Aspects

6.7.1 Context and Stakeholder Views - Hydrogeology

The protection of groundwater is of importance to stakeholders in the area. Groundwater is used by pastoralists as stock and sometimes domestic water supplies and some for road construction by various groups including Heathgate. Protection of groundwater is intrinsic to DEWNR, the EPA, the Traditional Owners, and some Non Government Organisations (NGOs). Surface water also helps recharge the surficial aquifer (e.g. Willawortina Formation) which is used in some areas for stock water.

Due to its naturally radioactive nature (specifically, the high fluoride and often uranium and radium-226 concentrations) there are no potential beneficial uses of the Eyre Formation aquifer at the Beverley North ML area other than for mining.

It is noted that there would be no change to GAB extraction rates arising from the Beverley North Mine, and no potential impact of the Beverley North Mine (based on currently defined wellfields) on the GAB as it is not present at the current mining area (refer Section 3.10). Should the GAB be found in areas not yet drilled, the presence of the very thick Bulldog Shale aquitard would render the risks negligible, as was established at Beverley (Heathgate 2007). Thus the risks and control and monitoring measures will be unchanged from those addressed in the Beverley PEPR.

6.7.2 Potential Impacts – Hydrogeology

Potential impacts considered in Table 6-6 are:

4.1 Groundwater contamination of Eyre or Namba Formations outside the ML preventing stock watering

4.2 Contamination (including radiological) of the overlying aquifer units overlying the mined areas arising from mining activities, where that aquifer exists[22]

4.3 Contamination (including radiological) of the underlying aquifer units underlying the mined areas arising from mining activities - at the Pepegoona and Pannikan sites the underlying aquifer is Fractured Rock.

[22] For Pepegoona and Pannikan the Willawortina Formation is dry; elsewhere on the Beverley North ML it is known to contain groundwater that is or has been used for stock.

6.7.3 Control and Management Strategies – Hydrogeology

The management strategies to minimise the risks associated with groundwater have been used and progressively reviewed and improved at Beverley since operations commenced. These strategies will be applied to the Beverley North Mine. No historic excursions of mining solution or injected waste water into the official monitor well network have been recorded.

The management strategies listed in Table 6-6 are summarised as follows:

Design Measures

- Well construction to meet well permit conditions
- Exploration holes cement grouted
- Production and monitor wells cement grouted and integrity tested
- Wells that do not pass integrity tests are cemented up and abandoned or repaired and retested
- Monitor wells installed at appropriate depths, distances and spacing.
- Prior to lixiviant injection, the degree of connectivity between all monitor wells (lateral, overlying, and underlying) and the production wellfield will be established with a pumping test. This pumping test will be in addition to any pumping test already conducted.

The required outcome of this pumping test would be for connection to be demonstrated between lateral monitor wells and their related target zone of the wellfield, and no significant connection shown to overlying and underlying monitor wells. If connectivity of a lateral monitor well has not been clearly demonstrated, that monitor well will be re-worked or replaced until the above connectivity conditions have been met. In addition to the demonstration of connectivity of a monitor well with its target zone, the initial water chemistry must be demonstrated to be consistent with the baseline water chemistry of nearby monitor wells in the network.

If there appears to be a connection with any under or overlying monitor well, evidence will be established that demonstrates:

1. that this connection is not significant with respect to mining; and
2. how mining can be conducted safely.

Records of these pump tests will be provided to the regulators before lixiviant injection begins.

Thus lixiviant injection cannot commence until a full monitor well network is in place, in which each monitor well has been specifically tested as described above and demonstrated to pass these connectivity conditions.

Management Measures

- Monitor underlying and overlying (if present) aquifer water levels and quality
- Monitor target aquifer water levels and quality
- Adjust injection and extraction balances in mined areas to maintain control of mining solutions
- Undertake further integrity testing of any production well or monitoring well that has been modified or undergone rehabilitation which in either instance involved the use of a drilling rig or other action that may have compromised the integrity of the well
- Undertake further integrity testing of any production well at every three years of operation, or prior to re-use if it is more than three years since the last test
- Natural attenuation is acknowledged as a potential appropriate control measure for ISR mines to avoid impact on aquifer environmental values (Commonwealth of Australia 2010). Heathgate has undertaken studies into natural attenuation to demonstrate that this will occur

in the Pepegoona ore zone aquifer with some certainty and in an appropriate timeframe, and has committed to undertake a single pore volume groundwater sweep to enhance this natural attenuation. These studies will be further validated through monitoring during mine operation and after wellfield closure (see Section 7 - Closure and Rehabilitation).

6.7.4 Likelihood and Severity of Consequence, Risk and Risk Acceptance - Hydrogeology

The inherent risks for hydrogeology aspects 4.1 to 4.3 were all **low.**

The design and operational measures proposed (based on those in use at Beverley in 2010) reduce all residual likelihoods confirming the **low** risks which are considered acceptable.

6.7.5 Specific Outcomes – Hydrogeology

The specific outcomes to be achieved by the above management measures are:

- No compromise to the environmental values of the Eyre or Namba Formations aquifer outside the ML
- No compromise to the environmental values of the Willawortina aquifer.
- No compromise to the environmental values of the underlying aquifer(s)[23].

6.7.6 Outcome Measurement Criteria – Hydrogeology

The specific outcome measurement criteria to be achieved by the above management measures are:

- No migration of mining solution in the Eyre or Namba Formation aquifers outside the ML (except for areas where a Cross Boundary Agreement applies that has been accepted by the Director of Mines) as demonstrated by Excursion Control Limit (ECL) and EC monitoring and response.
- Compliance with the Eyre and Namba Formation outcome will be demonstrated by either no exceedence of ECLs at lateral monitor wells or by demonstration of compliance with the contingency measures described in Section 6.7.8.2
- Monitoring of ECL parameters and EC demonstrates no compromise of the environmental values of the Willawortina aquifers, should it be present and saturated, as a result of mining operations.
- Monitoring of ECL parameters and EC demonstrates no compromise of the environmental values of the underlying aquifer(s), as a result of mining operations.

6.7.7 Leading Indicator Criteria – Hydrogeology

Lead indicators that will provide early warning of the possible impending breach of outcome measurement criteria are:

- Overlying and underlying aquifers
    - Water levels and level trends in overlying monitoring wells (ECL parameters)
    - Water quality and quality trends in underlying aquifer monitoring wells (ECL parameters)

[23] At the Pepegoona and Pannikan deposits the underlying aquifer is the Fractured Rock Aquifer. The GAB is the underlying aquifer elsewhere. There is to be no compromise to the environmental values of the GAB from any Beverley North mining activities.

- Target aquifer
    - Water quality and quality trends in the mined aquifer monitoring and observation wells (ECL parameters).

Discussion – Excursion Control Levels and Parameters

Excursion Control Levels (ECLs) are agreed concentrations of selected water quality parameters that have emerged from operating experience as the best indicators of the influence of mining or disposal solution on natural groundwaters.

In accordance with the U.S. Nuclear Regulatory Commission's "Standard Review Plan for In Situ Leach Uranium Extraction License Applications" (NUREG1569), an excursion will be deemed to have occurred if any two excursion indicators in any monitor well exceed the respective ECLs. NUREG suggests that excursions must be detected long before mining solutions could seriously degrade the quality of ground-water outside the target area. Excursion Control Parameters (ECPs) should be:

- Strong indicators of the ISR process and are not significantly attenuated by geochemical reactions in the aquifers
- Chosen parameters should be easily analysed to allow timely data reporting
- Parameters that are found in significantly higher concentrations during in ISR operations than in the natural waters and
- Set high enough to avoid false positives (false alarms from natural fluctuations in water chemistry).

The ECPs are: pH; sulphate (SO4); and uranium (U).

The actual levels (as concentrations) apply for the Eyre Formation only. The Eyre Formation ECLs are pH 4.5, SO_4 2 g/L and U 1 mg/L, as referenced in the RWMP.

Discussion – Potential for Cumulative Effects

The Pepegoona and Pannikan deposits were the first identified in the Beverley North Project. As they are in the same formation as Four Mile East and other Beverley North mineralisation that may be mined in the future, there can be expected to be some further impact on the Eyre Formation in the district. There could be a potential for additive effects with respect to water quality in aquifers. Aquifer integrity, groundwater 'quantity' and surface-groundwater interaction are not at risk.

If mining at Four Mile East were to go ahead as well as Beverley North (initially at Pepegoona and Pannikan), there will be an incremental increase in Eyre Formation that is affected by mining solution until the full effects of enhanced natural attenuation are complete. However, Pepegoona is not on the flow path of groundwater that would migrate from Four Mile East, nor from Pannikan, although Pannikan is in the general 'up gradient' direction of Pepegoona (see Figure 3-19 for flow paths). Also, it is far enough that the migration of attenuating former mining solutions would not reach Pepegoona in any case.

Pannikan is possibly in the flow path from Four Mile East. However, it is also far enough that the migration of attenuating former mining solutions would not reach it.

If further mining areas in Beverley North were to be within the downgradient attenuation zone of Four Mile East or each other, then some of the attenuation capacity of the unmined aquifer next to and downgradient of a down-gradient deposit could be 'needed' to attenuate migrating former mining solutions from an up-gradient deposit. This would have the effect of increasing the downgradient area needed to finalise attenuation of former mining solutions at the down-gradient deposit, or increasing the downgradient area needed to finalise attenuation for the up-gradient deposit.

However, because the distance separation is sufficient (>5 km) and flow path is different, additional modelling to examine this possibility was not undertaken for the Beverley North project area as Pepegoona, Pannikan and Four Mile East can be considered unconnected operations.

6.7.8 Company Compliance Monitoring Plan – Hydrogeology

Hydrogeological studies have been undertaken over the mining area, with additional regional studies in the surrounds to understand the regional hydrogeological setting. The discussion below relates to monitoring at the Pepegoona deposit.

6.7.8.1 Beverley North Monitoring

A monitoring well network for the currently identified Pepegoona and Pannikan deposits has been established or planned that will monitor groundwater in all aquifers above, below, and adjacent to the target zone within the mined aquifer. The network comprises three types of well:

- Lateral Monitor Wells – These wells monitor the mining aquifer laterally adjacent to the target zone. In the case of the Pepegoona and Pannikan deposits, this is the Eyre Formation.
- Overlying Monitor Wells – These wells monitor the first permeable sand unit above the ore zone sands, if any aquifers are identified in that formation
- Underlying Monitor Wells – These wells monitor the underlying aquifer underlying the ore zone. In the case of the Pepegoona and Pannikan deposits, this is the Fractured Rock Aquifer.

Further, in cases where mining is close to lease boundaries and Lateral Monitor Wells are adjacent to lease boundaries, Observation Wells screened in the most appropriate part of the Eyre Formation will be installed between wellfields and Lateral Monitor Wells for 'early warning' of possible movement of mining solution towards the lease boundaries.

An overview of the Pepegoona and Pannikan deposits groundwater compliance monitoring plan is given in Table 6-12. It is set out in more detail, as will be initially undertaken, in Appendix D (excluding Observation Wells, which are a specific operational aspect). Note, however, that updates to the monitor and observation well networks will be given in each annual Beverley North Annual Compliance Report (ACR). It is the general plan given in Table 6-12 that sets out the requirements under the PEPR rather than Appendix D. So long as groundwater monitoring is undertaken according to Table 6-12 the requirements of this PEPR are fulfilled, as the individual wells that need to be monitored will vary from time to time depending on the status of wellfield construction and activity at the Beverley North mine, as has been the case at the Beverley Mine since the approval of its 2008 MARP[24].

[24] Now termed a PEPR

Table 6-12 Company Compliance Monitoring Plan – Groundwater

	Method	Parameters	Criteria	Frequency
Lateral Monitor Wells close to the ML Boundary	Wire-line Sonde Logging or pumped sampling and laboratory testing	Level, EC, pH, SO_4, U	ECLs	Monthly
Lateral Monitor Wells (others)	Wire-line Sonde Logging or pumped sampling and laboratory testing	Level, EC, pH, SO_4, U	ECLs	Quarterly
Overlying Monitor Wells	Pumped sampling and laboratory testing	Level, EC, pH, SO_4, U	ECLs	Monthly
Underlying Monitor Wells	Pumped sampling and laboratory testing	Level, EC, pH, SO_4, U	ECLs	Monthly
Observation Wells close to ML boundary	Wire-line Sonde Logging, pumped sampling and laboratory testing or down-hole water quality probes	Level, EC, pH, SO_4*, U*	n/a	Fortnightly

* U and SO_4 not included in down-hole measurements, if these are undertaken

A map showing the current distribution of monitor and observation wells as at December 2010 is given as Figure 6-3 and 6-4. A schematic showing the relationships between mining, monitoring and observation wells is given as Figure 6-5.

Any alterations to the monitoring network will be provided on a quarterly basis to the regulatory authorities and recorded in the ACR. These notifications will demonstrate that the appropriate spacing of monitor wells and replacement of obsolete monitor wells with suitable new monitor wells has been undertaken according to the logic given below.

Note that the groundwater monitoring program (excluding Observation Wells) is elaborated on in Appendix D as required by the South Australian regulators.

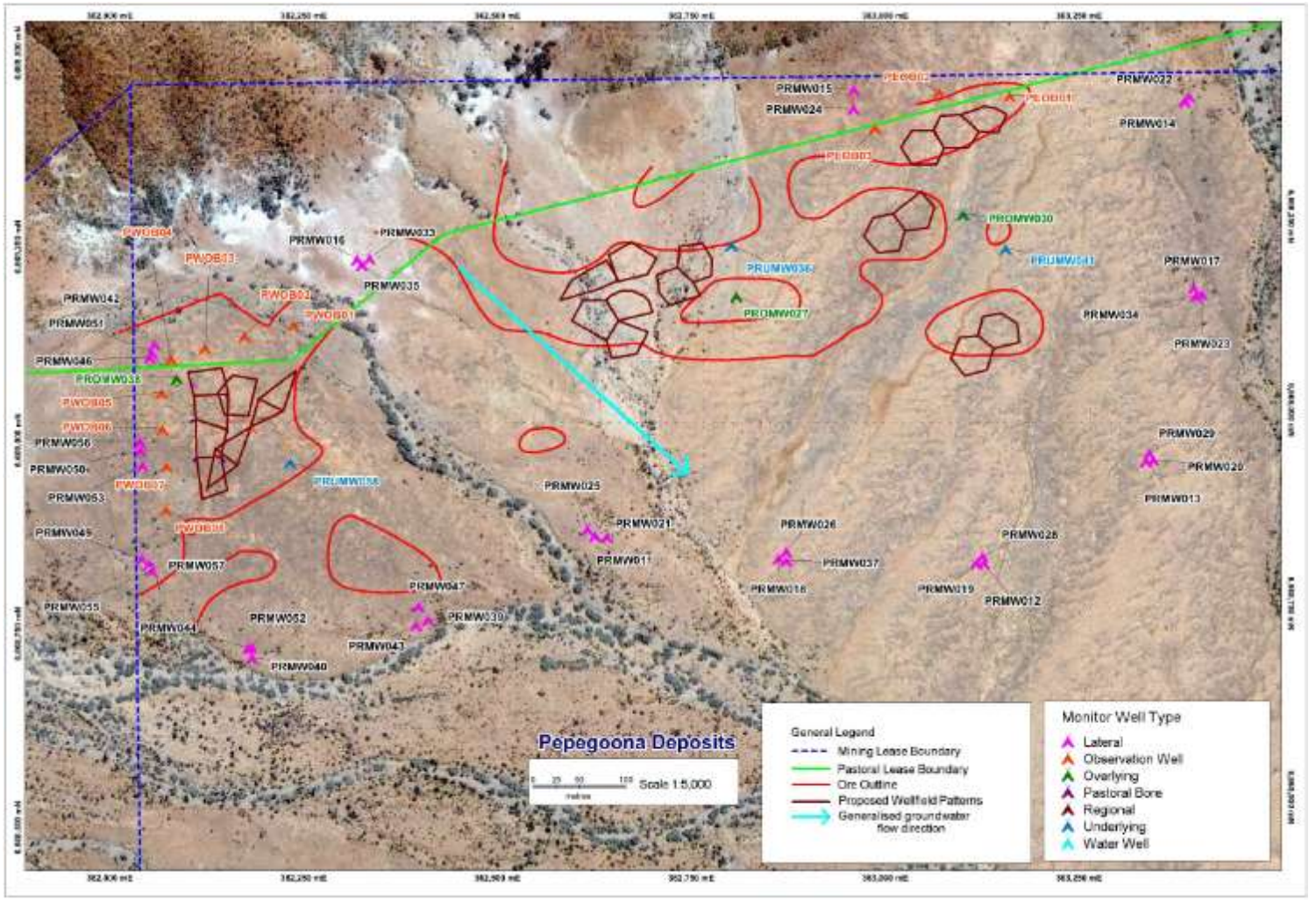

Figure 6-3 Beverley North Monitor Wells (Pepegoona) as at January 2011

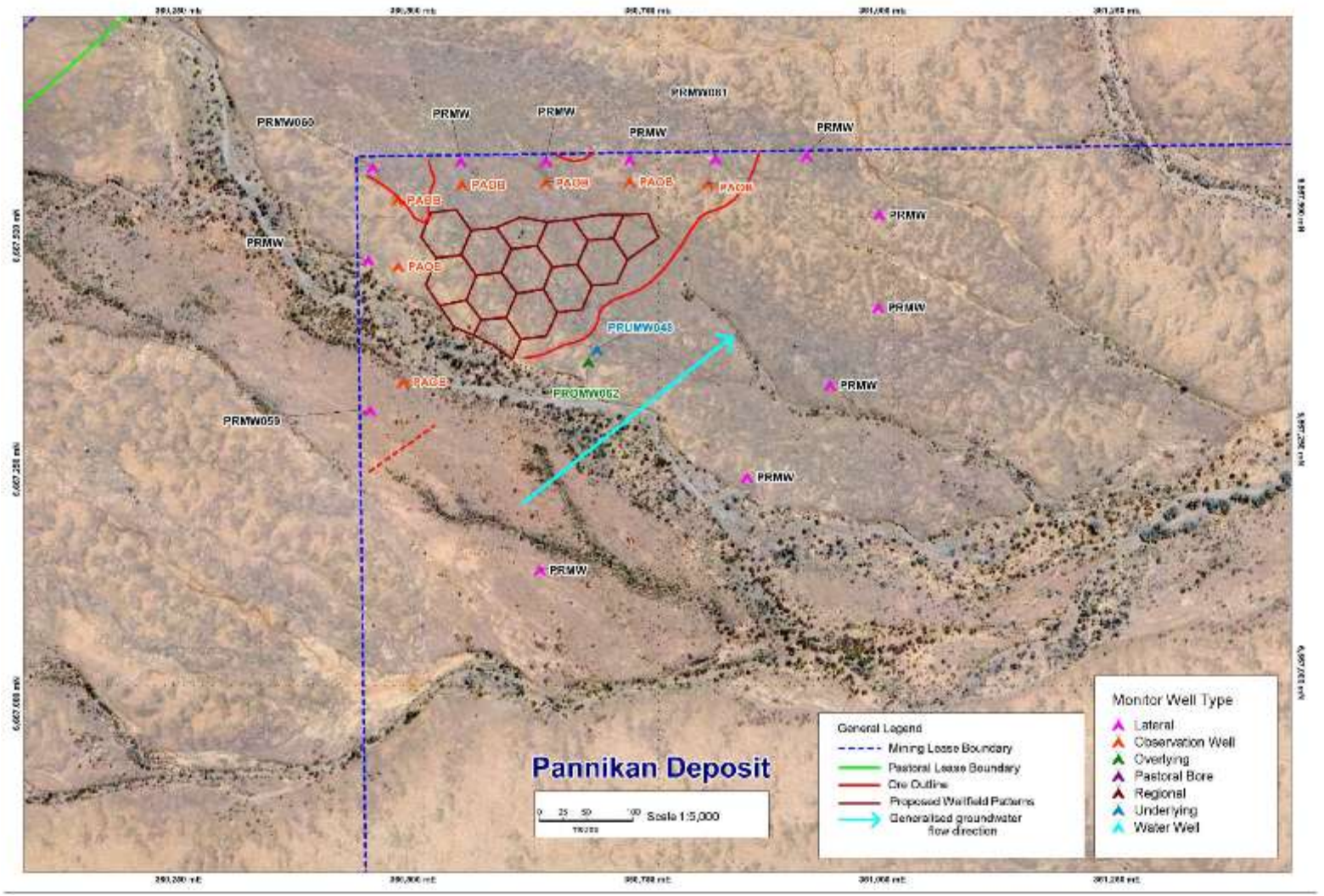

Figure 6-4 Beverley North Monitor Wells (Pannikan) as at January 2011

Notes: Wellfields will be within the network of monitor wells and are expected to be at the corners of the polygons shown. Final locations of some production, monitor and observation wells will be confirmed based on the results of further delineation and production drilling, and actual locations will be given in the ACR.

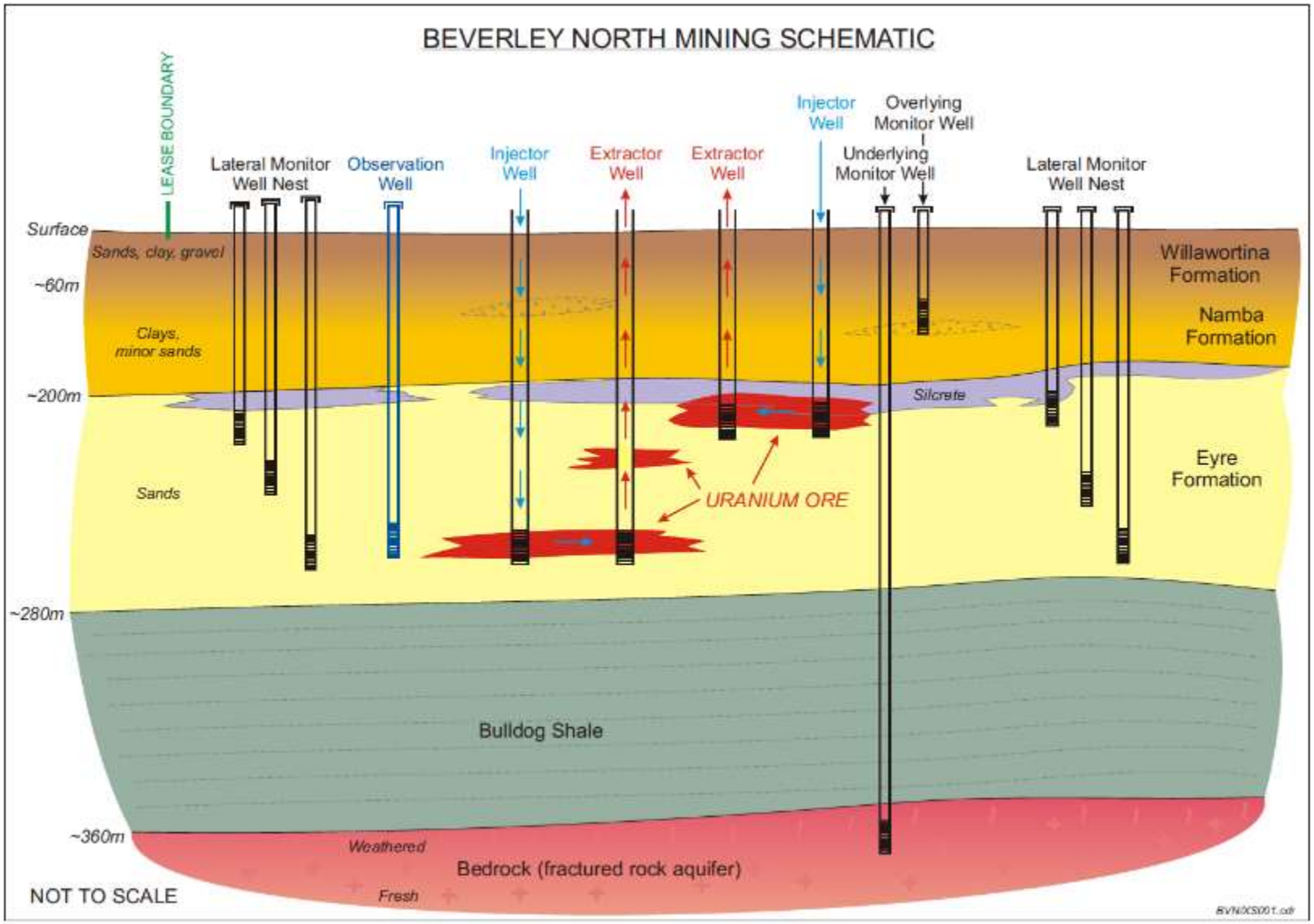

Figure 6-5 Beverley North Mining and Monitor Wells Schematic (Pepegoona and Pannikan)

Lateral Monitor Wells

Overview

Lateral monitor wells must effectively monitor a considerable thickness of aquifer (up to 70 m for Pepegoona and Pannikan). The monitor well construction and sampling methods will ensure that the entire aquifer thickness is effectively monitored and mining fluids cannot move past a monitoring point undetected.

Location

The following rationale underpins the design of the lateral monitor well network:

- Well spacing – The specification of well spacing is based on a risk management approach. In areas where the likelihood of mining solution reporting to a monitor well is negligible (i.e. up-gradient) well spacing is increased. In areas where the likelihood of contact is greater (down-gradient) well spacing is decreased. The generalised spacing for Beverley North is:
    - up-gradient: 750 m
    - lateral to flow: 500 m
    - down-gradient: 250 m
- Wells are located within 250 m of the ore zone defined by the currently delineated 0.015 m% Grade-Thickness ore outline
- Well locations are refined to allow for cultural consideration, topography, and surface environmental constraints, e.g. if mining occurs close to a mining lease boundary, as at Pepegoona West and Pannikan, upgradient wells are installed closer together.

Lateral monitor wells were installed for the Beverley North FLT and are applicable for mining of Pepegoona and Pepegoona West deposits. The well locations are presented in Figure 6-3. Each site has two or three wells screened at different depths (see next item). The same logic is applied at Pannikan (Figure 6-4).

Well Construction

- Wells will be constructed using 2, 4 or 6 inch (50, 100 or 150 mm) PVC casing
- Screens will be slotted PVC screens with single or two stage completion
- Screened intervals will be selected to screen only permeable sand units with blank casing placed against lower permeability silt or clay units
- The screened intervals will monitor sand units through the full thickness of the mined formation (up to approximately 70 m for Pepegoona and Pannikan). This may be by one, two or three wells at a given location depending on the location of suitable sands and their separation, as it is difficult to install a single well with screens separated by more than a few metres
- Each screened interval will be developed individually, through isolation and airlifting
- Wells will be pressure cemented and integrity tested to 1000 kPa.

Sampling

Sampling Methods

- Either pumps or depth-specific grab-samplers (sondes) will be used to sample these wells. The latter is acceptable as they are in a through-flow aquifer where water in the screened interval is continually flushed by natural flow

- In the case of sondes, these will be run into each well on a wire-line for each sampling event, or a dedicated or separately run low flow pump used. Where there are multiple screens in a well, the screens will be sampled sequentially starting nearest the surface to avoid disturbing screened areas prior to sampling
- Sondes or low-flow pumps will take depth-specific groundwater samples for the measurement of excursion control parameters with depth
- ECL parameters are pH, SO_4 and U
- In the event that a significant change in chemical parameters is observed, each screened interval will be re-sampled. Samples will be analysed for a full suite of parameters in the laboratory. Assessment of the excursion and any required remediation work will be undertaken accordingly.

Sampling Frequency

Samples will be taken in each well quarterly if distant from and ML boundary, or monthly if adjacent to an ML boundary.

Well Purging

It is important that the water within the well screen is refreshed with groundwater from the aquifer to ensure that excursions are detected. There is no benefit in monitoring stagnant water within a well, which is not representative of the surrounding groundwater.

The monitoring regime addresses this requirement in two ways:

- Isolated airlift development of discrete well screen interval will ensure that each well screen is open to the surrounding aquifer.
- The natural groundwater flow in the currently known ore zones is in the order of 20-30 m/year. This natural flow will result in continual refreshment of water inside the well screen with groundwater from the aquifer. Estimated refresh rates are approximately 6 days. Calculations of refresh rates are as follows (Armstrong, D pers. Comm. Nov. 2008):

Volume in Screen	=	$\pi \times r^2 \times L$
	=	0.055 m^3
Inflow Rate	=	K x dh/dl x 2r x L
	=	0.0088 m^3/day
Refresh time	=	Volume / Inflow Rate
	=	6.2 days

Where	r (screen radius)	=	0.05 m
	L (screen length)	=	7 m (not required for calculation as it cancels out)
	K (aquifer permeability)	=	5 m/day
	dh/dl (hydraulic gradient)	=	0.0025

Note that pumping techniques are also suitable for sampling wells in this situation; the flow-through nature of the monitored aquifer should reduce the amount of purging required to take a representative sample. Minimal purging (a few 10s of litres) is required if the pump inlet can be placed within the well screen. For some well construction configurations the pump inlet must be placed above the screen and purging of in the order of 100 to 100s of litres may be required.

Overlying Monitor Wells

Overview

Overlying monitor wells are designed to detect potential leakage of fluids into the overlying aquifer (if one is present). These wells are located such that no production area is more that

250 m distant from any overlying monitor well. The well locations for Pepegoona and Pannikan deposits are presented in Figure 6-3 and 6-4. This methodology is consistent with the methodology currently applied to overlying monitor wells at the Beverley Mine.

Well Construction

- Wells will be constructed using 2 or 4 inch (50 or 100 mm) PVC casing with slotted PVC screens.
- Screens will access the first suitable permeable unit overlying the ore zone of the mined formation (but not within the zone of possible routine effects of mining)
- Wells will be developed though airlift pumping
- Wells will be integrity tested to 1000 kPa.

Sampling

Sampling Methods

- Wells will be sampled using low flow pumps and laboratory analysis for excursion control parameters (pH, SO_4, U)
- Wells will be purged until stable physico-chemical parameters of pH, EC and DO are observed in the field.

This is consistent with the sampling procedure currently employed at the Beverley Mine.

Sampling Methods

- Wells will be sampled using low flow pumps (or bailers as a backup) and laboratory analysis for excursion control parameters

Sampling Frequency

- Each well will be sampled monthly. Following completion of the first year of mining it is proposed that the sampling frequency be reviewed from a risk management approach (no excursions - less frequent sampling is required).

Underlying Monitor Wells

Overview

Underlying monitor wells are designed to detect leakage of fluids into the underlying aquifer. At the Pepegoona and Pannikan deposits the underlying aquifer is the Fractured Rock Aquifer. These wells are initially located such that no production well is more that 250 m from any underlying monitor well. The well locations are presented in Figure 6-3 and 6-4. This methodology is consistent with the methodology currently applied to overlying monitor wells at the Beverley Mine (no specific spacing is required for underlying GAB wells, as it has been established that there is no credible risk to the GAB and monitoring from the three established GAB water supply wells is appropriate and sufficient).

Heathgate anticipates that the three underlying wells at Pepegoona and one at Pannikan will similarly demonstrate that there is no credible risk to the underlying aquifer, as it is protected by some 80 m of very low permeability Bulldog Shale and a very significant upward hydraulic gradient of is apparent. Therefore, if additional minable resources at Beverley North are found in the Eyre or Namba Formations where the same absence of credible risk applies, the 250 m guideline will not be required for underlying aquifer monitoring.

Well Construction

- Wells are constructed using PVC casing pressure cemented to the base of the aquitard above the indentified underlying aquifer

- Screens are open holes below the base of the aquitard (if in competent rock), or 3 to 6 m screens depending ground conditions
- Wells will be developed though airlift pumping
- Wells will be integrity tested to 1000 kPa.

Sampling

Sampling Methods

- Wells will be sampled using low flow pumps and laboratory analysis for excursion control parameters (pH, SO_4, U)
- Wells will be purged until stable physico-chemical parameters of pH, EC and DO are observed in the field.

This is consistent with the sampling procedure currently employed at the Beverley Mine

Sampling Frequency

- Each well will be sampled monthly. Following completion of the one year of mining it is proposed that the sampling frequency be reviewed from a risk management approach (no excursions - less frequent sampling is required).

Observation Wells

Overview

Observation wells are designed as 'early warning' to detect migration of mining solution where mining occurs close to the ML boundary and the applicable Lateral Monitor Wells are close to the ML boundary. At the Pepegoona and Pannikan deposits Observation Wells are required to the north of the Pepegoona deposit and to the north and west of the Pepegoona West and Pannikan deposits. The well locations are presented in Figure 6-3 and 6-4. They are placed to give suitable coverage compared to the geometry of the wellfield, boundary and Lateral Monitor Wells.

Well Construction

- Wells will be constructed using 2, 4 or 6 inch (50, 100 or 150 mm) PVC casing
- Screens will be slotted PVC screens with single or two stage completion
- Screened intervals will be selected to screen the permeable sand units most applicable to the adjacent mining.
- Each well will be developed individually by airlifting
- Wells will be integrity tested to 1000 kPa.

Sampling

Sampling Methods

- Wells will be sampled using pumps and laboratory analysis for excursion control parameters (pH, SO_4, U) and EC, or if down-hole probes are used, for pH and EC only
- When pumped, wells will be purged until stable physico-chemical parameters of pH, EC and DO are observed in the field.

This is consistent with the sampling procedure currently employed at the Beverley Mine.

Sampling Frequency

- Each well will be sampled fortnightly during mining. Following completion of the one year of mining it is proposed that the sampling frequency be reviewed from a risk management approach (no excursions - less frequent sampling is required).

6.7.8.2 Mining Formation – Contingency Measures – Mining Not Adjacent to a Lease Boundary and Mining Adjacent to a Lease Boundary where a Cross Boundary Agreement is in place.

An excursion will be deemed to have occurred if any two excursion indicators (pH, SO_4, U) in any monitor well exceeded their respective ECL or a single indicator exceeds its ECL by 20%. Should monitoring of a monitor well or wells show an excursion, the affected well or wells will be re-sampled.

If the excursion is confirmed (which does not in itself constitute a breach of lease conditions), the Director of Mines and SA EPA RPB will be notified and the pumping rates in the nearby area will be adjusted to 'pull' the affected water back into the mining zone and weekly monitoring of the affected monitor wells instituted until the excursion is resolved.

Experience with non-regulatory monitor wells at Beverley has been that this will be sufficient to correct an excursion. If an excursion persists for four weeks or more, however, the following contingency measures will be undertaken to ensure and demonstrate that the lease condition has not been exceeded:

- Installation of two additional mining formation monitor wells at approximately 50 m and 150 m distance from the affected well or wells towards the nearest lease boundary (or closer together if the lease boundary is closer than 150 m).
- The pumping regime at the mining area will be further adjusted, if required, to ensure an inward-sloping hydraulic gradient is established (as shown by monitor well water levels) to demonstrate that solution is being drawn back into the mining area.

These additional wells will be monitored on a weekly basis for the ECL parameters until the excursion is resolved. Should the excursion have moved further into the additional well, enough further additional wells will be installed such that the full extent of the excursion is quantified to the satisfaction of the Director of Mines and SA EPA RPB.

6.7.8.3 Mining Formation – Contingency Measures – Mining Adjacent to a Lease Boundary where no Cross Boundary Agreement is in place.

The above contingency measure is not applicable in the case where mining is close to a lease boundary and monitor wells are adjacent to that boundary. In this case, Observation Wells are used as an early warning of migration of mining solution beyond the designed mining areas and contingency measures are based on the flow balancing of the active wells and monitoring of the Observation Wells. However, the same definition of an excursion applies in the monitor wells, i.e. the first paragraph of Section 6.7.8.2 still applies.

Modelling (PathCAD, in in-house software) of flow around the wells was undertaken to establish the appropriate injection rates (reduced on the side of patterns closest to lease boundaries) and also the affects and time characteristics of inadvertent over-injection at those sites. Up to four weeks 'grace' is indicated by the modelling, so a more frequent checking and correction program is being instituted as below.

- Daily checks of the balance targets and 'actuals';
- Maps are available to wellfield operators to ensure they can turn off the appropriate injection wells if an extractor fails
- Balance sheets are formatted, and work instructions prepared so as to highlight balance inconsistencies to Wellfield Operators
- Weekly reviews of the actual flows are conducted and assessed

As described earlier, there is fortnightly sampling of the relevant Observation Wells.

The frequency of monitoring for relevant lateral monitoring wells will be increased to weekly to demonstrate no mining fluids have migrated from the lease boundary until such time as the

concentration of all excursion indicators in observation wells falls below the excursion control limits

6.8 Fauna Aspects

6.8.1 Context and Stakeholder Views - Fauna

A desktop fauna assessment of the Beverley North Project area was undertaken by EBS in 2009 (EBS 2009). A full copy of this report is provided as Appendix E of Heathgate (2010b). As recommended by that assessment, a field survey was undertaken in March 2010 (EBS 2010; Appendix B here).

The nature of the Beverley North Mine requires the disturbance and removal of some vegetation and disturbance of other fauna habitat. The fauna affected are widespread in the area and the proportion of habitat removal is very small compared with the surrounding area, such that no species are threatened by mining operations. Nevertheless, it is considered important to minimise the impact on fauna, which is the aim of the management strategies described shortly.

The conservation of native fauna and its diversity is of importance to stakeholders in the area. Fauna management is considered in pastoral leases (primarily control of pest species) and native fauna conservation is intrinsic to conservation interests including Vulkathunha-Gammon Ranges National Park and the private Arkaroola Wilderness Sanctuary and the Traditional Owners. It is of interest to the Commonwealth with respect to the protection of rare or endangered species and biodiversity conservation.

Small fauna may be killed during vegetation and soil clearing but the main effect on fauna is displacement into the surrounding habitat. Some additional fauna deaths occur accidentally due to incidents involving vehicles, falling into drill pits or drill holes, or theoretically from contact with mining solutions. Local populations of house mice have become established at the processing plant and camp and it could be possible for feral predators such as cats and wild dogs, or feral herbivores such as rabbits to increase and put additional pressure on native fauna.

6.8.2 Potential Impacts - Fauna

The potential impacts considered in Table 6-6 are:

5.1 Reduction in native species density and diversity caused by wellfield development, access road construction and operations

5.2 Reduction in native species density and diversity resulting from an increase in feral animals caused by creation of food sources, modified habitat and waste management operations

5.3 Reduction in adjacent pastoralist viability due to increase in feral animals due to mining operations.

6.8.3 Control and Management Strategies - Fauna

The management strategies to minimise the risks to native fauna have been used and progressively reviewed and improved at Beverley over its years of operations. These strategies will be applied at Beverley North. Those most directly related to the identified potential impact events are given in Table 6-6. A fuller list is given below:

Design Measures

- Minimise perennial vegetation clearing by design
  - Fencing patches of vegetation and soaks to protect seed stock and habitat
  - Running pipeline on surface

- Wellfield and project planning
- Fencing of process areas to exclude larger fauna.

Management Measures

- Enforcement of Environmental Clearance Permit system
- Enforcement of speed limits within ML and approach roads
- Backfilling of exploration and delineation drill holes
- Rapid backfilling and rehabilitation of mud pits
- Presence of drilling crews (discouraging fauna near pits and operations)
- Rescue of trapped fauna
- Placing stockpiled vegetation as habitat
- Recreational hunting banned within all Heathgate ML, EL, RL and MPL areas
- Increase personnel awareness via inductions and notices
- Daily Plant and Wellfield Environmental Checklist
- Prohibition on pets within the lease area
- Trapping and destruction of feral species.

6.8.4 Likelihood and Severity of Consequence, Risk and Risk Acceptance - Fauna

The inherent risk for all fauna aspects was **low**. With the design and operational measures (which are based on those in use at Beverley in 2010), all residual likelihoods were reduced and all residual risks were **low**, which is considered acceptable.

6.8.5 Specific Outcomes – Fauna

Specific outcomes to be achieved by the above management measures are:

- No net adverse impacts from the site operations on native fauna abundance or diversity in the lease area and in adjacent areas
- No introduction of new weeds, plant pathogens or pests (including feral animals), nor increase in abundance of existing weed or pest species in the lease area compared to adjoining pastoral areas[25].

6.8.6 Outcome Measurement Criteria – Fauna

- Results of monitoring program show no reduction of native vertebrate density and diversity compared with local area background[26]
- Results of monitoring program show no increase in feral vertebrates, compared with local area background.

Note that control sites are chosen with the following criteria:

[25] Whist this outcome includes vegetation it is included here as the Mining Lease condition lists feral animals with weeds.
[26] Based on assessment by the appropriately qualified and experienced specialists engaged to undertake and assess the monitoring program.

- control sites are planned approximately 5 km away from planned disturbance areas, as chosen by a suitably qualified and experienced specialist.
- confirmation is received from Beverley staff that the control site is not in known mineralisation.

Also note that the highly variable nature of fauna monitoring makes numerical comparisons of vertebrate abundance or diversity unreliable. For example, the number of small reptiles captured can vary significantly with air temperature, which in this region can vary by 10°C or more during the one or two weeks of a fauna survey.

6.8.7 Leading Indicator Criteria – Fauna

- Trends of the monitoring program.

6.8.8 Company Compliance Monitoring Plan - Fauna

The fauna monitoring program at Beverley has been developed using the years of experience at the site. The program set out in Table 6-13 is based on the program approved for Beverley ML 6321 in 2008 (Heathgate 2008b), the Beverley North desktop assessment (EBS 2009) and the baseline survey undertaken in autumn 2010 (EBS 2010; Appendix B here), but also takes into account the risk assessment and criteria developed above.

The fauna trapping site locations are shown in Figure 6-6 and all were again monitored in spring 2010 (Ecological Associates, in preparation). The sites shown in Figure 6-6 were located for general mining on the Beverley North ML. In the future these will be adopted and monitored in spring only.

Table 6-13 Company Compliance Monitoring Program – Fauna

Location	Method	Parameter	Frequency
Lease and Local Area at established points. See Figure 6-6.	Terrestrial mammal and reptile trapping program utilising a line of pitfall traps with nearby Elliot and cage traps. Fauna will be identified, sexed (if feasible), marked and released unless otherwise required by trapping permit (e.g. voucher specimens for SA Museum). Undertaken at all nominated sites.	Total number of species and abundance at each site	Annual survey
	Bird transect – walked traverse logging species and abundance. Undertaken at all sites.		Annually
BN04	Microchiropteran bat trapping - using harp trap each night.		Annual survey
Dam near CON07	Anabat – record ultrasonic echolocation calls and send to specialist consultant for analysis.		1 to 3 evenings during annual fauna survey
	Microchiropteran bat trapping – mist net set up on evenings when wind conditions allow.		
Lease and Local Area	Spotlight traverse – night drive with spotlight randomly around site and local area roads recording number and species of animals.		Annually
Wellfield (minor drainage & gibber), CON04 & CON05	Bird Transect – walked traverse logging species and abundance.		Monthly

6.9 Air Quality Aspects

6.9.1 Context and Stakeholder Views – Air Quality

The main air quality aspects that are considered are both radiological. This region is naturally dusty and this dust and the small emissions of the Beverley power station and diesel generators

and vehicles are not appreciable issues other than very local OHS considerations. The two radiological air quality aspects relate to the gas radon (and its decay products) and uranium bearing dust.

Management of radiation is the primary focus of the Environment Protection Authority Radiation Protection Branch (SA EPA RPB) through the RPC Act 1982. Other stakeholders are also interested in the minimisation of radioactive emissions and the protection of workers, the public and the environment from possible adverse impacts of enhanced radiation exposure.

The RMP and RWMP (separately approved under the RPC Act 1982) have been designed to enable Heathgate to critically review the radiological impact of the Beverley Mine site and to demonstrate compliance with the requirements of the Licence issued under that Act, administered by the SA EPA RPB. The Beverley plans have been amended to incorporate activities at the Beverley North Mine.

The Plans provide details of any potential issues related to occupational and environmental radiation and satisfy the monitoring and reporting requirements under relevant regulations and Codes of Practice for the commercial mining and milling of radioactive ores. Operations are conducted in accordance with the RMP and RWMP, the ARPANSA (2005) Code of Practice and Safety Guide and the National Standard for Limiting Occupational Exposure to Ionizing Radiation (ARPANSA 2002). Other key points are:

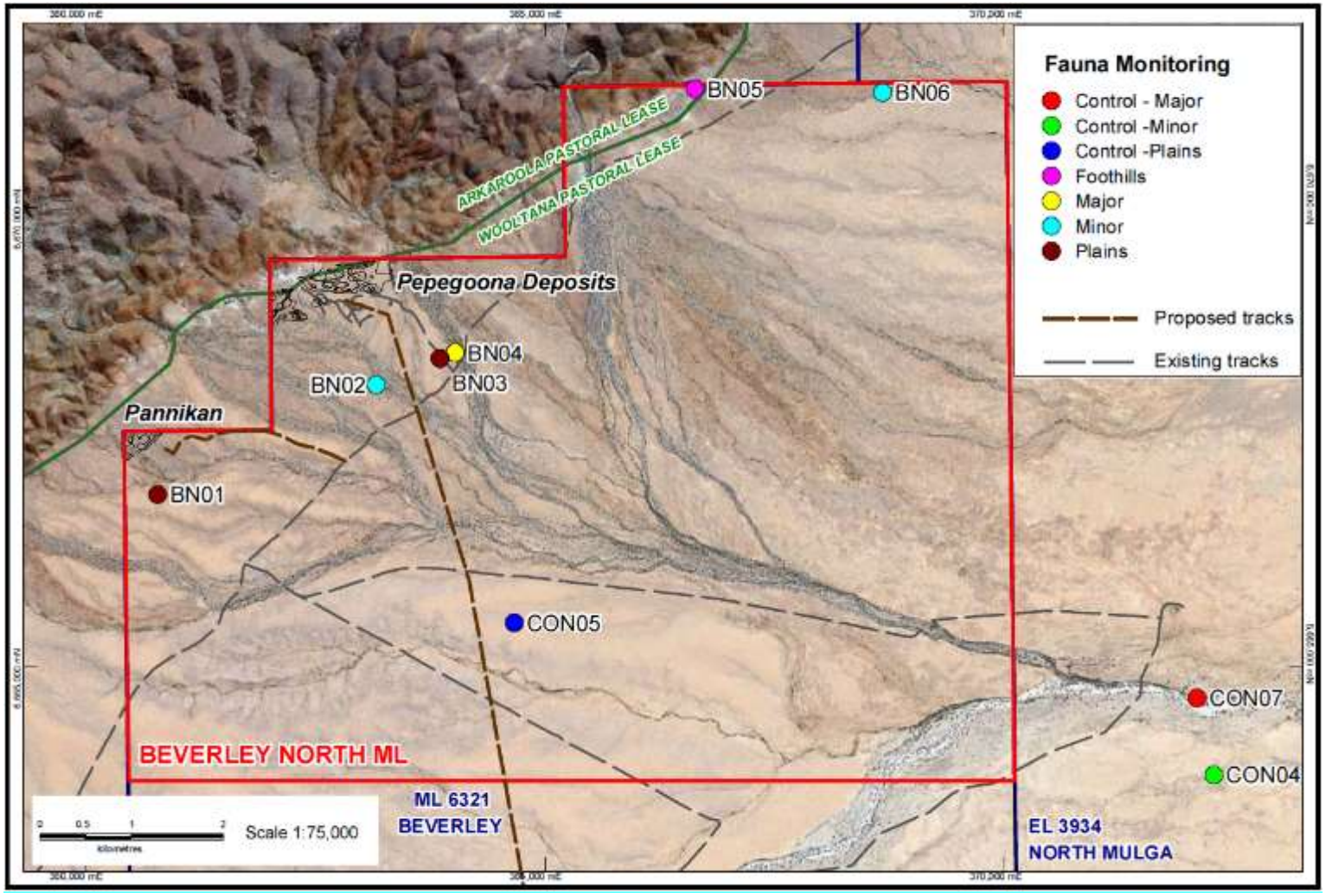

Figure 6-6 Fauna Monitoring Sites

- The SA EPA RPB was consulted before the background monitoring program was established
- The ALARA principle is applied to minimise the radiation dose to personnel and the public
- Operations covered by the ARPANSA (2005) Code need to demonstrate use of Best Practical Technology (BPT).

6.9.2 Potential Impacts – Air Quality

The potential impact considered in Table 6-6 is:

6.1 Radon and radionuclide-bearing dust release from processing area and water management bunds (and other sources) increasing radiation doses to the environment or the public.

6.9.3 Control and Management Strategies – Air Quality

The management strategies to minimise the risks due to radiation are set out in the separately approved RMP and RWMP. Those most directly related to the identified potential impact event are given in Table 6-6 and below. Fuller details are given in the RMP and RWMP.

Design Measure

- Good ventilation.

Management Measures

- Radon and Radon progeny monitoring and review
- LLA in dust monitoring and review
- Good maintenance, including clean up of any minor seepage or spills that may occur within the plant bunded area and regular removal of any scale that may possibly include radionuclides.

The **low** risk of radon and radionuclide-bearing dust exposure has been confirmed by operational monitoring for the last nine years at Beverley. As the same procedures and policies will be applied at Beverley North, it is expected that radiations risks will be similarly **low** at Beverley North.

6.9.4 Likelihood and Severity of Consequence, Risk and Risk Acceptance – Air Quality

The inherent risk for air quality aspect 6.1 was **low**. With the design and operational measures (which are based on those in use at Beverley in 2010), the residual risk is **low,** which is considered acceptable.

6.9.5 Specific Outcomes – Air Quality

The specific outcome to be achieved by the above management measures is:

- No adverse impacts to workers, public or the environment due to radon or radionuclide-bearing dust release or radiological aspects of seepages and spills.

6.9.6 Outcome Measurement Criteria – Air Quality

The measurement criterion for the outcome of implementing design control measures and operational management measures is:

- Estimated radiation doses to the public (and workers) are within applicable limits as defined under the RPC Act.

6.9.7 Leading Indicator Criteria – Air Quality

The leading indicator that is used to track air quality is:

- Monitoring of radon decay products and radionuclide dust in the satellite plants and wellfields remain below the investigation levels.

The details of the monitoring are available in the Beverley RMP (refer Section 4.3). The investigation levels vary according to the place and mode of measurement but are all set below levels that could cause radiation doses to exceed the applicable limits if they were maintained long-term.

6.9.8 Company Compliance Monitoring Plan – Air Quality

The compliance monitoring program includes the monitoring of:

- Radionuclide-bearing dust and radon decay products at the Pepegoona weather station (as well as ongoing monitoring at the Beverley processing plant and accommodation camp).
- Monitored doses are calculated and are demonstrated to be within applicable limits as defined under the RPC Act 1982.

Detailed information on the monitoring methods, frequency and locations are available in the Beverley RMP as well as in the RWMP. Heathgate reports quarterly to the regulators including air quality measurements graphed against the internal investigation levels. The investigation of any excursions above these investigation levels (which vary according to the place and mode of measurement) and demonstration of the return to normal levels are included in these quarterly reports.

6.10 Heritage Aspects

6.10.1 Context and Stakeholder Views - Heritage

A Native Title Mining Agreement for Beverley, including Beverley North, has been successfully negotiated with the Adnyamathanha community representatives and registered with DSD.

Aboriginal heritage issues are of very high importance to the Native Title Holders and to Heathgate. The maintenance of a good and mutually beneficial relationship with the Native Title Holders is a high priority for Heathgate. Information here is a summary only.

No items of significant European settlement heritage have been identified at Beverley North.

6.10.2 Potential Impacts - Heritage

The potential impact considered in Table 6-6 is a general one, viz.:

7.1 Impacts on Aboriginal heritage as a result of mine activity.

Potential impacts could be of a physical nature with cultural aspects, such as the disturbance of significant vegetation, artefacts or human remains or of a primarily cultural nature such as disturbance of a culturally significant site.

6.10.3 Control and Management Strategies - Heritage

The measures listed in Table 6-6 are all of an operational nature:

- Areas flagged if necessary, following an Aboriginal Heritage Clearance survey
- Checking of flagged areas for disturbance
- Maintain and improve the use of Aboriginal Heritage Clearance survey
- Protection of heritage sites in accordance with State and Commonwealth legislation.

6.10.4 Likelihood and Severity of Consequence, Risk and Risk Acceptance - Heritage

The inherent risk for heritage aspect 7.1 was **high**. With the design and operational measures (which are based on those in use at Beverley in 2009), the residual risk was reduced to **low** (with a **rare** likelihood), which is considered acceptable.

6.10.5 Specific Outcomes – Heritage

The specific outcome to be achieved by the above management measures are:

- No disturbance to Aboriginal artefacts or sites of significance unless prior approval under the relevant legislation is obtained

6.10.6 Outcome Measurement Criteria – Heritage

The specific outcome measurement criteria to be achieved by the above management measures are:

- Demonstration that documented Aboriginal Heritage Clearance surveys of all operational areas
- Audits show flagged areas are not disturbed.

6.10.7 Leading Indicator Criteria – Heritage

- The leading indicator will be near-miss incident reports relating to potential disturbance of flagged areas.

6.10.8 Company Compliance Monitoring Plan – Heritage

The map (not reproduced here) showing all identified sensitive areas is updated after every clearance survey.

Flagged areas will be checked for disturbance six-monthly and after any relevant incident report.

6.10.9 Heritage Management

The Work Area Clearance methodology, adopted by the company in association with the Native Title applicants, has been developed to minimise any potential deleterious impact upon Aboriginal cultural values at all stages of exploration and development within the area.

The survey team is selected by representatives of the Adnyamathanha community and consists of up to 8 members. The team is assisted by up to two anthropologists and usually about 5 Heathgate personnel.

The methodology entails distinct types of clearance:

- Hole by hole – in which individual pegs are placed where drilling is desired and the survey team inspects each one (used mainly in the early stages of exploration where very low drilling density is required – typically 100 m centres or more);
- Line – in which a line (usually an old pastoral station track) is driven or walked and the survey team identifies sensitive areas if present with respect to a 50 m zone on either side of the line. This is done on the understanding that drilling may take place anywhere within this zone other than the identified sensitive areas and subject to the final individual drill hole sites being monitored by Heathgate's Aboriginal Liaison Officers.
- Area – in which an area is driven or walked and the survey team identify sensitive areas if present. This is done on the understanding that drilling may take place anywhere within this area other than the identified sensitive areas and subject to the final individual drill hole sites being monitored by Heathgate's Aboriginal Liaison Officers.

- Blanket/production – same as for area clearance except that the area in question has been identified as a future production area and thus close-spaced drilling (typically 25 m spacing) will be required. This type of clearance involves closer inspection so that further monitoring by Heathgate's Aboriginal Liaison Officers is not required.

As noted above the map showing all identified sensitive areas is updated after every clearance survey.

In addition to conducting clearances, the survey team also, on an ad hoc basis, inspects areas previously cleared to confirm that sensitive areas have been protected and the works have been conducted in accordance with the relevant clearance reports.

6.11 Third Party Aspects

6.11.1 Context and Stakeholder Views – Third Party Issues

The Beverley North Mine partly straddles the boundary between the Wooltana and Arkaroola pastoral leases. Jointly owned infrastructure (boundary fencing and fencing access roads) are affected by operation of the wellfields. The operators of the Arkaroola Wilderness Sanctuary and the pastoral sub-lessee of Wooltana Station (the Wooltana pastoral lease is owned by Heathgate) are also particularly concerned to be informed about activities that are undertaken; other stakeholders (government departments, other neighbours, some external groups) also wish to be kept informed on activities.

There is no public infrastructure involved as the ML is remote from public power, water, telecommunications, gas and petroleum liquids infrastructure. No pastoral watering points are affected.

6.11.2 Potential Impacts – Third Party Issues

The potential impact considered in Table 6-6 is:

8.1 Damage to adjacent public or private infrastructure, including that caused by fire, as a result of mine activity.

Potential impacts could be of a physical nature, such as the disturbance or possible destruction of fencing, or of a primarily relational nature such as disappointment to discover aspects of mining activity they were not aware of (even if they have been authorised by regulators).

6.11.3 Control and Management Strategies - Third Party Issues

The management strategies to minimise the risks to Third Parties most directly related to the identified potential impact events are given in Table 6-6. A fuller list is given below:

Design Measure

- Separation of pastoral, touristic and mine traffic where possible
- Installation of gates in fencelines
- Fire fighting equipment
- Roads/tracks act as fire breaks

Management Measures

- Fencing maintenance or replacement on a new, agreed alignment
- Maintenance of gates
- Obtain authorisation for any necessary changes to third-party property
- Repair of any accidental damage to third-party property
- Design control measures to be implemented should fuel loads become significant
- Maintain good landholder relationships as part of ongoing community liaison
- Advise landholders of mining program of activities, particularly in regard to the impact of operation on the land and of rehabilitation progress (see Section 6.14).

6.11.4 Likelihood & Severity of Consequence, Risk and Risk Acceptance - Third Party Issues

The inherent risk for aspect 8.1 and 8.2 were **low**. With the design and operational measures, the residual risk was reduced to **low** (with a **rare** likelihood), which is considered acceptable.

6.11.5 Specific Outcomes – Third Party Issues

The specific outcome to be achieved by the above management measures is:

- No unauthorised damage to adjacent public or private property and infrastructure, including that caused by fire, as a result of mine activity.

6.11.6 Outcome Measurement Criteria – Third Party Issues

The specific outcome measurement criteria to be achieved by the above management measures are:

- Any fires caused by mining operations are controlled within the ML boundary
- Any accidental damage to infrastructure is made good as soon as practicable.

6.11.7 Leading Indicator Criteria – Third Party Issues

There are no specific leading indicators proposed for third party issues.

6.11.8 Company Compliance Monitoring Plan – Third Party Issues

Please refer to the ongoing community engagement plan given below.

A table providing details of community consultation will be provided to the quarterly Beverley Environment Consultation Committee meetings.

6.12 Radiological Aspects

The RWMP and RMP will be the key documents for radiological aspects of the Beverley North Mine operation, concerning the protection of the environment and the public, as well as workers (refer Section 4.3).

In Table 6-6, and in Sections 6.4 to 6.9, radiological issues relevant to the various categories of aspect (surface water, air quality etc) are listed with reference to the appropriate specific identifier where that radiological issue is considered.

6.13 Waste Disposal Aspects

As described in Section 4.7, only certain wastes are disposed of at Beverley North under this PEPR and the RWMP:

- drilling cuttings
- airlift water
- surplus drilling mud
- domestic-type waste water.

Other wastes are returned to Beverley for disposal, recycling or reuse, such as:

- bleed water
- radioactive waste
- domestic waste.

Neither a conventional landfill nor low-level radioactive waste repository are included in the current approvals.

Waste management and disposal is covered in a number of the headings in Table 6-6 and the sections above. However, in order to accommodate Lease Condition Second Schedule condition 2, a specific outcome is provided here.

6.13.1 Specific Outcomes – Waste Disposal

The specific outcome to be achieved by the above management measures is:

- No wastes are disposed of within the Beverley North ML unless prior approval under the relevant legislation is obtained.

6.13.2 Outcome Measurement Criteria – Waste Disposal

The specific outcome measurement criterion to be achieved by the above management measures is:

- No evidence of unauthorised disposal of wastes within the Beverley North ML.

6.13.3 Leading Indicator Criteria – Waste Disposal

There are no specific leading indicators proposed for waste management.

6.13.4 Company Compliance Monitoring Plan – Waste Disposal

No specific waste disposal monitoring is required for Beverley North (waste management was described in Section 4.7). However, a statement of compliance will be included in the ACR, as will a comment on the status of any applications to change the waste management and disposal arrangements (if applicable).

6.14 Ongoing Community Engagement Plan

Heathgate is committed to ongoing consultation and transparency and recognises the importance of information dissemination on any environment, heritage management and Aboriginal issues that might potentially be associated with the Beverley North Mine.

Different mechanisms for consultation with various stakeholder groups have been established (refer Sections 5.1and 5.2). The ongoing engagement plan is set out in Table 6-14.

Table 6-14 Ongoing Community Engagement Plan

Community Group	Forum	Frequency	Notes
Regional Aboriginal Communities	Beverley Advisory Committee	Quarterly	Meetings are held at the Beverley site. In addition to providing a forum for dissemination of information, the advisory committee presents an opportunity for the Aboriginal community of the Northern Flinders Ranges to raise any issues of concern it may have.
	Clearance visits	As required	Heathgate conducts a number of Aboriginal Heritage Clearances with Native Title Holders as part of the ongoing exploration and mine development program. These clearances ensure that future activities will not interfere with Aboriginal heritage and that past activities have been conducted in accordance with previous clearance reports. They also allow further consultation to ensure the local Aboriginal people are up to date with any mine developments.
	NAIDOC Day celebration	Annual	Each year, Heathgate hosts NAIDOC Day celebrations at Beverley. The day typically consists of speeches, flag raising, a mine tour and a BBQ in the creek featuring traditional camp oven cooked kangaroo and damper. The day provides many opportunities for Adnyamathanha and non-Adnyamathanha staff to interact with visiting Adnyamathanha people and to discuss any issues relating to the mine.
State and Federal regulators and stakeholders	Beverley Environmental Consultative Committee (BECC)	Six-monthly	Chaired by DSD and held in Adelaide, this has a current standard agenda covering: • Welcome and opening remarks • Minutes of previous meeting • Matters arising • Status of operations and discussion of any incidents • Meeting conditions of approval • Approvals sought or granted • Notification of changes to procedures • Significant staff or organisational changes • Public consultation activities • Commonwealth matters • General business There is also an opportunity for Heathgate to meet and discuss issues with the other active uranium miner in South Australia, Olympic Dam, in an informal meeting over lunch following the BECC meeting.

Community Group	Forum	Frequency	Notes
State regulators and stakeholders	ISR Radiation Review Committee	Quarterly	Chaired by EPA RPB and held in Adelaide, this has a current standard agenda covering: • Minutes of previous meeting • Matters arising • Status of operations • Approvals sought or granted • Incidents and notifications • Occupational and environmental radiation monitoring results • Other business Note: it is under discussion whether every second ISR Radiation Review Committee might be subsumed into the BECC meeting due to the similarity of material covered (see next item).
Holder of sub-lease on Wooltana Station (pastoralist)	Informal meeting	Two-monthly	These discussions are generally held at the Beverley site and are a forum for exchange of business planning (mining and pastoral), discussion on maintenance or creation of watering points for stock, fencing etc. The sub-lease holder is also a neighbour, being based at nearby Wertaloona Station.
Nearby landholders	Informal meetings	Ad-hoc	The land uses of the properties surrounding Wooltana Station (owned by Heathgate) are pastoral and private (Arkaroola Wilderness Sanctuary) or government (Vulkathunha-Gammon Ranges National Park and Lake Frome Regional Reserve). As our closest neighbour, the most frequent discussions are with the owners of Arkaroola Wilderness Sanctuary. Arkaroola management will be specifically advised of any drilling on the Arkaroola lease.
Broader district	Informal meetings	Ad-hoc	Heathgate has been a participant in the review of the Leigh Creek Health Service. It has become an SES Community Response Team attached to the Hawker and Districts SES.

7 MINE CLOSURE AND REHABILITATION PLAN

7.1 Baseline Data and Context

7.1.1 Baseline Data

An extensive baseline has been compiled for the Beverley area, including Beverley North, and this information is available as a baseline reference for rehabilitation and closure. A summary of this baseline is provided in Section 3. Available baseline studies undertaken specifically for Beverley North are reported in Heathgate 2010a and baseline creek sediment samples analyses have been received and were reported in the 2011 ACR. The report on the field fauna is given in Appendix B (EBS 2010).

Baseline studies for the Beverley area and Beverley North include climate, flora, fauna, heritage, hydrology, hydrogeology, soils, seismicity and radiological background.

As also described in Section 5, extensive consultation has taken place, and will continue (Section 6.13).

7.1.2 Context

The Beverley North Mine, as well as the existing Beverley Mine, is located in the pastoral zone of South Australia and was developed as a greenfields site, i.e. there was no prior mining in the areas now occupied by or proposed for the Beverley North Mine. The long-term objective for rehabilitation is the return of the landscape to pastoral and conservation use. The default case is that all infrastructure installed under Mining Act approvals will be removed and rehabilitated.

As detailed earlier in the document, the mine closure groundwater remediation plan employs monitored enhanced natural attenuation within an attenuation zone as the preferred method to achieve aquifer rehabilitation, with initial amelioration of mining solution in mined-out wellfields by a groundwater flush. Because of the small scale of the Beverley North Mine, additional remediation in the future to achieve the required environmental outcomes is extremely unlikely.

It is possible that some facilities (primarily access roads) to be built on the Beverley North ML area may be handed over for other activities on the cessation of mining, subject to appropriate approvals and handover arrangements. Any change to the full return to the pre-mining pastoral and conservation uses will be subject to future stakeholder involvement and planning.

The objective of return of the ML to the pre-mining pastoral and conservation uses is attainable given that:

- ISR mining leaves the soil profile largely intact and major soil changes through the construction of pads (for footings, hardstands, roads, etc.) are limited in area.
- The largely Mitchell grass / chenopod plain vegetation has been shown to be highly resilient, under both past excessive grazing pressures and intensive drilling activities.
- General drainage will be unaltered by the development and only minor changes in surface hydrology would occur.
- All wastes would be taken off-site to the Beverley operations. There is thus no long-term hazard to biological communities, or to any user of the land surface.

The requirements for pastoral use, of a land condition similar to the present, are also likely to be the requirements for other land uses, dependent on the natural landscape, such as expanded conservation reservation or recreational usage.

Mining may be ongoing in the area after the currently known Beverley, and Beverley North orebodies are exhausted. It is possible that the processing plant, camp and airstrip at Beverley may be retained as a central facility for other deposits within economic distance. In this scenario,

the Beverley North wellfields may be closed and rehabilitated in advance of other infrastructure. The appropriate tenure will be maintained for infrastructure kept after the exhaustion of the Beverley and Beverley North orebodies.

Staged mine closure and rehabilitation will occur for the Beverley North area, as has occurred on the existing Beverley ML 6321 where wellfields have been closed. This involves commencement of rehabilitation as soon as practical after the completion of mining. Hence, at the final closure of mining operations, rehabilitation to be carried out will largely be limited to the most recently active mining area and the dismantling of surface facilities.

7.2 Stakeholder Involvement and Issues

The Beverley North Mine is a continuation of ISR mining methods already utilised at Beverley, and as such there has been the extensive stakeholder involvement of two Environmental Impact Statements, the PER / MLA and MARP process from 2006 to 2008 for the Beverley Extension area, the PER / MLA and MARP process in 2008 to 2009 for Beverley Four Mile, the PER / MLA process from 2009 to 2010 for Beverley North, the RLA and MARP process for the Beverley North FLT, subsequent PEPR amendments, a number of government inquiries and regular scheduled meetings with State (quarterly) and Federal authorities (six-monthly), as well as many other discussions (refer Section 6.12).

The South Australian EPA-commissioned CSIRO review (CSIRO 2004) also considered rehabilitation issues. The rehabilitation measures have evolved since mining commenced with a number of undocumented small surface rehabilitation trials undertaken.

More recently (and as recommended by CSIRO 2004), Ecosystem Function Analysis (EFA; Tongway & Hindley 2004) has been undertaken at some early rehabilitation sites at Beverley since 2006, with the current intention of annual surveys. The trends established by EFA will allow further refinement of surface rehabilitation techniques as progressive rehabilitation begins in earnest, as well as provide evidence of appropriate rehabilitation outcome for areas rehabilitated.

As these results are interpreted and provided to the stakeholders, closure and rehabilitation of the Beverley North Mine activities will be further reviewed and determined in consultation with the appropriate regulatory authorities, the pastoralist, indigenous peoples and other direct stakeholders via the consultation processes set out in Section 6.13.

Heathgate's detailed Mine Closure and Rehabilitation Plan for Beverley North, which will include a listing of individual or grouped infrastructure and specific treatments, will be initially provided to stakeholders ahead of time to allow sufficient time for any necessary negotiation. In the case of commercial mining on the ML, it would be provided three years prior to the anticipated final completion of commercial mining and processing. This will include detailed plans of areas for rehabilitation and any infrastructure that will be left, subject to appropriate approvals. Note that Heathgate currently assumes that all infrastructure will be removed.

7.3 Scope of Domain

All of the Beverley North ML is expected to be returned to pastoral use (Wooltana Station) or conservation (Arkaroola), i.e. there are two 'domains' in that sense. However, more effort will be required at the site of the satellite plants, entirely on Wooltana Station, whereas rehabilitation of the wellfields will be straightforward. Therefore three closure domains are proposed:

- Satellite plant sites (pastoral)
- Wellfields and other infrastructure (pastoral)
- Other infrastructure (conservation).

Maps and specific procedures will be required for the decommissioning of the satellite plants and wellfields to meet the requirements of the Radiation Protection and Control Act 1982 (SA), in

particular as set out in the ARPANSA (2005) *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* and reflected in the Radioactive Waste Management Plan (as amended from time to time)

7.4 Potential Social and Environmental Impacts

Heathgate's current planning associated with the Beverley operations assumes that it will remove all facilities on decommissioning, and the same is expected for the Beverley North ML. Some access roads and fencing may be left, at the request of the pastoralists.

The final closure of the Beverley North Mine would be expected to occur at the same time as closure of the Beverley operations, which, in the absence of other operations taking its place, will significantly reduce employment in the region. The economic contributions of the operations would then cease.

In the case of the local Aboriginal communities at Nepabunna and Iga Warta, a proportion of community payments have been invested in long-term projects, which will continue to benefit those peoples after final closure of Beverley and Beverley North mining operations. Furthermore, some of the Aboriginal royalties may be invested or used in community development initiatives, thus providing additional benefits.

There will also be the positive legacy of improved skills and employability of staff and contractors who have worked at the mine both in the local region and the main other areas workers have been drawn from (Adelaide and the Iron Triangle region of mid north South Australia).

As discussed earlier, it is possible that some facilities (e.g. access roads) may be handed over for other activities on the cessation of mining, subject to appropriate approvals and handover arrangements.

7.5 General Standards

The Mine Closure and Rehabilitation Plan will ensure that the following standards are taken into account:

- General economic standards;
    - That the community are left with no residual liability for site rehabilitation or maintenance
    - That any adverse economic effects are minimised
    - That provision is made for reasonable access for future mining (or reprocessing) of any remaining resource
- General social standards;
    - Effective ongoing community engagement
    - Closure minimises the disruption/impact on the community.

Rehabilitation and mine closure and completion will be undertaken with reference to the recently released DITR (2006a, b) documents *Mine Closure and Completion* and *Mine Rehabilitation,* and guidelines from PIRSA (2009). The applicable legislation is listed in Table 6-1.

Rehabilitation and mine closure will involve the return of disturbed land to 'a stable, productive and self-sustaining condition, after taking into account the beneficial uses [in this case, pastoral] of the site and the surrounding land.' In the case of Beverley North, the beneficial uses are pastoral and conservation. Rehabilitation includes:

- Physical, geochemical and ecological stability
- The protection of the quality of the surrounding water resources
- A condition where the risk of adverse effects to people, livestock, other fauna and the environment in general has been reduced to a level acceptable to stakeholders.

The establishment of monitoring and reporting criteria for successful final rehabilitation may include reference to:

- Appropriate mechanisms for formal 'sign-off' of rehabilitation as completed
- Australian Standards as they apply at the time the rehabilitation is 'signed-off'
- Comparative measures for example reference photographs
- Agreed times for the proving of rehabilitation actions
- Requirements under other legislation e.g. the *Environmental Protection Act 1993* (SA) and the *Radiation Protection and Control Act 1982* (SA), in particular as set out in the ARPANSA (2005) *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* and reflected in the Radioactive Waste Management Plan (as amended from time to time).

7.6 Closure Outcomes and Criteria

7.6.1 General Outcomes

The general outcomes for closure of the Beverley North Mine, as adapted from the DITR (2006a), are to ensure that:

- The interests of stakeholders are considered in the mine closure process
- The closure process can occur in an orderly, cost-effective and timely manner
- The cost of closure is properly provided for and that the community is not left with an on going liability
- There are clear accountabilities and resources available to implement the Mine Closure and Rehabilitation Plan
- A point can be reached where Heathgate has met the closure criteria.

The general criteria for rehabilitation and closure of the Beverley North Mine as adapted from the DITR (2006a) are that:

- The post-mining landscape is safe and physically stable
- The post-mining land uses (pastoral and conservation) are able to continue
- The rehabilitation monitoring demonstrates that the land is suitable for relinquishment.

The principal aims of the planning for closure of the mine are:

- Non-target aquifers are maintained with existing potential beneficial uses
- That the landforms are rehabilitated to ensure general conformity with the surrounding natural landforms and ecosystems
- That rehabilitation is carried out progressively, where possible
- The rehabilitation monitoring demonstrates that the land is suitable for relinquishment.

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 would be provided to the South Australian Government. A cost estimate is provided in Section 7.11. The bond will be reassessed and adjusted annually as required by the South Australian Government.

7.6.2 Specific Outcomes

Hydrogeology

The specific outcomes to be achieved with respect to hydrogeology are (refer Section 6.7.5):

- No compromise to the environmental values of the overlying aquifer (Willawortina Formation)
- No compromise to the environmental values of the underlying aquifers or other non-target aquifers (Fractured Rock Aquifer and GAB Aquifer)
- No compromise of environmental values of the orebody aquifers (Namba and Eyre Formations)
- No compromise to the ability of other existing mining lessees with an approved PEPR to achieve their approved groundwater closure criteria[27]

Note that environmental values are defined according to ANZECC/ARMCANZ (2000). For ML 6321, initial closure criteria (to be confirmed when a more detailed rehabilitation program is proposed) are given in Table 7-1 of the existing Beverley PEPR. Similar criteria are proposed for the Beverley North Mine:

- Three consecutive years (minimum) of post-closure water quality from selected overlying aquifer (if present) and at selected underlying monitor wells are within two standard deviations of the mean of all previous measurements for pH, SO_4, and U
- Three consecutive years (minimum) of post-closure water quality from at least selected overlying aquifer (if present) and selected underlying monitor wells demonstrate a sustained hydraulic gradient neutral or from those wells to corresponding wells in the target aquifer
- Selected wells will be agreed with DSD and the EPA
- Target Aquifer (Eyre Formation at Pepegoona and Pannikan deposits);
    - Three consecutive years (minimum) of post-closure groundwater level monitoring show re-establishment of hydraulic gradients not exceeding the pre-mining hydraulic gradients (i.e. natural groundwater throughflow is not accelerated by a steeper gradient)
    - Three consecutive years (minimum) of post-closure groundwater quality monitoring show trends in accordance with enhanced natural attenuation modelling predictions, and the achievement of the required outcomes above
- There are no existing off-lease mining operations[20] within the flow path of mining fluids as established by the groundwater flow modelling.

Soil, Vegetation, Fauna, Public and Amenity

The potential surface impacts following closure include changes to vegetation and habitat. The overarching outcome is for the area to be suitable for return to pre-mining use. Heathgate uses EFA to assess soil and vegetation impacts (refer Section 6.4.8 and, in particular, Section 6.5.8 and Table 6-9 of this report), and would use the same methodology for Mine Closure and Rehabilitation soil and vegetation assessment.

EFA uses a number of indices for both soil and vegetation related measurements:

- Stability

[27] Demonstration of this closure outcome is determined at the time of PEPR approval under this Mining Lease

- Infiltration
- Nutrient cycling
- Lower plant cover (% and plants/ha)
- Upper plant cover (% and plants/ha).

Under EFA, these indices are combined in a manner that allows the progress of a monitored site towards self sustainability. Where a site reaches or can be confidently predicted to meet a sustainability threshold, the site is considered to be progressing satisfactorily towards that outcome even though the full obtainment of local norms may take some decades due to the slow growth rates of perennial plants.

In addition, regular photographs of the EFA sites will be taken. Annual EFA of an analogue (background) site at Beverley North commenced in 2010. Results of the 2007 to 2009 monitoring for Beverley ML 6321 are given in Outback Ecology (2007, 2008, 2010a) given with the corresponding Beverley ACR (Heathgate 2008c, 2009c, 2010c). The background indices are variable within and between the three main landscapes (Mitchell Grass Plain, minor and major drainage lines – refer Section 3.11) and may be expected to vary with future climatic conditions; the same can be expected at Beverley North.

The last four years of EFA data for Beverley have been examined to establish draft objective criteria as part of the final rehabilitation planning for both Beverley and Beverley North (Outback Ecology 2010b). A proposal to the authorities to establish a trial of the interim completion criteria proposed by Outback Ecology will be made during 2010 or 2011.

The approval of qualitative closure indices is scheduled for at least two years before final rehabilitation of Beverley, but will be brought forward to fit the rehabilitation schedule for Beverley North if is scheduled for final rehabilitation before Beverley ML 6321. Resolution of this matter at an early time is in Heathgate's interest, and their development is being pursued by the company in the short to medium term.

The specific outcomes to be achieved with respect to soil, vegetation, fauna, public and amenity are (refer also to relevant parts of Section 6):

- The external visual amenity of the site is acceptable to relevant stakeholders
- Risks to the health and safety of the public and fauna are as low as reasonably achievable
- Ecosystem and landscape function is resilient, self sustaining and indicating that the pre-mining ecosystem and landscape function will ultimately be achieved
- The site is physically stable
- All waste materials left on site are chemically and physically stable.

Specific criteria related to these are:

- Amenity;
    - All infrastructure not handed over to other responsible entities (subject to approval) are removed from the site
    - All bunded areas are rehabilitated back to compatibility with the local landscape
    - The view of remaining facilities is to be similar to that of pastoral facilities
- Risks;
    - All radiation cleanup standards achieved and accepted as ALARA by the EPA RPB

- All process chemicals remnants removed to EPA contaminated sites standards or local norms
- All bunded areas removed and re-contoured to be compatible with the local landscape
- All wells either capped or filled to surface to avoid leaving traps for small fauna, to the appropriate guideline (DSD Information Sheet M21) or Land and Water Biodiversity Committee 2003)

- Ecosystem and landscape function, including physical stability of the site;
  - Representative test sites on rehabilitated areas have achieved or by trends may be confidently predicted to reach and pass sustainability thresholds as defined by EFA
- Waste materials were either removed from site or demonstrated to be chemically and physically stable.

7.7 Sustainable Closure Strategy

Both passive and active methods of rehabilitation will be used. Passive methods will be used in small areas of surface disturbance, where nearby plants provide some seed stock and shelter for the area being rehabilitated. Active methods will be used where the rehabilitation area is larger and needs to have an additional source of seed.

The general control and management measures with respect to groundwater are described in Section 6.7.3; outcome measurement criteria are given in Section 6.7.6, and leading indicator criteria are given in Section 6.7.7 and Section 7.6 above for closure.

The general control and management measures with respect to soils, vegetation and other matters are described in relevant parts of Section 6; outcome measurement criteria and leading indicator criteria are given in relevant parts of Section 6 and in Section 7.6 above for closure.

7.8 Closure Maps and Sections

At final rehabilitation all infrastructure is proposed to be removed and rehabilitated. Should some infrastructure be retained (subject to appropriate approvals and handover arrangements) plans clearly showing infrastructure to be kept and areas to be rehabilitated will be provided in the detailed Mine Closure and Rehabilitation Plan. All areas will be returned to the approximate pre-mining contours. As such no cross sections are provided.

7.9 Residual Risk Assessment

There are three main risks associated with potentially not meeting the desired rehabilitation outcomes. These are summarised in Table 7-1, with the identifiers R.1 and R.2 (revegetation aspects) and R.3 (groundwater aspects). The measures (set out above) result in low residual risks for each of these potential impact events. These low risks are considered acceptable.

Table 7-1 Potential Impact Events and Residual Risks - Rehabilitation

ID	Potential Impact Event	Residual Risk Level
R.1	Failure of revegetation to meet pre-mining use in a reasonable timeframe due to insufficient rehabilitation – soil and seed sources	Likelihood: Unlikely Consequence: Minor Risk: **LOW**
R.2	Failure of revegetation to meet pre-mining use in a reasonable timeframe due to salinisation, acidification or other contamination of soil arising from accidental escape of mining or waste disposal fluid, bund overflows or chemical or fuel spills	Likelihood: Rare Consequence: Minor Risk: **LOW**

ID	Potential Impact Event	Residual Risk Level
R.3	Compromise of protected potential beneficial uses of the Willawortina, Fractured Rock, GAB, Eyre or Namba Formation aquifers.	Likelihood: Rare Consequence: Minor Risk: **LOW**

7.10 Evaluation of Groundwater Status Leading to and Following Closure

As described in the groundwater modelling section (Section 3.10.4), enhanced natural attenuation of residual mining solution can be expected to protect the potential beneficial uses of the Eyre Formation aquifer outside the attenuation zone downgradient of the mining operations. This model was run for full-scale mining of the Pepegoona deposit.

Appendix E here includes details of the groundwater flush methodology applied to the Beverley North Mine. Salient aspects are given here – more technical detail is given in the appendix.

As groundwater levels and flow directions settle back to close to natural, these down-gradient wells will provide breakthrough curves of residual ameliorated mining solution as it moves through natural aquifer material at near-natural direction and velocity. The planned spacing of these wells will be: 20 m, 40 m, 60 m, 100 m from the down-gradient edge of the mined-out outer wellfield. It is also possible that the closer well or two might be affected by 'flare' of mining solution, the known and anticipated phenomenon of a small area outside of the outer injection wells of a mining pattern being part of the flow-path between injection and extraction wells.

In parallel, when an up-gradient wellfield is completed, an array of up-gradient non-regulatory monitor wells will be established at distances of approximately 20 m and 40 m from the edge of the wellfield. One line of production wells at distances of approximately 0 m (outermost injection wells), 20 m, 40 m, 60 m, and 100 m, will be used to examine the intrusion of natural groundwater into a mined-out and flushed wellfield. This will provide data to validate the model and again approximately two years of data will allow quantitative validation of the model. The geometry of these is shown in Figures 7-1, 7-2 and 7-3. The exact location will be determined after additional groundwater information from the mining and associated monitor wells has been evaluated taking into account lease boundaries and local vegetation and heritage aspects. Together with operational monitoring data from the establishment of wellfields (e.g. the breakthrough curves of injected mining solutions reaching extraction wells at the commencement of mining), this data will be used to refine and recalibrate the hydrogeological and hydrogeochemical models of the Pepegoona orebody and its surrounds, and if warranted that around Pannikan and other potential future orebodies.

The proposed well array is close enough to detect the early stages of natural attenuation as groundwater movement is in the order of 20 m/yr and the closest monitor wells are within approximately 10 m of the edge of mining-affected groundwater.

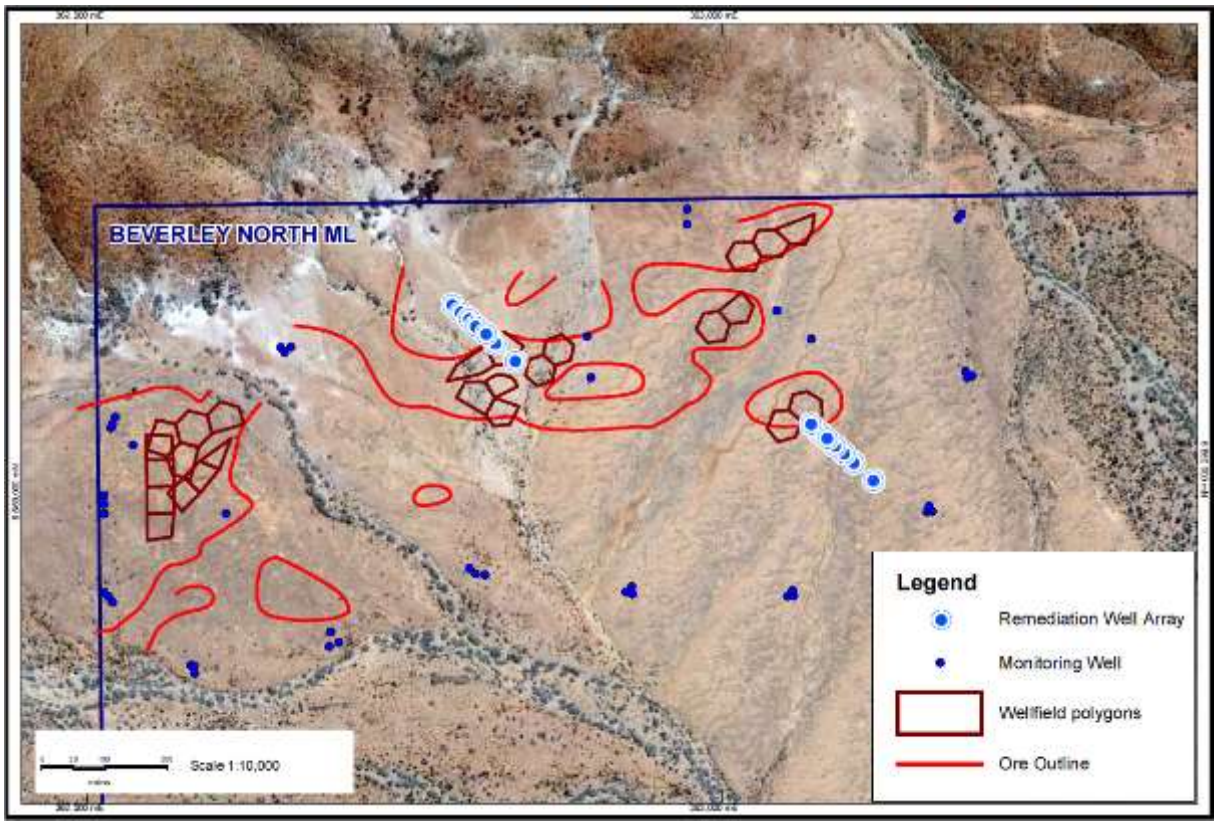

Figure 7-1 Aquifer Remediation Validation Monitoring Arrays at Pepegoona – Up-gradient and Down-gradient

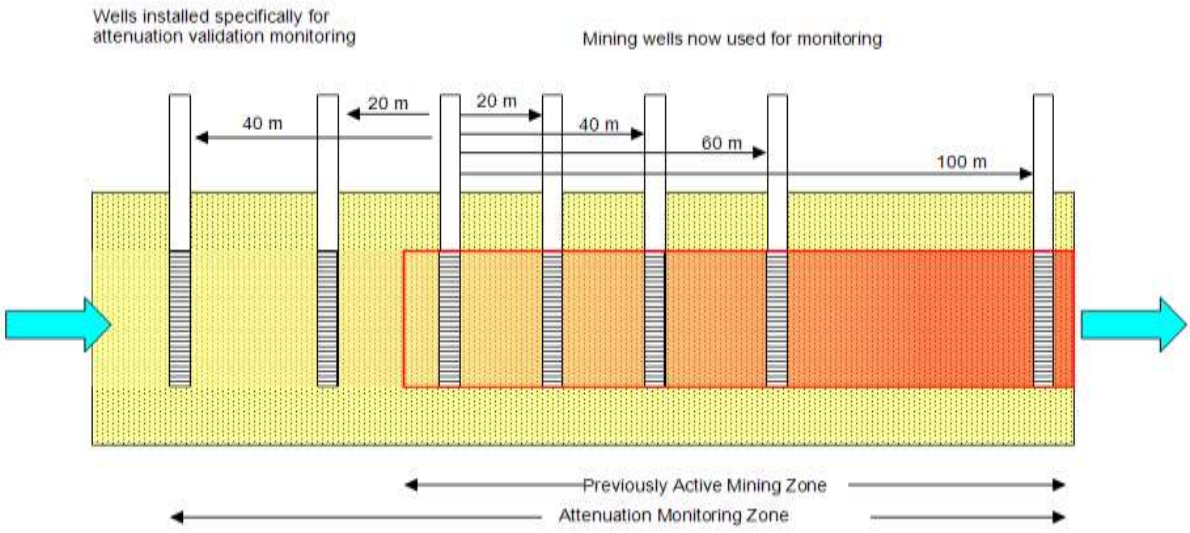

Figure 7-2 Upgradient Attenuation Validation Monitor Well Arrangement (diagrammatic)

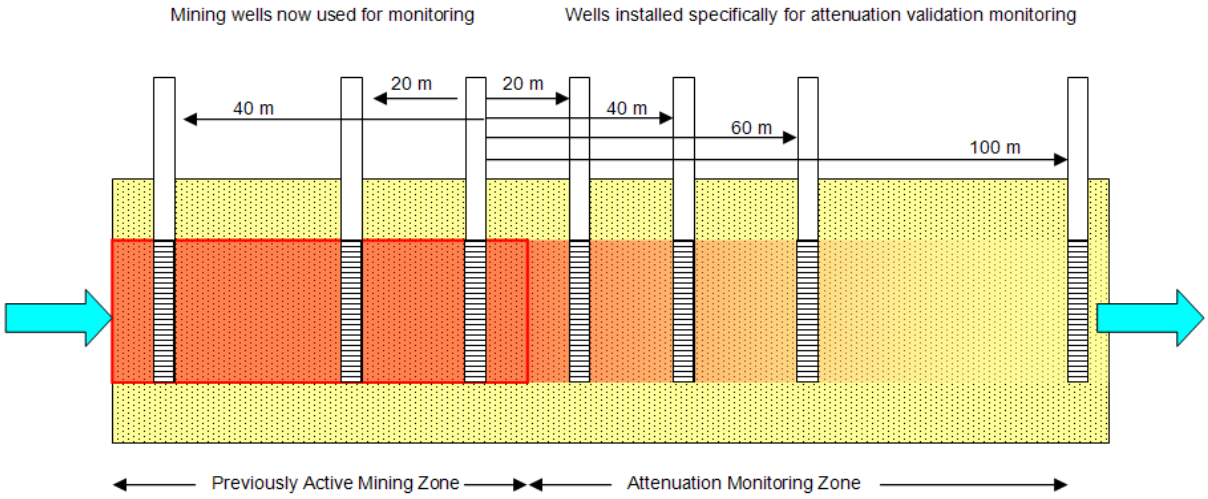

Figure 7-3 Downgradient Attenuation Validation Monitor Well Arrangement (Diagrammatic)

When sufficient data has been gathered, the hydrogeological model will be re-run if warranted, then the geochemical model will be refined to provide a better fit to this actual down-gradient and up-gradient data. All of the assumptions of the model would then be reviewed and the model re-run and re-validated. The predictions of long-term enhanced natural attenuation will then be repeated with the updated model. This is likely to be possible within 5-6 years of the commencement of mining, when infrastructure is still largely in place

If refined modelling predicts that impacts on the aquifer that could affect the groundwater use category beyond the attenuation zone of the Frome Embayment, then the use of further active remediation methods will be examined using the same model. Currently, the additional remediation methods that could be examined are:

- Additional groundwater flush
- Mixing
- Pump, treat and re-inject, e.g.
    - Reverse Osmosis
    - Electrodialysis or
    - Virtual Curtain/CSIRO hydrotalcite technology (c.f. Douglas *et al.* 2010)
- Non mineralised leaching
- Addition of remediation agents
    - An alkali, e.g. NaOH[28]
    - A reductant, e.g. H_2S
    - CSIRO/Virtual Curtain's technology (an in-situ reactive neutralising barrier based on magnesium oxide/hydroxide technology)[29].

[28] Soda ash (NaOH) is less likely to cause clogging by precipitation of gypsum or other sulphates that would be likely if lime ($CaCO_3$) were to be used, but the exact reagent would be determined by laboratory trials before implementation, if this option is pursued.

[29] http://www.wipo.int/pctdb/en/wo.jsp?WO=2007112509&IA=AU2007000452&DISPLAY=DESC

The refined model would be used to select one or more technologies that would meet the commitment to keep the attenuation zone within the Frome Embayment, in conjunction with the regulating authorities. This will necessarily include consideration of the disposal of a waste stream that would be created by some of these technologies and well as energy, ground disturbance and costs.

The best option as determined by a best practicable technology (BPT) assessment, or possibly two or three technologies, would then undergo field validation trials. If necessary, the actual field effectiveness will be incorporated into a new run of the model to assess the techniques effectiveness in meeting the required environmental outcome.

When the preferred technology is confirmed, implementation would follow. A summary of the timing of this process is given in Table 7-2. This may be subject to amendment, particularly dependent on the use of the satellite plant for other ISR amenable uranium deposits that are within economic pipeline distance and the actual time taken to mine out the Pepegoona deposit.

Table 7-2 Summary of Timing – Groundwater Closure Assessment

Step	Milestone	Timing (from commencement of mining)
1	First qualitative data – breakthrough curves and reagent consumption	Year 1
2	First mined-out wellfield data	Year 2 or3
3	First down-gradient edge wellfields finished, internal and adjacent down-gradient data	Year 3 or 4
4	Re-validation and re-running of hydrogeological/geochemical model	Year 5
5	Decision on the possible requirement for additional active remediation	Year 5
6	IF REQUIRED: Trialing of BPT	Year 5
7	Implementation of additional active remediation	Years 6 to 9

If step 7 is required, data on its effectiveness would be gathered and steps 5 and 6 re-done.

Heathgate will co-operate with CSIRO with their development of the 'Virtual Curtain' technology and keep up with other developments in the field (c.f. Douglas *et al*. 2010). This will speed consideration of additional active remediation if it is later required to be examined more thoroughly.

7.11 Closure Cost Estimate

As an existing operation, the Beverley mine has had a bond in place since its establishment. This is reviewed each year, most recently in June 2010. At that time the appropriate bond was calculated to be $10,325,000. This figure was based on an increment of 2.6% Adelaide All Groups CPI increase with a 10% third party management cost over the detailed estimate provided in 2009.

A separate bond has been calculated for closure of the Beverley North operation by DSD. A copy of the rehabilitation cost calculation undertaken is given in Appendix F which results in a closure cost estimate of $3,541,997. This includes a 10% normal project variation allowance ($292,727), and 10% third party management cost. As the Beverley North Mine operations are largely identical to the equivalent aspects of the pre-existing Beverley operations (with the exception that uranium is not produced for export), Heathgate proposes that the same system of

bi-annual (odd-numbered years) recalculation with a consumer price index (CPI) increment implemented on even-numbered years. This calculation assumes that no additional groundwater intervention is required. Heathgate understands that DSD will take this possibility into consideration when setting the bond for the ML.

7.12 Mine Closure Schedule

The mine closure schedule cannot be determined in any detail given the anticipated use of the satellite plant for other nearby uranium deposits that have been identified by exploration.

There is also the possibility as mentioned above that some infrastructure may be handed over for other uses at the end of mining, as described in Section 7.2, subject to appropriate approvals and handover arrangements.

Subject to appropriate approvals, it is also possible that some Beverley North facilities may be kept on a standby or care-and-maintenance status after the initial cessation of some or all of the wellfields, pending improved market conditions or technology improvements that would allow additional uranium to be extracted from wellfields or other nearby deposits, or while feasibility investigations or approvals of nearby deposits are undertaken, the mining of which may rely on the use of Beverley North infrastructure. However, this will only be done if the appropriate approvals are in place.

A conceptual mine closure schedule is given in Table 7-3, assuming no standby or care-and-maintenance. Heathgate will provide DSD a Mine Completion Report prior to lease relinquishment, in accordance with guidelines approved by the Director of Mines.

Table 7-3 Conceptual Mine Closure Schedule – Subject to Amendment

Time from official closure	Milestone / Activity	Notes
- 1 year	Draft Formal Closure Plan	Provided to stakeholders for discussion / negotiation.
- 1 year	Soil stockpile assessment	Soil stockpile from clearing for the processing plant and wellfields will be assessed for its suitability for respreading. EFA closure criteria formalised if not already done.
0	Closure plan formally adopted	Tenders let for salvageable items etc. Some unwanted items may be removed prior to official closure if they don't compromise possible future groundwater remediation.
0	Official closure	Commencement of post-closure environmental monitoring. Undertake one-pore-volume flush. Final rehabilitation commences.
Commencing 6 months	Salvage of suitable items, demolition and burial of unsuitable items not possibly required for future additional groundwater remediation	Rehabilitation activities and post-closure environmental monitoring.
1 year	Majority of physical rehabilitation not possibly required for future additional groundwater remediation complete. Return of part of bond.	First annual review of post-closure environmental monitoring. Recalculation of bond.
2 years	Decision made on any additional groundwater remediation and implementation of any additional remediation (if relevant). Continuation of post-closure environmental monitoring.	Second annual review of post-closure environmental monitoring. Findings assessed and discussed with regulators to set additional requirements, if needed, and confirm relinquishment conditions. Recalculation of bond.
3-4 years (if required)	If required; assessment and acceptance of additional remediation. Continuation of post-closure environmental monitoring	Progressive assessment of findings and discussion with regulators. Confirm relinquishment conditions. Annual post-closure monitoring reviews.
3-7 years	Physical surface rehabilitation complete. Confirmation post-closure environmental monitoring. Lease relinquished to DSD and return of remainder of bond.	Annual post-closure monitoring reviews. Relinquishment conditions met, post-closure environmental monitoring ceases.

8 MANAGEMENT SYSTEMS AND CAPABILITY

8.1 Management Commitment

Heathgate believes that sound environmental management is an important component of its overall management responsibility. Heathgate demonstrates its environmental performance through implementation of an Environmental Management System (EMS) which is based on the ISO 14001 Standard and which addresses all of Heathgate's operations. The Standard will also be used in ongoing development and improvement of this EMS.

The EMS covers both the Beverley and Beverley North operations.

The cornerstones of the EMS are:

- Heathgate's Environment Policy
- The development and implementation of environmental objectives and targets
- The ongoing monitoring and reviewing of environmental performance
- Continual improvement of Heathgate's environmental performance.

Heathgate's Environment Policy was last updated in November 2009 and is reproduced, as displayed in Heathgate's Adelaide office and at Beverley, in Figure 8-1. It will also be displayed at the Beverley North satellite plant.

Heathgate insists that its employees, contractors and agents conduct all business activities in a manner that is protective of the environment.

Environment Policy

Heathgate Resources Pty Ltd (Heathgate) is committed to conducting all of its mine operation activities in an environmentally responsible and prudent manner with the objective of minimising any adverse impacts to the air, land and water resources, to the lowest reasonably achievable level. Heathgate utilises environmental objectives, targets and plans in an endeavour to continually improve its overall environmental performance.

Integral to the Environment Policy are goals focused on:

- Waste minimisation;
- Zero pollution events;
- Compliance with all applicable laws and regulations concerning the environment;
- Environmental awareness training; and
- Minimum site disturbance.

Heathgate insists that its employees, contractors and agents conduct all business activities in a manner that is protective of the environment.

David Williams
President
November 2009

HEATHGATE

Figure 8-1 Heathgate Environment Policy

8.2 Environment Management System

An EMS is designed to enable an organisation to address environmental values, economic imperatives and public expectations. An EMS creates a system of processes and procedures to examine performance against environmental goals and to continually achieve higher levels of performance.

The ISO 14001 Standard emphasises the need for continual improvement in the organisation's environmental performance (Figure 8-2). Further, a systematic approach to environmental performance fosters a more efficient use of resources, so the EMS should provide benefits to the organisation's bottom line. As part of its commitment to minimise the environmental impacts of its operations, Heathgate has developed an Environment Management System (EMS).

The Environment Policy (see above), EMS Procedures Manual and the Procedures Registers are the key EMS documents.

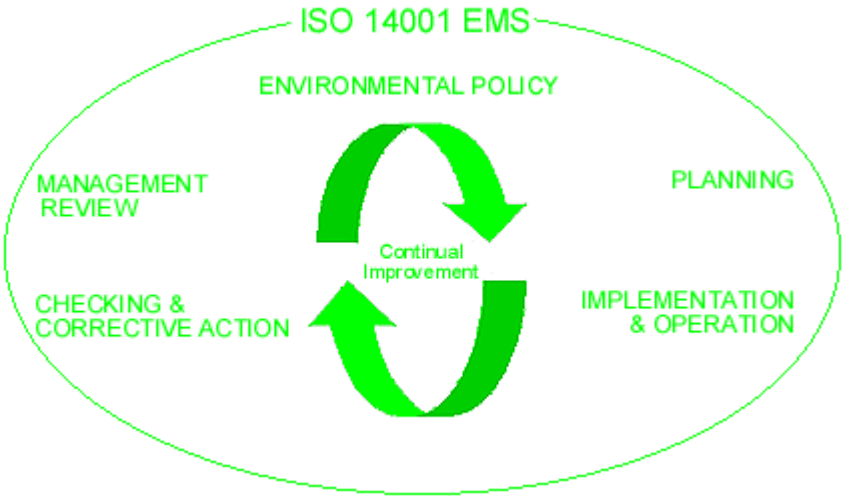

Figure 8-2 ISO 14001 Continual Improvement Cycle

8.3 Planning

8.3.1 Environmental Aspects and Impacts

ISO 14001 requires an organisation to establish and maintain a set of procedures to identify environmental impacts of its activities, products or services (that it can control and over which it can be expected to have an influence) in order to determine those which have, or can have, significant impacts on the environment.

To meet the requirements of the Standard, Heathgate has conducted a comprehensive HAZID (Hazard Identification process) and developed a Risk Register. Heathgate's risk assessment process is based on the AS 4360/1996 Risk Management Standard. The Register is reviewed and updated from time to time, particularly since AS 4360's replacement by ISO 31000 in 2010. The Risk Register is used to rank the identified impacts in terms of significance (refer Section 6.3). The assessment criteria are based on a consideration of business, safety and environmental factors.

This risk assessment allows Heathgate to prioritise the relative risks of its current activities, determine the significance of each environmental impact identified and nominate how the issue will be addressed. In Section 6, Table 6-1 refers to relevant legislation and Table 6-6 includes the potential identified events, the assigned risk levels, the control and management strategies, outcomes and outcome measurement criteria.

The procedure for identifying and evaluating the environmental aspects and impacts of Heathgate's operations is documented in the Risk Management Procedure. Reassessment of the environmental aspects and impacts is required annually or when there are significant changes to operations.

Note that the internal risk management procedure takes a different format to that required by the guidelines for this document. The Risk Assessment presented in Section 6.3 has been drawn from Heathgate's internal documentation but presented in the guideline format.

8.3.2 Legal and Other Requirements

ISO 14001 requires an organisation to 'establish and maintain a procedure to identify and have access to legal and other requirements that are applicable to the environmental aspects of its activities, products or services'.

Heathgate understands the importance of meeting and where practicable, exceeding, its regulatory obligations. Heathgate has developed a procedure and a Legal and Other

Requirements Register. The Legal Register provides a summary of applicable Commonwealth and State Laws, Codes of Practice, Heathgate Resources' Policies, Initiatives, Licensing and Permits.

8.3.3 Objectives and Targets

ISO 14001 requires an organisation to 'establish and maintain documented environmental objectives and targets. In accordance with the Standard, Heathgate has established objectives and targets by considering:

- Legal and other requirements
- Environmental goals arising from its environmental policy
- Significant environmental impacts.

As required by the Standard, technological options, views of interested parties and financial, operational and business requirements were also considered.

The ESH (Environment, Safety and Health) Manager will coordinate an annual review of the objectives and targets. A review is also required to assess the impacts from changes to Heathgate's operations, the results of management reviews as well as environmental audit findings and recommendations. The revision of objectives and targets will form the basis for continual improvement in Heathgate's environmental performance.

The environmental outcomes and criteria developed in this PEPR constitute the basis of objectives and targets for the purposes of ISO 14001.

8.3.4 The Environmental Management Program

ISO 14001 requires that an organisation establishes and maintains an Environmental Management Program to achieve its objectives and targets. The Program includes the:

- Designation of responsibility for achieving objectives and targets at each relevant function and level of organisation
- The means and time-frame by which they are to be achieved.

In meeting these requirements and those of the regulators, Heathgate historically developed an Environmental Management and Monitoring Plan (EMMP) for Beverley ML 6321 that addressed those aspects assessed as having environmental impacts of relatively high significance, assigned tasks and responsibility for meeting environmental targets and specified a framework for their achievement.

For the purposes of this PEPR and ISO 14001, a separate EMMP has not been prepared and the relevant information is in the PEPR and the procedures of the EMS.

8.3.5 Implementation and Operation

Effective implementation and operation of the EMS requires Heathgate to develop capabilities and support mechanisms necessary to achieve the EMS objectives and targets. Heathgate recognises that environmental improvements will require the continued allocation of resources, especially human and financial. Heathgate has committed to ongoing human resources and will seek additional funding as required through its budgetary process.

8.3.6 Structure and Responsibility

ISO 14001 requires roles, responsibilities and authorities to be defined, documented and communicated to facilitate effective environmental management. The Standard requires that senior management will provide human, technological and financial resources and appoint a management representative who will:

- Ensure the EMS requirements are established, implemented and maintained
- Report on the performance of the EMS to top management for review and as a basis for improvement.

Heathgate has appointed an ESH Manager to oversee the development and implementation of the EMS. The ESH Manager is responsible for ESH matters for both the Beverley and Beverley North. This appointed person works together with other ESH, mining and administrative staff to implement and maintain the EMS.

The ESH Manager has the authority to ensure compliance, identify and implement solutions and act upon incidents. The ESH Manager assists Management and Supervisors to inform and educate staff and contractors of their roles and responsibilities with respect to the Heathgate EMS. The ESH Manager also coordinates audits and management reviews.

As at mid 2010, the ESH Manager is supported by an environmental team of six, a safety team of four and a radiation protection team of two:

- Senior Environment Advisor
- Environment Advisors (x4)
- Environment Technician
- Senior Safety Advisor
- Safety Advisor
- Medics/Safety and Emergency Services Advisors (x2)
- Senior Radiation Advisor
- Radiation Advisor.

As progressive rehabilitation occurs and risk assessments and monitoring requirements are revised from time to time, the appropriate number of staff in the team and the balance between staff and consultants may be varied. All environmental and radiation advisors hold appropriate tertiary qualifications and safety advisors hold or are studying for formal certificate or diploma qualifications. Various additional tasks are carried out by consultants hired for specific purposes, currently including:

- Annual vegetation survey
- Annual fauna survey
- Annual Ecosystem Function Analysis survey.

8.3.7 Training, Awareness and Competence

ISO 14001 requires that an organisation establish and maintain a program to identify and address environmental training and awareness for all its stakeholders. Heathgate's stakeholders include clients, management, employees, contractors, suppliers and visitors to the mine site. The standard requires that all staff, whose work may create a significant environmental impact, receive appropriate training.

Heathgate has developed a Training, Awareness and Competence Procedure to ensure that:

- The importance of compliance with the environmental policy, EMS procedures and requirements is communicated to stakeholders
- Stakeholders are aware of the significant environmental impacts (actual and potential) of their work activities and of the environmental benefits of improved personal performance

- Stakeholders are aware of their individual roles and responsibilities and are aware of the potential consequences of departure from specified operating procedures
- Stakeholders are adequately trained to successfully perform their designated roles and responsibilities.

Documentation for the Training and Awareness Program and Register is maintained by the Human Resources (HR) Department. Records are kept in accordance with the Records Procedure.

8.3.8 Communication and Reporting

ISO 14001 requires that an organisation establish and maintain procedures for internal communication between various levels and functions of the organisation regarding its environmental aspects and the EMS. The Standard also requires an organisation to consider processes for external communication on its significant environmental aspects, together with a mechanism to record these communications.

Heathgate recognises that communicating its environmental objectives, targets and performance to all stakeholders is an essential component of the EMS. It provides for a greater understanding of Heathgate's environmental impacts and an acceptance of the organisation's effort to improve its environmental performance. Heathgate encourages the use of electronic communication to reaffirm its commitment to the protection of the environment by avoiding excess paper use.

Through effective internal communication, particularly results of EMS monitoring, audits and management reviews, employees will be well informed and thereby generate greater ownership of the environmental process. This will result in a higher level of motivation for continuing environmental improvement.

Heathgate maintains an email address, publicrelation@heathgate.com.au to take questions from the interested public, advertised on its website www.heathgate.com.au. Its staff members are regular participants and presenters in industry-related conferences in South Australia and elsewhere.

An Ongoing Community Engagement Plan is given in Section 6.13.

An Annual Environmental Report was produced and made available on the Heathgate website for the years 2001 to 2007 inclusive. From 2008 the report took the form of a Mining and Rehabilitation Compliance Report (MARCR) following the PIRSA (2007) Regulatory Guideline 3. Subsequently this report has been renamed to the Annual Compliance report (ACR)

As required by the lease and EPBC approval conditions, Heathgate will report to the Director of Mines (and where relevant the Commonwealth Minister responsible for the EPBC Act) any non-compliant criteria (see Sections 6 and 7) of the environmental outcomes to be achieved, as detailed in this PEPR. As a minimum, non-compliances will be reported in the quarterly regulator meetings. Spills of mining or disposal solution and groundwater excursions will be reported according to the requirements of the RWMP and the licence to mine or mill radioactive ores issued under the RPC Act, which aim to be reported within one working day.

8.3.9 EMS Documentation

ISO 14001 requires that an organisation will establish and maintain information, in paper or electronic form, to:

- Describe the core elements of the EMS and their interaction
- Provide direction to related documentation.

Heathgate satisfies these requirements by maintaining its EMS in electronic form located at the Heathgate Intranet site.

The core elements of Heathgate's EMS are:

- The Environment Policy demonstrating Heathgate's commitment to and providing direction for continual improvement in environmental performance
- The EMS Procedures Manual, consisting of general procedures to enable implementation and reviewing of the EMS to ultimately achieve continued improvement in environmental performance. The EMS Procedures Manual refers to other documents that register and record the processes and outcomes of these procedures
- The EMS Registers are the working documents of the EMS. Typically, performance of the procedures requires the recording of information within these registers.

All EMS documents contained within and related to the above core elements will be clearly named and sufficiently referenced to be accessible to interested parties.

8.3.10 Document Control

In accordance with ISO 14001, Heathgate has established a Document Control Procedure to control all ESHMS documentation such as manuals, forms, records and registers. The ESH Manager is responsible for the original copy of the EMS to ensure that its documents are controlled.

The Standard states that this documentation will be kept legible, dated, identifiable and retained for a specified period. The Document Control Procedure is required to include provisions for the creation and modification of various types of document.

A Document Control Register has been established by Heathgate to ensure that in accordance with the standard:

- All relevant environmental documents can be easily located within Heathgate's offices
- Documents are periodically reviewed and revised as necessary under the authorisation of the ESH Manager
- Up-to-date versions of relevant documents are available at locations where operations essential to the effective functioning of the EMS are performed
- Obsolete documents are immediately removed to prevent their inadvertent use
- Obsolete documents retained for legal or other purposes are held and are suitably identified in the Document Control Register.

A common Document Control Register applies to both the Beverley and Beverley North operations; however the files on the register are identifiable for audit purposes.

The ESH Manager is responsible for implementing the Environmental Document Control Procedure and maintaining and ensuring the updating of all EMS manuals and associated documents.

8.3.11 Operational Control

ISO 14001 requires that when actual or potential significant impacts have been identified, the activities associated with these impacts are identified and control measures are implemented. Control and planning measures must:

- Document procedures to prevent deviations from the system
- Establish operational criteria within the procedures
- Identify procedures that have significant environmental aspects
- Establish procedures to ensure suppliers and subcontractors are aware of the requirements of the EMS.

Operational Control is required to ensure that activities associated with potential significant environmental impacts are conducted under controlled conditions. Standard Operating Procedures (SOPs) have been developed for the more significant impacts of Heathgate's activities. Each SOP identifies the environmental impact associated with an aspect of Heathgate's operations and specifies management measures that could reduce these impacts.

The ESH Manager is responsible for ensuring that all SOPs are maintained in accordance with the Operational Control Procedure and are documented in the Operational Control Manual (SOP Manual). The ESH Manager is also responsible for ensuring the communication of the requirements of the SOP to stakeholders.

8.3.12 Emergency Preparedness and Response

ISO 14001 requires that an organisation shall establish and maintain procedures to identify the potential for and to respond to accidents and emergencies and for preventing and mitigating the environmental impacts that may be associated with them. The standard also requires that these procedures will be reviewed and revised when necessary, in particular after the occurrence of accidents, and they will be periodically tested where practicable.

Heathgate has developed a compliant Environmental Emergency Preparedness and Response Procedure that, in conjunction with the Emergency Procedures, will ensure accidents and emergency situations will be adequately managed to minimise potential adverse environmental impacts.

It is the responsibility of the ESH Manager to identify, with the assistance of qualified staff, the potential environmental impacts of accidents and emergency situations and to ensure that section leaders and contract managers understand their responsibilities to make sure services are performed in accordance with the EMS.

The Environmental Emergency Preparedness and Response Procedure will be reviewed annually and revised to reflect Heathgate's current operations. This review process will be coordinated by the ESH Manager, who may seek external professional advice. The ESH Manager will carry out or instigate an investigation and review of the procedure following any emergency incident where a significant environmental impact has, or potentially may have occurred.

8.3.13 Checking and Corrective Action

In order to facilitate continual improvement, Heathgate recognises the importance of ongoing monitoring and implementing any required adjustments. Heathgate has established and maintains procedures for the measurement and evaluation of its environmental management and performance. Procedures are also in place for the ESH Manager to undertake or instigate investigations of situations where the EMS was not conformed with and to recommend any necessary corrective and preventative actions.

8.3.14 Monitoring and Measurement

ISO 14001 requires that an organisation establish and maintain procedures to enable ongoing monitoring and measuring (for the evaluation) of environmental performance of activities that can have a significant environmental impact. These procedures must address the recording of information to track performance, relevant operational controls and conformance with objectives and targets.

Records must be kept detailing the calibration and maintenance of monitoring equipment used and a documented procedure established for reviewing compliance with relevant environmental legislation and regulations.

The SOPs address those activities that have been determined to have significant environmental impacts. They include monitoring and measurement instructions to be followed by all staff and

contractors. When the monitoring and measurement data has been recorded, it is stored in the Environmental Database.

The ESH Manager is responsible for assessing the effectiveness of the EMS through periodic reviews of the monitoring data that are reported annually in the ACR (Section 8.3.7). This will enable the identification of those functions requiring corrective actions and those being successfully implemented. Monitoring and measurement functions will be audited to assist in evaluating the effectiveness of the EMS.

8.3.15 Non-conformance and Preventative and Corrective Action

ISO 14001 requires that in the case of non-compliance with an element of the EMS:

- The responsibility and authority for initiating investigation, taking action to mitigate any impacts caused and corrective action will be defined
- Procedures will be established and maintained for investigating and correcting non-conformance to:
    - determine the cause
    - identify and implement corrective action
    - initiate preventative actions
    - apply controls to ensure that preventative actions taken are effective
    - record any changes in written procedure resulting from the corrective action.

Heathgate has a compliant Non-conformance and Corrective and Preventative Action Procedure. Effective and prompt action must be initiated should an activity or function result in an unforeseen environmental impact or fail to comply with the EMS.

The ESH Manager has been assigned responsibility and authority to initiate an investigation into a non-conformance event.

The Non-conformance and Corrective Action Procedure details a protocol to enable a non-conformance to be identified and addressed via a Corrective Action Request or equivalent. It also details actions to prevent further non-conformances, including the alteration of procedures.

Following implementation, the procedure assesses and verifies the effectiveness of the corrective or preventative action.

8.3.16 Records

ISO 14001 requires that procedures for the identification, maintenance and disposition of environmental records should be established and maintained. These records, including training records and the results of audits and reviews are required to be legible, identifiable and traceable to the activity, product or service involved. They must be stored and maintained, be readily retrievable and protected against damage, deterioration or loss.

Heathgate has met the requirements of the standard by incorporating the following records in this EMS:

- The training and awareness program registers training sessions conducted to address training and awareness needs and equip Heathgate stakeholders with the knowledge and skills required to undertake their individual EMS roles and responsibilities
- The EMS Communications Register contains records of all environmental communication
- The Document Control Register records all EMS and records and their location
- The Non-conformance and Corrective Action Register equivalent (within Heathgate's incident reporting system) is a record of EMS Non-conformances.

The Environmental Records Procedure has been combined with the Document Control Procedure for management of all EMS documents and environmental records.

8.3.17 EMS Audit

ISO 14001 requires that programs and procedures for periodic EMS audits be established and maintained in order to determine:

- Whether or not the EMS;
    - conforms to the requirements of the standard and the planned arrangements set out in this PEPR, procedures and work instructions
    - has been properly implemented and maintained
- That Heathgate's environmental performance is improving.

The standard requires that the audit program also covers the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits.

Heathgate has developed a compliant EMS Audit Procedure that addresses:

- The activities and areas to be audited
- The frequency of audits
- The responsibility associated with conducting an audit
- Communication of the audit findings
- Auditor competence.

The ESH Manager will appoint appropriately trained persons from Heathgate or external to the company to undertake audits of the Heathgate EMS. Auditors will be required to provide an audit report within three months of completing an audit. The audit report, which will be presented to senior management, will detail all audit activities, functions and elements of the EMS and provide details of any non-conformances and corrective or preventative actions to be undertaken within a specified time frame.

8.3.18 Management Review

ISO 14001 requires that at specified intervals, senior management will review the EMS to determine continued suitability and effectiveness. This review should include results of audits, a review of performance against objectives and targets, procedures, incidents, concerns of interested parties, the suitability of the policy and the suitability of the EMS in view of changing conditions. The Standard also requires the management review process to ensure that necessary information is gathered for management evaluation and that the review is documented.

Heathgate established a Management Review Procedure, which is implemented and maintained by the ESH Manager, to meet these requirements. The procedure enables senior management to undertake a complete review of the ongoing suitability and effectiveness of the EMS. The review process, which includes a review of internal and external audits, public and customer comments and legislative requirements, is coordinated by the ESH Manager. The ESH Manager ensures the results of the review are documented and distributed to stakeholders.

The ESH Manager will initiate and participate in a review of the EMS at least once per year to consider the impact of changes in the company's operations, legislative requirements and technology.

ESH and other staff will initiate corrective action in accordance with the Non-conformance, Corrective and Preventative Action Procedure where improvements to the EMS are identified

during reviews. The ESH Manager will maintain records demonstrating the implementation of the corrective actions.

8.4 Previous Experience of Operator

Heathgate has owned the Beverley deposit since 1990 and operated that mine since 2000. The staff and long-term contractors comprise a mixture of personnel with up to 10 years site experience (some of whom worked on the original Beverley FLT) and senior staff members have experience at other mine sites as operators, contractors, consultants and regulators.

This experience is directly applicable to operations at Beverley North.

8.5 SA EPA 2004 Review

In 2004 the SA EPA released its report "*Review of Environmental Impacts of the Acid In-Situ Leach Uranium Mining Process*" undertaken on its behalf by CSIRO Land and Water (CSIRO 2004). The review was in response to claims that acid in-situ leach (ISL) mining and disposal of waste would contaminate groundwater. It was a valuable opportunity for the EPA to re-examine the impacts of this mining process used in South Australia (EPA 2007).

The CSIRO review resulted in 13 recommendations, the majority of which related to groundwater monitoring and the impact of natural attenuation processes on the presence of mining and disposal fluids. The South Australian Cabinet accepted the report and committed to fully implement the recommendations of the review.

The existing mechanisms of EPA-RPB approvals (RMP and RWMP) and DSD PEPR amendments were used to implement the recommendations.

In June 2007 the SA EPA released its report "*Review of environmental impacts of the acid in-situ leach uranium mining process – Implementation of recommendations*" (EPA 2007). The abstract of that report is reproduced below.

> *The recommendations from the Review of Environmental Impacts of the Acid In-situ Leach Uranium Mining Process (2004) have now been implemented into the appropriate regulatory programs of the South Australian Environment Protection Authority (EPA) and Department of Primary Industry and Resources, South Australia (PIRSA). Details of how the recommendations have been actioned are provided in the summary (see Page 8).*
>
> *Some outcomes from the recommendations require ongoing monitoring and assessment. Such requirements have also been included in the relevant monitoring programs.*
>
> *This report has been developed with the agreement from PIRSA and Department for Water, Land and Biodiversity Conservation (DWLBC.)*

The interested reader is referred to the 2007 EPA report, which tabulates the recommendations and how they were individually implemented. The learnings from the review have been incorporated into the design of the Beverley North project.

9 APPROVAL CONDITIONS

9.1 DSD Approval Conditions

First Schedule		
Aspect	***Condition***	***Management & Measures***
	1. Mining operation authorised by this lease must only be for the recovery of Uranium in accordance with the mining lease proposal document dated 8 April 2010 and subsequent response document dated 30 July 2010	Accepted
	2. The Lessee must not commence or undertake any mining operations the land until a Mining and Rehabilitation Program (MARP[30]) has been approved by the Minister and a bond has been paid in accordance with Section 62 of the *Mining Act 1971*.	Accepted
	3. The Lessee must prepare a MARP that complies with the requirements of guidelines approved by the Director of Mines and include criteria that are developed in consultation with relevant stakeholders.	Accepted

[30] Now termed a PEPR

	4. The criteria included in the MARP must demonstrate clear and unambiguous achievement of the environmental and mine closure outcomes specified in the Second Schedule by • Including the specific parameters to be measured and monitored by the Lessee • Specifying the locations that the parameters will be measured, or how these locations will be determined • Clearly stating the acceptable values for demonstrating achievement of the outcome, with consideration of any inherent errors of measurement • Specifying the frequency of monitoring by the Lessee • Identifying what background[31]	Accepted
	5. The Lessee Must implement and comply with the approved MARP.	Accepted – this document
	6. The Lessee must review the MARP on request of the Director of Mines within a time specified in the request and submit the revised MARP for approval to the Director of Mines.	Accepted
	7. The Lessee agrees to the approved MARP being made available for public inspection.	Accepted
	8. The Lessee must provide information as requested by and to the Director of Mines, on the Lessee's capability and competence to comply with the requirements of the *Mining Act, 1971*, the conditions of this lease, and the MARP in accordance with approved guidelines or as otherwise specified by the Director of Mines	Accepted

[31] Including the predicted effect of other mining leases with an approved PEPR in determining background groundwater data for relevant aquifers.

	9. The Lessee must provide to the Director of Mines a Mining and Rehabilitation Compliance Report (MARCR[32]) on operations carried out on the Lease and compliance with the approved MARP. The MARCR must be submitted every year, within 2 months after the anniversary of the date the Lease was granted, or at some other time agreed with the Director of Mines in accordance with guidelines approved by the Director of Mines. The Lessee agrees to the MARCR being made available for public inspection.	Accepted with the proviso that the report will be provided each March covering the previous 12 months ending in December. The three months reporting timeframe requested reflects experience at Beverley where the complexity of monitoring and time taken to receive certain analytical results makes two months insufficient to properly prepare an ACR.
	10. The Lessee must, if requested by the Director of Mines, undertake an independent audit of achievement of the environmental outcomes in the MARP, by an independent expert approved by the Director of Mines and submit the audit to the Director of Mines. The lessee agrees to the audit being made available for public inspection. The Lessee must meet all the charges and costs in undertaking the independent audit.	Accepted
	11. At least 3 months prior to Lease relinquishment or expiry, the Lessee must provide to the Minister a Mine Completion Report prepared in consultation with the landowner and in accordance with guidelines approved by the Director of Mines, which demonstrates achievement of the closure criteria as specified in the current MARP.	Accepted

[32] Now an ACR

	12. The Lessee must, prior to commencing operations under this Lease and for the duration of the lease maintain public liability insurance to cover all operations under the Lease in the name of the Lessee for a sum not less than $50 million or such greater sum as specified by the Director of Mines, and make such amendments to the terms and conditions of the insurance as the Director of Mines may require. A copy of the cover note of certificate of currency for the insurance must be provided to the Director of Mines upon request. If requested by the Director of Mines, the Lessee must engage an independent and reputable risk assessor to prepare a risk assessment report detailing the public liability risks arising out of the conduct of operations on the lease, and recommending the level of amount of public liability cover (in respect of any one occurrence) that should be effected and maintained by the Lessee. In preparing the risk assessment report, the assessor must consult with the landowner and the Director of Mines. In specifying the level of insurance required, the Director of Mines accepts no liability for the completeness, adequacy of the sum insured the limit of liability, the scoped coverage, the conditions or exclusions of the insurance in respect of how the Lessee may or may not respond to any loss, damage or liability.	Accepted
	13. The Lessee must report any non-compliance with these conditions and approved MARP to the Director of Mines. A verbal notification must be provided within 24 hours, after the Lessee becomes aware of the non-compliance. A written report must be provided within 3 calendar days or such time period as approved by the Director of Mines.	Accepted
	14. In requesting a review of the bond required under the *Mining Act1971* the Minister may request that written quotes from a third party are obtained by the Lessee for the cost of rehabilitating the site to the requirements specified in the approved MARP. The Lessee must meet all the charges and costs in obtaining and maintaining the Bond.	Accepted

Second Schedule		
Aspect	***Condition***	***Management & Measures***
Soil	1. The Lessee must, in constructing and operating the Lease ensure that soil affected by mining activities is suitable for a return to pre-mining use.	1. EFA is used to assess soil and vegetation impacts (refer Section 6.4.8 and, in particular, Section 6.5.8 and Table 6-9 of this report). The same methodology is proposed for mine closure (Section 7.6.2). Refer also to Section 3.13, Table 6-6 and remainder of Section 6.4.
Waste disposal and hazardous substances	2. The Lessee must not dispose of any waste within the lease unless prior approval under the relevant legislation is obtained.	2. No unauthorised wastes would be disposed of within the lease. Refer to Section 4.7.
	3. The Lessee must in constructing and operating the lease ensure that there are no adverse impacts to the environment due to radon release, uranium-bearing materials, or radiological aspects of seepages and spills.	3. The RWMP and RMP will be the key documents for management of radiological aspects of the Beverley North operations. Radiological issues relevant to the various categories of aspect (surface water, air quality etc) are listed in Table 6-6, and discussed as appropriate in Sections 6.4 to 6.11.
Native Vegetation	4. The Lessee must, in constructing and operating the Lease ensure no loss of abundance or diversity of native vegetation on or off the Lease to native vegetation through: • clearance, • dust/contaminant deposition • fire or • other damage unless prior approval under the relevant legislation is obtained.	4. Native vegetation management is discussed in Section 6.5, and Table 6.6, including fire aspects. Refer also to Section 3.11. The Compliance Monitoring Plan includes use of EFA for vegetation monitoring to provide a statistical comparison of mine-affected and control areas (Section 6.5.8). Significant Environmental Benefit (SEB) compensation is discussed in Section 6.5.8 and Appendix C.
Weeds and Pests (feral animals)	5. The Lessee must, in constructing and operating the lease ensure no introduction of new species of weeds[33], plant pathogens or pests (including feral animals), nor increase in abundance of existing weed or pest species in the lease area compared to adjoining pastoral properties.	5. Weed and pests (feral animal) management is discussed in Sections 6.5 and 6.8, and Table 6-6. A specific outcome to be achieved by the management measures is no introduction of new weeds, plant pathogens or pests (including feral animals), nor increase in abundance of existing weed or pest species in the lease area compared to adjoining pastoral areas (Sections 6.5.5 and 6.8.5).

[33] Weeds are defined in this condition as any invasive plant that threatens native vegetation in the local area or any species recognised as invasive in South Australia.

Second Schedule		
Aspect	***Condition***	***Management & Measures***
Surface Water	6. The Lessee must in constructing and operating the lease ensure no compromise of pastoral use of downstream surface water bodies.	6. Surface water management is discussed in Section 6.6; in particular control and management strategies are discussed Section 6.6.3, and Table 6-6. The specific outcome for surface water management is no compromise of pastoral use of downstream surface water bodies (Section 6.5.5).
Groundwater	7. The Lessee must, in constructing and operating the lease ensure that there is no compromise to the environmental values of the Willawortina aquifer.	7. Groundwater management is discussed in Section 3.10, Table 6-6 and Section 6.7. In particular the general control and management measures are described in Section 6.7.3; outcome measurement criteria are given in Section 6.7.6; leading indicator criteria are given in Section 6.7.7; and closure outcomes are addressed in Section 7.6.
	8. The Lessee must, in constructing and operating the lease ensure that there is no compromise to the environmental values of the Namba aquifer outside of the mining lease.	8. as above
	9. The Lessee must, in constructing and operating the lease ensure that there is no compromise to the environmental values of the Eyre Formation aquifer outside the mining lease.	9. as above
	10. The Lessee must, in constructing and operating the lease ensure that there is no compromise to the environmental values of the Fractured Rock aquifer.	10. as above
	11. The Lessee must, in constructing and operating the lease ensure that there is no compromise to the environmental values of the Great Artesian Basin aquifer.	11. as above. Although the Pepegoona and Pannikan deposits are outside the GAB, Heathgate acknowledges that it's protection is an integral part of environmental protection at Beverley North.
Native Fauna	12. The Lessee must in constructing and operating the lease ensure that there are no net adverse impacts from the site operations (including fire) on native fauna abundance or diversity in the lease area and in adjacent areas.	12. Native fauna management is discussed in Section 6.8.3, Table 6-6 and Section 6.8. In particular, Section 6.8.8 describes the Company Compliance Monitoring Plan for fauna. Section 6.5, Vegetation Aspects, includes fire management. The majority of fauna monitoring sites are on the ML.

Second Schedule		
Aspect	***Condition***	***Management & Measures***
Aboriginal Heritage	13. The Lessee must, in constructing and operating the Lease, ensure that there is no disturbance to Aboriginal artefacts or sites of significance unless prior approval under the relevant legislation is obtained.	13. Heritage management is discussed in Section 3.14, Table 6.6, and Section 6.10. All Aboriginal heritage sites have been identified in an Aboriginal Heritage survey. These sites will be protected in accordance with State and Commonwealth legislation.
Protection of third party property	14. The Lessee must, in constructing and operating the Lease, ensure that there is no unauthorised damage (including that caused by fire) to adjacent public or private property and infrastructure.	14. Fencing and stock-watering points are maintained to the satisfaction of the pastoral sub-lessee (Heathgate holds the Wooltana pastoral lease and subleases most of the property to a local pastoralist) and where applicable its neighbour Arkaroola – gates have been installed for access to monitoring locations on Arkaroola adjacent to Pepegoona. No public roads or other infrastructure are affected. See Section 6.11, Third Party Aspects
Closure and rehabilitation	15. The Lessee must demonstrate that the following outcomes (in so far as they may be affected by mining operations) are expected to be achieved indefinitely post mine closure to the satisfaction of the Director of Mines: a. No compromise to the environmental values of the Willawortina Formation, Namba aquifer, Eyre Formation, Fractured Rock and Great Artesian Basin aquifers b. The external visual amenity of the site is acceptable to relevant stakeholders c. Risks to the health and safety of the public and fauna are as low as reasonably achievable d. Ecosystem and landscape function is resilient, self-sustaining and indicating that the pre-mining ecosystem and landscape function will ultimately be achieved. e. The site is physically stable f. All waste materials left on site are chemically and physically stable g. No compromise to the ability of other existing mining lessees with an approved MARP to achieve their approved	15. Closure and rehabilitation is addressed in Section 7. Closure outcomes are discussed in Section 7.6. The following management particular management measures apply: a, b, c. The general control and management measures with respect to groundwater are described in Section 6.7.3; outcome measurement criteria are given in Section 6.7.6; and leading indicator criteria are given in Section 6.7.7. Refer also to Section 3.10, Table 6.6, remainder of Section 6.7 and Section 7, especially 7.10. d. Refer to Sections 3.4 and 4.6.5, and general outcomes in Section 7.6.1. e. Refer to Sections 4.6.1, 4.6.5 and 7. f. Refer to Section 6.5.8; Table 6.6 and Section 7.6. Refer also to remainder of Section 6.5 and Section 7. g. The currently defined Beverley North operations have no groundwater interaction with the only other approved Mining Lease in the district, Beverley ML6321, hence this is fulfilled.

Second Schedule		
Aspect	***Condition***	***Management & Measures***
	groundwater closure criteria[34]	
	16. The Lessee must specify closure criteria that will be used to demonstrate (within 10 years of the cessation of mining) the clear and unambiguous achievement of the closure outcomes	16. Closure outcomes are discussed in Section 7.6 and a proposed timetable for demonstration of closure criteria in Section 7.12.
Leading Indicators	The MARP must include additional leading indicator criteria for the Second Schedule lease conditions 1 and 7 – 11. Notes: Environmental Values the environmental values recognised in 'ANZECC & ARMCANZ 2000. Australian and New Zealand guidelines for fresh and marine water quality. National Water Quality Management Strategy Paper No 4, Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, Canberra.' : a)	17. Leading indicator criteria are given in Section 6. Including acknowledgement of the ANZECC/ARMCANZ 2000 guidelines.
OTHER ENVIRONMENTAL CONDITIONS		
Aspect	***Condition***	***Management & Measures***
Landholder liaison	17. Where the pastoral lease holder differs from the mining lease holder, the Lessee must ensure that the occupier of the land is fully advised of their program of activities, particularly in regard to the impact of operations on the land and rehabilitation progress.	18. See Section 5, Stakeholder Consultation, 6.11, Third Party Aspects and 6.13, Ongoing Community Engagement Plan.

[34] Demonstration of this closure outcome is determined at the time of PEPR approval under this Mining Lease

Other Legislation	19. The above environmental outcomes do not derogate from the operation of any other Acts that may be applicable to this operation including (but not limited to): • *Aboriginal Heritage Act* 1988 • *Environment Protection Act* 1993	19. Noted, see Table 6-1 and elsewhere.

9.2 Commonwealth Approval Conditions

Conditions	***Management Measure***
General obligations	
1. The proponent must ensure that the action achieves the following outcomes:	
Groundwater	
(a) no compromise of the Environmental Values of the Willawortina Formation, Fractured Rock or Great Artesian Basin aquifers;	Accepted, Section 6.7 and Appendix D.
(b) no compromise of the Environmental Values of the Namba Formation and Eyre Formation aquifers outside the Beverley North Mining Lease;	Accepted, Section 6.7 and Appendix D.
Biodiversity	
(c) no loss of abundance or diversity of native vegetation on or off the Beverley North Mining Lease through clearance, or any other damage, unless prior approval under the relevant legislation is obtained;	Accepted, Section 6.5.

Conditions	***Management Measure***
(d) no net adverse impacts (including from fire) from the site operations on native fauna abundance or diversity in the Beverley North Mining Lease area and adjacent areas;	Accepted, Section 6.5 and 6.8.
(e) no introduction of new weeds, plant pathogens or pests (including feral animals), or increase in abundance of existing weed or pest species in the Beverley North Mining Lease compared to adjoining land;	Accepted, Section 6.5 and 6.8.
Aboriginal Heritage	
(f) no disturbance to Aboriginal artefacts or sites of significance unless prior approval under the relevant legislation is obtained;	Accepted, Section 6.10.
General	
(g) no compromise of pastoral use of downstream surface water bodies;	Accepted, Section 6.6
(h) soil affected by mining activities is suitable for return to pre-mining land use following mine closure;	Accepted, Section 6.4
(i) no adverse impacts to the public or the environment from radiological aspects of the action; and	Accepted, Section 6.12
(j) no disposal of waste within the Beverley North Mining Lease unless prior approval under the relevant legislation is obtained.	Accepted, Section 4.7
2. The proponent must implement control and management strategies to achieve the outcomes in condition 1. The control and management strategies may include the following in relation to the outcomes required under:	
(a) condition 1(a) & (b) – the measures indicated at section 7.7.3 of the Public Environment Report;	Accepted, Section 6.7.3
(b) condition 1(c), & (e) – the measures indicated at section 7.5.3 of the Public Environment Report;	Accepted, Section 6.7.3
(c) condition 1(d) – the measures indicated at section 7.8.3 of the Public Environment Report;	Accepted, Section 6.8.3
(d) condition 1(f) – the measures indicated at section 7.10.3 of the Public Environment Report;	Accepted, Section 6.10.3
(e) condition 1(g) – the measures indicated at section 7.6.3 of the Public Environment Report	Accepted, Section 6.6.3

Conditions	*Management Measure*
(f) condition 1(h) – the measures indicated at section 7.4.3 of the Public Environment Report;	Accepted, Section 6.4.3
(g) condition 1(i) – the measures indicated at sections 7.4.3, 7.6.3, 77.3 & 7.9.3 of the Public Environment Report; and	Accepted, Sections 6.4.3, 6.6.3, 67.3, 6.9.3, 6.12
(h) condition 1(j) – the measures indicated at section 7.4.3 of the Public Environment Report.	Accepted, Sections 4.7 and 6.4.3
Alternative control and management strategies may be implemented if they will achieve the outcomes in condition 1.	Minor variations to the measures given in the PER, that will achieve the outcomes given in condition 1, are given in this PEPR.
Monitoring and Management Plan	
3. The proponent must develop a Monitoring and Management Plan (the Monitoring Plan) to measure the achievement of each outcome in condition 1. The Monitoring Plan must specify:	This PEPR constitutes the Monitoring and Management Plan (the Monitoring Plan) for the purposes of this condition.
(a) the area to which the Monitoring Plan applies;	Accepted, the monitoring plan applies to ML 6387 and, if required under the circumstances explained in the PEPR, to monitoring locations immediately east of ML 6387.
(b) criteria to demonstrate the clear and unambiguous achievement of the outcomes in condition 1;	Accepted, Sections 6.4 to 6.11
(c) the parameters to be monitored;	Accepted, Sections 6.4 to 6.11 and Appendix D.
(d) frequency of monitoring;	Accepted, Section 6.4 to 6.11 and Appendix D.
(e) the responsibility for interpreting the monitoring results;	Accepted, Sections 8.3.4 to 8.3.6
(f) leading indicator criteria and the response activities that will be implemented if a leading indicator is reached;	Accepted, Sections 6.4 to 6.11 (also Section 7.10 for groundwater aspects of closure)
(g) an outline of control and management strategies that may be used to achieve the outcomes in condition 1; and	Accepted, Sections 6.4 to 6.11

Conditions	***Management Measure***
(h) reporting arrangements to management, external stakeholders and the public.	Accepted, Sections 8.3.4 to 8.3.6 and 6.13
4. The Monitoring Plan must also include a program for obtaining monitoring data to validate predictions of enhanced natural attenuation of mining fluids and determine the impact of groundwater flush. The program must also take into account any cumulative impacts on groundwater arising from other *in situ* recovery mining activities.	Accepted. This PEPR constitutes the Monitoring and Management Plan (the Monitoring Plan) for the purposes of this condition; Section 7.10

5. The action must be confined to the area specified in the Monitoring Plan. The action cannot commence operation within the area designated in the Monitoring Plan until the Plan is approved by the Minister. The approved Monitoring Plan must be implemented.	Accepted. This PEPR constitutes the Monitoring and Management Plan (the Monitoring Plan) for the purposes of this condition.
Mine closure plan	
6. The proponent must develop a Mine Closure Plan for the Beverley North Mining Lease (the Mine Closure Plan). The Mine Closure Plan must describe how the following outcomes, in so far as they may be affected by mining operations, will be achieved indefinitely post mine closure:	This PEPR constitutes the Monitoring and Management Plan (the Monitoring Plan) for the purposes of this condition; see Section 7 of this PEPR.
(a) no compromise to the Environmental Values of the Willawortina Formation, Namba Formation, Eyre Formation, Fractured Rock and Great Artesian aquifers;	See Section 7
(b) risks to the health and safety of the public and fauna are as low as reasonably achievable;	See Section 7
(c) ecosystem and landscape function is resilient, self-sustaining and indicating the pre-mining ecosystem and landscape function will ultimately be achieved;	See Section 7
(d) the site is physically stable; and	See Section 7
(e) all waste materials left on site are chemically and physically stable.	See Section 7

(f) no compromise to the ability of other existing mine lease operators to achieve their approved closure criteria.	See Section 7. The currently defined Beverley North operations have no groundwater interaction with the only other approved Mining Lease in the district, Beverley ML6321, hence this is fulfilled.
7. The action cannot commence operation until the Mine Closure Plan is approved by the Minister. The approved Mine Closure Plan must be implemented.	See Section 7 for the preliminary closure plan
8. The Mine Closure Plan must be revised by the proponent prior to mine closure to take into account the results of the monitoring in Condition 4 to validate predictions of enhanced natural attenuation of mining fluids. The revised Mine Closure Plan must:	
(a) specify closure criteria that will be used to demonstrate the clear and unambiguous achievement of the closure outcomes;	See Section 7.6 for the preliminary closure criteria
(b) show how closure criteria can be achieved within 10 years of the cessation of mining;	See Section 175
(c) include a program for monitoring progress towards achievement of closure criteria; and	See Section 7, especially 7.10
(d) include remedial actions to be taken in the event that monitoring demonstrates that closure criteria will not be achieved in a 10 year period.	See Section 7.10
9. The revised Mine Closure Plan must be submitted to the Minister for approval. The approved revised Mine Closure Plan must be implemented.	Noted and accepted
Provision of bond	
10. To secure compliance with Conditions 1 and 6 of this approval, the proponent must, before commencing operation of the mine, comply with any requirement under the relevant approval granted by the government of South Australia to provide a bond in accordance with s 62 of the *Mining Act 1971* (SA).	Noted and accepted, no operations will commence until the bond required by DSD is in place.
11. If at any time the Minister determines in writing that s/he is not satisfied that either the Monitoring and Management Plan or the Mine Closure Plan is being or will	

be implemented, the Minister may require the proponent to provide a bond in favour of the Commonwealth for up to the full cost of rehabilitation liability.	Noted and accepted, although Heathgate considers that any additional bond should only be for the 'gap' between that held by the State and that required by the Commonwealth should be imposed.
12. In setting a bond amount in condition 11, the Minister may take account of any bond required under condition 10.	Noted and accepted, see note above.
13. The Minister may vary the bond amount required under these conditions to cover the full cost of rehabilitation liability at any time. The Minister may also decrease the bond amount required where the proponent has decreased the rehabilitation liability through undertaking rehabilitation.	Noted and accepted.
14. In providing for or varying a bond amount in accordance with these conditions, the Minister may request that the proponent obtain written quotes for the cost of rehabilitation liability under the Mine Closure Plan from a third party approved by the Minister.	Noted and accepted
15. The proponent must meet all the charges and costs in obtaining and maintaining the bond.	Noted and accepted
Community engagement plan	
16. The proponent must prepare a Community Engagement Plan to enable open dialogue with all stakeholders on compliance with the approval conditions. The action cannot commence operation until the Community Engagement Plan is approved by the Minister. The Community Engagement Plan must be implemented.	Noted and accepted. This plan is provided as part of the Beverley North PEPR; Section 6.13.
Publication of plans	

17. All plans approved by the Minister under these conditions must be published on the proponent's website within 20 business days of approval by the Minister, unless the plans are published within this time on an appropriate South Australian Government website.	Noted and accepted
18. The Department may require the proponent to publish on the internet a plan in a specified location or format and with specified accompanying text. The proponent must comply with any such requirement.	Noted and accepted
Notification of commencement	
19. Within 10 business days of commencement, the proponent must advise the Department in writing of the actual date of commencement.	Noted and accepted
20. If, at any time after five years from the date of this approval, the Minister notifies the proponent in writing that the Minister is not satisfied that there has been commencement of the action, the action must not commence without the written agreement of the Minister.	Noted and accepted
Request for variation of plans by proponent	
21. If the proponent wants to act other than in accordance with a plan approved by the Minister under these conditions, the proponent must submit a revised plan for the Minister's approval.	Noted and accepted. In normal circumstances this will be as part of an application to the appropriate State regulator. See Section 4.5.8 which sets out the procedure for changes.
22. If the Minister approves the revised plan, then that plan must be implemented instead of the plan originally approved.	Noted and accepted

23. Until the Minister has approved the revised plan, the proponent must continue to implement the original plan.	Noted and accepted
Revisions to plans by the Minister	
24. If the Minister believes that it is necessary or desirable for the better protection of a relevant controlling provision for the action, the Minister may require the proponent to make, within a period specified by the Minister, revisions to a plan approved under these conditions.	Noted and accepted
25. If the Minister requires a revision to a plan, the proponent must:	
(a) comply with the requirement; and	Noted and accepted
(b) submit the revised plan to the Minister for approval within the period specified in the request.	Noted and accepted
26. The proponent must implement the revised plan on approval of the Minister.	Noted and accepted
27. Until the Minister has approved the revised plan, the proponent must continue to implement the original plan.	Noted and accepted
Minimum timeframes for consideration of plans	
28. For any plan required to be approved by the Minister under these conditions, the proponent must ensure the Minister is provided at least 20 business days for review and consideration of the plan, unless otherwise agreed in writing between the	Noted and accepted

proponent and the Minister. This does not apply to urgent changes required to protect the environment.	
Timeframes	
29. If these conditions require the proponent to provide something by a specified time, a longer period may be specified in writing by the Department.	Noted and accepted
Auditing	
30. On the request of and within a period specified by the Department, the proponent must ensure that:	
(a) an independent audit of compliance with these conditions is conducted; and	Noted and accepted
(b) an audit report, which addresses the audit criteria to the satisfaction of the Department, is published on the Internet and submitted to the Department.	Noted and accepted
31. Before the audit begins, the following must be approved by the Department:	
(a) the independent auditor; and	Noted and accepted
(b) the audit criteria	Noted and accepted
32. The audit report must include:	
(a) the components of the project being audited;	Noted and accepted
(b) the conditions that were activated during the period covered by the audit;	Noted and accepted

(c) a compliance/non-compliance table;	Noted and accepted
(d) a description of the evidence to support audit findings of compliance or noncompliance;	Noted and accepted
(e) recommendations on any non-compliance or other matter to improve compliance;	Noted and accepted
(f) a response by the proponent to the recommendations in the report (or, if the proponent does not respond within 20 business days of a request to do so by auditor, a statement by the auditor to that effect); and	Noted and accepted
(g) certification by the independent auditor of the findings of the audit report.	
33. The financial cost of the audit will be borne by the proponent.	Noted and accepted
34. The proponent must:	
(a) implement any recommendations in the audit report, as directed in writing by the Department;	Noted and accepted
(b) investigate any non-compliance identified in the audit report; and	Noted and accepted
(c) if non-compliance is identified in the audit report - take action as soon as practicable to ensure compliance with these conditions.	Noted and accepted
35. If the audit report identifies any non-compliance with the conditions, within 20 business days after the audit report is submitted to the Department, the proponent must provide written advice to the Minister setting out the:	
(a) actions taken by the proponent to ensure compliance with these conditions; and	Noted and accepted
(b) actions taken to prevent a recurrence of any non-compliance, or implement any other recommendation to improve compliance, identified in the audit report.	Noted and accepted
Note 1: To avoid doubt, independent third party auditing may include audit of the proponent's performance against the requirements of any plan required under these conditions. Note 2: Audit criteria should focus on compliance with the outcomes specified in conditions 1 and 6.	Noted and accepted

Reporting compliance	
36. Within three months of every anniversary of the action commencing operation, or by a date otherwise agreed by the Minister, the proponent must provide a report to the Department addressing compliance with each of the conditions of this approval.	Noted and accepted. The report will be provided covering each calendar year by the end of March the following year, in the form of the annual Mining and Rehabilitation Compliance Report (or its equivalent document) required by DSD or as a separate report if an ACR or equivalent is not prepared for DSD..
37. The proponent must ensure that the report is publicly available on the internet within 20 days of it being submitted to the Minister.	Noted and accepted
38. Reports must be provided until the Minister is satisfied that the closure outcomes in Condition 3 have been met.	Noted and accepted
Reporting non-compliance	
39. The proponent must, when first becoming aware of a non-compliance with these conditions, or a plan required to be approved by the Minister under these conditions:	
(a) report the non-compliance business days; and	Noted and accepted
(b) bring the matter into compliance within a reasonable time frame specified in writing by the Department.	Noted and accepted, although Heathgate may need to negotiate what constitutes a reasonable time frame depending on circumstances.
Submission of plans and reports	
40. To avoid doubt, a plan or report prepared to address State requirements may also be submitted to address the requirements of these conditions provided that the plan or report addresses the relevant matters identified in these conditions. This includes audit reports required under condition 30 and compliance reports required under condition	Noted and accepted; see note on Condition 36 regarding annual reporting.

Record-keeping	
41. The proponent must:	
(a) maintain accurate records substantiating all activities associated with or relevant to these conditions of approval, including measures taken to implement a plan approved under these conditions; and	Noted and accepted
(b) make those records available on request to the Department. Such records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with these conditions.	Noted and accepted
Note: Audits or summaries of audits carried out under these conditions, or under section 458 of the EPBC Act, may be posted on the Department's website. The results of such audits may also be publicised through the general media.	Noted
Dictionary	
42. In these conditions, unless otherwise indicated: ***As low as reasonably achievable*** has the meaning given in the Code of Practice and Safety Guide: Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing, ARAPNSA 2005. ***Beverley North Mining Lease*** is the area for which Heathgate Resources has applied for a mining lease and which currently comprises part of Exploration Lease EL 4387 granted by the South Australian Government. ***Commencement of the action*** is any preparatory works required to be undertaken, including clearing of vegetation, the erection of any on-site temporary structures and/or the use of construction or excavation equipment on site for the purposes of breaking the ground. ***Conditions*** means these conditions attached to the approval of the action; ***Department*** is the Australian Government department responsible for administering Part 4 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). ***EPBC Act*** is the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). ***Environmental Values*** are the environmental values recognised in '*ANZECC & ARMCANZ 2000. Australian and New Zealand guidelines for fresh and marine water*	Noted

quality. National Water Quality Management Strategy Paper No 4, Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, Canberra' and as described in the Public Environment Report for the Beverley North Mining Project. ***Minister*** means the Minister responsible for Part 4 of the EPBC Act, and includes a delegate of the Minister under s.133 of the EPBC Act. ***Plan*** includes a report, study, or strategy (however described). ***Proponent*** means the holder of the approval to which these conditions relate, and includes any person acting on behalf of the proponent. ***Public Environment Report*** means the *Beverley North Project Mining Lease Proposal and Draft Public Environment Report* prepared for Heathgate Resources Pty Ltd by URS, dated 8 April 2010. ***Significant Environmental Benefit*** has the meaning defined in regulations under the *Native Vegetation Act 1991* (SA).	
43. Unless otherwise indicated, words in these conditions have the same meaning as in the EPBC Act.	Noted
44. Unless the contrary is indicated, in these conditions:	
(a) words in the singular number include the plural and words in the plural number include the singular; and	Noted
(b) condition headings are inserted for convenient reference only and have no effect in limiting or extending the language of condition to which they refer.	Noted

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APPENDIX A Updated Regional Conceptual Hydrogeological Model and Additional Technical Memorandum

SKM (2010)

APPENDIX B Baseline Fauna Survey

EBS 2010

APPENDIX C Significant Environmental Benefit

C1 Overview

This plan contains information required by the *Guidelines for a Native Vegetation Significant Environmental Benefit Policy* for the clearance of native vegetation associated with the minerals and petroleum industry (DWLBC 2005) not presented elsewhere in this PEPR.

General description of native vegetation on the Retention Lease is provided in Section 3.11 of the main report text and associated fauna is described in Section 3.12. More information on the vegetation is given in Appendix E of the Beverley North Retention Lease Application – Field Leach Trial "Report on a Baseline Survey of Vegetation in the Beverley North MLA (EL 4387) August – December 2009 (Badman 2010 in Heathgate 2010b).

This appendix sets out vegetation clearing on the ML which is subject to Significant Environmental Benefit (SEB) compensation. It also describes how the SEB will be provided for in areas to be cleared.

C2 Background and Initial Considerations

The area of proposed clearing consists of two main vegetation types:

- Mitchell grass plain (currently small chenopods dominate) – the majority of clearing
- Minor drainage lines.

It is also possible that a small amount of major drainage line vegetation will require clearing for mining operations to occur at Beverley North.

Badman (2007) has a final section that outlines the calculation of the SEB ratio needed to calculate compensation for vegetation cleared in the Beverley situation. Based on his assessment and as previously negotiated with PIRSA, Heathgate proposes to adopt a basic SEB ratio of 4:1 for vegetation clearance associated with its operations. The reduction in ratio from the maximum is based on extensive historic grazing impacts on Wooltana station and disturbance by pastoral tracks, fencelines and historic minerals exploration.

For areas that will be rehabilitated (i.e. wellfields, trunklines, satellite plant etc) the allowed discount of 50% has been claimed, resulting in a final SEB ratio of 2:1. There are some very minor area (some tracks and possibly water tanks) areas of clearing that may be retained long term. However, this is insignificant compared to that which will be rehabilitated and has not been included separately.

C3 Historic and Planned Native Vegetation Clearance

Figures C-1 and C-2 shows planned native vegetation clearance associated with the Beverley North mine. Clearing is estimated to be >90% Mitchell Grass plains.

C3.1 Allowance for Partial Clearing in Wellfields

Prior to 2004, wellfields at Beverley were cleared and topsoil removed and stockpiled adjacent to the wellfield for later respreading. This had been considered best practice. However, two observations were made suggesting this was not the best approach:

- Volunteer vegetation was establishing in cleared areas

- Topsoil stockpiles suffered wind erosion losses.

From 2004, topsoil and its associated vegetation have not been deliberately removed from the majority of the area of wellfields. Rather, it is removed then replaced within weeks for drill pits and only removed for adjacent stockpiling for roads. For larger areas, such as the communal mud pits and satellite plant footprint, topsoil has been separately stockpiled for later respreading.

The area actually cleared for wellfields established since 2004 is calculated as follows:

(Area between wells x 1.2) x 0.8

Where 1.2 is an enlargement factor to allow for minor roads and tracks, and 0.8 is a factor to allow for partial clearing. Based on Figures C-1 and C-2, the life-of-Mine (Beverley North Mine) SEB-liable clearing is 32 ha (wellfields, satellite plant facility and associated ancillary infrastructure).

Table C-1 Summary of Areas Approved for Clearing (Life-of-Mine, Beverley North Mine)

	Clearing subject to SEB (ha)
Total	32

Heathgate's preference is to provide local SEB by a private arrangement (see below). However, for comparative purposes a calculation of the SEB compensation amount is given in Table D-2, where a payment is made into the Native Vegetation Fund. A value of land of $2.66/ha has been used, with a management cost of $800/ha. The land value is based on the 2009 unimproved value of $672,053 for the Wooltana Lease provided by the Pastoral Land Management Group in April 2010 and an area of 977 square miles (253,042 ha).

Table C-2 SEB Calculation (Life-of-Mine, Beverley North Mine)

Type	Planned Area Clearance (ha)	Initial Ratio	Final Ratio*	SEB Area (ha)	Management cost (based on area cleared)	SEB value (Based on SEB area	Total Compensation (if SEB area not provided)
TOTALS	32	4:1	2:1	64	$25,600	$170	$25,770

* Using a 50% discount for areas that will be revegetated.

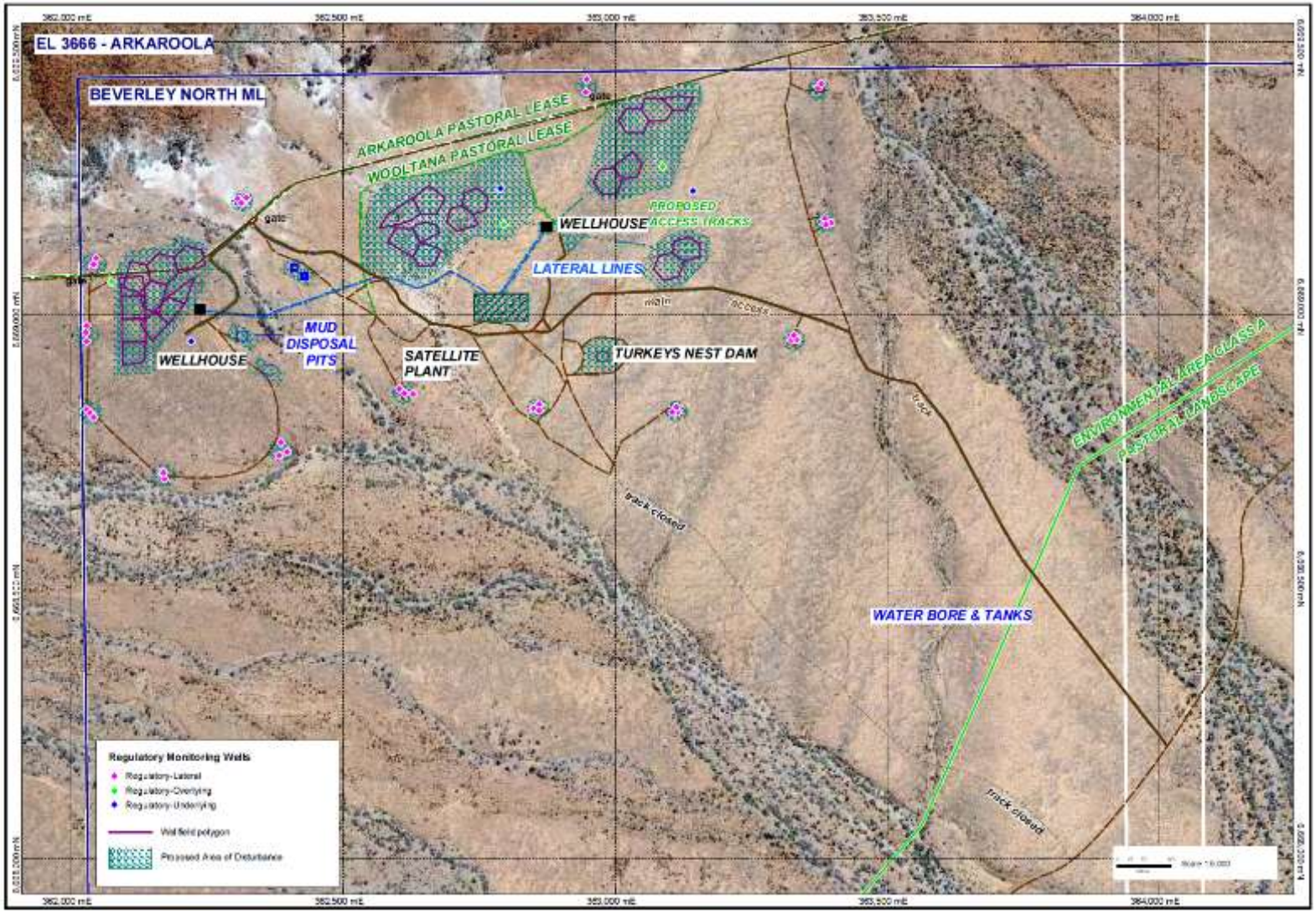

Figure C-1: Planned Native Vegetation Clearance – Pepegoona Deposits

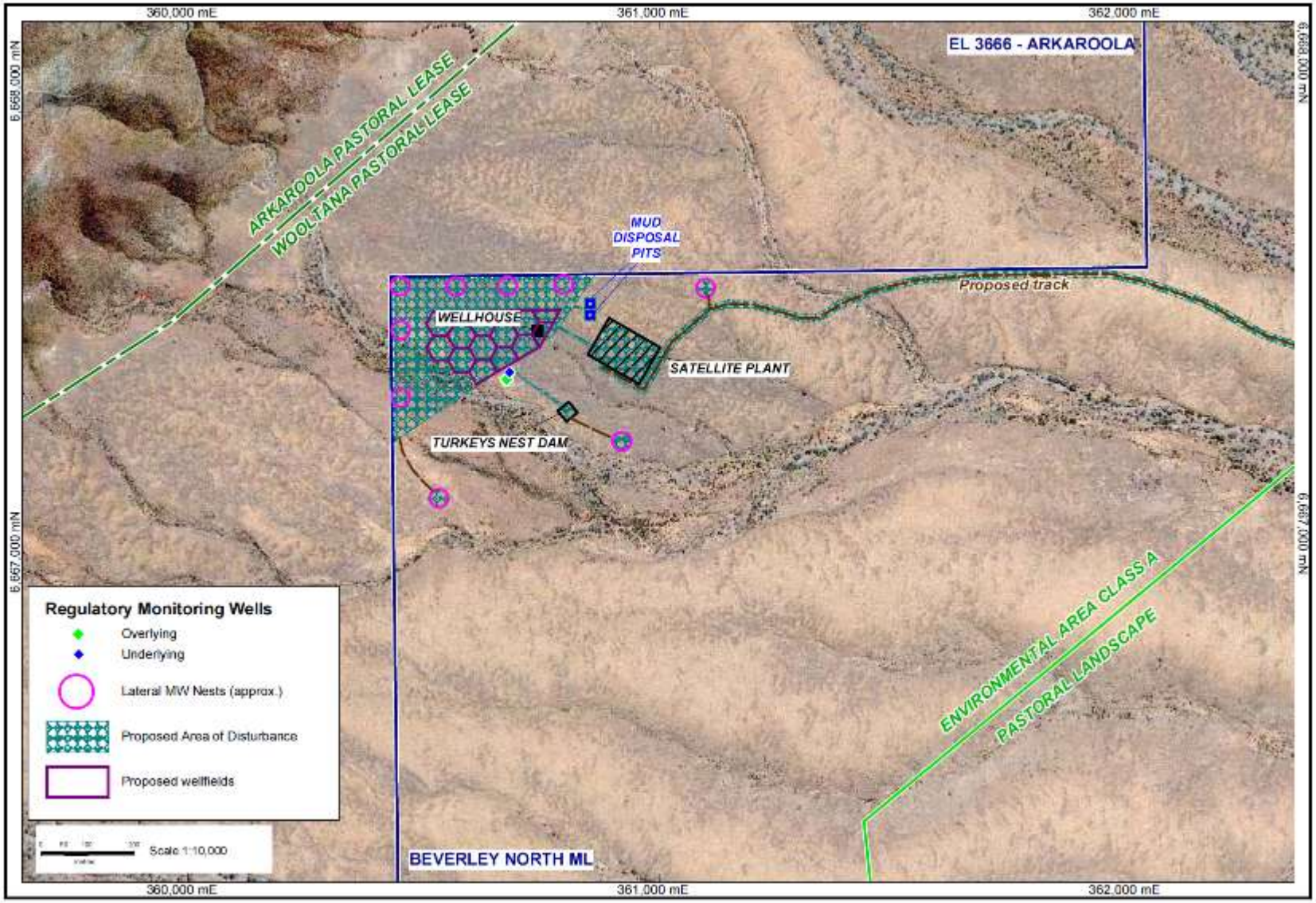

Figure C-2: Planned Native Vegetation Clearance – Pannikan Deposit

The anticipated area to be cleared is 32 ha. The corresponding SEB area is 64 ha, equivalent to a monetary amount of $25,770. Heathgate is committed to provide the required Significant Environmental Benefit in compensation of native vegetation to be cleared on the Beverley North Mine.

A potentially suitable conservation project on Arkaroola has been identified for SEB compensatory purposes pertaining to the Beverley ML6321. A meeting was held between PIRSA, DEWNR and Heathgate on 25 March 2010 and it was noted that the project was expandable and as such has potential to provide a SEB offset for possible future expansion which Heathgate and associated entities may pursue.

This project is envisaged to provide additional protection to an area of habitat for the nationally vulnerable *Acacia araneosa* (Spidery or Balcanoona Wattle). The protection of other native vegetation and fauna within that area would also be enhanced by this project.

A suitably detailed proposal was delivered to PIRSA on 30 September 2010 and it is envisaged that approval of this will take place prior to 31 December 2010.

The actual amount cleared to the end of a calendar year will be provided with supporting detail in the corresponding ACR. Any adjustments to the SEB will be made on an annual basis. If additional SEB is required, an appropriate payment will be made into the Native Vegetation Fund or approved equivalent, or a corresponding approved SEB area allocated.

APPENDIX D Groundwater Monitoring Program Details

APPENDIX D Groundwater Monitoring Program Details

D1 Introduction

D3.1 Scope

This monitoring program describes the environmental monitoring activities that are undertaken by Heathgate Resources Pty Ltd (Heathgate) for the Beverley North Mine. It includes monitoring of the ISR mining areas themselves and non-potable water supply wells used mainly for road watering.

This program is to satisfy the requirements of the Beverley North ML PEPR and the forthcoming water licence issued by DEWNR.

In its current form all mining and local water supply at Beverley North is in the Tertiary Eyre Formation. The hydrogeology of the area, mining technique and monitoring rationale are given in Sections 3.10, 4.5 and 6.7 of the main report and are not reproduced in detail here. Water is consumed in two ways by the project:

1. Bleed water is drawn from the wellfields by maintaining a small excess of extraction over injection during mining, to assist in the control of the movement of mining solution. This water is trucked to Beverley where it is used in the processing plant in lieu of local groundwater.

2. Water from specific water supply wells that is used for drilling and road watering.

Note that potable water is imported from Beverley which is reverse osmosis treated GAB water. No GAB water is taken from Beverley North.

D3.2 Responsible Personnel

Heathgate employs a Senior Environment Advisor and sufficient experienced and qualified staff to fulfil the requirements of this monitoring program and hence comply with legal and other obligations for the Beverley North Mine Project relating to the mine water supply. See Section 6.7 of the main report.

D3.3 Monitoring Plan Review, Modification and Reporting

This monitoring program is reviewed annually. All changes or amendments following the review are documented in the ACR (with other monitoring) and if required by the forthcoming DEWNR water licence, in the annual report required under that licence.

Modifications to the monitoring program are submitted to and assessed by the appropriate government agencies as required. Individual well changes do not require individual approvals, but changes to monitoring frequency and parameters do.

D3.4 Designated Area

The designated area is the Beverley North Mining Lease.

D2 Mine Performance Monitoring

Because of the recirculating nature of ISR mining, water consumption is taken to be the amount of bleed water returned to Beverley, not the circulation rate of extraction and injection.

The volume of bleed water is metered and recorded at the Barren Lixiviant Tank at each satellite plant. Volumes will be recorded and reported for each satellite plant individually (Table D-1). It can be considered to be an extraction spread over all active wellfields connected to that particular satellite plant. Note that this is mining water and will

typically have a pH of 1.7 to 2, be moderately saline and high in dissolved iron. It will also contain milligram per litre concentrations of uranium and other trace elements.

Table D-1 Company Compliance Monitoring Plan – Bleed Water

Location	Method	Parameter	Frequency
Pepegoona satellite plant Pannikan satellite plant	Flow measured by meter	Flow volume	weekly

The risk-based approach of the rationale for all environmental monitoring for the Beverley North project is given in Chapter 6 of the main report. There are three classes of monitor well:

1. Lateral Monitor Wells (laterals) which allow pressure measurement and sampling in the geological formation being mined
2. Overlying Monitor Wells (OMWs) which allow pressure measurement and sampling from groundwater above the geological formation being mined
3. Underlying Monitor Wells (UMWs) which allow pressure measurement and sampling from groundwater below the geological formation being mined.

All scheduled mining is in the Eyre Formation. At these mining locations (Pepegoona, Pepegoona West and Pannikan), the main regional shallow aquifer (Willawortina Formation) was unsaturated, and OMWs were established in the Namba Formation. Also at these locations the GAB is absent, so UMWs were established in the deep Fractured Rock Aquifer.

Because of the thickness of the Eyre Formation being mined, Laterals Monitor Wells are established as nests of two or three single-screen wells to access relevant sections of the Eyre Formation, although the PEPR allows multi-screen wells as an option.

Following the risk assessment, the following groundwater monitoring program has been established (Table D-2, reproducing Table 6-12 with the exception of Observation Wells, which are part of operational management rather than environmental monitoring). It is Table 6-12 (and therefore Table D-2) that would require government approval to modify, not Table D-3 listing the wells as of a certain date. Lateral monitor wells close to the ML boundary will be monitored monthly whilst the more distant lateral monitor wells will be monitored quarterly as outlined in Table D-2. ECLs (excursion control limits) are explained in Chapter 6, as are contingency actions should excursions occur.

Table D-2 Company Compliance Monitoring Plan – Groundwater Quality

	Method	Parameters	Criteria	Frequency
Lateral Monitor Wells close to the ML Boundary	Wire-line Sonde Logging or pumped sampling and laboratory testing	Level, EC, pH, SO_4, U	ECLs	Monthly
Lateral Monitor Wells (others)	Wire-line Sonde Logging or pumped sampling and laboratory testing	Level, EC, pH, SO_4, U	ECLs	Quarterly
Overlying Monitor Wells	Pumped sampling and laboratory testing	Level, EC, pH, SO_4, U	ECLs	Monthly
Underlying Monitor Wells	Pumped sampling and laboratory testing	Level, EC, pH, SO_4, U	ECLs	Monthly

Maps showing the locations of compliance monitor wells as at November 2010 are given in Figures 6-3 and 6-4 of the main text. The wells as at November 2010 are listed in Table D-3, including those committed to at Pepegoona and Pannikan that are yet to be drilled and named. Eastings and Northings are given in map datum GDA94.

This table will be updated in each annual report (ACR or DEWNR licence report).

Table D-3 Company Compliance Monitoring Plan – List of Wells

Well Name	Type	Deposit	Easting	Northing
PRMW011	Lateral – Eyre Fm	Pepegoona	362610.94	6668854.34
PRMW012	Lateral – Eyre Fm	Pepegoona	363112.38	6668819.42
PRMW013	Lateral – Eyre Fm	Pepegoona	363322.03	6668951.39
PRMW014	Lateral – Eyre Fm	Pepegoona	363371.25	6669415.27
PRMW015	Lateral – Eyre Fm	Pepegoona	362944.88	6669430.46
PRMW016	Lateral – Eyre Fm	Pepegoona	362304.32	6669211.54
PRMW017	Lateral – Eyre Fm	Pepegoona	363383.05	6669174.42
PRMW018	Lateral – Eyre Fm	Pepegoona	362847.86	6668825.68
PRMW019	Lateral – Eyre Fm	Pepegoona	363103.14	6668818.75
PRMW020	Lateral – Eyre Fm	Pepegoona	363330.96	6668952.27
PRMW021	Lateral – Eyre Fm	Pepegoona	362626.32	6668852.98
PRMW022	Lateral – Eyre Fm	Pepegoona	363377.31	6669422.28
PRMW023	Lateral – Eyre Fm	Pepegoona	363393.91	6669166.64
PRMW024	Lateral – Eyre Fm	Pepegoona	362944.26	6669406.12
PRMW025	Lateral – Eyre Fm	Pepegoona	362601.35	6668862.43
PRMW026	Lateral – Eyre Fm	Pepegoona	362857.68	6668834.24
PROMW027	Overlying – Namba	Pepegoona	362793.06	6669163.99
PRMW028	Lateral – Eyre Fm	Pepegoona	363110.38	6668828.15
PRMW029	Lateral – Eyre Fm	Pepegoona	363326.11	6668960.74
PROMW030	Overlying – Namba Fm	Pepegoona	363085.67	6669269.71
PRMW033	Lateral – Eyre Fm	Pepegoona	362320.27	6669212.81
PRMW034	Lateral – Eyre Fm	Pepegoona	363386.16	6669164.2
PRMW035	Lateral – Eyre Fm	Pepegoona	362310.2	6669203.86
PRUMW036	Underlying – Fractured Rock	Pepegoona	362786.95	6669229.63
PRMW037	Lateral – Eyre Fm	Pepegoona	362858.21	6668821.82
PROMW038	Overlying – Namba Fm	Pepegoona	362071.49	6669057.9
PRMW039	Lateral – Eyre Fm	Pepegoona	362395.44	6668746.2
PRMW040	Lateral – Eyre Fm	Pepegoona	362168.96	6668696.94
PRUMW041	Underlying – Fractured Rock	Pepegoona	363140.35	6669225.34
PRMW042	Lateral – Eyre Fm	Pepegoona	362043.18	6669101.25
PRMW043	Lateral – Eyre Fm	Pepegoona	362380.42	6668738.93
PRMW044	Lateral – Eyre Fm	Pepegoona	362163.22	6668709.72
PRMW046	Lateral – Eyre Fm	Pepegoona	362037.04	6669084.78
PRMW047	Lateral – Eyre Fm	Pepegoona	362383.26	6668763.08
PRMW049	Lateral – Eyre Fm	Pepegoona	362026.65	6668824.56
PRMW050	Lateral – Eyre Fm	Pepegoona	362025.14	6668964.39
PRMW051	Lateral – Eyre Fm	Pepegoona	362039.64	6669090.78
PRMW052	Lateral – Eyre Fm	Pepegoona	362168.53	6668709.95
PRMW053	Lateral – Eyre Fm	Pepegoona	362027.77	6668945
PRMW055	Lateral – Eyre Fm	Pepegoona	362039.08	6668809.64
PRMW056	Lateral – Eyre Fm	Pepegoona	362026.09	6668978.25

Well Name	Type	Deposit	Easting	Northing
PRMW057	Lateral – Eyre Fm	Pepegoona	362033.18	6668818
PRMUW058	Underlying – Fractured Rock	Pepegoona	362218.29	6668949.26
tba	Lateral – Eyre Fm	Pepegoona	362026.09	6668978.25
tba	Lateral – Eyre Fm	Pepegoona	362033.18	6668818
tba	Lateral – Eyre Fm	Pepegoona	362026.09	6668978.25
tba	Lateral – Eyre Fm	Pepegoona	362033.18	6668818
PRUMW048	Underlying – Fractured Rock	Pannikan	360683.78	6667360.04
PRMW059	Lateral – Eyre Fm	Pannikan	360445.16	6667295.07
PRMW060	Lateral – Eyre Fm	Pannikan	360443.52	6667556.5
tba	Overlying – Namba Fm	Pannikan	360675.2	6667347.73
tba	Lateral – Eyre Fm	Pannikan	360807.9	6667562.68
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
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tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba
tba	Lateral – Eyre Fm	Pannikan	tba	tba

D3 Water Supply Monitoring

The local water supply well for Pepegoona is PRWW001, located to the south-east of the deposits adjacent to the entrance road (see Figure 4-1, marked as 'Water Bore & Tanks). A second local water supply well (included in the DEWNR licence) will be located on the entrance road to Pannikan. Each is licensed to take an average of 5 L/s, although in practice the actual amount will be less.

Although not required under the PEPR, these water supply wells must be metered and monitored under the DEWNR licence. Regular water samples are also taken and will be reported in the ACR and if required by the forthcoming DEWNR water licence, in the annual report required under that licence.

The wellheads at these water supply wells do not permit routine water levels to be taken. However, it was demonstrated during the Pepegoona pumping test that the drawdown in pumped wells in the Eyre Formation in this area at 5 L/s is in the order of a few metres only. Water levels in this aquifer are checked as part of mine performance and regional groundwater monitoring. The monitoring program is given in Table D-4.

Table D-4 Company Additional Monitoring Plan – Groundwater Supply Wells

Well	Method	Parameter	Frequency
PRWW001 (Pepegoona) (tba) (Pannikan)	Flow measured by meter. Sampled using water supply pump, tap at wellhead.	Flow volume	weekly
		EC, pH, SO_4, U	Quarterly
		Ra-226	Six-monthly

As demonstrated in the licence application, the extensive nature and high transmissivity and storage of the Eyre Formation aquifer in the area is such that the planned extractions will only have a very minor effect. No specific contingency measures are proposed concerning the groundwater supply wells. However, combined with mine performance and regional monitoring, this assertion will be checked on an annual basis as part of the reporting process.

D3 Regional Monitoring

A number of regional investigation wells were drilled during early investigations in the Beverley North area. Existing wells were surveyed as documented in 2008 (Appendix K in Heathgate 2009a).

Regional effects on groundwater are of very low risk, and as such regional monitoring is not included in the compliance monitoring. However, a low level of monitoring is proposed to extend the hydrogeological baseline information in the area. Two regional monitoring wells near Pepegoona (PRMW04 and PRMW07) and four in the vicinity of Pannikan (4MRMW06, 07, 13 and 16) are included, together with the pastoral Pepegoona Bore (although this is about 10km from the mining lease and in a different aquifer to the mining areas) (Table D-5). Locations compared to the Pepegoona and Pannikan deposits are shown in Figure D-1.

Table D-5 Company Additional Monitoring Plan – Regional

Well	Method	Parameter	Frequency
PRMW004 (Eyre Formation) PRMW007 (Eyre Formation) Pepegoona Bore (Willawortina Formation) Pannikan Bore (Willawortina Formation) 4MRMW06 (Eyre Formation) 4MRMW07 (Eyre Formation) 4MRMW13 (Eyre Formation) 4MRMW14 (Eyre Formation)	Manual dipping	Water level	Quarterly

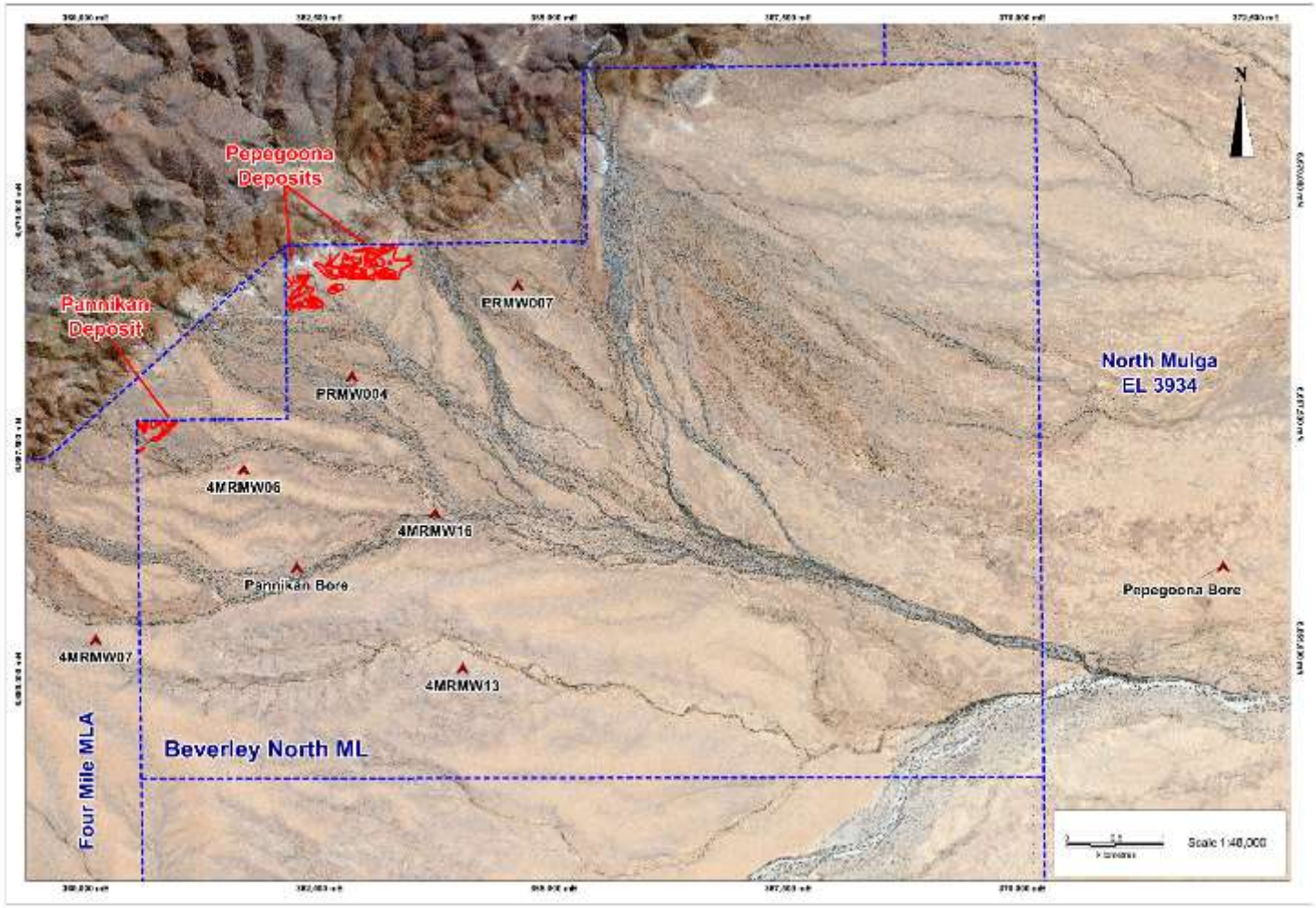

Figure D-1 Beverley North Regional Monitor Wells

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.

APPENDIX F Bond Calculations

TABLE OF CONTENTS

1 INTRODUCTION

This Financial Security—Calculations for Decommissioning document has been prepared by Heathgate Resources Pty Ltd (Heathgate) to estimate the cost of decommissioning and rehabilitation of the Beverley North mine, wellfields and associated infrastructure within the ML.

The objective of decommissioning is to return disturbed areas of the ML to the same condition, and or equivalent land use (pastoral on Wooltana or conservation on Arkaroola) as before the construction of the Beverley North Mine.

All cost estimates for the decommissioning and rehabilitation are quoted in Australian dollars, and are valid for site development up to and planned in December 2010. The basis for the costs and the calculations are shown in Section 4 of this appendix. The estimate of decommissioning and rehabilitation also includes a reasonable contingency amount to cover the costs of repairing any unforeseen environmental harm caused by the implementation of the project.

If additional deposits are proposed for mining in the future, as expected, calculations will be undertaken for future mining operations and included in Beverley North ML PEPR amendments or updates.

2 GENERAL DECOMMISSIONING AND REHABILITATION PLAN

The general plan for decommissioning and rehabilitation of the Beverley North ML is to:

- Plug and abandon any wells installed on-site for the purposes of exploration, delineation, production, pump testing, and monitoring
- Remove and dispose any process facilities including process vessels, equipment, holding bunds, piping, and associated utilities
- Remove any ancillary facilities and supporting infrastructure no longer deemed to be of value to the residents of the region
- Rehabilitate and revegetate disturbed areas
- Provide post rehabilitation monitoring.

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(s). However, for the purposes of this cost estimate it is assumed that all infrastructure is rehabilitated.

It is assumed that all permanent disposal of decommissioned infrastructure would be via Beverley mine site landfill or low-level radioactive waste disposal facility. Therefore, there has been no allowance made for off-site transport and disposal costs. In addition, no disbursement has been made for the cost benefits of salvage items such as tanks, pumps and buildings.

3 DESCRIPTION OF FACILITIES

3.1 Wellfield Installations

Wellfield installations include all the cased wells installed by Heathgate including those wells installed for the pumping test, Water Circulation Facility, the Field Leach Trial and the production and monitor wells associated with routine mining.

Below is a summary of the wellfield installations which will require rehabilitation. More detail is provided in Section 4.2.

Installations required for the Beverley North Mine that will require decommissioning include:

- Production Wells
- Monitor Wells
- Disturbed ground
- Associated utilities.

3.1.1 Decommissioning and Rehabilitation

The cost to rehabilitate a well is dependent on well size (diameter) and average well depth. At Beverley North, production wells are 6 inch wells and monitor wells (lateral, overlying and underlying) are 4 inch wells. The well diameter, average well depth and cost per metre to plug and abandon 4 and 6 inch wells is used to determine the cost to rehabilitate the wells.

The cost to contour and scarify is based on disturbed area. This PEPR allows for approximately three wellfields, for the purposes of mining which was approved in the November 2010 MARP which will require contour and scarification.

The approximate cost to decommission and rehabilitate the wellfield installations is **$1,073,382**.

3.2 Mining Facilities

Decommissioning of the mining infrastructure will include the removal and disposal of any facilities including vessels, equipment, piping associated utilities and ancillary facilities and removal of supporting infrastructure no longer deemed to be of value to the residents of the region. If, as expected, further nearby deposits are mined, then all or the majority of the Beverley North mine infrastructure, associated utilities and facilities will be used for later mining operations.

3.2.2 Satellite Plants

Satellite Plant equipment scheduled for decommissioning includes:

- HDPE lined plant bunds
- Ion exchange columns
- Various tanks, including reagent and water tanks
- Miscellaneous pumps, valving and piping
- Chain link fencing
- Utilities.

Full details, including number of tanks and size of area currently requiring rehabilitation are provided in Section 4.3.

3.2.2 Ancillary facilities

Other ancillary facilities scheduled for decommissioning include:

- Office/crib buildings
- Control rooms
- Laboratories
- Ablution blocks
- Switch rooms
- Lateral lines and spiders lines

Full details of the area currently requiring rehabilitation are provided in Section 4.3.

3.2.3 Ancillary infrastructure

Other ancillary facilities that are scheduled for decommissioning include:

- Turkey nest dams (used for pumping test and airlift water)
- Groundwater supply well and tanks
- Communal mud pits
- Drillers' laydowns
- Unloading ramps.

Full details of the area currently requiring rehabilitation are provided in Section 4.3.

3.2.4 Decommissioning and Rehabilitation

The approximate cost to decommission and rehabilitate the mining, ancillary facilities and ancillary infrastructure on the Beverley North ML, as described above, are **$374,300, $338,140** and **$38,535** respectively.

3.3 Recurring Costs

Costs that have not been accounted for in the previous sections include accommodation, meals, transport and supervision of works. The approximate cost for these items during decommissioning and rehabilitation is **$229,823**

3.4 Long Term Monitoring

In accordance with the PEPR, Heathgate has made provision for continued water quality monitoring for up to seven years upon cessation of mining activities.

The approximate cost for the continued long term water quality monitoring on a quarterly basis is $**873,090**.

3.5 Provision for Project Variation

An allowance has been made of, $**292,727**, a 10% 'normal project variation', within the range provided in the DSD guidelines. This includes internal Heathgate project supervision costs.

3.6 Potential Additional Groundwater Remediation

In accordance the DSD guideline, Heathgate has undertaken a first-pass estimation of potential additional costs on the possibility of the requirement of additional groundwater treatment intervention at the Beverley North mine. This might be required if initial groundwater monitoring and comparison with modelling predictions indicates that the single pore volume groundwater flush was insufficient to meet the closure objectives. However, for the purposes of this document and the assessed small risk that would be required, these calculations are not given here.

4 FINANCIAL SECURITY

This document is based on that prepared by Heathgate to estimate the cost of decommissioning and rehabilitation of the Beverley North ML area. The objective of decommissioning is to return the disturbed areas on-site to the same condition, and or equivalent land use as before the construction of the Beverley North Mine.

Based on the cost estimates detailed above and summarised in the following table, the approximate value to decommission the Beverley North Mine (as of December 2010) is **$3,541,997**. Included within this amount is $292,727 as an estimated reasonable provision for project variation.

This calculation assumes no additional groundwater intervention is required.

Table 4.1Summary of Cost Estimates for Decommissioning and Rehabilitation

Location	Decommission and Rehabilitation Cost
Wellfield installations	$1,073,382
Satellite plant facilities	$374,300
Ancillary facilities	$338,140
Ancillary Infrastructure	$38,535
Recurring costs	$229,823
Long term monitoring	$873,090
Subtotal	***$2,927,270***
Provision for Project Variation (10%)	$292,727
Subtotal	***$3,219,997***
10% 3rd party management costs	$322,000
Total	***$3,541,997***

Heathgate proposes to lodge a financial security bond with the government of South Australia to cover the costs of returning the Beverley North Mine site to the agreed pastoral/conservation conditions. DSD will determine the amount of the bond.

Heathgate expects that a full review of the financial security bond will take place every second year and a CPI indexed review will take place in the alternate years.

4.1 Cost Assumptions

Table 4.2 - Recurring Costs and Assumptions

Item	Cost
Hourly labour	$65.00
Environmental Officer Rate	$76.06
Supervisor labour	$76.06
Accommodation & meals / person / day	$140.00
Vehicles hire per day	$100.00
Fuel cost per L	$1.23
Total Hours for works	5,632
Number of Crew	4
No. of Supervisors	1
Number of Months	3.81
No. of Days	117.33
Litres per day	200.00
Recurring Costs	
Supervision of Works	$107,092
Hire of 2 Vehicles	$11,733
Accommodation and Meals	$82,133
Cost of Fuel	$28,864
Total	***$229,823***

Table 4.3 - Non-recurring Cost Assumptions

Item	Cost
Cementing cost to plug 6 inch well / meter	$18.15
Cementing cost to plug 4 inch well / meter	$11.00
Average depth per production well (m) 6"	250
Average depth per lateral monitor well (m) 4"	250
Average depth per overlying monitor well (m) 4"	112
Average depth per underlying monitor well (m) 4"	366
Plug and abandon 6 inch production well	$4,537.50
Plug and abandon 4 inch lateral well	$2,750.00
Plug and abandon 4 inch overlying monitor well	$1,232.00
Plug and abandon 4 inch underlying monitor well	$4,026.00
Fence relocation per meter	$6.00
Transportation per km	$6.56
KMs per trip (to or from Adelaide) (km)	$650.00
Transportation costs per trip	$4,264.00
Crane hire per day	$2,500.00
Misc. equipment hire per day	$1,145.00
Cost to move wellhouse	$3,250.00
Contour and scarify/wellfield ($/ha)	$2,000.00

4.2 Wellfields

Table 4.4 Beverley North Wellfields

Item	Units	$/Unit	Hours	Cost
Production Wells	181	4,538		$821,288
Lateral Monitor Wells	67	2,750		$184,250
Overlying Monitor Wells	4	1,232		$4,928
Underlying Monitor Wells	4	4,026		$16,104
Wellhouses	3	3,250		$9,750
Contour/scarify ($/unit = $/ha)	3	2000		$6,000
Generator	3		20	$3,900
Misc. equipment hire	3	1145		$3,435
Crane Hire	3	2500		$7,500
Transportation of generator and diesel tank	3	4,264		$12,792
Misc. equipment hire	3	1145		$3,435
Crane Hire	3	2500		$7,500
Total			***20***	***$1,073,382***

4.3 Satellite Plants

Table 4.5 Beverley North Satellite Plants

Item	Units	$/unit	Hours	Cost
HDPE lined bund	4		300	$78,000
Ion exchange columns	8		75	$39,000
Hydrogen peroxide tanks	2		12	$1,560
Sulphuric acid tanks	2		12	$1,560
Process water tank	2		12	$1,560
Circulation tank	2		12	$1,560
Waste water tank	2		12	$1,560
Reverse osmosis water tank	2		12	$1,560
Seal flush tank	2		12	$1,560
Misc. pumps, valves, and piping	2		500	$65,000
Compressor	2		20	$2,600
Generator	2		20	$2,600
Electrical panels, wiring, and instrumentation	2		200	$26,000
Crane rental (2 cranes x 4 days)	16	2,500		$40,000
Transportation of equip/buildings/etc	20	4,264		$85,280
Contour/scarify	1	2,000		$2,000
Misc. equipment hire	20	1145		$22,900
Total			***1199***	***$374,300***

Table 4.6 Beverley North Ancillary Facilities

Item	Units	$/unit	Hours	Cost
Office/crib building	2		12	1,560.00
Control Room	2		12	1,560.00
Laboratory	2		12	1,560.00
Ablution blocks	2		12	1,560.00
Switch room	2		12	1,560.00
Carpark ($/ha)	0.4	2,000		800
Biocycle sewerage system	2		12	1,560
1.6 m high chain link fencing (m)	700	6		4,200
Beverley North Lateral Line (kms)	0.94		300	18,330
Beverley North Spider Lines (kms)	*38*		15	37,050
Diesel tank and bund	2		24	3,120
Decommission weather station	1		12	780
Misc. equipment hire	100	1,145		114,500
Crane rental	60	2,500		150,000
Total			***423***	***338,140***

Table 4.6 Beverley North Ancillary Infrastructure

Item	Units	$/Unit	Hours	Cost
Water supply wells	2	$4,537.50		$9,075.00
Water tanks	6		12	$4,680.00
Communal mud pits	6		24	$9,360.00
Unloading ramps	2		10	1,300
Drillers' laydowns 2 x 0.5 ha = 1 ha ($/ha)	1	2,000		2,000
Turkeys nests	2		24	$3,120.00
Access roads - 5 km x 9m = 4.5 ha ($/ha)	4.5	2,000		9,000
Total			***70***	***38,535***

* lump sum allowances as per DEF calculations

4.4 Long Term Monitoring

Table 4.7 Long Term Monitoring

Item	Units	$/unit	Hours	Cost
Environmental Officer	2		140	$21,297
Transportation (5 days)	14	$100.00		$1,400
Meals and accommodation (5 days)	14	$140.00		$1,960
Materials and supplies	2	$200.00		$400
Maintenance	2	$250.00		$500
Sample analysis	75	$75.00		$5,625
Total per quarter			***140***	***$31,182***
Total per year			***560***	***$124,727***
Total for 7 years			***3920***	***$873,090***

APPENDIX G Pepegoona West Barrier Wells