



Vimy Resources Limited

Soil Monitoring and Management Plan

(Outcome-Based Condition Environmental Management Plan)

Mulga Rock Uranium Project

EMP-EHS-004

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Summary

Title of the proposal	Mulga Rock Uranium Project (MRUP)
Proponent name	Vimy Resources Limited (Vimy)
Ministerial Statement Number	1046
Purpose of this Condition EMP	The Soil Monitoring and Management Plan is submitted to fulfil the requirements of Conditions 6 and 13 of the above Statement
EPA's environmental objective for the key environmental factor/s	Terrestrial Environmental Quality To maintain the quality of land and soils so that the environmental values, both ecological and social, are protected.
Condition environmental outcome or proposed measurable outcome	(1) Maintain soil quality within background concentrations established during baseline studies 10 metres from areas where dewater has been used for dust suppression in Sandhill Dunnart Habitat (i.e. E3 and S6 vegetation communities).
Key provisions	<p>Trigger Criteria 1:</p> <p>Soil salinity (as measured by Electrical Conductivity; EC_{1:5}) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities) in samples taken 5m from areas where dust suppression activities occurred \geq 60mS/m.</p> <p>Acidity (as measured by pH) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities) in samples taken 5m from areas where dust suppression activities occurred \geq 2 standard deviations above the mean (i.e. pH lower) established during baseline studies. Data will be adjusted for skew and kurtosis or whatever transformation is required to create a standard normal distribution.</p> <p>Concentration of key metals (Zinc, Nickel, Copper, Cobalt and Uranium; mg/kg) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities), in samples taken 5m from areas where dust suppression activities occurred \geq</p> <ul style="list-style-type: none"> • Zinc – 160 mg/kg dry weight • Nickel – 38 mg/kg dry weight • Copper – 70 mg/kg dry weight • Cobalt – 13 mg/kg dry weight • Uranium – 23 mg/kg dry weight <p>Threshold Criteria 1:</p> <p>Soil salinity (as measured by Electrical Conductivity; EC_{1:5}) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities) in samples taken 5m from areas where dust suppression activities occurred \geq 80mS/m.</p>



	<p>Acidity (pH) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities), in samples taken 10m from areas where dust suppression activities occurred ≥ 2 standard deviations above mean (i.e. pH lower) established during baseline studies. Data will be adjusted for skew and kurtosis or whatever transformation is required to create a standard normal distribution.</p> <p>Concentration of key metals (Zinc, Nickel, Copper, Cobalt and Uranium; mg/kg) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities), in samples taken 10m from areas where dust suppression activities occurred \geq</p> <ul style="list-style-type: none">• Zinc – 160 mg/kg dry weight• Nickel – 38 mg/kg dry weight• Copper – 70 mg/kg dry weight• Cobalt – 13 mg/kg dry weight• Uranium – 23 mg/kg dry weight
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1. Context, Scope and Rationale

1.1 Proposal

Vimy Resources Limited (Vimy) proposes to develop the Mulga Rock Uranium Project (MRUP or the Project) which lies approximately 240km east-north-east of Kalgoorlie-Boulder in the Shire of Menzies. The area is remote, located on the western flank of the Great Victoria Desert (GVD), comprising of a series of large, generally parallel sand dunes, with inter-dunal swales and broad flat plains.

The MRUP covers approximately 102,000 hectares on granted mining tenure (primarily M39/1104 and M39/1105) within Unallocated Crown Land (UCL). It includes two distinct mining centres, Mulga Rock East (MRE) comprising the Princess and Ambassador resources and Mulga Rock West (MRW) comprising the Emperor and Shogun resources, which are approximately 20km apart. The deposits will be mined using large-scale open pits to produce an annualised peak capacity of 2,180 t/a (4.8 Mlbs) U₃O₈.

The anticipated Life-of-Mine (LOM) is up to 16 years, based on the currently identified resource.

This Condition Environment Management Plan (CEMP) has been written in accordance with the *Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans* (EPA, 2016).

1.2 Key environmental factor

This Soil Monitoring and Management Plan specifically addresses the Terrestrial Environmental Quality environmental factor which is part of the overall Land Theme.

Soil quality is a key environmental factor for supporting vegetation and fauna communities, including Sandhill Dunnart (SHD) habitat E3 and S6. Altering the soil quality in these key habitat types has the potential to impact on the movement and distribution of Sandhill Dunnart, and thus maintaining the baseline soil quality is important to minimise the impact on this endangered species listed under the EPBC Act (Matters of National Environmental Significance; MNES) and Department of Parks and Wildlife (DPaW), and classified as Schedule 1 under the *Wildlife Conservation Act 1950*. The Sandhill Dunnart has been both sighted and its 'prime habitat' identified (S6 and E3 vegetation communities) within the MRUP.

Potential impacts of using saline dewater for dust suppression on soil quality include:

- Increased erosion and altered soil physical properties
- Change in soil (geo)chemical properties

1.3 Condition requirements

Condition	Section in Condition EMP
13-1 The proponent shall manage the implementation of the Proposal to meet the following environmental outcome: <ol style="list-style-type: none"> 1) Maintain soil quality within background concentrations established during baseline studies 10 metres from areas where dewater has been used for dust suppression in Sandhill Dunnart Habitat (i.e. E3 and S6 vegetation communities). 	Whole document

Condition	Section in Condition EMP
13-2 The proponent shall consult with the Department of Mines and Petroleum and prepare and submit a Soil Monitoring and Management Plan required by condition 6-1 that satisfies the requirements of condition 6-2, to meet the outcome of condition 13-1.	Section 4
13-3 The proponent shall continue to implement the version of the Soil Monitoring and Management Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the Soil Monitoring and Management Plan required by condition 6-1 satisfies the requirements of condition 6-2 to meet the outcome required by condition 13-1.	Whole document

In addition to Condition 13-1 protecting soil quality within E3 and S6 habitat areas from saline dewater used in dust suppression activities, Condition 14-1 protects soil quality, and overall Terrestrial Environmental Quality, from Acid and Metalliferous Drainage (AMD) from lignite oxidation in stockpiles, and overall soil quality from dewater used in dust suppression.

1.4 Rationale and approach

1.4.1 Survey and study findings

Soils

The soils throughout the project area have been mapped both at a regional scale and at a local scale. At a regional scale the project occurs within the Southern Great Victorian Desert Zone (Zone 124; ASRIS; CSIRO, 2014), with the majority of the MRUP occurring within soil-landscape unit AB47, which consists of plains and longitudinal and ring dunes, with interdunal corridors and plains and occasional salt pans. There is a minor occurrence of soil-landscape unit My99, comprising plains of extensive gravel pavements and small tracts of longitudinal dunes.

At the local scale, a detailed soil survey has been undertaken by SWC (2015) that identified that all soils within the MRUP have a depositional origin, either by colluvial, alluvial or Aeolian process. The uppermost layers (surficial Quaternary sediments) are principally comprised of just two soil materials, these being either dunal sand or reddish brown sandy loam in the interdunal zones. The surficial soils generally exhibit optimal physical (non-hardsetting, non-dispersive) and chemical (slightly acidic pH, non-saline) soil properties.

Based on the distribution of the above two dominant soil materials (i.e. dunal sand and sandy loam), only three morphologically distinct soil types or soil mapping units occur across the entire project area, these are:

- SMU1: Deep Dunal Sand
- SMU2: Sandy Duplex Soil
- SMU3: Calcareous Loamy Soil

Flora and Vegetation

A defined Soil-Vegetation Association exists within the MRUP. The distribution of vegetation is strongly controlled by the thickness of the surficial dunal sand, such that as the thickness of the dunal sand increases, the accessibility to readily available water stored in the profile decreases, and thus there is a distinct change from taller, denser Eucalypt woodland, E3 and E5 vegetation, to shorter more sparse shrub vegetation characterised by S6 and S8.

Within the MRUP a total of 26 vegetation communities have been identified and mapped (MCPL, 2015). Of these communities the E3 and S6 vegetation types represent prime Sandhill Dunnart habitat:

- E3 – Low open woodland of *Eucalyptus gongylocarpa* over *Eucalyptus youngiana*, *Eucalyptus ceratocorys*, *Grevillea jucicolia*, *Hakea francisiana* and *Callitris Preissii* over *Acacia helmsiana*, *Cryptandra distigma* and mixed low shrubs over *Triodia desertorum*, *Chrysitrix distigmata* and *Lepidobolus deserti*. This community occurs on yellow and yellow-orange sands of flats, slopes and between dunes.
- S6 – Low Shrubland of *Thryptomene biseriata*, *Allocasuarina spinosissima*, *Allocasuarina acutivalvis* susp. *acutivalvis*, *Jacksonia arida*, *Calothamnus gilesii*, *Acacia fragilis*, *Conospermum toddii*, *Pityrodia lepidota*, *Lomandra leucocephala*, *Anthotroche pannosa* and mixed low shrubs over *Triodia desertorum* with *Lepidobolus deserti* with emergent *Eucalyptus gongylocarpa*, *Eucalyptus youngiana*, *Eucalyptus ceratocorys* and *Eucalyptus mannensis* subsp. *mannensis*. This community occurs on yellow sand dunes.

Groundwater

Numerous groundwater related studies and modelling investigations have been undertaken to assess aspects of the environment relevant to the management of groundwater.

The area intended to be mined is located within a remnant oxbow paleochannel, which was active and subsequently filled during the Eocene Period, and subsequently covered by Miocene and Quaternary sediments. The water table in the palaeochannel occurs at an elevation of about 285 to 290m Australian Height Datum (AHD). Groundwater throughout the project area is around 29 to 49m below ground level (bgl), and generally lies within fine-grained carbonaceous sediments of Eocene age, which represents the orebody to be mined. The water table is flat (i.e. low hydraulic gradient), and there is negligible recharge (by infiltrating rainfall) or discharge out of the channel. The low hydraulic gradient that does exist indicates minor flow from the north to south. The initial mining area (Mulga Rock East - MRE) sits in a tributary area where the water level is somewhat higher, at up to 300m AHD – still between 29 and 49m bgl. Mining in the latter years (Mulga Rock West - MRW) will take place in an area with a flat-water table within the main palaeodrainage (basin).

Dust suppression requirements for the MRUP are generally around 0.2GL/a (or around 440kL/day; Rockwater, 2015; Advisian, 2017), with all water sourced from dewatering of the paleodrainage channel to access the orebody. The groundwater within the active mine areas of the paleodrainage channel has an average pH of 4.4 and a TDS range from 6,067mg/L to 146,900mg/L. The groundwater is best described as saline to hypersaline, acidic, reducing and with some elevated metal concentrations.

Trigger and threshold levels

The outcome required by Ministerial Condition 13-1(1) is that soil quality must be maintained within background concentrations, established during baseline studies, 10 metres from areas where dewater has been used for dust suppression in E3 and S6 vegetation community areas.

Vimy proposes to undertake baseline studies to determine the average surface soil (top 10cm) quality (salinity, acidity and metals content) in the approximate areas where roads are due to be built, where they will be disturbing Sandhill Dunnart Habitat (E3 and S6 vegetation communities). A total of 20 samples will be taken from randomly selected appropriate locations along the line of proposed roads within the correct vegetation community areas that will establish average salinity and acidity in those soils and an assessment of normal variation (the standard deviation from the mean) and similarly for metal content of the soil in relation to key metals that might be in dewater that will subsequently be used for dust suppression activity, namely Zinc, Nickel, Copper, Cobalt and Uranium.

The **trigger** level for salinity will be set at 60 mS/m EC_{1:5}. In order to provide advanced warning of excessive overspray leading to a deterioration in soil quality at 10m from where dewater has been

applied, the sampling for monitoring purposes will be undertaken at a distance of 5m from the area where dewater has been applied and will initially only involve a test for salinity every six months and a test for acidity and metals every two years. In the event that the trigger level for salinity was exceeded for a sample taken 5m from where dust suppression activity had taken place the soil sample would be taken for acidity and metals testing and a further sample would be undertaken at 10m for salinity to check whether the threshold might also be being exceeded.

The **threshold** level for salinity will be set at set at 80 mS/m EC_{1:5}. The threshold level will relate to samples taken from a location 5m from where dewater has been applied – testing for threshold level exceedance will initially involve only salinity testing at six monthly intervals and only if the salinity testing suggests that overspray has reached the area (because salinity was above 80 mS/m) would samples be sent for analysis for acidity and metals. Samples will also be sent for analysis for acidity and metals every two years.

1.4.2 Key assumptions and uncertainties

It is assumed that the desktop investigations and surveys undertaken for MRUP have sufficiently identified the species and mapped the vegetation within and surrounding the Project area. However, due to natural disturbances such as fire, it is possible that species may not have been recorded during the survey effort.

It is assumed that the desktop and field investigations and surveys undertaken for the MRUP have sufficiently identified the groundwater and soil characteristics of the project and surrounding areas.

It is assumed that the desktop investigations and surveys undertaken for MRUP have sufficiently identified the fauna species within and surrounding the Project area. However, with transient and migratory species, it is possible that some species have not been recorded during the survey effort.

Although there are the above assumptions and uncertainties, it is considered that the work undertaken to date to characterise the environment is sufficient to assess risk and to monitor and confirm impact, if it occurs.

1.4.3 Management approach

The management approach to be applied is based on sound scientific and technical understanding of the distribution of the soils throughout the MRUP of their properties, such that the impact on Terrestrial Environmental Quality can be established. Performance indicators and response actions have therefore been developed on these principles to ensure that they are realistic, attainable and effectively reduce the risks.

In addition, Vimy has developed a Ground Disturbance Activity Permit (GDAP) system that will prevent any unauthorised dust suppression activities from occurring. All proposed dust suppression activities will be assessed for potential impacts on soil quality, and must be internally authorised before commencing. This process will therefore ensure that impacts on Terrestrial Environmental Quality, and in particular E3 and S6 habitats, are minimised.

Furthermore, the management approach will rely on:

- Environmental Inductions – to ensure that all new personnel entering the MRUP are aware of the environmental qualities within the MRUP and how their actions may impact on these qualities.
- Environmental Training – this will ensure that all personnel involved in dust suppression activities, are properly trained, are competent to perform the task, and that fit-for-purpose equipment is used to minimise the environmental impacts.
- Engineering – The use of appropriately designed dribble bars that reduce likelihood of overspray during dust suppression.

- Contributing Factors – identification and implementation of management actions to minimise and prevent the contributing factors that may cause an impact on soil quality.

In the unlikely event that, despite Environmental Inductions and Training and the use of fit for purpose equipment, dust suppression activities result in soil contamination of adjacent areas then the following management approach will be implemented:

- Substitution – the highly saline water, used for dust suppression activities, derived from mine dewatering, would be diluted with the fresh-brackish water from Kakarook North Borefield for use on roads adjacent to E3 and S6 habitats to the extent necessary to ensure that soil salinity remained below the Trigger Criteria 1.

1.4.4 Rationale for choice of provisions

As defined in Section 1.4.1 the groundwater to be utilised in dust suppression activities is saline-hypersaline, with a salinity (Electrical Conductivity, EC) of around 12,000mS/m and a Total Dissolved Solids (TDS) of around 75,000mg/L. In addition, the groundwater is considered highly acidic (average pH of 4.4) and may contain elevated metals and metalloids. The application of this water has the potential to impact on soil quality and vegetation health at a local scale. Given the surficial soils are inherently non-saline, the application of the saline-hypersaline groundwater will likely result in a measurable change in the salinity of the surface soils and indicate that the local area was subjected to overspray during dust suppression activities; hence salinity (EC) will be used as the primary performance indicator to identify areas of saline water overspray and requiring further investigation to assess potential impacts.

A 'Trigger Level' of 60mS/m at a distance of 5m from where dust suppression activity has been occurring has been chosen, as this would indicate that the sample was above what would be expected for samples taken at normal background levels and is occurring at a distance 'halfway between where dust suppression activities have been occurring and the distance required to be compliant by Ministerial Condition 13-1(1)' and therefore it would act as a good early warning signal that overspray might be occurring.

A 'Threshold Level' of 80mS/m and at a distance of 5m from where dust suppression activity has been occurring has been chosen, as this would indicate that the salinity was approaching levels which could adversely affect the vegetation at a location half way between where dust suppression activity was taking place and where the Ministerial condition requires there to be no adverse effect. Note that a sample that breached the 'Threshold Level' would be highly unlikely to be a breach of the Ministerial Condition 13-1(1) in isolation as it would require excessive overspray to have continued undetected (despite sampling 'closer in' for trigger criteria purposes) for a long period of time and at a distance that 'overspray would have been highly unlikely to travel'. It would be far more likely to be a 'natural outlier' than evidence of persistent overspray at a distance further than such spray would be expected to carry.

Although it is acknowledged that the acidic and metal-laden nature of the groundwater may impact on soil quality and have an adverse impact on both SHDs and their habitat, it is recognised that salinity will be the primary contributing factor to any impact, and thus it is the primary Trigger and Threshold Criteria used in this CEMP.

Despite the fact that salinity will be the primary contributing factor to any impact, soils will also be sampled for acidity and metals at the same sites and depths as those proposed for salinity sampling. The trigger levels for acidity (pH) will be determined by evaluation of the initial soil samples which will be analysed to determine mean acidity levels in the soil and the associated standard deviation. The data will be normalised to adjust for the logarithmic nature of pH readings and for any skew or kurtosis demonstrated by the distribution of the samples around the mean. A pH value will be calculated that represents 2 standard deviations below the mean (i.e. more acidic than) after normalising the

distribution. The threshold levels for acidity will be the same values as for the trigger levels but at 10m as opposed to 5m from where dust suppression activities had taken place.

The trigger and threshold levels for key metals were derived from Ecological Soil Screening Levels (Eco-SSL) determined by the United States Environmental Protection Agency for various metals for their potential impact upon Terrestrial Plants. The trigger values are for samples taken at 5m and the threshold values are for samples taken at 10m. The Eco-SSL levels were as follows:

- Zinc – 160 mg/kg dry weight
- Nickel – 38 mg/kg dry weight
- Copper – 70 mg/kg dry weight
- Cobalt – 13 mg/kg dry weight

In addition, a trigger and threshold value for Uranium was set at 23 mg/kg dry weight (at 5m and 10m respectively) being the level of uranium in soil recommended by the 'Canadian Council of Ministers of the Environment' (CCME) in *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health* (CCME, 2007) as it related to the protection of human health in agricultural or residential/parkland use. This is a very conservative value as it is designed to protect human health in the context of direct exposure to the contaminated soil or ingestion of food grown in the soil. That conservatism also involved assuming the human being that was exposed to the soil was a preschool toddler that also directly ingested some of the soil and was therefore subject to a large exposure per unit of mass; it also included the assumption of 100% uptake of uranium in the soil. The same CCME recommendations as they related to protection of the environment (as opposed to human health) in residential/parkland uses (i.e. excluding Agricultural land where the risk is food ingestion by domestic animals and wildlife), the soil quality guideline was a much higher value of 500 mg/kg.

Baseline levels will be established immediately prior to the construction of roads (or any other infrastructure where dust suppression activities are intended to occur) and thereafter sampling for salinity will take place every six months. Acidity (pH) and metals (Zinc, Nickel, Copper, Cobalt and Uranium) will be included in the initial sampling and then only sampled for every two years, or earlier in the event that salinity monitoring indicates that there has been an adverse impact on soils (an adverse impact being that there has been sufficient overspray so as to cause salinity levels to exceed Trigger Levels). Once the results from the acidity and metals sampling have been assessed, the CEMP will be reviewed to consider whether there remains any reason to continue acidity and metals sampling other than after a salinity reading above the Trigger Level and to ascertain whether the trigger and threshold levels are appropriate.

2. Condition EMP Provisions

This section of the EMP identifies the legal provisions that Vimy proposes to implement to ensure that the soil quality within SHD habitats, 10m from areas where dewater has been used for dust suppression, is maintained within background concentrations. It identifies the performance indicators that Vimy will implement and how they will be monitored and reported, to achieve the environmental outcome of Condition 13-1. Table 1 provides a detailed list of these provisions.

This section also identifies how Vimy will review and revise the performance indicators and the corresponding response actions if the performance indicators are exceeded.

2.1 Outcome

The environmental outcome of Condition 13-1 of Ministerial Statement 1046 is:

- Condition 13-1(1): Maintain soil quality within background concentrations established during baseline studies 10 metres from areas where dewater has been used for dust suppression in Sandhill Dunnart Habitat (i.e. E3 and S6 vegetation communities).

2.2 Performance indicators (environmental criteria)

The following performance indicators (Trigger and Threshold criteria) have been identified to ensure that the above environmental outcome is achieved:

**Trigger
riteria 1:**

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-
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-
- 23

**Threshold
Criteria 1:**

The Threshold Value for soil salinity (as measured by Electrical Conductivity using w/v method; EC_{1:5}) taken at a location 5m from the edge of where dust suppression activities have taken place within Sandhill Dunnart habitat areas (E3 and S6 vegetation communities) is >80mS/m .

The Threshold Value for acidity (pH) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities), 10m from areas where dust suppression activities occurred is ≥ 2 standard deviations above mean established during baseline studies. Data will be adjusted for skew and kurtosis or whatever transformation is required to create a standard normal distribution.

The Threshold Values for key metals expressed in mg/kg dry weight in Sandhill Dunnart Habitat (E3 and S6 vegetation communities), 10m from areas where dust suppression activities occurred are as follows:

- Zinc – 160
- Nickel – 38
- Copper – 70
- Cobalt – 13
- Uranium – 23

2.3 Response actions

The following specific response actions will be implemented if monitoring identifies that the above performance indicators are exceeded.

Trigger Criteria 1:

Trigger level actions

- Investigation of affected areas, involving soil sampling (0-10cm) and laboratory testing for pH, EC and metals (Zn, Ni, Cu, Co & U) both at 5m distance and at 10m distance and possibly closer to dust suppression activity area to establish whether the cause is overspray and how far it has carried.
- If the initial investigation establishes that there is a likelihood that overspray has been occurring – then there would be an investigation into the causes of the overspray and measures introduced to ensure that the cause was rectified.
- Any Environmental Incident would be reported.
- A check would be made on the health of the local vegetation and if it was deemed that there had been some adverse health implications rectification measures would be implemented – most likely the application of a small amount of fresh water to areas where salinity was considered to be high enough to affect vegetation health and sufficient to dilute the effect down to levels that would not adversely impact the vegetation.

Threshold Criteria 1:

Threshold contingency actions

- Investigation of affected areas, involving soil sampling (0-10cm) and laboratory testing for pH, EC and metals (Zn, Ni, Cu, Co & U) of area between dust suppression activity and monitoring site location and laterally for as far as elevated readings were still being recorded to establish whether the cause is overspray and how far it has carried.
 - If the initial investigation establishes that there is a likelihood that overspray has been occurring – then there would be an investigation into the causes of the overspray and measures introduced to ensure that the cause was rectified. Dust suppression measures would be suspended until rectification measures designed to decrease overspray were introduced.
 - Any Environmental Incident would be reported.
 - A check would be made on the health of the local vegetation and if it was deemed that there had been some adverse health implications rectification measures would be implemented – most likely the application of a small amount of fresh water to areas where salinity was considered to be high enough to affect vegetation health and sufficient to dilute the effect down to levels that would not adversely impact the vegetation.
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2.4 Monitoring

For each performance indicator (environmental criteria) listed in Section 2.2, a specific monitoring program or task will be undertaken to measure performance against the environmental outcome and whether the ‘Trigger level actions’ or ‘Threshold contingency actions’ listed in Section 2.3 need to be implemented. If monitoring identifies that the performance indicators have not been met, then there is a risk that the environmental outcome will also not be achieved.

The specific monitoring tasks to be undertaken for each performance indicator are outlined below.

Monitoring parameter	Response actions
Frequency of sampling:	<p>Initial sampling of EC, pH and metals to take place in vegetation community E3 and S6 areas in close proximity to where infrastructure (roads) will be built just prior to their construction.</p> <p>Biannual (six monthly) soil sampling for EC at 5m from where dust suppression activities have taken place (but also at 10m if trigger exceed and expanded to include pH and metals).</p> <p>Biennial (every 2 years) soil sampling for pH levels and metal concentration of Zinc, Nickel, Copper, Cobalt and Uranium (or earlier if EC sampling indicates that there is a potential problem). Frequency of acidity and metal sampling to be reviewed in light of results.</p>
Number of sampling sites:	20 samples taken each time sampling occurs from locations approximately 5m from where dust suppression activity has taken place in E3 and S6 vegetation communities adjacent to roads and tracks where dust suppression is applied. Exact locations to be randomly selected from within suitable areas but weighted towards areas where overspray was most likely to have occurred (if any).
Duration of sampling program:	Length of dust suppression activity.
Sampling method:	Surface soil sampling (0-10cm).
Sampling approach:	Six monthly sampling will take place adjacent to areas where dust suppression spray has most frequently been utilised. Any further sampling contingent upon outcomes of initial sampling.

As specified in Condition 6-4, if the above monitoring indicates exceedance of 'trigger criteria' and / or 'threshold criteria', then:

- 1) report the exceedance to the CEO of DWER in writing within seven (7) days of the exceedance being identified;
- 2) immediately implement the trigger level actions and / or threshold contingency actions specified in the Condition Environmental Management Plan(s) and continue implementation of those actions until the trigger criteria and / or threshold criteria are being met and implementation of the trigger level actions and / or threshold contingency actions are no longer required;
- 3) investigate to determine the cause of the trigger criteria and / or threshold criteria being exceeded;
- 4) identify additional measures required to prevent the trigger and / or threshold criteria being exceeded in the future;
- 5) investigate to determine potential environment harm or alteration of the environmental that occurred due to threshold criteria being exceeded; and
- 6) provide a report to the CEO of DWER within ninety (90) days of the exceedance being reported. The report will include:

- a) details of trigger level actions or threshold contingency actions implemented;
- b) the effectiveness of the trigger level actions, or threshold contingency actions implemented, monitored and measured against trigger criteria and threshold criteria;
- c) the findings of the investigations required by Condition 6-4(3) and 6-4(5);
- d) additional measures to prevent the trigger or threshold criteria being exceeded in the future; and
- e) measures to prevent, control or abate the environmental harm which may have occurred.

2.5 Reporting

Reporting of the above monitoring results, and achievement of the performance indicators that satisfy the environmental outcome, will occur in the Compliance Assessment Report (CAR) to be submitted annually (in March; starting in 2018) to the CEO of DWER.

In accordance with Condition 4-6, the CAR shall:

- 1) be endorsed by Vimy's CEO or other person delegated to sign on the CEO's behalf;
- 2) include a statement as to whether Vimy has complied with the conditions;
- 3) identify all potential non-compliances and describe corrective and preventative actions taken;
- 4) be made publicly available in accordance with the approved Compliance Assessment Plan (CAP); and
- 5) indicate any proposed changes to the CAP required by Condition 4-1.

The CAR will also include:

- Monitoring results and trends against performance indicators;
- Any exceedance of trigger criteria and / or threshold criteria;
- A review of the response actions and their appropriateness in achieving the performance indicators and the overall environmental outcome; and
- Proposed revision of the performance indicators, and corresponding response actions, if required, to obtain formal approval from DWER to amend the CEMP.

In addition to the CAR, all results from specific monitoring programs (e.g. dust monitoring, vegetation health monitoring) and details of any environmental discharges (e.g. saline water spills) will be presented in the Annual Environmental Report (AER). Furthermore, results of rehabilitation performance will be reported in the annual Mine Rehabilitation Fund (MRF) document.

3. Adaptive Management and Review of the Condition EMP

3.1 Review and revision of performance indicators and response actions

In the event that a performance indicator (trigger or threshold) is exceeded, or the identified response actions do not result in the performance indicator(s) being met, then Vimy will review and revise the risk assessment, review and revise performance indicator(s) and response actions and identify additional response actions where necessary.

Risks and key impacts associated with response actions and priorities will be reviewed and revised and, if necessary, implement the following adaptive management procedure:

- Investigate the potential cause for the performance indicator exceedance and identify any impacts to soil quality resulting from this exceedance.
- If the causes of the exceedance or the efficacy of the response actions are found to be deficient, then the risk assessment will be reviewed and revised risk based response actions will be implemented, following formal approval from DWER, so that the environmental outcome is met.

Vimy will also implement adaptive management to learn from the implementation of mitigation measures, monitoring and evaluation against performance indicators, to more effectively meet the environmental outcome. The following approach will be followed:

- Monitoring data will be systematically evaluated and compared to baseline and reference site data in a process of adaptive management to verify whether responses to the impact are the same or similar to predictions.
- Re-evaluate the risk assessment and revision of risk-based priorities on the basis of monitored information.
- Increased understanding of the local and regional ecological regime.
- Revision when response actions are not as effective as predicted.
- External changes during the life of the proposal (e.g. changes to the sensitivity of the key environmental factor, implementation of other activities in the area, etc.).
- Review of CEMP – changes to CEMP provisions required by a condition, timeframe, etc.

3.2 Corrective Actions

If the results of monitoring show that the management targets are not being met (or more likely are on track to not being met in the near future), then the corrective actions outlined in the table below will be implemented.

Performance Indicator	Corrective Action	Responsibility
<p>Soil salinity (as measured by Electrical Conductivity; EC_{1:5}) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities) 5m from areas where dust suppression activities occurred $\geq 60\text{mS/m}$.</p> <p>Acidity (pH) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities) 5m from areas where dust suppression activities occurred ≥ 2 standard deviations above mean established during baseline studies. Data will be adjusted for skew and kurtosis or whatever transformation is required to create a standard normal distribution.</p>	<ul style="list-style-type: none"> • Undertake further sampling to determine whether the occurrence is more widespread and whether it is likely to be caused by overspray. • If overspray implicated undertake an investigation to determine the causes of the overspray having occurred and implement rectification measures to prevent overspray from occurring. For example: <ul style="list-style-type: none"> ○ If caused by spraying in high winds, ensure that measures designed to prevent spraying in high winds are properly enforced. ○ If caused by faulty equipment – ensure equipment fault is rectified and better checks implemented to prevent faulty equipment being utilise. 	Mine Manager and Environmental Manager

Performance Indicator	Corrective Action	Responsibility
<p>Concentration of key metals (Zinc, Nickel, Copper, Cobalt and Uranium; mg/kg) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities), 5m from areas where dust suppression activities occurred \geq</p> <ul style="list-style-type: none"> • Zinc – 160 mg/kg dry weight • Nickel – 38 mg/kg dry weight • Copper – 70 mg/kg dry weight • Cobalt – 13 mg/kg dry weight • Uranium – 23 mg/kg dry weight 	<ul style="list-style-type: none"> ○ If caused by improper containment of run-off from roads after spraying – improve containment measures. • Whilst investigation into causes is being undertaken either cease dust suppression or use clean water for dust suppression until remedy effected. • Investigate impact upon local vegetation if any and apply appropriate remedial measures if local vegetation health appears to have deteriorated. • Most likely remedial action would be to dilute area of increased salinity by application of freshwater sufficient to restore health to local vegetation. 	
<p>Soil salinity (as measured by Electrical Conductivity; EC), in Sandhill Dunnart Habitat (E3 and S6 vegetation communities), 5m from areas where dust suppression activities occurred \geq 80 mS/m.</p> <p>Acidity (pH) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities) 10m from areas where dust suppression activities occurred \geq 2 standard deviations above mean established during baseline studies. Data will be adjusted for skew and kurtosis or whatever transformation is required to create a standard normal distribution.</p> <p>Concentration of key metals (Zinc, Nickel, Copper, Cobalt and Uranium; mg/kg) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities), 10m from areas where dust suppression activities occurred \geq</p> <ul style="list-style-type: none"> • Zinc – 160 mg/kg dry weight • Nickel – 38 mg/kg dry weight • Copper – 70 mg/kg dry weight • Cobalt – 13 mg/kg dry weight • Uranium – 23 mg/kg dry weight 	<ul style="list-style-type: none"> • Undertake further sampling to determine whether the occurrence is more widespread and whether it is likely to be caused by overspray. • If overspray implicated undertake an investigation to determine the causes of the overspray having occurred and implement rectification measures to prevent overspray from occurring. For example: <ul style="list-style-type: none"> ○ If caused by spraying in high winds, ensure that measures designed to prevent spraying in high winds are properly enforced. ○ If caused by faulty equipment – ensure equipment fault is rectified and better checks implemented to prevent faulty equipment being utilise. ○ If caused by improper containment of run-off from roads after spraying – improve containment measures. • Whilst investigation into causes is being undertaken either cease dust suppression or use clean water for dust suppression until remedy effected. • Investigate impact upon local vegetation, if any, and apply appropriate remedial measures if local vegetation health appears to have deteriorated. • Most likely remedial action would be to dilute area of increased salinity by application of freshwater sufficient to restore health to local vegetation. 	<p>Mine Manager and Environmental Manager</p>

4. Stakeholder consultation

Extensive consultation regarding the potential environmental impacts that may result from the MRUP occurred during the Public Environmental Review (PER; Section 3). Specific consultation with regards to this CEMP with the Department of Mines, Industry Regulation and Safety (DMIRS; formerly the Department of Mines and Petroleum - DMP) is outlined below.

Date	Decision Making Authority	Comment	Response
29/12/2016	DMP	Met with Ian Mitchell and Emily Safe to discuss MRUP and the requirements under Condition 13 and 14 regarding potential impacts on soil quality.	No response needed
22/02/2017	DMP	Met with DMP Environmental Officers to discuss the Draft CEMP and its fulfilment of Ministerial Statement 1046	Vimy to ensure that this CEMP is prepared in accordance with MS 1046
24/05/2017	DMP	Met with Ian Mitchell, Damien Montague and Emily Safe to discuss specific management of AMD and other aspects that may impact soil quality.	No response needed

Table 1: CEMP Provisions (outcome-based) table

Purpose of EMP	To meet the legal requirements of Condition 13 of Ministerial Statement 1046			
EPA Factor	Terrestrial Environmental Quality			
EPA Objective	To maintain the quality of land and soils so that environmental values are protected			
MS 1046 Condition 13-1 Environmental Outcome:	(1) Maintain soil quality within background concentrations established during baseline studies 10 metres from areas where dewater has been used for dust suppression in Sandhill Dunnart Habitat (i.e. E3 and S6 vegetation communities).			
Outcome-based provisions				
Risk / Impact	Environmental Criteria	Response Actions	Monitoring	Reporting
Soil Quality	<p>Trigger Criteria 1: Samples will be taken at locations 5m from the edge of where dust suppression activities have taken place within Sandhill Dunnart habitat areas (E3 and S6 vegetation communities).</p> <p>The trigger value for soil salinity (as measured by Electrical Conductivity using w/v method; EC_{1:5}) is >60mS/m.</p> <p>The trigger value for acidity (pH) is ≥ 2 standard deviations above the mean for soil acidity established during baseline studies. The sample data will be adjusted for skew and kurtosis or whatever transformation is required to create a standard normal distribution.</p>	<p>Trigger level actions</p> <ul style="list-style-type: none"> Investigation of affected areas, involving soil sampling (0-10cm) and laboratory testing for pH, EC and metals (Zn, Ni, Cu, Co & U) both at 5m distance and at 10m distance and possibly closer to dust suppression activity area to establish whether the cause is overspray and how far it has carried. If the initial investigation establishes that there is a likelihood that overspray has been occurring – then there would be an investigation into the causes of the overspray and measures introduced to ensure that the cause was rectified. Any Environmental Incident would be reported. A check would be made on the health of the local vegetation and if it was deemed 	<p>Initial sampling of EC, pH and metals to take place immediately prior to the construction of infrastructure (roads) where they will be being built in vegetation community E3 and S6 areas.</p> <p>Biannual (six monthly) soil sampling for EC.</p> <p>Biennial (every 2 years) soil sampling for pH levels and metal concentration of Zinc, Nickel, Copper, Cobalt and Uranium (or earlier if EC sampling indicates that there is a potential problem).</p> <p>Frequency of acidity and metal sampling to be reviewed in light of results.</p>	CAR AER

Risk / Impact	Environmental Criteria	Response Actions	Monitoring	Reporting
	<p>The trigger values for key metals expressed as mg/kg (ppm) dry weight are as follows:</p> <ul style="list-style-type: none"> • Zinc – 160 • Nickel – 38 • Copper – 70 • Cobalt – 13 • Uranium – 23 	<p>that there had been some adverse health implications rectification measures would be implemented – most likely the application of a small amount of fresh water to areas where salinity was considered to be high enough to affect vegetation health and sufficient to dilute the effect down to levels that would not adversely impact the vegetation.</p>	<p>20 samples taken each time salinity sampling occurs from locations approximately 5m from where dust suppression activity has taken place in E3 and S6 vegetation communities adjacent to roads and tracks where dust suppression is applied. Exact locations to be randomly selected from within suitable areas but weighted towards areas where overspray was most likely to have occurred (if any).</p>	
	<p>Threshold Criteria 1: Soil salinity (as measured by Electrical Conductivity; EC_{1:5}) in Sandhill Dunnart Habitat (E3 and S6 vegetation Soil salinity (as measured by Electrical Conductivity; EC_{1:5})) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities) 5m from areas where dust suppression activities occurred ≥ 80mS/m.</p> <p>Acidity (pH) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities), 10m from areas where dust suppression activities occurred ≥ 2 standard deviations above mean established during baseline studies. Data will be adjusted for skew and kurtosis or whatever transformation is</p>	<p>Threshold contingency actions</p> <ul style="list-style-type: none"> • Investigation of affected areas, involving soil sampling (0-10cm) and laboratory testing for pH, EC and metals (Zn, Ni, Cu & Co) of area between dust suppression activity and monitoring site location, and laterally for as far as elevated readings were still being recorded, to establish whether the cause is overspray and how far it has carried. • If the initial investigation establishes that there is a likelihood that overspray has been occurring – then there would be an investigation into the causes of the overspray and measures introduced to ensure that the cause was rectified. Dust suppression measures would be suspended until rectification measures designed to decrease overspray were introduced. 	<p>Additional sampling of EC and pH and metal concentrations if trigger levels exceeded – number being sufficient to establish extent.</p> <p>Monitoring lasts as long as dust suppression activity is enduring.</p> <p>Surface soil sampling (0-10cm).</p>	

Risk / Impact	Environmental Criteria	Response Actions	Monitoring	Reporting
	<p>required to create a standard normal distribution.</p> <p>Concentration of key metals (Zinc, Nickel, Copper, Cobalt and Uranium; mg/kg) in Sandhill Dunnart Habitat (E3 and S6 vegetation communities), 10m from areas where dust suppression activities occurred ≥</p> <ul style="list-style-type: none"> • Zinc – 160 mg/kg dry weight • Nickel – 38 mg/kg dry weight • Copper – 70 mg/kg dry weight • Cobalt – 13 mg/kg dry weight • Uranium – 23 mg/kg dry weight 	<ul style="list-style-type: none"> • Any Environmental Incident would be reported. • A check would be made on the health of the local vegetation and if it was deemed that there had been some adverse health implications rectification measures would be implemented – most likely the application of a small amount of fresh water to areas where salinity was considered to be high enough to affect vegetation health and sufficient to dilute the effect down to levels that would not adversely impact the vegetation. 		



5. References

DER (2015). *Identification and investigation of acid sulphate soils and acidic landscapes*, Department of Environment Regulation (DER), Perth, Western Australia.

MCPL (2015). *Assessment of Flora and Vegetation Surveys conducted for the Mulga Rock Uranium Project, Great Victoria Desert, WA*. Unpublished report by Mattiske Consulting Pty Ltd for Vimy Resources, October, 2015.

National Committee on Soil and Terrain (2009). *Australian Soil and Land Survey Field Handbook*, CSIRO Publishing, Collingwood, Australia.

SWC (2015). *Terrain Analysis and Materials Characterisation for the Mulga Rock Uranium Project*. Unpublished report prepared for Vimy Resources Limited, October 2015.

Rockwater (2015). *Results of Hydrogeological Investigations and Numerical Modelling, Mulga Rock Uranium Project*. Unpublished report prepared for Vimy Resources Limited, October 2015