Vimy Resources Limited

Soil Monitoring and Management Plan

(Management-Based Condition Environmental Management Plan)

Mulga Rock Uranium Project

EMP-EHS-010

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Summary

Title of proposal	Mulga Rock Uranium Project
Proponent name	Vimy Resources Limited
Ministerial Statement Number	1046
Purpose of this EMP	The Management-based Soil Monitoring and Management Plan is submitted to fulfil the requirements of conditions 7 and 14 of the above Statement.
Key environmental factor/s and objective/s	Terrestrial Environmental Quality To maintain the quality of land and soils so that environmental values are protected.
Key environmental objectives	(1) Minimise impacts on soil quality as far as practicable resulting from lignite oxidation within stockpiles and the use of dewater for dust suppression.
Key provisions	**Management Target 1**: All sulphidic (carbonaceous) material to be directly disturbed by mining, is identified and appropriately managed to minimise impacts on soil quality. **Management Target 2**: Control runoff from above ground Potential Acid Forming (PAF) storage areas. **Management Target 3**: Minimise sulphide oxidation and release of Acid and Metalliferous Drainage (AMD) from permanent post-mine landforms. **Management Target 4**: All soil impacted by AMD is appropriately identified and managed to prevent further impact on soil quality. **Management Target 5**: No inappropriate handling or utilisation of sulphidic (carbonaceous) material. **Management Target 6**: Minimise the impacts on soil quality from paleodrainage channel groundwater used in dust suppression.

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-northeast of Kalgoorlie-Boulder in the Shire of Menzies. The area is remote, located on the western flank of the Great Victoria Desert, comprising 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 (formerly M39/1080 and M39/1081), 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) U_3O_8.

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 Factors

This *Soil (Management-based) Monitoring and Management Plan* specifically addresses the Terrestrial Environmental Quality, which is part of the overall Land Theme.

The MRUP occurs within the regional Yellow Sand Plain (YSP) area, which consists predominantly of Quaternary parallel yellow sand dunes with intervening swales and broad flat plains. The surface of the swales and plains represents the top of the underlying Miocene sediments, which the surficial dunes were deposited over (i.e. the upper surface of the Miocene sediments was once the original land surface prior to the Aeolian deposition of the sand dunes).

The Miocene sediments overlay a thick carbonaceous Eocene Formation which was deposited primarily under lacustrine conditions within the oxbow-shaped paleodrainage channel, and which hosts the uranium deposit to be mined at the MRUP. The upper 10-15m of the Eocene sediments have been oxidised in response to the uplift of the eastern Yilgarn Craton, and subsequently the current redox boundary, coinciding with the present groundwater level, and orebody occurs at between 29-49m below ground level (bgl). Acid and Metalliferous Drainage (AMD) is evident in the current Eocene sediments due to the low pH and elevated metal concentrations in the groundwater. Disturbance of the Eocene carbonaceous sediments may increase AMD based on geochemical testing.

Mining will involve excavating the overburden materials (Quaternary dunes, and Miocene and oxidised Eocene sediments) to expose the orebody. All overburden materials are classified as geochemically benign, with exception of the basal 2-5m which directly overlies the orebody. The basal overburden clays are less weathered or oxidised than the overlying sediments, and thus they contain residual sulphides and elevated metals, more aligned to the underlying orebody. As the orebody occurs at and below the groundwater level, dewatering is required. The groundwater in the paleodrainage channel is characterised as highly to moderately acidic and highly to hypersaline, with some elevated metals.

Given the limiting properties exhibited by the carbonaceous (lignitic) Eocene sediments (orebody) and the groundwater, the following impacts on Terrestrial Environmental Quality may occur as a result of inappropriate utilisation and handling:

- AMD in response to sulphide oxidation of stockpiled carbonaceous material and subsequent seepage
  - This could result in seepage of a liquid which would be acidic and would contain elevated concentrations of metals and metalloids, lowering the pH and increasing the concentration of contained metals in affected soils. Were this soil to be left untreated it could subsequently be accessed by the roots of any vegetation regrowth in the area and may adversely impact those plants.
- Use of dewatered groundwater for dust suppression
  - This could result in any soil that was impacted being contaminated by being made more acidic, more saline and having a higher concentration of metals and metalloids present. Were this contamination to continue undetected for an extended period it could eventually result in the pH becoming so low or the salinity becoming so high that vegetation in the area would be adversely impacted.

Any temporarily stockpiled carbonaceous material will stored in areas scheduled for future mining within the Ambassador/Princess mining area. These areas are marked in blue in Figure 1 below:

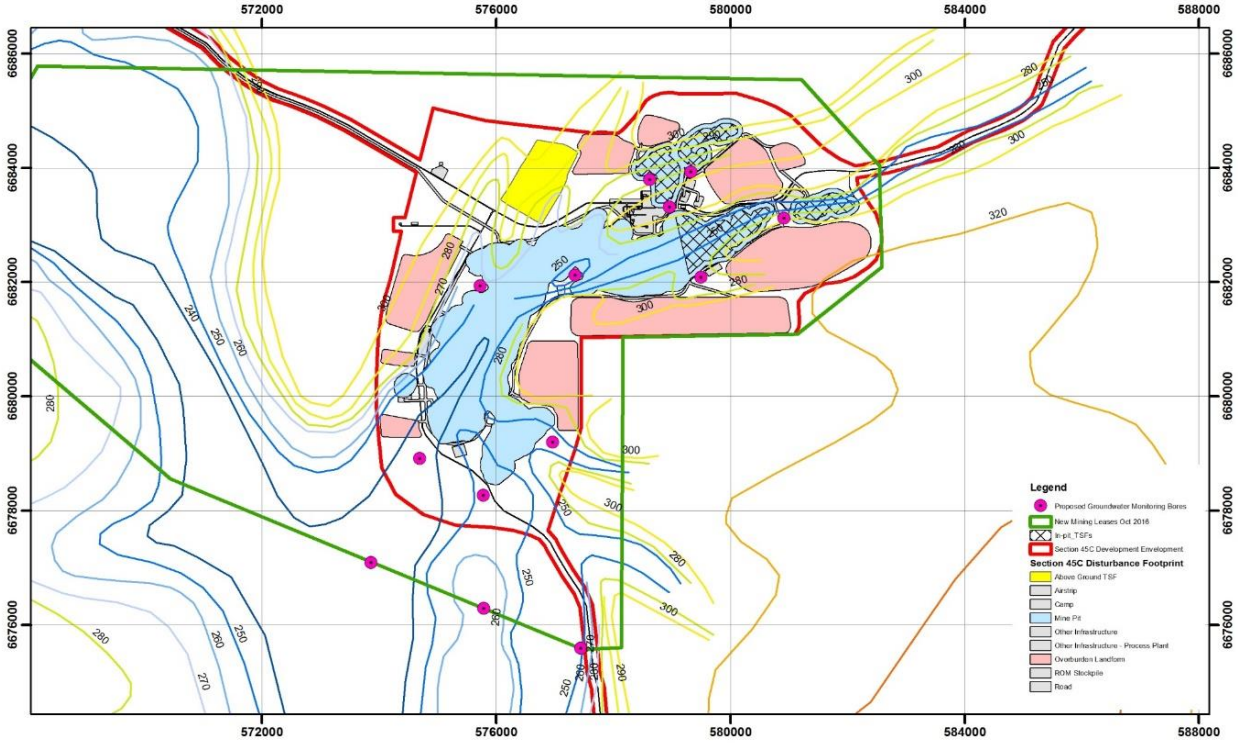

Figure 1: Mining areas (blue) where temporary stockpiles might be located

The most likely locations will be the hatched area southeast of the Process Plant. The entire Ambassador/Princess area is underlain by calcrete.

Adverse impacts on Terrestrial Environmental Quality from surface erosion of post-mine landforms, and subsequent deposition into the surrounding environment, will be managed by detailed landform evolution modelling, design and construction, and given the favourable physical properties of the geochemically benign overburden materials, the risk of impact is considered very low; hence no specific management actions or targets are required minimise the impacts on soil quality.

Furthermore, the risk of lateral tailings liquor seepage from the side walls of the in-pit TSF's, and potential impact on Terrestrial Environmental Quality, is considered low as the thick unsaturated soil profile (vadose zone) exists at a moisture content at or well below field capacity, and thus the very low permeability of these sediments, at this moisture content (as determined by the Hydraulic Conductivity Function - HCF), is rate limiting and prevents lateral seepage from occurring. Consequently, any lateral seepage of tailing liquor will be constrained to the immediate vicinity of the pit wall, minimising any potential impact on Terrestrial Environmental Quality; hence no specific management actions or targets are required minimise the impacts on soil quality.

1.3 Condition requirements

Condition	Section in Condition EMP
14-1 The proponent shall manage the implementation of the Proposal to meet the following **environmental objective**: (1) minimise impacts on soil quality as far as practicable resulting from lignite oxidation within stockpiles and the use of dewater for dust suppression.	Whole document
14-2 The proponent shall consult with the Department of Mines and Petroleum and prepare and submit a Soil Monitoring and Management Plan required by condition 7-1 that satisfies the requirements of condition 7-2, to meet the objectives required by condition 14-1.	Section 4
14-3 The Soil Monitoring and Management Plan required by 7-1 shall include provisions required by condition 7-2 to manage potential impacts to soil quality including but not limited to Acid and Metalliferous Drainage seepage into soil from oxidation of lignite and use of dewater for dust suppression.	Section 2
14-4 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 7-1 satisfies the requirements of condition 7-2 to meet the objective required by condition 14-1.	Whole document

Impacts to soil quality within Sandhill Dunnart Habitat (i.e. E3 and S6 vegetation communities) from dust suppression using saline groundwater are explicitly addressed by Condition 13 and the *Soil (Outcome-based) Monitoring and Management Plan* in accordance with Condition 13-2. These impacts are therefore excluded from this CEMP, which covers the general application of saline dewater to disturbance areas.

In addition, impacts on soil quality from seepage from the above-ground TSF are explicitly covered by Condition15-1(3) and the associated *Tailings Storage Facility Monitoring and Management Plan*, whilst potential impacts from sediment loss from the TSFs are explicitly covered by Condition 16 and the associated *Above Ground Tailings Storage Facility Monitoring and Management Plan*. Please note that no above-ground TSF is currently planned.

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, 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

Groundwater

Numerous groundwater related studies and modelling investigations have been undertaken to assess aspects of the environment relevant to the management of groundwater. These include Rockwater (2015) and Advisian (2017).

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 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 4.43 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.

1.4.2 Key assumptions and uncertainties

It is assumed that the desktop investigations and surveys undertaken for MRUP have adequately captured the variability of the soils and groundwater within the MRUP and surrounding areas. It is therefore considered that the properties of the soils and groundwater are well understood across the Project Area and that potential impacts on terrestrial environmental quality are known.

It is assumed that all dust suppression will be confined to current and proposed mine pits and infrastructure areas (i.e. roads, plant site) where topsoil has been removed prior to spraying of saline water. Similarly, it is assumed that the handling and utilisation of all sulphidic carbonaceous material will be controlled and will be constrained to defined areas, including stockpiles, overburden landforms (OL) and ROM pads (i.e. it represents a point source, as opposed to a diffuse source of potential contamination).

1.4.3 Management approach

To minimise impacts, as far as practicable, on soil quality from AMD and dust suppression activities, Vimy will:

- Manage the handling and utilisation of known Potential Acid Forming (PAF) materials.
- Restrict the use of saline water to infrastructure areas and / or proposed disturbance areas where topsoil has been removed.
- Control potentially acidic, saline and metal-laden runoff from above ground PAF storage areas and areas that receive dust suppression.

In addition, Vimy has developed a Ground Disturbance Activity Permit (GDAP) system that will prevent any unauthorised clearing and dust suppression activities from occurring. All proposed clearing and subsequent 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 are minimised.

In addition, 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 the handling and utilisation of PAF materials, and 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.
- Contributing Factors – identification and implementation of management actions to minimise and prevent the contributing factors that may cause an impact on soil quality.

If impacts on soil quality are reported then investigations will be undertaken to determine the contributing factors and re-evaluate the appropriateness of existing management actions, establishing new management actions if required, to achieve the management targets and overall environmental objectives.

1.4.4 Rationale for choice of provisions

A management target has been established for each contributing factor listed in Section 1.2 that may cause an impact on soil quality in the Development Envelope of the MRUP. It is expected that by implementing the identified management actions, the management targets will be achieved which will ensure that the environmental objective is met.

Further protection of soil quality is provided by the following Conditions and mitigating factors:

- Dust suppression – Condition 13-1 requires the maintenance of "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)".
- Tailings seepage – the impacts from tailings seepage from either the base of the potential Above-Ground TSF or the side-walls of the In-Pit TSFs is restricted by the requirement for a 1m thick clay liner below the Above-Ground TSF (Condition 15-1(3) and the rate limiting permeability of the unsaturated sediments surrounding the mine pits.
- Sedimentation – detailed landform evolution modelling (LEM) will be undertaken to guide the design and construction of the various post-mine landforms and ensure that their erosion rate and sediment loss will not result in an adverse impact on surrounding soil quality. Rehabilitation monitoring, as specified in the Mine Closure Plan for the site, will ensure that excessive erosion does not occur or is remedied to acceptable levels.

2. EMP Provisions

This section of the CEMP identifies the legal provisions that Vimy proposes to implement to minimise impacts as far as practicable on soil quality. It identifies the management actions that Vimy will implement and how they will be monitored and reported, to achieve the management target; thus, ensuring that the environmental objectives of Condition 14-1 are met. Table 1 provides a detailed list of these provisions.

This section also identifies how Vimy will review and revise management actions if the management targets are exceeded.

2.1 Objective

As specified in Ministerial Statement No. 1046 the environmental objective for Condition 14 is:

- Condition 14-1(1): Minimise impacts on soil quality as far as practicable resulting from lignite oxidation within stockpiles and the use of dewater for dust suppression.

2.2 Management Targets

The following Management Targets have been identified to ensure that the above environmental objectives are met:

- **Management Target 1**: All sulphidic (carbonaceous) material to be directly disturbed by mining is identified and appropriately managed to minimise impacts on soil quality.
- **Management Target 2**: Control runoff from above ground PAF storage areas.
- **Management Target 3**: Minimise sulphide oxidation and release of AMD from permanent post-mine landforms.
- **Management Target 4**: All soil impacted by AMD is appropriately identified and managed to prevent further impact on soil quality.
- **Management Target 5**: No inappropriate handling or utilisation of sulphidic (carbonaceous) material.

- **Management Target 6** Minimise the impacts on soil quality from paleodrainage channel groundwater used in dust suppression.

No management targets have been established for potential impacts from tailings seepage as they are sufficiently protected by Condition 15-1(3) and Condition 16-1(1), and the various mitigating factors listed in Section 1.4.4.

2.3 Management actions

The following specific management actions will be implemented to achieve the above Management Targets. They are prioritised such that the greatest management effort will be placed on the Project activities that have the highest risk of causing environmental impact.

2.3.1 Risks / Impacts

Acid and Metalliferous Drainage (AMD)

Risk Rating: High

***Corresponding Management Target* 1**. All sulphidic (carbonaceous) material to be directly disturbed by mining is identified and appropriately managed to minimise impacts on soil quality.

Management Actions to be implemented to achieve Management Target 1:

- **Management Action 1** (Investigations) – conduct geochemical characterisation, as required, to confirm presence / absence of PAF materials.
  - **'**As required' in this context means samples have been taken by grade control drilling, in advance of mining and, upon visual inspection and after comparison with proximate samples, there is some uncertainty as to whether the area directly above the ore zone should be characterised as containing PAF materials and there is a desire not to treat that material as PAF unless absolutely necessary (otherwise it will be treated as PAF) in which case there will be a requirement to test for PAF materials to determine clearly whether it requires treatment as PAF or whether it can be treated as benign (NAF material) and disposed of differently.
- **Management Action 2** (Reporting) – record location of all stored or stockpiled PAF material.

***Corresponding Management Target* 2**. Control runoff from above ground PAF storage areas.

Management Actions to be implemented to achieve Management Target 2:

- **Management Action 3** (Drainage control) – implement and maintain drainage control structures to minimise runoff from stored PAF materials interacting with the surrounding environment.
  - The only PAF material that will be placed into overburden landforms will be PAF material taken from directly above the ore zone, which is predominantly clay-like material. When placed into an overburden landform it will be located away from the periphery. The material will be shaped and compacted so that it resists water penetration and naturally sheets off any water. It will subsequently be covered with at least 5m of benign overburden material.
  - PAF material that is placed in backfill will be preferentially located at the base of backfill operations so that any seepage or runoff from that material while exposed will be into the aquifer directly beneath the mine floor where backfilling is taking place.
  - Any PAF material being stored in temporary buffering stockpiles will be located in areas due for subsequent mining, the topsoil or growth medium will be removed prior to

construction and the area will be bunded to prevent run-off spreading to surrounding areas of soil.

***Corresponding Management Target* 3**. Minimise sulphide oxidation and release of AMD from permanent post-mine landforms.

Management Actions to be implemented to achieve Management Target 3:

- **Management Action 4** (Cover systems) – isolate all sulphidic material stored within permanent post-mine landforms.
  - **T**he only sulphidic material being stored within permanent post-mine landforms will be material taken from the partially oxidised layer sitting just above the ore zone. This clay-like material will be shaped and compacted when deposited in the landforms. The compaction will decrease its permeability and shaping will be undertaken to ensure that there will not be significant pooling of liquid in its upper surface should there subsequently be rainfall penetration from above. This partially oxidised clay-like PAF material is likely to require many years of exposure (potentially hundreds) before it generates any AMD and is expected to be covered with benign overburden material within weeks of being placed in an overburden landform.
  - Nested piezometers will be used to check that no drainage occurs from Overburden Landforms that host significant PAF material and that the PAF cells are properly isolated.

***Corresponding Management Target* 4**. All soil impacted by AMD is appropriately identified and managed to prevent further impact on soil quality.

Management Actions to be implemented to achieve Management Target 4:

- **Management Action 5** (Impacted soil) – conduct soil (geochemical) investigations following removal of PAF materials stored on the land surface.
- **Management Action 6** (Removal) – all AMD impacted soil that poses a risk to the surrounding environment will either be remediated or excavated and appropriately disposed of.
  - AMD impacted soil is either soil under a PAF storage area after the PAF material has been removed and is determined to be affected by seepage during the geochemical testing or soil in the region of any PAF stockpile after a significant rainfall event that has resulted in a run-off that exceeded the containment abilities of locally constructed bunding and which subsequent geochemical testing confirms has been impacted to the extent that it could adversely impact vegetation.
  - Since downwards seepage resulting from AMD drainage will interact with the underlying calcrete layer, it will be neutralised and any contained metals encapsulated in the gypsum created; appropriate remediation methods might include spraying low salinity water to wash the contaminants down to the calcrete layers.
  - If upon geochemical testing the contamination is considered sufficiently severe that it cannot be remediated by washing (and removal of that overburden material is not part of the MRP mining schedule) final disposal will involve excavating the soil, if it meets the threshold of a contaminated site under the appropriate legislation.
  - Appropriate disposal of contaminated material will depend upon the nature and level of contamination, prioritised by NORM and then PAF classifications. The most likely outcome will be that it is put into backfill operations (like the disposal of PAF material) or encapsulated within an overburden landform, but if that was not regarded as suitable due to a high level of contamination it could be disposed of to the operating in-pit TSF.

***Corresponding Management Target* 5**. No inappropriate handling or utilisation of sulphidic (carbonaceous) material.

Note - Inappropriate handling or utilisation of sulphidic material would be any handling or utilisation of sulphidic material that had the potential to have an adverse impact upon the environment. That would mainly be both stockpiling sulphidic material in the wrong location (such that drainage could have an adverse impact) and allowing the material to remain unprocessed for a long enough period that oxidation leading to acidification could commence (meaning that AMD could commence). Characterisation of incompletely oxidised overburden material immediately above the main redox boundary shows that the source of AMD from that material is mostly associated with residual organic matter (rather than sulphides); as a result, inappropriate handling or utilisation of sulphidic material would relate to inter-burden barren material (from a NORM perspective) or ROM, handled through the mine to the process plant circuits and accounted for accordingly.

Management Actions to be implemented to achieve Management Target 5:

- **Management Action 7** (Environmental Induction) – new site personnel will undertake an environmental induction, emphasising the environmental qualities of the MRUP area.
- **Management Action 8** (Environmental Training) – personnel involved in the handling and utilisation of sulphidic (lignite) material will be trained so that they understand the potential risks if this material is inappropriately managed.
- **Management Action 9** (GDAP tracking) – all lignitic (carbonaceous) material will be tracked under the GDAP system when it is sent anywhere other than directly for further processing. In other words unless it is sent directly to the ROM pad at the Processing Plant there will need to be authorisation under the GDAP system to place it anywhere else and it will continue to be monitored (which includes the length of time located in a particular location) under the GDAP system until it is sent for processing.

Dust Suppression

Risk Rating: High

Corresponding Management Target: **6**. Minimise the impacts on soil quality from paleodrainage channel groundwater used in dust suppression.

Management Actions to be implemented to achieve Management Target 6:

- **Management Action 10** (Dust suppression) – dust suppression with paleodrainage channel groundwater will only occur in operational / infrastructure areas after topsoil has been removed.
  - The removed soil or regrowth material will be stockpiled in a location sufficiently far from where dust suppression activities will be occurring that the risk of contamination from the dust suppression water is negligible.
- **Management Action 11** (Runoff) – saline water runoff from dust suppression activities will be contained.
  - The containment will be achieved by the design of the infrastructure; in particular roads will have drainage ditches designed to contain run-off associated with dust suppression water being applied.
- **Management Action 12** (Spills) – engineering controls (e.g. bunding or trenching) will be used around paleodrainage channel groundwater sources to minimise the impact from spills.
  - Where the paleochannel groundwater source is located within the pit (in-pit bores and in-pit sumps), spillage controls will not be necessary.

- Where the bore extracting the groundwater is located outside the pit area the location will be bunded.
- Pipelines located outside the pit area (between bores and the Process Plant and between the Process Plant and the Reinjection Borefield, will either be bunded or trenched depending on the location and context.
- Any dams or turkey's nests will be lined and do not require further protection against any spillage.

- **Management Action 13** (Incidents) – all overspray reports and spills to be reported as an environmental incident.
- **Management Action 14** (Environmental Induction) – new site personnel will undertake an environmental induction, emphasising the environmental qualities of the MRUP area.
- **Management Action 15** (Environmental Training) – personnel involved in dust suppression activities will be trained so that they understand the potential risks to soil quality.
  - That training will include education concerning the impacts of weather upon the trajectory of dust suppression water, in particular the impact of high winds upon spray carry and the potential need to cease dust suppression water application in high winds.
- **Management Action 16** (Competence) – only personnel who have undertaken Environmental Training will be able to operate dust suppression equipment (e.g. water cart).
- **Management Action 17** (Fit-for-Purpose) – ensure all equipment used in dust suppression activities are fit-for-purpose to minimise impacts on soil quality.
  - Fit-for-purpose in this context means that dust suppression equipment delivers the correct amount of water to the particular area where it is required to be applied so that it achieves the objective of supressing the generation of dust when disturbed by Vimy's equipment whilst at the same time not delivering too much water so as to cause excessive run-off or delivering water outside the area intended for its application.

2.4 Monitoring

For each management action listed above, a specific monitoring program or task will be undertaken to ensure that the management action is implemented, and its requirements met. If monitoring identifies that the requirements of the management action has not been met, then there is a risk that the management target will not be achieved and that the environmental objectives are not attained.

The specific monitoring tasks to be undertaken for each management action is outlined below.

Management Action	Monitoring
Management Target 1: All sulphidic (carbonaceous) material to be directly disturbed by mining is identified and appropriately managed to minimise impacts on soil quality.	
1. Conduct geochemical characterisation, as required, to confirm presence / absence of PAF materials.	Each time grade control drilling activity is undertaken the samples directly above the ore zone will be subject to a visual inspection and a comparison with the results of previous testing undertaken in the same area. If that visual inspection suggests that there is any risk of PAF materials being present, or the comparison with proximate samples, then geochemical testing will take place to determine the amount that is present. The geochemical determination will establish definitively whether PAF materials are present. Where significant PAF material is placed in an above ground location (within an Overburden Landform or in a

Management Action	Monitoring
	Temporary Stockpile) a nested piezometer will be installed in an appropriate location to check whether there has been any liquid draining from the area. If readings suggest that drainage has occurred samples of the liquor will be taken to check for AMD. There will be an annual audit of geochemical characterisation results to ensure that if PAF materials have been detected they were subsequently treated appropriately.
2. Record location of all stored or stockpiled PAF material.	Once it is established that PAF materials are present in an area proposed for mining (as a consequence of the geochemical testing), the GDAP system will then be used to store the estimated location of the PAF material and to keep track of its subsequent movements. This is a continuous and ongoing monitoring process. There will be an annual audit of the effectiveness of the use of the GDAP system to track and monitor PAF material.
Management Target 2: Control runoff from above ground PAF storage areas.	
3. Implement and maintain drainage control structures to minimise runoff from stored PAF materials interacting with the surrounding environment.	Areas where PAF materials are being stored will be visually inspected on a regular basis as part of routine maintenance and inspected after any significant rainfall events. This will include inspection of nested piezometers designed to detect drainage after rainfall events. Annual audit of drainage control works undertaken in PAF storage areas and environmental incident reports of any overflowing of these drainage controls.
Management Target 3: Minimise sulphide oxidation and release of AMD from permanent post-mine landforms.	
4. Isolate all sulphidic material stored within permanent post-mine landforms.	Sulphidic material stored within permanent post-mine landforms will be tracked by the GDAP system and therefore monitoring is a continuous process that starts when the PAF material is identified and continues until it has been safely encapsulated. Nested piezometers will be used to check that significant PAF material located in Overburden Landforms are isolated and not generating AMD seepage. Annual review of cover design modelling and annual audit of as-constructed cover systems to ensure they are built to the required specifications.

Management Action	Monitoring
Management Target 4: All soil impacted by AMD is appropriately identified and managed to prevent further impact on soil quality.	
5. Conduct soil (geochemical) investigations following removal of PAF materials stored on the land surface.	Occurs only when removal of PAF materials has occurred (which will have been being monitored by the GDAP system). If PAF material are stored at surface for a period longer than two years in a location where AMD seepage could adversely impact soil quality, nested piezometers will be installed to ensure that there has been no AMD. Annual audit of soil investigation reports to ensure appropriate identification and delineation of AMD impacted soil.
6. All AMD impacted soil that poses a risk to the surrounding environment will either be remediated or excavated and appropriately disposed of.	Occurs when it has been identified by geochemical testing that there is AMD impacted soil. A risk analysis will be undertaken to establish whether this soil can be successfully remediated and if it can't whether it represents a risk to vegetation that warrants excavation and disposal elsewhere. Annual audit of earthmoving records identifying the handling and utilisation of all AMD impacted soil materials.
Management Target 5: No inappropriate handling or utilisation of sulphidic (lignite) material.	
7. New site personnel will undertake an environmental induction, emphasising the environmental qualities of the MRUP area.	New site personnel register participation in environmental inductions. Annual audits of induction records.
8. Personnel involved in the handling and utilisation of sulphidic (carbonaceous) material will be trained so that they understand the potential risks if this material is inappropriately managed.	Personnel to be involved in the handling and utilisation of sulphidic materials register participation in the appropriate training. Annual audits of the personal engaged in the handling and utilisation of sulphidic materials and of the associated training records.
9. All lignitic (carbonaceous) material will be tracked under the GDAP system when it is sent anywhere other than directly for further processing. In other words unless it is sent directly to the ROM pad at the Processing Plant there will need to be authorisation under the GDAP system to place it anywhere else and	The GDAP system operates continuously recording the presence of PAF materials and the location of where it is transferred to. An annual audit will be undertaken to ensure that PAF materials identified have been suitably tracked and dealt with.

Management Action	Monitoring
it will continue to be monitored (which includes the length of time located in a particular location) under the GDAP system until it is sent for processing.	
Management Target 6: Minimise the impacts on soil quality from paleodrainage channel groundwater used in dust suppression.	
10. Dust suppression with paleodrainage channel groundwater will only occur in operational / infrastructure areas after topsoil has been removed.	GDAP system used to authorise where dust suppression activities are allowed to occur. GDAP system will not authorise dust suppression activities in areas where topsoil has not first been removed and recorded as having been removed under the GDAP system. Annual audit of GDAP records to ensure compliance.
11. Saline water runoff from dust suppression activities will be contained.	Areas where dust suppression activity has taken place will be subject to routine visual inspections (as part of maintenance activities) and will be inspected after significant rainfall events that may have caused erosion of containment. Annual audit of GDAP records which require dust suppression activities using paleodrainage channel groundwater, including are the necessary controls in place, to be authorised.
12. Engineering controls (e.g. bunding or trenching) will be used around paleodrainage channel groundwater sources to minimise the impact from spills.	The engineering controls will be subjected to regular visual inspections (as part of routine maintenance) and will be inspected after significant rainfall events that may have adversely impacted them. Annual audit of drainage control structures around paleodrainage channel groundwater sources to ensure they are effective and maintained.
13. All overspray reports and spills to be reported as an environmental incident.	Annual audit of environmental incident records.
14. New site personnel will undertake an environmental induction, emphasising the environmental qualities of the MRUP area.	New site personnel register participation in environmental inductions. Annual audits of induction records.

Management Action	Monitoring
15. Personnel involved in dust suppression activities will be trained so that they understand the potential risks soil quality.	Personnel to be involved in dust suppression activities register participation in the appropriate training. Annual audits of training records.
16. Only personnel who have undertaken Environmental Training will be able to operate dust suppression equipment (e.g. water cart).	Annual audits of training records and operator logbooks.
17. Ensure all equipment used in dust suppression activities are fit-for-purpose to minimise impacts on soil quality.	Annual audit of mine equipment logbooks to establish correct machinery was used for dust suppression.

As specified in Condition 7-5, if the above monitoring indicates that one or more Management Actions specified in this CEMP have not been implemented, then:

(1) A report will be issued to the CEO of the DWER, in writing, within 7 days of identification of the failure to implement the Management Action/s.

(2) An investigation will be undertaken to determine the cause of the Management Action/s not being implemented.

(3) The potential environmental harm or alteration that may have occurred due to the failure to implement the Management Action/s will be determined.

(4) A written report will be issued to the CEO of the EPA within 21 days of the reporting required by Condition 7-5(1), with the report containing:

  (a) the cause for the failure to implement the Management Action/s;

  (b) the findings of the investigation required by Conditions 7-5(2) and 7-5(3);

  (c) the relevant changes to the implemented to the Management Actions; and

  (d) the measures to be undertaken to prevent, control or abate the environmental harm which may have occurred.

As specified in Condition 7-4, if the above monitoring indicates that one or more Management Targets specified in this CEMP have not been met, then:

(1) A report will be issued to the CEO of the DWER, in writing, within 21 days of identification of the Management Target/s not being met.

(2) An investigation will be undertaken to determine the cause of the Management Target/s not being met.

(3) A written report will be issued to the CEO of the DWER within 90 days of the reporting required by Condition 7-4(1), with the report containing:

(a) the cause of the Management Target/s not being met;

(b) the findings of the investigation required by Condition 7-4(2);

(c) details of the revised and / or additional Management Actions to be implemented to ensure that the Management Target/s are met; and

(d) relevant changes to the proposal activities.

2.5 Reporting

Reporting of the above monitoring results, and achievement of the Management Actions and Management Targets that satisfy the environmental objective, 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).

(5) Indicate any proposed changes to the CAP required by Condition 4-1.

The CAR will also include:

- Monitoring results and trends against Management Targets.
- Any exceedance of Management Targets.
- A review of the Management Actions and their appropriateness in achieving the Management Targets and the overall environmental objective.
- Proposed revision of the Management Actions, if required, to obtain formal approval from DWER to amend the CEMP.

In addition to the CAR, all clearing and disturbance areas, including rehabilitated areas, will be submitted in the annual Mine Rehabilitation Fund (MRF) reporting, and results from specific monitoring programs and any environmental discharges (e.g. saline water spills) will be presented in the Annual Environmental Report (AER).

3. Adaptive Management and Review of the EMP

3.1 Review and revision of management actions

In the event that a management target is not met or is exceeded, Vimy will review and revise the risk assessment, review and revise Management Actions and identify additional Management Actions where necessary.

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

- Investigate the potential cause of failing to meet the Management Targets and identify any impacts on soil quality resulting from this failing.
- If the causes of failing to meet the Management Targets or any impacts identified are a result of the MRUP, the risk assessment will be reviewed and revised risk based management actions will be implemented, following formal approval from DWER, so that the MRUP environmental objective is met.

In accordance with Conditions 7-2(5) and 7-6, the Management Actions will be reviewed annually (or as directed by the CEO) and revised so that the Management Targets, and the overall environmental objectives, are met.

Vimy will also implement adaptive management to learn from the implementation of mitigation measures, monitoring and evaluation against Management Target/s, to more effectively meet the environmental objectives. 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.
- The risk assessment will be re-evaluated and the risk-based priorities will be revised on the basis of monitored information.
- The Management Actions will be reviewed if existing actions are shown not to be as effective as predicted.
- Management Actions will be updated when external changes during the life of the proposal occur (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, then the corrective actions outlined below will be implemented.

Performance Indicator	Corrective Action	Responsibility
Inappropriate handling and utilisation of sulphidic (lignite) material. • *Specific* – lignitic material is put in a location that is unsuitable or is stored for too long a period given its location with the result that there is the potential for an adverse impact to soil quality. • *Measurable* – the location of the lignitic material is outside the area approved for such purposes (authorised under GDAP system) or endures for a longer period than expected (authorised under GDAP system). • *Achievable* – it is not expected that any material will be placed outside suitable locations or for periods longer than expected and therefore it should be 100% achievable. • *Relevant* – this is dealing with the risk that PAF material may be put in a location and left there for sufficient duration that it could have an adverse impact upon soil quality. This process will be controlled through continuous tracking/monitoring from the GDAP system. • *Time Bound* – the need to avoid inappropriate handling and utilisation of lignitic material will persist for as long as there is potential for mining activity to disturb such material which is effectively for the life of the Project.	• Immediately stop the inappropriate activities to prevent further impact on soil quality. • Report inappropriate handling and utilisation of sulphidic material to CEO of DWER within 21 days of it being identified. • Conduct investigation to determine specific cause of the inappropriate activities. • Review the sulphidic material management process and develop additional management actions if required. • Implement appropriate control measures to reduce or rectify impact on soil quality. • In the unlikely event that there has been inappropriate handling and utilisation of lignitic material – it is likely to have been caused by a failure of control related to the GDAP system; therefore appropriate control measures to prevent occurrence would likely be to implement a higher level of control over permissions associated with the handling of lignitic material. • Rehabilitate as soon as practicable. • Review and revise management actions so that management targets and environmental objectives are met.	Mine Manager and Environmental Manager

Performance Indicator	Corrective Action	Responsibility
Excessive runoff from PAF storage areas. • *Specific* – There is runoff from an area where PAF material has been stored above ground and that runoff is determined to be excessive. 'Excessive runoff' is defined in this context as being sufficient runoff that it not only overwhelms the existing containment structures, but it also mobilises sufficient PAF material past the containment structures such that it poses a risk to the environment when so relocated. • *Measurable* – given the absence of significant sheet flow any PAF material mobilised by runoff is not expected to travel far, if at all. Excessive runoff would be measured by the amount and distance that the PAF material was transported by the runoff past the containment structures and the resultant potential for an adverse impact upon soil quality. • *Achievable* – it is not expected that there will be PAF material stored under circumstances where containment structures don't contain run-off. It should be 100% achievable; especially since PAF material will mostly be stored in areas where there are natural depressions meaning that any surface water flow would probably be towards them. • *Relevant* – this performance indicator relates to PAF material stored above ground which carries with it the risk that rainfall could spread such material. • *Time Bound* – the need to avoid PAF material being spread by excessive runoff will persist for as long as PAF material is stockpiled in areas where it could result in runoff spreading it around; which is effectively for the life of the Project.	• Report excessive runoff to CEO of DWER within 21 days of it being identified. • Conduct investigation to determine the contributing factors for the excessive runoff. • Quantify any impacts on soil quality surrounding the PAF storage areas. • Implement appropriate control measures to reduce or rectify impact on soil quality. • In the unlikely event that there has been excessive runoff (as defined) – the most likely cause would be inappropriate location and/or inadequate containment structures; therefore appropriate control measures to prevent occurrence would likely be to implement stricter location requirements within the GDAP system and/or a requirement for more significant containment measures. • Review and revise management actions so that management targets and environmental objectives are met.	Mine Manager and Environmental Manager

Performance Indicator	Corrective Action	Responsibility
Observable AMD from post-mine landforms. • *Specific* – acid mine drainage (AMD) is observed to be coming from post-mine landforms. • *Measurable* – it will be measurable via elevated pH levels in the soil. • *Achievable* – There is not expected to be any AMD from post-mine landforms. The quantities of PAF materials will not be significant in this context and will be located preferentially away from the periphery and at the base of the landform. As such it is unlikely that water will penetrate the landform far enough to be able to affect these materials – in short there won't be the liquid necessary to cause drainage. In the unlikely event that there were to be drainage, any AMD would be expected to migrate harmlessly down towards the underlying aquifer where it would not have any significant impacts. It will only be observable if for currently unforeseen reasons it migrates horizontally and therefore has adverse environmental impacts upon sensitive soils. There should be no observable impacts from post-mine landforms as result of AMD being contained within such landforms and compliance should be 100%. • *Relevant* – the possibility of there being acid drainage from overburden landforms is extremely remote. However, Vimy is committed to there being no adverse impacts from the overburden landforms. • *Time Bound* – Overburden landforms will be constructed in different locations throughout the entire mine life (although the majority of overburden will actually be used to backfill within existing pits). Once an overburden landform has been completed in a particular location it will then be rehabilitated by ensuring appropriate cover systems are put in place. The requirement to ensure completed landforms don't result in AMD that adversely impacts the environment is an obligation that lasts the entire mine life and beyond until such time as rehabilitation has been completed.	• Report observable AMD from post-mine landforms to CEO within 21 days of it being detected. • Conduct investigation to determine the contributing factors for the observable AMD from the post-mine landform/s. • Quantify impacts to soil quality and the surrounding environment. • Implement appropriate control measures to reduce or rectify impact on soil quality and the environment. • In the unlikely event that there has been observable AMD from a constructed landform – the most likely cause would be inappropriate location of PAF materials within the landform; therefore appropriate control measures to prevent occurrence would likely be to implement stricter location requirements for the placement of PAF materials within landforms as authorised by the GDAP system. • Review and revise management actions so that management targets and environmental objectives are met.	Mine Manager and Environmental Manager

Performance Indicator	Corrective Action	Responsibility
Inappropriate clean-up of AMD impacted soil. • *Specific* – the circumstances are that there has been acid mine drainage from a temporary stockpile of PAF material and after the temporary stockpile has been removed it is found that the underlying soil has been adversely impacted (namely that liquor with a low pH level, and containing heavy metals as a result, has contaminated the soil) and that having identified this impact actions to rectify the situation have not been successful. • *Measurable* – the initial impact will be measured by undertaking geochemical sampling of both pH levels and key heavy metals. After the clean-up the area will be sampled again using the same geochemical tests. • *Achievable* – Testing will determine whether the desired output (an appropriate clean up of the soil) has been achieved. If washing does not achieve the desired result consideration will be given to excavation (if the risk assessment suggest it is warranted). However, in the unlikely event that there has been AMD the application of fresh water to wash down the contaminants should achieve a suitable reduction in risk to subsequent vegetation growth such that excavation is not required. • *Relevant* – Vimy is committed to ensuring that any AMD will not adversely impact soils such that there could be adverse consequences. • *Time Bound* – the commitment lasts as long as the mine life.	• Report failure of clean-up activities to CEO of DWER within 21 days of geochemical testing indicating that clean-up has not been successful. • Conduct investigation to determine why the clean-up was not successful and did not mitigate the impact on soil quality. • Implement appropriate control measures to prevent further impact on soil quality and the environment. • If there had been an inappropriate clean-up of AMD impacted soils an analysis would be undertaken to determine why the initial response was ineffective and whether a different approach should be used in future as part of clean up measures. • Review and revise management actions so that management targets and environmental objectives are met.	Mine Manager and Environmental Manager

Performance Indicator	Corrective Action	Responsibility
Observable impacts on soil quality from dust suppression activities. • *Specific* – the groundwater used for dust suppression purposes will be highly saline and would be expected to adversely impact vegetation health if applied to soils outside areas where topsoil had been cleared. Visual inspection of vegetation health in close proximity to areas where dust suppression sprays have been applied would most likely detect observable impacts. This will be backed up by soil testing for altered salinity which acts as a marker for the presence of dewatered groundwater having impacted upon soils. • *Measurable* – the presence of an impact on soil quality from dust suppression activities will be initially measurable through an increase in salinity measured by electrical conductivity. If an impact in terms of an increase in salinity is detected, then testing would take place for an increase in acidity (as measured by pH) and the concentration of key metals (mg/kg) in the soils as well. • *Achievable* – there is not expected to be any impacts on soils from dust suppression activities and so should be 100% achievable • *Relevant* – the groundwater being used for dust suppression purposes will be saline, but not necessarily low pH or containing high concentrations of metals. This salinity could adversely affect vegetation. Ensuring no elevation in soil salinity will ensure that no contaminants will be being spread by dust suppression measures. • *Time Bound* – the commitment to ensure that dust suppression does not adversely impact soils, and therefore vegetation, lasts for as long as there will be dust suppression activities.	• Report observable impacts on soil quality from dust suppression activities to CEO of DWER within 21 days of tests determining that soil has been impacted. • Conduct investigation to determine the contributing factors for the impact on soil quality. • Quantity the impacts on the environment that may result from the degradation of soil quality. • Implement appropriate control measures to reduce or rectify impact on soil quality and the environment. • If there had been an observable impact on soil quality form dust suppression activities – the most likely cause would be improperly set up dust suppression equipment or the undertaking of dust suppression activities in unsuitable weather conditions. The appropriate controls would be either better or more regular maintenance checks on the equipment or better communication of the likelihood of high winds to dust suppression operatives when such weather is forecast and the need to suspend activities should the winds arise. • Review and revise management actions so that management targets and environmental objectives are met.	Mine Manager and Environmental Manager

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 (management-based) table

Purpose of EMP	**To meet the legal requirements of Condition 14 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 14-1 Environmental Objectives:	**(1) Minimise impacts on soil quality as far as practicable resulting from lignite oxidation within stockpiles and the use of dewater for dust suppression.**

Management-based provisions				
Risk / Impact (Risk Ranking)	**Management Actions**	**Management Targets**	**Monitoring**	**Reporting**
Acid and Metalliferous Drainage (AMD) (High).	Investigations – conduct geochemical characterisation, as required, to confirm presence / absence of PAF materials.	All sulphidic (carbonaceous) material to be directly disturbed by mining is identified and appropriately managed to minimise impacts on soil quality.	Each time grade control drilling activity is undertaken the samples directly above the ore zone will be subject to a visual inspection and a comparison with the results of previous testing undertaken in the same area. If that visual inspection suggests that there is any risk of PAF materials being present, or the comparison with proximate samples, then geochemical testing will take place to determine the amount that is present. The geochemical determination will establish definitively whether PAF materials are present. Where significant PAF material is placed in an above ground location (within an Overburden Landform or in a Temporary Stockpile) a nested piezometer will be installed in an appropriate location to check whether there has been any liquid draining	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
			from the area. If readings suggest that drainage has occurred samples of the liquor will be taken to check for AMD. There will be an annual audit of geochemical characterisation results to ensure that if PAF materials have been detected they were subsequently treated appropriately.	
	Reporting – Record location of all stored or stockpiled PAF material.		Once it is established that PAF materials are present in an area proposed for mining (as a consequence of the geochemical testing), the GDAP system will then be used to store the estimated location of the PAF material and to keep track of its subsequent movements. This is a continuous and ongoing monitoring process. There will be an annual audit of the effectiveness of the use of the GDAP system to track and monitor PAF material.	CAR
	Drainage control – implement and maintain drainage control structures to minimise runoff from stored PAF materials interacting with the surrounding environment.	Control runoff from above ground PAF storage areas.	Areas where PAF materials are being stored will be visually inspected on a regular basis as part of routine maintenance and inspected after any significant rainfall events. This will	CAR AER

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
			include inspection of nested piezometer designed to detect drainage after rainfall events. Annual audit of drainage control works undertaken in PAF storage areas and environmental incident reports of any overflowing of these drainage controls.	
	Cover systems – isolate all sulphidic material stored within permanent post-mine landforms.	Minimise sulphide oxidation and release of AMD from permanent post-mine landforms.	Sulphidic material stored within permanent post-mine landforms will be tracked by the GDAP system and therefore monitoring is a continuous process that starts when the PAF material is identified and continues until it has been safely encapsulated. Annual review of cover design modelling and annual audit of as-constructed cover systems to ensure they are built to the required specifications.	CAR MRF
	Impacted soil – conduct soil (geochemical) investigations following removal of PAF materials stored on the land surface.	All soil impacted by AMD is appropriately identified and managed to prevent further impact on soil quality.	Occurs only when removal of PAF materials has occurred (which will have been being monitored by the GDAP system). If PAF material are stored at surface for a period longer than two years in a location where AMD seepage could	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
			adversely impact soil quality, nested piezometers will be installed to ensure that there has been no AMD. Annual audit of soil investigation reports to ensure appropriate identification and delineation of AMD impacted soil.	
	Removal – all AMD impacted soil that poses a risk to the surrounding environment will be excavated and appropriately disposed of.		Occurs when it has been identified by geochemical testing that there is AMD impacted soil. A risk analysis will be undertaken to establish whether this soil can be successfully remediated and if it can't whether it represents a risk to vegetation that warrants excavation and disposal elsewhere. Annual audit of earthmoving records identifying the handling and utilisation of all AMD impacted soil materials.	CAR
	Environmental Induction - new site personnel will undertake an environmental induction, emphasising the environmental qualities of the MRUP area.	No inappropriate handling or utilisation of sulphidic (carbonaceous) material.	New site personnel register participation in environmental inductions. Annual audits of induction records.	CAR
	Environmental Training - personnel involved in the handling and utilisation of sulphidic		Personnel to be involved in the handling and utilisation of sulphidic	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	(carbonaceous) material will be trained so that they understand the potential risks if this material is inappropriately managed.		materials register participation in the appropriate training. Annual audits of training records.	
	GDAP Tracking - all lignitic material will be tracked under the GDAP system when it is sent anywhere other than directly for further processing. In other words unless it is sent directly to the ROM pad at the Processing Plant there will need to be authorisation under the GDAP system to place it anywhere else and it will continue to be monitored (which includes the length of time located in a particular location) under the GDAP system until it is sent for processing.		The GDAP system operates continuously recording the presence of PAF materials and the location of where it is transferred to. An annual audit will be undertaken to ensure that PAF materials identified have been suitably tracked and dealt with.	CAR
Use of paleodrainage channel groundwater for dust suppression (Moderate).	Dust suppression – dust suppression with paleodrainage channel groundwater will only occur in operational / infrastructure areas after topsoil has been removed.	Minimise the impacts on soil quality from groundwater used in dust suppression.	GDAP system used to authorise where dust suppression activities are allowed to occur. GDAP system will not authorise dust suppression activities in areas where topsoil has not first been removed and recorded as having been removed under the GDAP system. Annual audit of GDAP records to ensure compliance.	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	Runoff – saline water runoff from dust suppression activities will be contained.		Areas where dust suppression activity has taken place will be subject to routine visual inspections (as part of maintenance activities) and will be inspected after significant rainfall events that may have caused erosion of containment. Annual audit of GDAP records which require dust suppression activities using paleodrainage channel groundwater, including are the necessary controls in place, to be authorised.	CAR
	Spills – engineering controls (e.g. bunding or trenching) will be used around paleodrainage channel groundwater sources to minimise the impact from spills.		The engineering controls will be subjected to regular visual inspections (as part of routine maintenance) and will be inspected after significant rainfall events that may have adversely impacted them. Annual audit of drainage control structures around paleodrainage channel groundwater sources to ensure they are effective and maintained.	CAR
	Incidents – all overspray reports and spills to be reported as an environmental incident.		Annual audit of environmental incident records.	CAR AER

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	Environmental Induction - new site personnel will undertake an environmental induction, emphasising the environmental qualities of the MRUP area.		New site personnel register participation in environmental inductions. Annual audits of induction records.	CAR
	Environmental Training - personnel involved in dust suppression activities will be trained so that they understand the potential risks soil quality.		Personnel to be involved in dust suppression activities register participation in the appropriate training. Annual audits of training records.	CAR
	Competence – only personnel who have undertaken Environmental Training will be able to operate dust suppression equipment (e.g. water cart).		Annual audits of training records and operator logbooks.	CAR
	Fit-for-purpose – ensure all equipment used in dust suppression activities are fit-for-purpose to minimise impacts on soil quality.		Annual audit of mine equipment logbooks to establish correct machinery was used for dust suppression.	CAR
Tailings liquor seepage from the Above-Ground TSF (Low).	Not Applicable – protection of Terrestrial Environmental Quality from tailings liquor seepage from the Above-Ground TSF is explicitly covered by Condition 15-1(3) and thus its management is covered in the Tailings Storage Facility Monitoring and Management Plan. Note - current plans do not envisage the development of an Above-Ground TSF.			
Tailings liquor seepage from the In-Pit TSF (Low).	Not Applicable – the risk of lateral tailings liquor seepage from the side walls of the in-pit TSF's, and potential impact on Terrestrial Environmental Quality, is considered low as the thick unsaturated soil profile (vadose zone) exists at a moisture content at or well below field capacity, and thus the very low permeability of these sediments, at this moisture content (as determined by the Hydraulic Conductivity Function - HCF) is rate limiting and prevents lateral seepage from occurring.			

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	Consequently, any lateral seepage will be constrained to the immediate vicinity of the pit wall, minimising any potential impact on Terrestrial Environmental Quality.			
Sediment loss from post-mine landforms (Low).	Not Applicable - Adverse impacts on Terrestrial Environmental Quality from surface erosion of post-mine landforms, and subsequent deposition into the surrounding environment, will be managed by detailed landform evolution modelling, design and construction, and given the favourable physical properties of the geochemically benign overburden materials, the risk of impact is considered very low; hence no specific management actions or targets are required minimise the impacts on soil quality.			

5. References

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