

7. ASSESSMENT METHOD

A systematic approach has been used to identify and assess the potential impacts and to determine the mitigation and management measures to prevent or minimise potential impacts. The results of the assessment are presented and discussed in Sections 8 to 13. The assessment approach has been developed to ensure that it addresses the requirements of the *EPBC Act* and *EP Act*. The scope of the assessment was established in the Environmental Scoping Document (ESD) for the Thunderbird Mineral Sands Project, which was approved by the Western Australian EPA on 5 July 2016.

7.1 ENVIRONMENTAL FACTORS AND OBJECTIVES

Environmental factors include physical environmental resources that are valued by society for their ecological, social or economic value and may be impacted by an aspect of a project. Key environmental factors for the project were identified through a scoping process which included:

- Submission of Referral Documentation summarising the results of preliminary environmental investigations.
- Agency consultation.
- Preparation of an ESD by Sheffield in consultation with the EPA.

Environmental objectives are the desired goals that, if met, will indicate that the proposal is not expected to have a significant impact on that part (factor) of the environment. As detailed in the ESD, the preliminary key environmental factors and environmental objectives considered relevant to the proposal are listed in Table 48.

Table 48: Key Environmental Factors

Environmental Factor	Environmental Objective
Mine Site Development Envelope	
Flora and Vegetation	To maintain representation, diversity, viability and ecological function at the species, population and community level.
Terrestrial Fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.
Hydrological Processes	To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.
Inland Waters Environmental Quality	To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.
Heritage	To ensure that historical and cultural associations, and natural heritage, are not adversely affected.
Rehabilitation and Decommissioning	To ensure that premises are decommissioned and rehabilitated in an ecologically sustainable manner.
Offsets	To counterbalance any significant residual environmental impacts or uncertainty through the application of offsets.
Derby Port Development Envelope	
Marine Environmental Quality	To maintain the quality of water, sediment and biota so that the environmental values, both ecological and social, are protected.
Amenity	To ensure that impacts to amenity are reduced as low as reasonably practicable.

'Offsets' and 'Rehabilitation and Decommissioning' are considered to be integrating factors by the EPA. These integrating factors were identified as preliminary key environmental factors in the ESD and therefore will be continued to be assessed as such.

The potential impacts and their proposed management on the preliminary key environmental factors for the Mine Site Development Envelope and Derby Port Development Envelope are assessed in Sections 8 and 9 respectively. In addition to preliminary key environmental factors, Matters of National Environmental Significance are identified and discussed separately in Section 13, as required in the ESD.

7.2 OTHER FACTORS

Other environmental factors considered relevant to the proposal, but not of significance to warrant further assessment by the EPA, are listed in Table 49. The potential impacts and proposed management of other environmental factors for the Mine Site Development Envelope and Derby Port Development Envelope are assessed in Sections 10 and 11 respectively.

Table 49: Other Environmental Factors

Environmental Factor	Environmental Objective
Mine Site Development Envelope	
Landforms	To maintain the variety, integrity, ecological functions and environmental values of landforms.
Subterranean Fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.
Terrestrial Environmental Quality	To maintain the quality of land and soils so that the environment values, both ecological and social, are protected.
Air Quality and Atmospheric Gases	To maintain air quality for the protection of the environment and human health and amenity, and to minimise the emission of greenhouse and other atmospheric gases through the application of best practice.
Human Health	To ensure that human health is not adversely affected.
Port Development Envelope	
Benthic Communities and Habitat	To maintain the structure, function, diversity, distribution and viability of benthic communities and habitats at local and regional scales.
Marine Fauna	To maintain the diversity, geographic distribution and viability of fauna at the species and population levels.
Terrestrial Environmental Quality	To maintain the quality of land and soils so that the environment values, both ecological and social, are protected.
Human Health	To ensure that human health is not adversely affected.

7.3 ASSESSMENT APPROACH

In addition to environmental factors and objectives, the ESD provides a detailed scope of work to be addressed in the Public Environmental Review (this document), including a detailed assessment of impacts and identification of mitigation and management measures. The approach used to assess potential impacts from the project is based on determining the likelihood and consequence following exposure to stressor/s. The approach generally aligns with the processes outlined in Australian Standard/New Zealand Standard (AS/NZS) ISO 31000:2009 Risk Management and Handbook 203:2012 Managing Environment-related Risk. Table 50 lists and defines impact assessment terms used throughout this Public Environmental Review.

Table 50: Impact Assessment Term Definitions

Term	Definition
Consequence	The implication of the potential impact on an environmental or socio-economic factor
Development Envelope	Mine Site: Includes the Mine Site and the Site Access Road. Derby Port: Includes the product storage facility and product export causeway.
Direct impact	Impacts that arise directly from the project e.g. loss of vegetation due to land disturbance.
Factor	Environmental factors include physical environmental resources that are valued by society for their ecological, social or economic value and may be impacted by an aspect of a project.
Hazard	A potential source of harm, or situation with a potential to cause loss or adverse effect.
Indirect impact	Impacts that occur as a result of direct project impacts e.g. a reduction in viability of wildlife populations following removal of habitat.
Inherent impact	Impact before the application of proposed mitigation and management measures.
Likelihood	The probability of a stressor impacting on an environmental factor.
Local/ localised	Includes Development Envelope/s and adjacent or surveyed areas associated with the project
Long term	Longer than 10 years.
Medium term	Longer than two years, but fewer than 10 years.
Permanent	Impacts that arise from irreversible changes in conditions caused by the project, such as alteration of the landscape by mining.
Potential impact	Interaction of a stressor with an environmental or socio-economic factor that can reasonably be expected or is likely to occur in the lifetime of the project.
Regional	Terrestrial: Includes a broader land area, including the Dampier Peninsula. Marine: WA Coastal Waters and coastline between Beagle Bay and Camden Sound, including King Sound.
Residual impact	Impact remaining after the application of proposed mitigation and management measures.
Short term	Fewer than two years.
Stressor	A source of potential harm, or a situation with a potential to cause loss or adverse effects.

7.3.1 Consequence of Potential Impacts

A number of aspects were considered in determining the consequence of each potential impact, including:

- Type of impact (direct or indirect).
- Geographic extent, size and scale.
- Duration, frequency, reversibility of the potential impact.
- Whether the potential impacts are from planned or unplanned events.
- Sensitivity of the receptor/resource and the value of the receptor/resource and whether impacts are likely to be from planned or unplanned events.

The definitions for these aspects are described in Table 51.

Table 51: Environmental Impact Consequence Definitions

Incidental	Minor	Moderate	Major	Severe
Key Environmental Factors				
Terrestrial Flora and Vegetation				
Localised and short term decrease in health, abundance and structure of vegetation communities that are well represented in the region.	Localised and medium term decrease in health, abundance and structure of vegetation communities that are well represented in the region.	Localised and long term decrease in health, abundance and structure of vegetation communities that are not well represented in the region.	Widespread and medium term decrease in health, abundance and structure of vegetation communities that are not well represented in the region.	Permanent loss of vegetation communities that are not well represented in the region.
No direct loss of conservation significant flora in Development Envelope although increased stress incurred through indirect or induced processes.	Minor, localised loss of conservation significant flora either through direct, indirect or induced processes.	Regional loss of conservation significant flora with no impacts on species survival.	Project places significant pressure on continued survival of conservation significant species.	Project results in extinction of conservation significant species on a regional scale.
Manageable, localised weed infestation that does not result in competition with native species.	Manageable, localised weed infestation that results in minor competition with native species.	Localised weed infestation that results in competition with native species requiring considerable management/control measures.	Regional weed infestation that results in competition with native species requiring extensive management/control measures.	Uncontrollable regional weed infestation that results in competition with native species.
Revegetation				
Revegetation progress is slightly impeded. Achievement of species diversity, vegetation coverage, and plant survival approaches predicted levels (with consideration of natural variability and conditions).	Revegetation progress experiences minor impediment. Localised and isolated failure to reach species diversity, vegetation coverage, and plant survival targets.	Revegetation progress experiences moderate impediment. Localised and permanent, or widespread failure to reach species diversity, vegetation coverage, and plant survival targets.	Revegetation progress experiences major impediment. Widespread and permanent failure to reach species diversity, vegetation coverage, and plant survival targets.	Revegetation is deemed unsuccessful. Cleared land remains in a denuded state.

Incidental	Minor	Moderate	Major	Severe
Terrestrial Fauna				
Localised and short term loss of habitat (including that of conservation significant species) that is well represented in the region, overall habitat area remains intact with minimal fragmentation.	Localised and medium term loss of habitat (including that of conservation significant species) that is well represented in the region, some short term habitat fragmentation	Localised and permanent or widespread and long term loss of habitat (including that of conservation significant species) that is not well represented in the region, medium term habitat fragmentation.	Permanent and widespread loss of habitat (including that of conservation significant species) that is not well represented in the region, permanent habitat fragmentation.	Permanent loss and fragmentation of habitat (including that of conservation significant species) that is not well represented in the region.
Some displacement of fauna that has no lasting effects on population viability or abundance.	Some displacement of fauna that has short term effects on population viability or abundance.	Displacement of fauna that has medium term effects on population viability or abundance	Displacement of fauna that puts populations at risk of local extinction	Fauna displacement leads to extinction of species on a regional scale.
No measurable impacts to behaviour of fauna in local area.	Short term impact to behaviour of fauna in local area.	Medium term impact to behaviour of fauna in local area.	Long term and widespread impact to behaviour of fauna.	Permanent change to behaviour of fauna in the regional area.
Localised and short-term decrease in fauna abundance (including conservation significant fauna) occurring in the Development Envelope.	Localised and long-term or widespread, and short-term decrease in fauna abundance (including conservation significant fauna) within the Development Envelope.	Localised and irreversible or widespread and long-term decrease in fauna abundance (including conservation significant fauna).	Significant, widespread, and persistent decrease in fauna abundance (including conservation significant fauna).	Permanent loss of a significant portion of fauna population (including conservation significant fauna).
Localised and short term loss of Short Range Endemic (SRE) habitat that is well represented in the region, loss of SREs that has no effect on population viability or abundance.	Localised and medium term loss of SRE habitat that is well represented in the region, loss of SREs that has short term effects on population viability or abundance.	Localised and permanent or widespread and long term loss of SRE habitat that is not well represented in the region, loss of SREs that has medium term effects on population viability or abundance.	Permanent and widespread loss of SRE habitat that is not well represented in the region, loss of SREs that puts populations at risk of local extinction.	Permanent loss of SRE habitat that is not well represented in the region, loss of SREs leads to extinction of species on a regional scale.
Minor increase in pest species numbers, but does not result in impacts to the population viability or abundance of native species.	Minor increase in pest species numbers, resulting in localised impacts to the population viability or abundance of native species.	Major increase in pest species numbers, resulting in widespread impacts to the population viability or abundance of native species.	Pest species introduced and populations expand into the regional area resulting in long term exclusion of native species.	Pest species introduced and populations expand into the regional area resulting in permanent exclusion of native species.

Incidental	Minor	Moderate	Major	Severe
Hydrological Processes and Inland Waters Environmental Quality				
Surface Water				
Minor change to surface water quality within the project area that does not change its ability to be used by livestock and fauna	Minor change to surface water quality within the project area and downstream watercourses that does not affect its use by livestock and fauna.	Moderate change to surface water quality within the project area and downstream watercourses that affects its use by livestock and fauna in the short term.	Decline in surface water quality in the project area and downstream watercourses that prevents medium to long term use by livestock and fauna.	Decline in surface water quality on a regional scale that prevents long term use by livestock and fauna.
Short term changes to local water volumes that do not affect beneficial uses, including livestock and fauna.	Medium term changes to local water volumes that do not affect beneficial uses, including livestock and fauna.	Short term changes to regional water volumes that affect beneficial uses, including livestock and fauna.	Medium term changes to regional water volumes that affect beneficial uses, including livestock and fauna.	Project causes permanent loss of surface water resources that affects livelihoods and/or survival of communities.
Groundwater				
Minor, localised change to groundwater quality that does not change its ability to be used by beneficial uses, including livestock, fauna, groundwater dependent ecosystems and subterranean fauna.	Short term localised decline in groundwater quality that affects beneficial uses, including livestock, fauna, groundwater dependent ecosystems and subterranean fauna.	Medium term localised decline in groundwater quality that affects beneficial uses, including livestock, fauna, groundwater dependent ecosystems and subterranean fauna.	Short to medium term regional decline in water quality that prevents beneficial uses, including livestock, fauna, groundwater dependent ecosystems and subterranean fauna.	Long term regional decline in water quality that prevents beneficial uses, including livestock, fauna, groundwater dependent ecosystems and subterranean fauna.
Minor changes to local groundwater levels/availability that do not affect beneficial uses, including livestock, fauna, groundwater dependent ecosystems and subterranean fauna.	Local changes to groundwater levels/availability that do not affect beneficial uses, including livestock, fauna, groundwater dependent ecosystems and subterranean fauna.	Local changes to groundwater levels/availability that affect beneficial uses, including livestock, fauna, groundwater dependent ecosystems and subterranean fauna in the short to medium-term.	Regional changes to groundwater levels/availability that affect beneficial uses including livestock, fauna, groundwater dependent ecosystems and subterranean fauna in the medium term.	Regional changes to groundwater levels/availability that affect beneficial uses, including livestock, fauna, groundwater dependent ecosystems and subterranean fauna in the long term.

Incidental	Minor	Moderate	Major	Severe
Heritage				
No loss or disturbance of physical or cultural heritage within local area.	Loss or disturbance of non-significant physical or cultural heritage within local area in agreement with traditional owners and compliant with relevant legislation.	Loss or disturbance of significant physical or cultural heritage in agreement with traditional owners and compliant with relevant legislation.	Loss or disturbance of significant physical or cultural heritage that requires significant compensation compliant with relevant legislation.	Loss or disturbance of significant physical or cultural heritage not in agreement with traditional owners that requires significant compensation and is not compliant with relevant legislation.
Marine Environmental Quality				
Short term impacts to quality of water, sediment or biota that do not affect ecological and social values. Restricted to immediate vicinity of project disturbance.	Short to medium term, local impacts to quality of water, sediment or biota that do not affect ecological and social values.	Medium term, local impacts to quality of water, sediment or biota that affect ecological and social values.	Short term, regional impacts to the quality of water, sediment or biota that affects ecological and social values.	Long term, regional impacts to the quality of water, sediment or biota that results in a reduction in ecological and social values.
Amenity				
Minor, short term and infrequent loss of amenity within the local area. Total Suspended Particles (TSP) and dust deposition guideline levels are not exceeded for sensitive receptors.	Minor and short term, but frequent, loss of amenity within the local area. TSP and dust deposition guideline levels may be exceeded for sensitive receptors, but this rarely happens.	Medium term and frequent decreases in amenity within a local area. TSP and dust deposition guideline levels are exceeded occasionally for sensitive receptors.	Medium term decline in amenity within a regional area. TSP and dust deposition guideline levels are exceeded frequently for sensitive receptors.	Long term decline in amenity over a regional area. TSP and dust deposition guideline levels are exceeded almost constantly for sensitive receptors.
Noise levels remain below relevant guideline values at all locations.	Noise levels remain below relevant guideline values at most locations but some non-sensitive receptors impacted by minor exceedances.	Occasional exceedance of relevant guideline values at sensitive receptor locations.	Frequent exceedance of relevant guideline values at sensitive receptor locations.	Continuous exceedance of relevant guideline values at sensitive receptor locations.

Incidental	Minor	Moderate	Major	Severe
Other Factors				
Landforms				
Post mining landforms are consistent with their surroundings.	Post mining landforms are generally consistent with their surroundings with minor variations in elevation, profile and vegetation.	Post mining landforms are generally consistent with their surroundings but show distinguishable variation in elevation, profile and vegetation.	Post mining landforms are inconsistent with their surroundings with notable differences in elevation, profile and vegetation.	Post mining landforms are inconsistent with their surroundings, represented by significant differences in elevation, profile and vegetation.
Post mining landforms are stable.	Post mining landforms are stable but may experience minor erosion, such as rilling.	Post mining landforms are generally stable, but may experience moderate erosion, such as limited gullyng.	Post mining landforms are unstable, with significant erosion, such as tunnelling and gullyng, and subsidence.	Post mining landforms fail (e.g. TSF embankment failure), with extensive ongoing management issues.
Subterranean Fauna				
Short term loss to the representation, diversity, viability and ecological function of subterranean fauna species, populations or assemblages in the Development Envelope.	Medium term loss to the representation, diversity, viability and ecological function of subterranean species, populations or fauna assemblages in the local area.	Long term loss to the representation, diversity, viability and ecological function of subterranean fauna species, populations or assemblages in the local area.	Short or medium term loss to the representation, diversity, viability and ecological function of subterranean species, populations or fauna assemblages in the regional area.	Permanent loss to the representation, diversity, viability and ecological function of subterranean species, populations or fauna assemblages in the regional area.
Terrestrial Environmental Quality				
Loss of soil resources has short term impact on associated environmental values within Development Envelope.	Loss of soil resources has medium term impact on associated environmental values on a local scale.	Loss of soil resources has long term impact on associated environmental values on a local scale.	Loss of soil resources resulting in a short to medium term impact on associated environmental values on a regional scale.	Loss of soil resources that has a permanent impact on associated environmental values on a regional scale.
Land contamination within Development Envelope, easily treatable in short term and does not result in adverse impacts on associated environmental values.	Land contamination localised and treatable in medium term. Does not result in adverse impacts on associated environmental values.	Localised land contamination that results in adverse impacts on associated environmental values in the short to medium term.	Land contamination on a regional scale resulting in adverse impacts on associated environmental values requiring medium to long term management.	Land contamination on a regional scale resulting in permanent damage with severe environmental and socioeconomic disruption.

Incidental	Minor	Moderate	Major	Severe
Air Quality and Atmospheric Gases				
Emission levels remain below relevant National Environmental Protection Measures (NEPM) values at all receptor locations.	Emission levels remain below relevant NEPM values at most locations but some non-sensitive receptors impacted by minor exceedances.	Occasional exceedance of relevant NEPM values at sensitive receptor locations.	Frequent exceedance of relevant NEPM values at sensitive receptor locations.	Continuous exceedance of relevant NEPM values at sensitive receptor locations.
Benthic Communities and Habitat				
Short term changes restricted to immediate vicinity of project disturbance to the structure, diversity and distribution of benthic habitats and communities.	Short to medium term changes restricted to within 10 km of project disturbance to the structure, diversity and distribution of benthic habitats and communities.	Long term changes restricted to within 10 km of project disturbance to the structure, diversity and distribution of benthic habitats and communities.	Short to medium term, regional changes relating to the structure, diversity and distribution of benthic habitats and communities.	Long term, regional changes relating to the structure, diversity and distribution of benthic habitats and communities.
Marine Fauna				
Short term impact to conservation significant fauna habitat within the Port Development Envelope or immediate area of disturbance, overall habitat area remains intact.	Medium term or minor loss of conservation significant fauna habitat within 10km of project disturbance.	Long term or moderate loss of conservation significant fauna habitat within 10 km of project disturbance.	Long term or moderate loss of conservation significant fauna habitat in the regional marine environment.	Permanent loss of conservation significant fauna habitat in the regional marine environment.
Death of an individual animal of conservation significant species that does not impact on population's ability to survive locally.	Death of several animals of conservation significant species that does not impact on population's ability to survive locally.	Death of multiple animals of conservation significant species that compromises species ability to survive locally.	Death of multiple animals of conservation significant species that compromises species ability to survive regionally.	Death of multiple animals of conservation significant species that results in a regional extinction.
Short term disruption of marine fauna or minor disruption to breeding patterns and/or behaviour within the immediate area of project disturbance that does not affect population health or survival.	Short to medium term disruption of marine fauna or minor disruption to breeding patterns and/or behaviour within the immediate area of project disturbance that affects local population health or survival.	Short to medium term disruption to marine fauna breeding patterns and/or behaviour within 10km of project disturbance that affect local population health or survival.	Medium to long term disruption to marine fauna breeding patterns and/or behaviour in the regional marine environment that compromise population health and survival.	Permanent change to marine fauna breeding patterns and/or behaviour that affect species survival in the regional marine environment.

Incidental	Minor	Moderate	Major	Severe
Human Health				
Infrequent, perceptible increases in noise above baseline conditions within Development Envelope that do not affect the well-being of receptors.	Infrequent, perceptible increases in noise above baseline conditions in the local area that occasionally disrupts the well-being of receptors.	Occasional increases in noise above baseline conditions in the regional area that disrupts the well-being of receptors.	Frequent increases in noise above baseline conditions in the regional area that significantly disrupts the wellbeing of receptors.	A continuous increase in noise above baseline conditions in the regional area that significantly impacts the wellbeing of receptors.
Isolated, infrequent acute health impacts within the Development Envelope attributable to project emissions.	Isolated, infrequent acute health impacts in the local area attributable to project emissions.	Frequent acute health issues in the local area attributable to project emissions.	Chronic community health issues in local area attributable to project emissions.	Chronic community health issues in regional area attributable to project emissions.



7.3.2 Likelihood of Potential Impacts

Likelihood is the probability of a stressor impacting on an environmental factor, after the application of mitigation and management measures. Where practicable, likelihood was quantified based on quantitative information or data. Definitions for likelihood are presented in Table 52.

Table 52: Likelihood Definitions

Descriptor	Explanation
Rare /Rarely	May occur in exceptional circumstances (would be considered highly unusual); may occur in the next 30 -40 years (<5% per year).
Unlikely	Not likely to occur; may occur within the next 10- 20 years (5%-10% probability).
Possible /Possibly	May occur within 5-10 years (10%-50% probability).
Likely	Known to occur or has occurred in the past; is likely to occur in the next 24-36 months (50-80% probability).
Almost Certain / Almost Certainly	Expected to occur in the next 12-24 months (80-100% probability).

7.3.3 Residual Impact

The residual impacts were determined by assessing the likelihood and consequence when mitigation and management measures are applied. The level of residual impact was determined using the matrix shown in Table 53.

Where high or extreme residual impacts remained after mitigation, further options were examined in consultation with the project team. This process continued until impacts were considered to be reduced.

Table 53: Impact Assessment Matrix

Likelihood	Impact Consequence				
	Incidental	Minor	Moderate	Major	Severe
Rare	Low	Low	Medium	Medium	High
Unlikely	Low	Low	Medium	High	High
Possible	Low	Medium	Medium	High	Extreme
Likely	Low	Medium	High	Extreme	Extreme
Almost Certain	Medium	Medium	High	Extreme	Extreme

Residual impacts derived from use of this matrix are used in decision making according to the following categories:

- **'Low' residual impacts** are not considered to be of concern for decision making.
- **'Medium' residual impacts** are not considered to require specific attention in the decision on approval of the project and adequate mitigation is considered achievable using reasonable mitigation and management measures. Monitoring may be needed to confirm that impacts do not exceed predicted levels.
- **'High' residual impacts** are considered to require careful attention in decision making and specific mitigation and monitoring measures should be identified to ensure adverse impacts are as low as reasonably practicable or the likelihood of occurrence is significantly reduced or that beneficial impacts are delivered.

- **‘Extreme’ residual impacts** occur when a significant change from baseline is predicted that exceeds legal limits and accepted standards. These warrant substantial consideration, when compared with other environmental, social or economic costs and benefits in making decisions on whether or not to allow a project to go ahead. Specific mitigation measures and monitoring should be identified to ensure impacts are well managed and the likelihood of occurrence is reduced.

If the impact assessment process has been successful, the majority of residual impacts should be of no more than medium residual impact. High or extreme residual impacts should only arise where there are special circumstances preventing their mitigation, and management measures should aim to reduce the likelihood of these events occurring. There should be no residual impacts that are extreme unless they are being addressed by offsets.

7.4 SCREENING OF IMPACTS

During the assessment phase, a number of stressors that were included in the Environmental Scoping Document were screened out from further assessment, as they were either identified as being not likely to occur or were unlikely to have any discernible consequence on any factor different to background levels. These factors and stressors are outlined in the following impact assessment sections, as well as an explanation for excluding them from further assessment.

7.5 MITIGATION AND MANAGEMENT MEASURES

Impact assessment is designed to ensure that decisions on projects are made in full knowledge of potential impacts on the environment and society. A vital step within the process is the identification of measures that can be taken to ensure adverse impacts are as low as reasonably practicable and positive impacts are maximised. This is achieved by undertaking an assessment to identify where significant impacts could occur and then working with the wider project team to identify technically and financially feasible ways of mitigating and reducing risk.

When developing the mitigation and management measures for this project, the following hierarchy of control was considered:

- **Avoidance:** Significant avoidance and minimisation measures have been incorporated into decision making and Mine Site design.
- **Minimisation:** Measures that minimise an impact (for example by storing hydrocarbons in impermeable storage areas).
- **Reduction:** Measures that reduce or eliminate the impact of an activity (for example implementing measures to reduce dust emissions from vehicle travel on unsealed roads).
- **Correction:** Measures that correct or rectify an impact (for example via restoration, repair, or rehabilitation).
- **Compensation:** Measures to compensate for impacts from project activities (for example by replacing lost or damaged environmental components in kind or with agreed substitute resources).

Many of the mitigation and management measures included in this assessment will be included in the Environmental Management Plans associated with the implementation of the project. These plans will include monitoring programs, which will be used to verify impact predictions and the effectiveness of the mitigation and management measures. An adaptive management framework will exist during implementation, and plans will be updated as required according to new information or changing circumstances, experiences and lessons.

7.6 DEALING WITH UNCERTAINTY

Impact assessments often include a level of uncertainty, which exists due to a number of factors, including limited understanding of complex systems and factors that cannot be fully understood due to limited available data. The impact assessment was based on current knowledge, available data from existing and commissioned studies and professional judgement.

Where identified impacts had a level of uncertainty, the approach has been to take a conservative and cautious view of the potential impacts of the project. Several areas of additional study shall be undertaken during detailed design, construction and operations. These are identified and will be used to inform the development of detailed mitigation and monitoring plans.