

East End No.5 Project Environmental Impact Statement

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Background

Cement Australia (Exploration) Pty Ltd and Cement Australia (Queensland) Pty Ltd have made a joint mining lease application. Both companies are part of the Cement Australia Group.

The Cement Australia Group mines limestone and clay at the East End Mine for manufacturing cement clinker at Fisherman's Landing north of Gladstone. The East End Mine is located seven kilometres south-west of Mount Larcom and commenced mining operations in 1980. This has mainly been carried out on Mining Lease (ML) No. 3631, which adjoins the proposed mining lease (MLA80156) to the north-west.

Exploration has identified significant resources within the proposed mining lease. The resource is located close to existing mine infrastructure and includes rail loops, railways, road access, rail loading plant and ancillary mine facilities.

As the resource adjoins the current East End Mine, its exploitation would involve an extension of the existing mining operations to the south-east across the common lease boundary. The same open cut mining methods currently employed on ML3631 would be used on the new lease.

This includes progressively removing the upper top soil layer and vegetation, mainly pasture grass, then either reusing it for rehabilitation works or stockpiling for future rehabilitation use. Clay overburden will be removed by hydraulic excavator or front end loader into haul trucks and then transported to the primary crusher or adjacent surge pile on ML3631. Underlying clay and limestone, and massive limestone strata, will be fragmented by drilling and blasting then loaded out to the primary crusher pile by excavator, front end loader and haul truck combinations. Mining operations will be carried out below the water table, which will require the workings to be dewatered. No mineral processing will be carried out on the proposed lease. A series of benches, with elevations corresponding with those on ML3631, will be developed and advanced sequentially. Vertical separation between benches will be about 15 metres. Operational and final batter angles and bench widths will be designed to achieve the required level of safety.

The mining process will generate a quantity of material unsuitable for clinker production.

These materials include:

- high alkali limestone
- volcanic rock, which occurs as dykes within the limestone deposit and sidewalls
- clay materials, either in excess of requirements or with unsuitable chemical characteristics.

These materials will be removed to ML80002 and ML80127, and stored for later use or rehabilitation. A water filled void will remain after mining.

Approximately 2.5 million tonnes of lime and clay are mined annually and it is anticipated that this rate of mining would continue on the new lease. It is anticipated that mining will commence on the proposed mining lease in about five years.

No additional infrastructure or ancillary facilities are required apart from access and haul road construction, fencing and establishing environmental controls.

A wide range of environmental controls are currently in place on the East End Mine lease and it is anticipated that similar controls would be employed on the proposed lease.

Executive summary

The executive summary conveys the most important aspects and options relating to the project in a concise and readable form. It should use plain English and avoid the use of jargon and esoteric terms. The structure of the executive summary should follow the Environmental Impact Statement (EIS) and focus strongly on the key issues and conclusions.

Glossary of terms

A glossary of technical terms, acronyms and abbreviations is included before the main text of the EIS.

1 Introduction

The introduction explains why the EIS has been prepared and what it sets out to achieve. The introduction should reflect the level of significance of particular impacts by addressing the level of analysis and detail of information required in the EIS. Sufficient information should be provided to meet the assessment requirements for any approvals that would be needed to carry out the project. It should also define the target audience and contain an overview of the structure of the document. Factual information contained in the EIS should be referenced.

1.1 Project proponent

This section provides details of the project proponents, including details of any joint venture partners.

1.2 Project description

A brief description of the project's key elements should be provided and illustrated. Any associated major infrastructure requirements should also be summarised. Detailed descriptions of the project should follow in section 3.

1.3 Project objectives and scope

A statement of the objectives leading to the development of the proposal and a brief outline of the events leading up to the proposal's formulation should be provided. This should include alternatives, envisaged time scale for implementation and project life, anticipated establishment costs and actions already undertaken within the project area.

The current status of the project should be described and an outline of the project's relationship to other developments or actions, whether or not they have been approved, should be included. The consequences of not proceeding with the project should also be discussed.

1.4 The environmental impact statement (EIS) process

This section clarifies the methodology and objectives of the environmental impact statement under the relevant legislation.

1.4.1 Methodology of the EIS

This section provides a description of the EIS process steps, timing and decisions to be made for relevant stages of the project. A brief description of studies or surveys that have been undertaken for the purposes of developing the project and preparing the EIS should be provided. This should include reference to relevant baseline studies or investigations previously undertaken. This section should also indicate how the consultation process (which will be described in detail in section 1.5) would integrate with the other components of the impact assessment, including the stages, timing and mechanisms for public input and participation.

The information in this section is required to ensure:

- relevant legislation is addressed
- readers are informed of the process to be followed
- stakeholders are aware of any opportunities for input and participation.

1.4.2 Objectives of the EIS

Having described the methodology of the EIS, a succinct statement of the EIS objectives should be made. The structure of the EIS can then be outlined as an explanation of how the EIS will meet its objectives. The reader should be able to distinguish the EIS as the key environmental document providing advice to decision makers who are considering approvals for the project.

While the terms of reference provide guidance on the scope of the EIS studies, they should not be seen as exhaustive or limiting. It is important for proponents and their consultants to recognise that there cannot be perfect knowledge of what the EIS studies may find in advance of undertaking an EIS.

During the preparation of the EIS, if it transpires that previously unforeseen matters not addressed in the terms of reference are found to be relevant to the assessment of impacts of the proposal, those matters should be included in the EIS.

In addition, it is essential that the main text of the EIS should address all relevant matters concerning environmental values, impacts on those values and proposed mitigation measures. No relevant matter should be raised for the first time in an appendix or the draft Environmental Management plan (EM plan).

The depth and scope of the assessment in the EIS will need to commensurate with the values to be impacted and the scale of those impacts. When considering whether an impact is significant or not, the proponent should take into account the intensity of the impact and the context in which it would occur.

The EIS is a public document. Its purpose is to provide information to regulatory agencies and inform the public of the scope, impacts and mitigation measures of the proposal. The main text should be written in plain English, avoiding jargon as much as possible. Additional technical detail may be provided in appendices. The main text should not assume the reader's prior knowledge of the project site. The reader should not have to have visited the site to understand the issues involved in the proposal.

In brief, the EIS should provide public information about the need for, and likely effects of, the project. It should set out acceptable standards and levels of impacts (both beneficial and adverse) on environmental values, and demonstrate how environmental impacts can be managed through the protection and enhancement of the environmental values. Discussion of options and alternatives, and their likely relative environmental management outcomes, are a key aspect of the EIS.

The role of the EIS in providing the project's draft EM plan should also be discussed. In particular, reference should be made to the EM plan's role in providing management measures that can be carried over into conditions that would attach to any approval(s), environmental authorities and permits for the project.

1.4.3 Submissions

This section should include information on how and when public submissions on the draft EIS can be made, and how they will be addressed and taken into account during the decision-making process.

1.5 Public consultation process

An appropriate public consultation program is essential to the impact assessment. This section outlines the methodology that will be adopted to identify and mitigate socio-economic impacts of the project. Information about consultation that has already taken place, and the results of such consultation, should be included.

Inclusion of a list of affected and interested persons, as well as a statement of how the proponent proposes to consult with those persons, is a statutory requirement of the EIS process in the *Environmental Protection Act 1994* (See section 7). Similar requirements, though non-statutory, are usually applied to EIS processes under other State legislation.

The public consultation program should provide opportunities for community involvement and education. It may include interviews with individuals, public meetings, interest group meetings, production of regular summary information and updates, and other consultation mechanisms that encourage and facilitate active public consultation.

The public consultation process should identify broad issues of concern to local community and interest groups. The process should continue from project planning through commissioning, project operations and final decommissioning. Refer to the Department of Environment and Resource Management (DERM) guideline, *Issue Identification and Community Consultation*.

1.6 Project approvals

1.6.1 Relevant legislation and policy requirements

This section explains the legislation and policies controlling the approvals process. Reference should be made to the Queensland *Environmental Protection Act 1994*, *Integrated Planning Act 1997* and other relevant Queensland laws. Any requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* should also be included.

Local Government planning controls, local laws and policies applying to the development should be described. A list of the approvals required for the project and the expected program for approval of applications should also be provided.

This information is required to assess how the legislation applies to the proposal, which agencies have jurisdiction, and whether the proposed impact assessment process is appropriate.

1.6.2 Planning processes and standards

This section discusses the project's consistency with existing land uses or long-term policy framework for the area (e.g. as reflected in local and regional plans), and with legislation, standards, codes or guidelines available to monitor and control operations on site. All relevant State and regional planning policies should be referred to. This information is required to demonstrate how the proposal conforms to state, regional and local plans for the area.

1.7 Accredited process for controlled actions under Commonwealth legislation

The proponent does not intend to refer the project to the Department of Environment, Water, Heritage and the Arts under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Following a review of possible impacts and matters of 'national environmental significance', the proponents considered that there will not be a significant impact upon a matter of national environmental significance due to the project.

2 Project need and alternatives

2.1 Project justification

This section describes and justifies the project with particular reference made to the economic and social benefits, including employment and spin-off business development, which the project may provide. The status of the project should be discussed in a regional, state and national context.

2.2 Alternatives to the project

This section describes feasible alternatives including conceptual, technological and locality alternatives to the project, and discusses the consequences of not proceeding with the project. Alternatives should be discussed in sufficient detail to enable an understanding of the reasons for preferring certain options and courses of action and rejecting others.

Comparative environmental impacts of each alternative should be summarised.

The interdependencies of the proposal components should be explained, particularly how any industrial developments (or various combinations of industrial developments) and infrastructure requirements relate to the proposal's viability. Should water supply, power, transport and/or storage infrastructure be included as an element of the proposal, this section should include a description and rationale for such infrastructure.

Reasons for selecting the preferred options should include technical, commercial, social and natural environment aspects. In particular, the principles of Ecologically Sustainable Development (ESD) should be included. The relationship of chosen waste management options and any emissions produced should be detailed.

This information is used to assess why the scope of the proposal is as it is, and to ensure that ESD principles have been considered and incorporated during the scoping and planning of the proposal.

3 Description of the project

This section describes the project through its lifetime of construction, operation and decommissioning. This information allows assessment of all aspects of a proposal including all phases from planning, construction and operation through to decommissioning. It also allows further assessment of the approvals that may be required and how they may be managed through the proposal lifecycle. Maps or figures showing the position of features or boundaries should use the GDA94 datum. The GDA94 datum should also be included in the text to describe the locations of any features (such as discharge points) or boundaries that may be relevant to subsequent approvals.

3.1 Location

3.1.1 Regional context

The regional context of the proposal should be described and illustrated on maps at suitable scales.

3.1.2 Local context

This section describes the local context of the proposal and includes real property descriptions of the project site as well as adjacent properties. Maps at suitable scales should be provided showing the precise location of the project area. In particular:

- the location and boundaries of land tenures, in place or proposed, that the project area is, or will be, subject to
- the location and boundaries of the project footprint showing all key aspects. This includes excavations, stockpiles, areas of fill, watercourses, other water bodies and wetlands, plant locations (including any conveyors), water storages, buildings, bridges, culverts, hardstands, car parks, etc
- the location of any proposed buffers surrounding the working areas.

This section should include a rectified aerial photo enlargement (preferably A3 size) to illustrate components of the project in relation to the land and mining tenures, and natural and built features of the area.

3.2 Construction

This section describes the extent and nature of the project's construction phase. The description should include the type and methods of construction, the construction equipment to be used and the plant items to be transported onto the construction site. Any staging of the proposal should be described and illustrated showing site boundaries, development sequencing and timeframes. The estimated numbers of people to be employed in the project construction phase should also be provided with a brief description of where those people may be accommodated and how they will be transported to the site.

3.3 Operations

The location and nature of the processes to be used should be described in this section and illustrated with maps, diagrams and artist's impressions as required. Operational issues to be addressed should include (but are not limited to):

- a description of plant and equipment to be employed
- the capacity of plant and equipment
- chemicals to be used.

Concept and layout plans highlighting proposed buildings, structures, plant and equipment associated with the processing operation should be provided. The nature, sources, location and quantities of all materials to be handled, including the storage and stockpiling of raw materials, should be described.

Anticipated production rates, wastes and recycle streams should be described.

3.3.1 Tenements and tenures

This section describes and illustrates any existing mining tenements and petroleum tenures overlying and adjacent to the project site, and any to be applied for this project.

3.3.2 Resource base and mine life

The results of studies and surveys undertaken to identify the mineral and natural resources required to implement the proposal (further detail should be provided in section 4.2.1.2, Geology) should be summarised. The location, volume, tonnage and quality of natural resources required should be described (e.g. land, water, timber, energy, etc). Specific details should be provided for:

- the proposed mine life and an outline of the coal/mineral resource base including the total thickness of seams or extent of the ore body
- the planned recovery of resources
- locations of any resources that would be sterilised by the planned activities
- the annual quantity of coal or mineral to be mined including any proposed ramping of production or staging of development
- typical cross sections of the existing and proposed mine workings including surface profiles and strata.

3.3.3 Mining methods and equipment

Specific details should be provided for:

- the mining type and methods to be used, including major equipment for various components of the operation
- the use of different techniques in areas of different topographic or geo-technical character
- chemicals to be used, including hydraulic fluids used and released in underground operations.

The description should refer to, and be complemented by, the figures previously presented in section 3.3.1 showing the locations of key aspects of the project. Additional figures should be provided if required.

3.3.4 Mine sequencing

Specific details should be provided for:

- the proposed sequence and timing of mining of each seam or ore body within the mining lease
- the physical extent of excavations, location of overburden and coal or mineral reject stockpiles to be handled during the project's operation or left after mining ceases. The description should include the rate of throughput of product, reject and overburden stockpiles
- the proposed progressive backfilling of excavations
- the area disturbed at each major stage of the project.

Information on the workforce numbers to be employed in the facility's operations should also be provided. This should encompass all phases (construction, commissioning, operation and decommissioning) and stages with a brief description of where those people may be accommodated and how they will be transported to the site. Comment should be made on the anticipated basis of employment (permanent, contract, etc).

3.3.5 Processing and products

This section describes the quantities and characteristics of the products produced on an annual basis. Indicative process flow-sheets showing material balances for the processing plant and the anticipated rates of inputs, along with similar data on products, wastes and recycle streams, should be provided.

3.3.6 Ongoing evaluation and exploration activities

This section describes the extent and nature of any proposed ongoing exploration, or geological or geo-technical evaluation, within the project area that may be required over the life of the project.

3.4 Product handling

This section describes and shows on appropriately scaled plans the proposed methods and facilities to be used for product storage and transfer from the processing plant to the storage facilities, and from the storage facilities

to the transport facilities. It should include discussion of any environmental design features of these facilities, including bundling of storage facilities, particularly where they prevent or minimise environmental impacts.

3.5 Infrastructure requirements

This section provides descriptions, with concept and layout plans, of requirements for constructing, upgrading or relocating all infrastructure for the project. The locations of any necessary infrastructure easements should be shown on the plan. The infrastructure matters to be considered include roads, rail, waterway crossings (including, but not limited to, bridges and culvert crossings), bridges, jetties, ferries, tracks and pathways, dams and weirs, bore fields, power lines and other cables, wireless technology (e.g. microwave telecommunications), and pipelines for any services (whether underground or above).

3.5.1 Transport—road/rail/ship

This section provides an overview of arrangements for the transport of plant, equipment, products, wastes and personnel during the construction and operational phases of the project. The description should cover the use of existing facilities and all requirements for the construction, upgrading or relocation of any transport-related infrastructure.

3.5.2 Energy

The EIS should describe all energy requirements including electricity, natural gas, and solid and liquid fuel requirements for the construction and operation of the proposal. The locations of any easements should be shown on the infrastructure plan. Energy conservation should be briefly described in the context of any Commonwealth, State and local government policies.

3.5.3 Water supply and storage

The EIS should provide information on the project's water usage including the quality and quantity of all water supplied to the site. In particular, the proposed and optional sources of water supply should be described (e.g. bores, any surface storage such as dams and weirs, municipal water supply pipelines, etc).

Estimated average and maximum rates of supply from each source should be provided. Any proposed water conservation and management measures should be described.

Potable water demand for the project should be determined, including the temporary demands during the construction period. Details of any existing town water supply to meet such requirements should be provided. If water storage and treatment is proposed on site for use by the site workforce, this should be described.

3.5.4 Stormwater drainage

An illustrated description of the proposed stormwater drainage system and the proposed disposal arrangements, including any off-site services, should be provided.

3.5.5 Sewerage

This section describes, in general terms, the sewerage infrastructure required by the project. If it is intended that industrial effluent or relatively large amounts of domestic effluent are to be discharged into an existing sewerage system, a capacity assessment of the existing system to accept the effluent should be provided in Section 4.3 'Waste'. For industrial effluent, this should detail the physical and chemical characteristics of the effluent(s).

3.5.6 Telecommunications

The EIS describes any impacts on existing telecommunications infrastructure (such as optical cables, microwave towers, etc.) and identifies the owners of that infrastructure.

3.5.7 Accommodation and other infrastructure

A description of any other developments directly related to the project (not described in other sections), such as fuel storage areas and equipment hardstand and maintenance areas, should be provided.

3.6 Waste management

This section provides an inventory of all wastes to be generated by the proposal during the construction, operational and decommissioning phases of the project. In addition to the expected total volumes of each waste produced, an inventory per unit volume of product produced must be included for the following:

- the tonnage of raw materials processed
- the amount of resulting process wastes
- the volume and tonnage of any re-usable by-products.

Schematic diagrams should be provided for each distinct stage of the project, e.g. construction or site preparation, commissioning, operation and decommissioning (simplified versions of those provided in section 3.3 may be provided for the operational phase. Schematic diagrams need to indicate the processes to be used and highlight their associated waste streams (i.e. all waste outputs: solid, liquid and gaseous) including recycling efforts such as stockpiling and reusing topsoil. The schematic diagrams, or an associated table, should cross-reference the relevant sections of the EIS where the potential impacts, and mitigation measures associated with each waste stream, are described. The physical and chemical characteristics of waste material from the process plant should be provided.

Taking into consideration best practice waste management strategies and the Environmental Protection Policy (EPP) (Waste), the proposals for waste avoidance, reuse, recycling, treatment and disposal should be described in the appropriate sub-sections below. Information on the variability, composition and generation rates of all waste produced at the site and processing plant should also be provided. Cleaner production waste management planning should be detailed, particularly how these concepts have been applied to preventing or minimising environmental impacts at each stage of the proposal.

This information enables the resource management agencies and other stakeholders to assess the efficiency of resource use and allocation issues.

3.6.1 Air emissions

This section describes in detail the quantity and quality of all air emissions (including particulates, fumes and odours) from the project during construction and operation. Particulate emissions include those that would be produced by any industrial process, or disturbed by wind action on stockpiles and conveyors, or by transportation equipment such as trucks, either by entrainment from the load or by passage on unsealed roads.

The methods to be employed in the mitigation of impacts from air emissions should be described in section 4.6.

3.6.2 Excavated waste

This section describes and shows the location, design and methods for constructing dumps for waste rock and subsoil, including reject clay and other excavated material. The location of the dumps, relative to topography and other natural features of the area, should be shown on a map.

The following should be detailed and discussed:

- An estimated annual tonnage and volume of waste rock and subsoil to be produced
- Characterisation addressing the properties of waste rock and subsoil that affect their erosion potential. Sampling should be representative, with profiles of all geological units included and based on accepted statistical procedures, and in accordance with recognised guidelines
- Details of any likely leachate quality expected under field conditions (including contaminants such as sulfate, pH, chloride, iron, major cations and anions) and any chemical species in sufficient quantity that is likely to be reactive and/or toxic
- Measures to ensure stability of the waste dumps, particularly the management of drainage
- Slope profiles that are consistent with intended land use and acceptable post-mining land management and maintenance
- Alternatives for excavated waste disposal, including in-filling of voids, off-site options and treatment of any contaminated soil.

3.6.3 Tailings

This section describes the tailings waste produced by preparation and/or processing plants and the proposed methods for its disposal.

3.6.4 Solid waste disposal

A description of the quantity and quality of solid wastes (other than waste rock, subsoil and tailings addressed in other sections) and the proposed methods of their disposal should be included.

3.6.5 Liquid waste

This section should present the origin, quality and quantity of wastewater, and any immiscible liquid waste, originating from the project (other than that addressed in previous sections). Particular attention should be given to the capacity of wastes to generate acid, and saline or sodic wastewater. A water balance for the proposal and processing plant is required to account for the estimated usage of water.

The EIS may need to consider the following effects:

- groundwater from excavations
- rainfall directly onto disturbed surface areas
- run-off from roads, plant and industrial areas, chemical storage areas
- drainage (i.e. run-off plus any seepage or leakage)
- seepage from other waste storages
- water usage for:
 - process use
 - dust suppression
 - domestic purposes
- evaporation
- domestic sewage treatment – disposal of liquid effluent and sludge
- water supply treatment plant – disposal of wastes.

3.7 Rehabilitation and decommissioning

This section describes the options, strategies and methods for progressive and final rehabilitation of the environment disturbed by the proposal. The strategic approach to progressive and final rehabilitation should be described. A preferred rehabilitation strategy should be developed with a view to minimising the amount of land disturbed at any one time. The final topography of any excavations, waste areas and dam sites should be shown on suitably scaled maps.

The strategies and methods presented for progressive and final rehabilitation of disturbed areas should demonstrate compliance with the DERM Guideline 18: Rehabilitation requirement for mining projects. The proposed rehabilitation should be consistent with the *Technical guidelines for the environmental management of exploration and mining in Queensland 1995*, except where superseded by Guideline 18.

The strategies and methods should have the following objectives:

- mining and rehabilitation should aim to create a landform with land use capability and/or suitability similar to that prior to disturbance, unless other beneficial land uses are pre-determined and agreed
- mine wastes and disturbed land should be rehabilitated to a condition that is self-sustaining or where the maintenance requirements are consistent with an agreed post-mining land use
- surface and ground waters that leave the lease should aim to meet or improve the water quality objectives of the receiving waters. Current and future water quality should be maintained at levels that are acceptable for users downstream of the site.

The means of decommissioning the proposal, in terms of the removal of plant, equipment, structures and buildings should be described, and the methods proposed for the stabilisation of the affected areas should be given. Information should be provided regarding decommissioning and rehabilitation of the plant site, removal of the processing plant, rehabilitation of concrete footings and foundations, hardstand areas, storage tanks and wharfage, as well as any potential for reuse of these facilities. Options and methods for the disposal of wastes from the demolition of plant and buildings should be discussed in sufficient detail to establish their feasibility and suitability.

The diversion of creeks and drainage lines should be minimised. Any proposals to divert creeks and drainage lines during operations, and their reinstatement after operations have ceased, should be described. Where dams are to be constructed, proposals for the management of these structures after the completion of the project should be included. Also, the final drainage and seepage control systems and long-term monitoring plans should be described.

Topsoil management should be included and consider transport, storage and replacement of topsoil to disturbed areas. The minimisation of topsoil storage times (to reduce fertility degradation) should also be addressed.

Impacts of the preferred rehabilitation strategy should be discussed in detail in the appropriate subsections of Section 4 (Environmental values and management of impacts), including issues such as final landform stability (section 4.2.2), rehabilitation of flora (section 4.8.2) and the long-term quality of water in any final voids (section 4.4.2). Implications for the long-term use and fate of the site should also be addressed, particularly the on-site disposal of waste and the site's inclusion on the Environmental Management Register or Contaminated Land Register.

4 Environmental values and management of impacts

This section should:

- describe the existing environmental values of the area that may be affected by the proposal. Environmental values are defined in section 9 of the *Environmental Protection Act 1994*, environmental protection policies and other documents such as the ANZECC 2000 guidelines and South East Queensland Regional Water Quality Management Strategy. Environmental values may also be derived following recognised procedures, such as described in the ANZECC 2000 guidelines. Environmental values should be described by reference to background information and studies, which should be included as appendices to the EIS
- describe the potential adverse and beneficial impacts of the proposal on the identified environmental values. Any likely environmental harm on the environmental values should be described
- describe cumulative impacts on environmental values caused by the proposal, both in isolation and in with other known existing or planned development or sources of contamination
- propose environmental protection objectives and commitments. All environmental protection commitments must be measurable and auditable
- examine viable alternative strategies for managing impacts. These alternatives should be presented and compared in view of the stated objectives and standards to be achieved. Available techniques, including best practice, to control and manage impacts to the nominated objectives should be discussed. This section should detail the environmental protection measures to be used in the planning, construction, operations, rehabilitation and decommissioning stages of the project, and any associated works. Measures should prevent, or where prevention is not possible, minimise environmental harm and maximise socio-economic and environmental benefits of the proposal. Preferred measures should be identified and described in more detail than other alternatives
- describe any computational model used to predict impacts and/or outcomes of mitigation measures. The description should address the inputs, assumptions, limitations, sensitivities, accuracy and precision of the model.

Any maps or figures showing the position of features or boundaries should use the GDA94 datum. The GDA94 datum should also be used in the text to describe the locations of any features (such as discharge points) or boundaries that may be relevant to subsequent approvals.

Environmental protection objectives may be derived from legislative and planning requirements that apply to the proposal including Commonwealth strategies, state planning policies, local authority strategic plans, environmental protection policies under the *Environmental Protection Act 1994*, and any catchment management plans prepared by local water boards or land care groups. Special attention should be given to mitigation strategies designed to protect the values of any sensitive areas and any identified ecosystems of high conservation value within the area of possible impact.

This section should address in a comprehensive and clear way all elements of the environment such as land, water, coast, air, waste, noise, nature conservation, cultural heritage, social and community, health and safety, economy, hazards and risk.

To achieve this, the following issues should be considered for each environmental value relevant to the project:

- environmental values affected: describe the existing environmental values of the area to be affected including values and areas that may be affected by any cumulative impacts (refer to any background studies in appendices – note such studies may be required over several seasons). It should be explained how the environmental values were derived (e.g. by citing published documents or by following a recognised procedure to derive the values)
- impact on environmental values: describe quantitatively the likely impact of the proposal on the identified environmental values of the area. The cumulative impacts of the proposal must be considered over time or in combination with other (all) impacts in the dimensions of scale, intensity, duration or frequency of the impacts. In particular, any requirements and recommendations of the Great Barrier Reef Marine Park Authority, relevant state planning policies, environmental protection policies, national environmental protection measures and integrated catchment management plans should be addressed
- Cumulative impacts on the environmental values of land, air and water, and cumulative impacts on public health and the health of terrestrial, aquatic and marine ecosystems, must be discussed in the relevant

sections. This assessment may include air and water sheds affected by the proposal and consider existing as well as other proposals competing for use of the local air and water sheds

- where impacts from the proposal will not be felt in isolation to other sources of impact, it is recommended that the proponent develop consultative arrangements with other industries in the proposal's area to undertake cooperative monitoring and/or management of environmental parameters. Such arrangements should be described in the EIS
- environmental protection objectives: describe qualitatively and quantitatively the proposed objectives for enhancing or protecting each environmental value. Include proposed indicators to be monitored that will demonstrate the extent that the objective is achieved as well as the numerical standard that defines the achievement of the objective (this standard must be auditable). The measurable indicators and standards can be determined from legislation, support policies and government policies as well as the expected performance of control strategies. Objectives for progressive and final rehabilitation and management of contaminated land should be included
- control strategies to achieve the objectives: describe the control principles, proposed actions and technologies to be implemented that are likely to achieve the environmental protection objectives. Include designs and relevant performance specifications of plant. Details are required to show that the expected performance is achievable and realistic
- environmental offsets: information is required to show that measures have been taken to avoid and minimise potential adverse impacts of the proposal. Environmental offsets may be proposed to counterbalance any remaining loss of environmental values, consistent with the specific-issue offset policies under the framework of the *Queensland Government Environmental Offset Policy 2008*
- monitoring programs: describe the monitoring parameters, monitoring points, frequency, data interpretation and reporting proposals
- auditing programs: describe how progress towards achievement of the objectives will be measured and reported, and whether external auditors will be employed. Include scope, methods and frequency of auditing proposed
- management strategies: describe the strategies to be used to ensure the environmental protection objectives are achieved and control strategies implemented. This could include a continuous improvement framework, details of corrective action options, reporting (including any public reporting), monitoring, staff training, management responsibility pathway, and any environmental management systems and how they are relevant to each element of the environment
- information quality: information given under each element should also state the sources, how recent the information is, how any background studies were undertaken (e.g. intensity of field work sampling), how the reliability of the information was tested, and what uncertainties (if any) are in the information.

It is recommended that the final TOR and the EIS follow the heading structure shown in the remainder of this section. The mitigation measures, monitoring programs, etc, identified in this section of the EIS should be used to develop the environmental monitoring program for the project (see section 5).

4.1 Climate

This section describes the rainfall patterns (including magnitude and seasonal variability of rainfall), air temperatures, humidity, wind (direction and speed) and any other special factors (e.g. temperature inversions) that may affect management of the proposal, including air quality within the region of the proposal. Extremes of climate (droughts, floods, cyclones, etc) should also be discussed with particular reference to water management at the proposal site. The vulnerability of the area to natural or induced hazards, such as floods and bushfires, should also be addressed. The relative frequency and magnitude of these events should be considered together with the risk they pose to management of the project.

The potential impacts due to climatic factors should be addressed in the relevant sections of the EIS. The impacts of rainfall on soil erosion should be addressed in section 4.2. The impacts of storm events on the capacity of waste containment systems (e.g. site bunding/stormwater management and tailings dams) should be addressed in section 4.4 for contamination of waterways, and in section 4.3 for the design of the waste containment systems. The impacts of winds, rain, humidity and temperature inversions on air quality should be addressed in section 4.6.

4.2 Land

4.2.1 Description of environmental values

This section describes the existing environment values of the land area that may be affected by the proposal. It should also define and describe the objectives and practical measures for protecting or enhancing land-based environmental values; describe how nominated quantitative standards and indicators may be achieved; and how the achievement of the objectives will be monitored, audited and managed.

4.2.1.1 Topography/geomorphology

The topography of the proposal site and any other potentially impacted area should be detailed with contours at suitable increments, shown with Australian Height Datum (AHD) and drafted to the GDA 94 datum. Significant features of the locality should be included on the maps. Such features include any locations subsequently referred to in the EIS (e.g. the nearest noise sensitive locations) that are not included on other maps in section 4.2. Commentary on the maps should be provided to highlight the significant topographical features.

4.2.1.2 Geology

The EIS should provide a description, map and series of cross-sections of the geology of the proposal area, referencing the physical and chemical properties of surface and sub-surface materials and geological structures within the proposed areas of disturbance. Geological properties that may influence ground stability (including seismic activity, if relevant), occupational health and safety, rehabilitation programs, or the quality of wastewater leaving any area disturbed by the proposal should be described. In locations where the age and type of geology is such that significant fossil specimens (such as of dinosaurs or their tracks) may be uncovered during construction or operations, the EIS should address the potential for significant finds.

4.2.1.3 Mineral resources and ore reserves

The EIS should provide a summary of the results of studies and surveys undertaken to identify and delineate the mineral resources and ore reserves within the project area (including any areas underlying related infrastructure).

The location, tonnage and quality of the mineral resources and ore reserves within the project area should be described. The mineral resources and ore reserves should be estimated and reported in accordance with the *Australasian code for reporting of mineral resources and ore reserves* (the JORC Code – available at www.jorc.org/main.php).

In addition, appropriately scaled maps should be provided showing the general location of the project area. In particular:

- the location and areal extent of the mineral resources to be developed or mined
- the location and boundaries of mining tenures, granted or proposed, that the project area is, or will be subject
- the location of the proposed mine excavation(s)
- the location and boundaries of any project sites
- the location and boundaries of any other features that will result from the proposed mining including waste/spoil dumps, water storage facilities and other infrastructure
- the location of any proposed buffers surrounding the working areas
- any part of the resource not intended to be mined and any part of the resource that may be sterilised by the proposed mining operations or infrastructure.

4.2.1.4 Soils

Soil profiles should be mapped at a suitable scale and described according to the *Australian soil and land survey field handbook* (McDonald et al, 1990) and *Australian soil classification* (Isbell, 1996).

Information should be presented according to the standards required in the *Planning guidelines: the identification of Good Quality Agricultural Land* (DPI, DHLGP, 1993), and *State Planning Policy 1/92: Development and the conservation of agricultural land*.

Information should also be provided on soil stability and suitability for construction of proposal facilities.

4.2.1.5 Land use

This section describes current land tenures and land uses in the proposal area, including native title issues and with particular mention of land with special purposes. The location and owners or custodians of native title in the area and details of native title claims should be included.

Suitably scaled maps showing the proposal location and existing land uses and tenures should be provided for the entire proposal area as well as surrounding land potentially affected by the development. The maps should identify areas of conservation value in any locality that may be impacted by the proposal. The location of existing dwellings, and zoning of all affected lands according to any existing town or strategic plan, should be included.

The land use suitabilities of the affected area should be described in terms of the physical and economic attributes. The assessment should set out soil and landform subclasses assigned to soil mapping units in order to derive land suitability classes. The limitations and land suitability classification system to be used is in Attachment 2 of *Land Suitability Assessment Techniques* in the *Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland 1995*.

Provide a land suitability map of the proposed and adjacent area, and set out land suitability and current land uses, e.g. for grazing of native and improved pastures and horticulture. Land classified as 'good quality agricultural land' in the Department of Natural Resources and Water's land classification system is to be shown in accordance with the planning guideline, *The Identification of Good Quality Agricultural Land*, which supports State Planning Policy 1/92.

4.2.1.6 Infrastructure

The location and owners or custodians of all tenures, reserves, roads and road reserves, railways and rail reserves, stock routes and the like, covering the affected land should be shown on suitably scaled maps. Locations of gas and water pipelines, power lines and any other easements should be indicated and the environmental values affected by this infrastructure described.

4.2.1.7 Sensitive environmental areas

The proximity of the proposal to any environmentally sensitive areas should be shown on a suitably scaled map. This section identifies whether any of those environmentally sensitive areas could be affected by the proposal, directly and indirectly.

It should indicate if the land affected by the proposal is, or is likely, to become part of the protected area estate, or is subject to any treaty. Consideration should be given to national parks, conservation parks, declared fish habitat areas, wilderness areas, aquatic reserves, heritage or historic areas or items, national estates, world heritage listings and sites covered by international treaties or agreements (e.g. Ramsar, JAMBA, CAMBA), areas of cultural significance and scientific reserves (see section 4.8 for further guidance on sensitive areas).

To obtain copies of plans of declared fish habitat areas contact the Queensland Department of Primary Industries and Fisheries or visit their website.

In addition, the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* should be addressed and a determination made on whether there are national environmentally significant matters relevant to this section that should be described.

4.2.1.8 Landscape character

This section describes in general terms the existing character of the landscape that will be affected by the proposal. It should comment on any changes that have already been made to the natural landscape since European settlement. It 'sets the scene' for describing particular scenic values in the following section on visual amenity. This section describes the general impression of the landscape that would be obtained while travelling through and around it, whereas the visual amenity section addresses particular panoramas and views (e.g. from constructed lookouts, designated scenic routes, etc.) that have amenity value.

4.2.1.9 Visual amenity

This section describes existing landscape features, panoramas and views that have, or could be expected to have, value to the community whether of local, regional, state-wide, national or international significance. Information such as maps, sections, elevations and photographs are to be used, particularly where addressing the following issues:

- major views, view sheds, existing viewing outlooks, ridgelines and other features contributing to the amenity of the area, including assessment from private residences
- focal points, landmarks (built form or topography), gateways associated with project site and immediate surrounding areas, waterways, and other features contributing to the visual quality of the area and the project site
- character of the local and surrounding areas including built form (scale, form, materials and colours) and vegetation (natural and cultural vegetation), directional signage and land use
- identification of the areas of the proposal that have the capacity to absorb land use changes without detriment to the existing visual quality and landscape character; and the value of existing vegetation as a visual screen.

4.2.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for protecting or enhancing the land-based environmental values identified through the studies outlined in the previous section. It should describe how nominated quantitative standards and indicators may be achieved, and how the achievement of the objectives will be monitored, audited and managed.

4.2.2.1 Resource Utilisation

With regard to resource stewardship, the EIS analyses the effectiveness of the mining proposal in achieving optimum utilisation of the mineral resources within the project area, and consider its impacts on other resources. It should demonstrate that the mining proposal will 'best develop' the mineral resources within the project area. That it will minimise resource wastage and avoid any unnecessary sterilisation of these or any other of the State's coal, mineral and petroleum (including gas and coal seam methane) resources potentially impacted upon or sterilised by the mining activities or related infrastructure.

The EIS provides detail on how the company plans to manage low grade and/or current uneconomic material to ensure that non-sterilisation of this significant potential future resource is considered. It should detail the basis for any non-stockpiling or sterilisation of current un-economic material. This section should also provide details and maps of expected residual or remnant resources within the project area including any low lying grade stockpiles, tailings, and current un-economic material.

4.2.2.2 Land use suitability

This section details the potential for the construction and operation of the proposal to change existing and potential land uses of the proposal site and adjacent areas. Post operations land use options should be detailed and include suitability of the area to be used for agriculture, industry or nature conservation. The factors favouring or limiting the establishment of those options should be given in the context of land use suitability prior to the proposal and minimising potential liabilities for long-term management.

The potential environmental harm caused by the proposal to the adjacent areas currently used for agriculture, urban development, recreation, tourism and other business as well as the implications of the proposal for future developments in the impact area, including constraints on surrounding land uses, should be described. If the development adjoins or potentially impacts on good quality agricultural land, then an assessment of the potential for land use conflict is required. Investigations should follow the procedures set out in the planning guideline, *The Identification of Good Quality Agricultural Land*, which supports *State Planning Policy 1/92*.

Outline incompatible land uses, whether existing or potential, adjacent to all aspects of the project, including essential and proposed ancillary developments or activities. Areas directly or indirectly affected by the construction and operation of these activities should be identified and measures to avoid unacceptable impacts defined.

4.2.2.3 Land disturbance

A strategy should be developed to minimise the amount of land disturbed at any one time. The strategic approach to progressive rehabilitation of landforms and final decommissioning should be described, particularly the impacts in the short, medium and long timeframes. The methods to be used for the proposal, including backfilling, covering, re-contouring, topsoil handling and revegetation, should be described. However, a description of erosion and sediment control could be deferred to section 4.2.2.5. Any proposals to disturb land that would impede or divert overland flow, watercourses, and any subsequent reinstatement, during construction or operations should be first described in this section. However, the potential impacts of interfering with flow on

the quantity and quality of water resources should be assessed in section 4.4. The final drainage and seepage control systems and any long-term monitoring plans should also be described.

In addition to assessing the operational phase of land disturbance, the EIS addresses the ultimate changes following implementation of the decommissioning and rehabilitation plan described in section 3.7. The EIS should detail the proposed long-term changes that will occur to the land after mining ceases, compared to the situation before mining commences. Those changes should be illustrated on suitably scaled maps and with contours at intervals sufficient to assess the likely drainage pattern for ground and surface waters (though the assessment of the impacts on drainage and water quality should be provided in the water resources section of the EIS). The mitigation measures for land disturbance to be used on decommissioning the site should be sufficiently detailed to enable assessment of their feasibility. In particular, the EIS should address the long-term stability of final voids and spoil dumps, safety of access to the site after surrender of the lease, and the residual risks that will be transferred to the subsequent landholder.

Rehabilitation success criteria for land disturbance should be proposed in this section, whereas rehabilitation success criteria for revegetation should be proposed in the section on nature conservation.

If geological conditions are conducive, the proponent should consider the possibility that significant fossil specimens (such as of dinosaurs or their tracks) may be uncovered during construction or operations. Strategies should be proposed for protecting the specimens and alerting the Queensland Museum to the find.

4.2.2.4 Land contamination

The EIS should describe the possible contamination of land from aspects of the proposals including waste, reject product, acid generation from exposed sulfidic material, and spills at chemical and fuel storage areas.

The means of preventing land contamination should be addressed. Methods proposed for preventing, recording, containing and remediating any contaminated land should be outlined. Intentions should be stated concerning the classification (in terms of the Queensland Contaminated Land Register) of land contamination on the land, processing plant site and product storage areas after proposal completion. A Preliminary Site Investigation (PSI) of the site, consistent with the DERM's *Draft guidelines for the assessment and management of contaminated land in Queensland*, should be undertaken to determine background contamination levels. The results of the PSI should be summarised in the EIS and provided in detail in an appendix.

If the results of the preliminary site investigation indicate potential or actual contamination, a detailed site investigation progressively managed in accordance with the stages outlined in Appendix 5 of the *Draft guidelines for the assessment and management of contaminated land in Queensland* should be undertaken.

In short, the following information may be required in the EIS:

- mapping of any areas listed on the Environmental Management Register or Contaminated Land Register under the *Environmental Protection Act 1994*
- identification of any potentially contaminated sites not on the registers, which may need remediation
- a description of the nature and extent of contamination at each site as well as a remediation plan and validation sampling.

The EIS should address management of any existing or potentially contaminated land in addition to preventing and managing land contamination resulting from project activities. The Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland can be downloaded from the DERM website at: http://www.derm.qld.gov.au/ecoaccess/contaminated_land/guidelines_and_information_sheets.html. Proponents should refer study proposals to DERM for review prior to commencement.

4.2.2.5 Erosion and stability

For all permanent and temporary landforms, possible erosion rates and management techniques should be described. For each waste rock and soil type identified, erosion potential (wind and water) and erosion management techniques should be outlined. An erosion-monitoring program, including rehabilitation measures for erosion problems identified during monitoring, should also be outlined. Mitigation strategies should be developed to achieve acceptable soil loss rates, levels of sediment in rainfall runoff, and wind-generated dust concentrations.

The report should include an assessment of likely erosion and stability effects for all disturbed areas, such as:

- areas cleared of vegetation

- waste dumps
- stockpiles
- dams, banks and creek crossings
- the plant site including buildings
- access roads or other transport corridors.

Methods proposed to prevent or control erosion should be specified and should be developed with regard to:

- (a) the long-term stability of waste dumps and voids
- (b) preventing soil loss in order to maintain land capability or suitability
- (c) preventing significant degradation of local waterways by suspended solids.

The mitigation measures should address the selective handling of waste rock and capping material to maximise long-term stability of final landforms in regard to slumping and erosion both on and below the surface. Erosion control measures should be developed into an erosion and sediment control plan for inclusion in the EM plan.

4.2.2.6 Landscape character

Describe the potential impacts of the project on landscape character of the site and the surrounding area. Particular mention should be made of any changes to the broad-scale topography and vegetation character of the area (e.g. due to spoil dumps), excavated voids and broad-scale clearing.

Details of measures to be undertaken to mitigate or avoid the identified impacts should be provided.

4.2.2.7 Visual amenity

This section should analyse and discuss the visual impact of the proposal on particular panoramas and outlooks. It should be written in terms of the extent and significance of the changed day and night skyline as viewed from places of residence, work and recreation, from road, cycle and walkways, from the air and other known vantage points, during all stages of the project as it relates to the surrounding landscape. The assessment must address the visual impacts of the project structures and associated infrastructure using appropriate simulation. Sketches, diagrams, computer imaging and photos are to be used, where possible, to portray the near views and far views of the completed structures and their surroundings from visually sensitive locations. Special consideration is to be given to public roads, public thoroughfares, and places of residence or work, which are within the line-of-sight of the project.

Detail should be provided of all management options to be implemented and how these will mitigate or avoid the identified impacts.

4.2.2.8 Lighting

Management of lighting of the project during all stages is to be provided, referencing objectives to be achieved and management methods to be implemented to mitigate or avoid:

- the visual impact at night
- night operations/maintenance and effects of lighting on fauna and residents
- the potential impact of increased vehicular traffic
- changed habitat conditions for nocturnal fauna and associated impacts.

4.2.2.9 Transport

The EIS provides sufficient information to make an independent assessment of how the State-controlled and local government road networks will be affected. Sufficient information should also be provided to enable an independent assessment of how the rail network (including infrastructure) will be affected. In both cases, the impacts along the whole route should be discussed along with how any impacts will be managed.

Details should be provided of the impacts on environmental values for any new roads or road realignments. The EIS should include detailed analysis of probable impact of identified construction and operational traffic generated by the project, in particular to impacts on road infrastructure, road users and road safety.

The EIS needs to identify impacts on the State-controlled and local government road networks, and to indicate clearly the corrective measures necessary to address adverse road impacts and the costs involved. This will require the proponent to compare the traffic situation and road conditions with and without the project.

Information about the impacts and proposed measures for dealing with those impacts should be prepared by the proponent in close consultation with the local District Office of the Department of Main Roads. Reference should be made to the Main Road's *Guidelines for Assessment of Road Impacts of Development*, available on the Main Roads website: www.mainroads.qld.gov.au.

The EIS should provide details of the impact on any current or proposed rail infrastructure.

Information on product spill contingency plans and the adequacy of equipment and facilities to deal with possible spills for the transport nodes of the proposal should be provided. This should indicate whether there is a need to update the plans based on increase in frequency of traffic and volumes to be transported.

The EIS should also address the potential impacts on privately owned or port authority operated ports, and State-controlled, Commonwealth-controlled or privately owned airports.

Additional water transport issues that should be considered include the potential for the proposal to impact on recreational crafts in rivers and dams.

4.3 Waste

This section should complement other sections of part 4 of the EIS by providing technical details of waste treatment and minimisation, with proposed emission, discharge and disposal criteria, whereas other sections describe how those emissions, discharges and disposals would impact on the relevant environmental values. The purpose of this format is to concentrate the technical information on waste management into one section in order to facilitate its transfer into the EM plan.

4.3.1 Description of environmental values

This section introduces and briefly describes the existing environment values that may be affected by the project's wastes. Refer to each of the waste streams described in section 3.6, referencing more detailed descriptions of the relevant environmental values in other sections of part 4 of the EIS.

4.3.2 Potential impacts and mitigation measures

This section brings together a description of the preferred methods (and any alternatives) used to deal with waste streams and outlines their impacts. The full description of the magnitude and nature of impacts on particular environmental values due to the management of waste should be provided in the relevant sections of part 4 of the EIS.

This section defines and describes the objectives and practical measures for protecting or enhancing environmental values from impacts by wastes. It also describes how nominated quantitative standards and indicators may be achieved for waste management, and how the achievement of the objectives will be monitored, audited and managed.

As part of the description, and unless issues related to excavated waste have been addressed in section 4.2 (in which case reference should be made to the appropriate subsection), this section should provide details of each waste in terms of:

- operational handling and fate of all wastes including storage
- on-site treatment methods proposed for the wastes
- methods of disposal (including the need to transport wastes off-site for disposal) proposed for any trade wastes, liquid wastes and solid wastes
- hazards associated with the handling and storage of wastes
- the potential level of impact on environmental values
- proposed discharge/disposal criteria for liquid and solid wastes
- measures to ensure stability of the dumps and impoundments
- methods to prevent seepage and contamination of groundwater from stockpiles and/or dumps

- design criteria to be used to ensure that waste containment and/or storage facilities perform satisfactorily
- market demand for recyclable waste (where appropriate)
- waste minimisation techniques processes proposed
- decommissioning of the site.

Having regard to the Environmental Protection (Waste Management) Policy 2000 (EPP (Waste)), the EIS indicates the results of investigation into the feasibility of using waste minimisation and cleaner technology options during all phases of the proposal. DERM has also released draft guidelines covering aspects of waste management under the EPP (Waste), which should be addressed.

Waste minimisation and treatment as well as the application of cleaner production techniques should be applied to gaseous wastes, particularly methane, nitrogen oxides, sulfur oxides, particulates and carbon dioxide. Particular attention should be given to measures that will maximise energy efficiency and minimise internal energy consumption in the proposal.

4.4 Water resources

4.4.1 Description of environmental values

This section describes the existing environment for water resources that may be affected by the proposal in the context of environmental values. Environmental values are defined or considered in documents such as the *Environmental Protection Act 1994*, Environmental Protection (Water) Policy 1997 (EPP (Water)), ANZECC 2000, the National Water Quality Management Strategy (NWQMS), the EPA Guideline: *Establishing draft environmental values and water quality objectives* and the *Queensland Water Quality Guidelines 2006*. The definition of waters in the EPP (Water) includes the bed and banks of waters, so this section should address benthic sediments as well as the water column.

4.4.1.1 Surface waterways

Surface watercourses and their quality and quantity in the area affected by the proposal should be described, with an outline of the significance of these waters to the river catchment system in which they occur (NB impacts on coastal water quality should be discussed in section 4.5 (Coastal environment)). Details should describe existing surface drainage patterns and flows in major streams and wetlands. Details of the likelihood of flooding, history of flooding (including extent, levels and frequency), and a description of present and potential water uses downstream of the areas affected by the proposal should be provided. Flood studies should include a range of annual exceedance probabilities for affected waterways. These should be based on observed data, if available, or use appropriate modelling techniques and conservative assumptions if there are no suitable observations. The flood modelling assessment should include local flooding due to short duration events from contributing catchments on site as well as larger scale regional flooding, including waterways downstream.

The EIS should describe, with photographic evidence, the geomorphic condition of any watercourses likely to be affected by disturbance or stream diversion. The description's results form the basis for the planning and subsequent monitoring of rehabilitation of the watercourses during or after the operation of the proposal.

An assessment is required of existing water quality in surface waters and wetlands likely to be affected by the proposal. The basis for this assessment should be a monitoring program, with sampling stations located upstream and downstream of the proposal. Complementary stream-flow data should also be obtained from historical records, if available, to aid in interpretation.

The water quality should be described and include seasonal variations or variations with flow where applicable. A relevant range of physical, chemical and biological parameters should be measured. The results should be compared to locally relevant central Queensland water quality objectives to gauge the environmental harm on any affected creek or wetland system.

Environmental values of surface waterways of the affected area should be described in terms of:

- values identified in the Environmental Protection (Water) Policy 1997
- sustainability, including quality and quantity
- physical integrity, fluvial processes and morphology of watercourses, including riparian zone vegetation and form

- any water resource plans, and land and water management plans relevant to the affected catchment.

The EIS should identify any current downstream users that may be impacted by the project. This includes any licence holders as well as those using surface water for stock and domestic purposes.

4.4.1.2 Groundwater

The EIS should review the quality, quantity and significance of groundwater in the proposal area, together with groundwater use in neighbouring areas.

The review should include a survey of existing groundwater supply facilities (bores, wells, or excavations) to the extent of any environmental harm. The information gathered for analysis includes:

- location
- pumping parameters
- draw down and recharge at normal pumping rates
- seasonal variations (if records exist) of groundwater levels.

A network of observation points that would satisfactorily monitor groundwater resources, both before and after commencement of operations, should be developed and described in the EIS.

This section of the EIS should address the nature and hydrology of the aquifers and provide a description of the:

- geology/stratigraphy – such as alluvium, volcanic, metamorphic
- aquifer type – such as confined, unconfined
- depth to and thickness of the aquifers
- a map of the current groundwater aquifers
- the significance of the resource at a local and regional scale
- depth to water level and seasonal changes in levels
- groundwater flow directions (defined from water level contours)
- interaction with surface water
- interaction with sea/salt water
- possible sources of recharge
- vulnerability to pollution.

The data obtained from the groundwater survey should be sufficient to enable specification of the major ionic species, pH, electrical conductivity, total dissolved solids and any potentially toxic or harmful substances.

Environmental values of the underground waters of the affected area should be described in terms of:

- values identified in the Environmental Protection (Water) Policy
- sustainability, including both quality and quantity
- physical integrity, fluvial processes and morphology of groundwater resources.

4.4.2 Potential impacts and mitigation measures

This section assesses potential impacts on water resource environmental values identified in the previous section. It also defines and describes the objectives and practical measures for protecting or enhancing water resource environmental values; describes how nominated quantitative standards and indicators may be achieved; and how the achievement of objectives will be monitored, audited and managed.

The EIS describes the possible environmental harm caused by the proposal to environmental values for water as expressed in the Environmental Protection (Water) Policy. DERM Operational Policy, *Waste water discharge to Queensland waters*, may be consulted for guidance on how discharge proposals will be assessed.

Where a licence or permit will be required under the *Water Act 2000* to take or interfere with the flow of water, this section should provide sufficient information to decide on the application. Similarly, waterway barrier works may need approval under the *Fisheries Act 1994*, and if so should be addressed.

Water management controls should be described, addressing surface and groundwater quality, quantity, drainage patterns and sediment movements. The beneficial (environmental, production and recreational) use of nearby surface and groundwater should be discussed, along with the proposal for the diversion of affected creeks during mining, and the stabilisation of those works. Monitoring programs that will assess the effectiveness of management strategies for protecting water quality during the construction, operation and decommissioning of the proposal should be described.

Key water management strategy objectives include:

- protection of important local aquifers and protection of their waters
- maintenance of sufficient quantity and quality of surface waters to protect existing beneficial downstream uses of those waters (including maintenance of in-stream biota and the littoral zone)
- minimisation of impacts on flooding levels and frequencies both upstream and downstream of the project.

Conduct a risk assessment for uncontrolled emissions to water due to system or catastrophic failure; implications of such emissions for human health and natural ecosystems; and list strategies to prevent, minimise and contain impacts.

4.4.2.1 Surface water and water courses

The potential environmental harm to the flow and the quality of surface waters from all phases of the proposal should be discussed. This should reference their suitability for the current and potential downstream uses and include the requirements of any affected riparian area, wetland, estuary, littoral zone, and any marine and in-stream biological uses. The impacts of surface water flow on existing infrastructure should be considered, referencing the Environmental Protection (Water) Policy 2009 and the *Water Act 2000*.

The hydrological impacts of the proposal should be assessed, particularly with regard to: stream diversions (whether temporary or permanent); scouring and erosion; the consequent impacts of subsidence; and changes to flooding levels and frequencies both upstream and downstream of the project. When flooding levels will be effected, modelling of afflux should be provided and illustrated with maps.

If discharge of waste water to surface waters is proposed, information that shows how the proposed discharge will meet the requirements of the policy, *Waste water discharge to Queensland waters* (EPA, 2007), should be provided.

Quality characteristics discussed should be those appropriate to the downstream and upstream water uses that may be affected. Chemical and physical properties of any waste water (including concentrations of constituents) at the point of entering natural surface waters should be discussed, along with toxicity of effluent constituents to flora and fauna. Consideration should be given to impacts on seawater quality due to discharge from the site.

Reference should be made to the properties of the land disturbed and processing plant wastes; the technology for settling suspended clays from contaminated water; and the techniques employed to ensure that contaminated water is contained and successfully treated on the site.

In relation to water supply and usage, and wastewater disposal, the EIS discusses anticipated flows of water to and from the proposal area. Where dams, weirs or ponds are proposed, the EIS investigates the effects of predictable climatic extremes (storm events, floods and droughts) on: the capacity of the dams to retain contaminants; the structural integrity of the containing walls; and the quality of water contained, and flows and quality of water discharged. The design of all water storage facilities should follow the current technical guidelines on site water management.

The need or otherwise for licensing of any dams (including referable dams) or creek diversions under the *Water Act 2000*, or the construction or raising of any waterway barrier works under the *Fisheries Act 1994*, should be discussed. Water allocation and water sources should be established in consultation with DERM.

This section assesses the impacts on water resources of any dams and roads and other infrastructure related to the project, and proposes management measures for identified impacts. All impacts on surface water resources and changes to flow immediately downstream of the project should be assessed by describing:

- local overland flow catchment characteristics and estimated change to the annual runoff

- changes to flows in watercourses immediately downstream of the site.

Having regard for the requirements of the Environmental Protection (Water) Policy, the EIS presents the methods to avoid stormwater contamination by raw materials, wastes or products and presents the means of containing, recycling, reusing, treating and disposing of stormwater. Where no-release water systems are to be used, the fate of salts and particulates derived from intake water should be discussed.

The Australian and New Zealand Environment and Conservation Council (ANZECC, 2000) *National Water Quality Management Strategy*, *Australian Water Quality Guidelines for Fresh and Marine Waters* and the Environmental Protection (Water) Policy 2009 should be referenced for evaluating the effects of various levels of contamination.

Options for mitigation and the effectiveness of mitigation measures should be discussed, with reference to sediment, acidity, salinity and other emissions of a hazardous or toxic nature to human health, flora or fauna. The EIS must include sufficient information on any watercourse diversion to demonstrate that any diversion can be constructed to meet engineering requirements and relevant regulatory guidelines. Such information will consider the following:

- requirement for diversion
- feasibility of the diversion to be designed, constructed and monitored in accordance with ACARP reports and DERM guidelines relating to watercourse diversions
- end of mine life strategies for the diversion.

Where it is proposed that creeks will be diverted, detail how rehabilitation will affect both the physical and ecological condition of the creek's bed and banks, and the quality of water in it. Furthermore, describe the monitoring that will be undertaken after decommissioning, and who will have responsibility for management measures and corrective action, to ensure that rehabilitated creeks do not degrade.

4.4.2.2 Groundwater

The EIS should include an assessment of the potential environmental harm caused by the proposal to local groundwater resources. This includes the identification and assessment of likely impacts to groundwater during and after mining.

The impact assessment should define the extent of the area within which groundwater resources are likely to be affected by the proposed operations as well as the significance of the proposal to groundwater depletion or recharge. It should also propose management options available to monitor and mitigate these effects. The response of the groundwater resource to the progression and, finally, cessation of the proposal should be described.

An assessment of the impact of the proposal on the local ground water regime caused by the altered porosity and permeability of any land disturbance should be undertaken.

An assessment of the potential to contaminate groundwater resources as well as measures to prevent, mitigate and remediate such contamination should be discussed.

4.5 Air

4.5.1 Description of environmental values

This section describes the existing air environment that may be affected by the proposal. The following topics may be addressed (NB the topics are not an exhaustive treatment of all possible air or impacts).

A description of the existing air shed environment, having regard for particulates and gaseous and odorous compounds, should be provided. The EIS should discuss the background levels and sources of suspended particulates, and any other relevant constituent (whether major or minor) of the air environment that may be affected by the proposal. Sufficient data on local meteorology and ambient levels of pollutants should be gathered to provide a baseline for later studies, or for the modelling of air quality environmental impacts within the air shed. Parameters should include air temperature, wind speed and direction, atmospheric stability, mixing depth and other parameters necessary for input to air dispersion models.

4.5.1.1 Greenhouse gas emissions

This section of the EIS should:

- provide an inventory of projected annual emissions for each relevant greenhouse gas, with total emissions expressed in 'CO2 equivalent' terms
- estimate emissions from upstream activities associated with the proposed project, including fossil fuel based electricity consumed
- briefly describe method(s) by which estimates were made.

The Australian Department of Climate Change's *National Greenhouse Accounts (NGA) Factors* (available via the internet) can be used as a reference source for emission estimates and supplemented by other sources, where practicable and appropriate.

4.5.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for protecting or enhancing environmental values for air; describes how nominated quantitative standards and indicators may be achieved; and how the achievement of the objectives will be monitored, audited and managed.

The objectives for air emissions should be stated in respect of relevant standards (ground level concentrations), relevant emission guidelines and any relevant legislation. Any significant emissions should be modelled using a recognised atmospheric dispersion model. The potential for interaction between the emissions from the processing plant and emissions in the air shed, and the likely environmental harm from any such interaction, should also be detailed.

Where appropriate, the predicted ground level concentrations in nearby areas should be provided. These predictions should be made for both normal and expected maximum emission conditions and the worst case meteorological conditions should be identified and modelled, where necessary. Ground level predictions should be made at any residential, industrial and agricultural developments believed to be sensitive to the effects of predicted emissions. The techniques used to obtain the predictions should be referenced, and key assumptions and data sets explained.

The assessment of the proposal's impact on air quality should include at least the following matters:

- A description of the pollution control equipment and techniques to be employed on the premises, and the features of the proposal designed to suppress or minimise emissions including dusts and odours
- A description of the back up measures to be incorporated, that will act in the event of failure of primary measures, to minimise the likelihood of plant upsets and adverse air impacts
- An air emission inventory of the proposed site for all potential point, line, area and volume sources including fugitive emissions. A complete list of emissions to the atmosphere including particulates (including dust), PM10, PM2.5, trace metals, odours and any toxic, persistent and/or hazardous substances
- Where possible, estimates of emission rates should be based on actual measurements from samples taken from similar facilities. These will preferably be full-scale facilities operating elsewhere, or otherwise from experimental or demonstration-scale facilities. Where this is not possible, use published emission factors and/or data supplied by manufacturers of process and control equipment
- The proposed level of emissions as compared with the best practice national and international source emission standards
- For other than insignificant emissions, an impact assessment with relevant inputs of emissions and local meteorology using an air dispersion model to provide estimates of the likely impacts on the surrounding environment. The model inputs should be as detailed as possible, reflecting any variation of emissions with time and including at least a full year of representative hourly meteorological data. Results of the dispersion modelling must be presented as concentration contour plots and frequency contour plots. The predicted average ground level concentration should be made for both normal and expected maximum emission conditions and the worst case meteorological conditions should be identified and modelled where necessary. Ground level predictions should be made at any residential, industrial and agricultural developments believed to be sensitive to the effects of predicted emissions. The techniques used to obtain the predictions should be referenced, and key assumptions and data sets explained

- An evaluation of the cumulative impacts of the proposed emissions on the receiving environment by considering the project in conjunction with existing and known likely future emission sources within the region. A description of air shed management and the contribution of the proposal to air shed capacity in view of existing and future users of the air shed for assimilation and dispersion of emissions
- Identification of 'worst case' emissions that may occur at start-up, shut-down or during 'upset' operating conditions. If these emissions are significantly higher than those for normal operations, it will be necessary to evaluate the worst-case impact, as a separate exercise to determine whether any planned buffer distance(s) between the facility and neighbouring sensitive receptors will be adequate
- If odour is an issue, an odour impact assessment using the criteria described in the Queensland DERM Guideline *Odour Impact Assessment from Developments*. The guideline sets out various approaches to assess potential impacts from developments proposals. Guidance provides the use of air dispersion modelling as a tool to predict ground level odour concentrations and comparison must be made with guideline values to determine the likelihood of adverse odour impacts
- The averaging period for ground level concentrations of pollutants that are modelled, which should be consistent with the relevant averaging periods for air quality indicators and goals in the Environmental Protection (Air) Policy 2008 and the National Environmental Protection Measure (NEPM) Air. Modelled air quality concentrations at the most exposed existing or likely future off-site sensitive receptors must be compared with the appropriate national and international ambient air quality standards including the Environmental Protection (Air) Policy 2008 and the National Environmental Protection Council (Ambient Air Quality) Measure
- A description of the measures to be used to minimise dust emissions during the transport of product from the mine to end users
- Where there is no single atmospheric dispersion model that is able to handle the different atmospheric dispersion characteristics exhibited in the proposal area (e.g. sea breezes, strong convection, terrain features, temperature inversions and pollutant re-circulation), a combination of acceptable models will need to be applied
- A discussion of the limitations and accuracy of the applied atmospheric dispersion models. The air quality modelling results should be discussed in light of the limitations and accuracy of the applied models.

4.5.2.1 Greenhouse gas abatement

This section of the EIS should propose and assess greenhouse gas abatement measures. It should include:

- a description of the proposed measures (alternatives and preferred) to avoid and/or minimise greenhouse gas emissions directly resulting from activities of the project, including activities such as transportation of products and consumables, and energy use by the project
- an assessment of how the preferred measures minimise emissions and achieve energy efficiency
- a comparison of the preferred measures for emission controls and energy consumption with best practice environmental management in the relevant sector of industry
- a description of any opportunities for further offsetting greenhouse gas emissions through indirect means.

Direct means of reducing greenhouse gas emissions could include such measures as:

- minimising clearing at the site (which also has imperatives besides reducing greenhouse gas emissions)
- integrating transport for the project with other local industries so that greenhouse gas emissions from the construction and running of transport infrastructure are minimised
- maximising the use of renewable energy sources
- co-locating coal seam methane use for energy production with coal extraction.

Indirect means of reducing greenhouse gas emissions could include such measures as:

- carbon sequestration at nearby or remote locations, either:
 - above ground, by such means as planting trees and other vegetation to achieve greater biomass than that cleared for the project
 - below ground by geosequestration

- carbon trading through recognised markets.

The environmental management plan in the EIS should include a specific module to address greenhouse abatement. That module should include:

- commitments to the abatement of greenhouse gas emissions from the project with details of the intended objectives, measures and performance standards to avoid, minimise and control emissions
- commitments to energy management, including undertaking periodic energy audits with a view to progressively improving energy efficiency
- a process for regular review of new technologies to identify opportunities to reduce emissions and use energy efficiently, consistent with best practice environmental management
- any voluntary initiatives, such as projects undertaken as a component of the national Greenhouse Challenge Plus program, or research into reducing the lifecycle and embodied energy carbon intensity of the project's processes or products
- opportunities for offsetting greenhouse emissions including, if appropriate, carbon sequestration and renewable energy uses
- commitments to monitor, audit and report on greenhouse emissions from all relevant activities and the success of offset measures.

4.5.2.2 Climate change adaptation

Climate change, through alterations to weather patterns and rising sea level, has the potential for future impact on developments designed now. Most developments involve the transfer to, or use by, a proponent of a community resource in one form or another, such as the granting of a non-renewable resource or the approval to discharge pollutants to air, water or land. Therefore, it is important that the project design be adaptive to climate change so that community resources are not depreciated by projects that would be abandoned or require costly modification before their potential to provide a full return to the community is realised. Consequently, the EIS should assess the project's vulnerabilities to climate change and describe possible adaptation strategies for the activity including:

- a risk assessment of how changing patterns of rainfall and hydrology, temperature, extreme weather and sea level (where appropriate) may affect the viability and environmental management of the project
- the preferred and alternative adaptation strategies to be implemented
- commitments to undertaking, where practicable, a cooperative approach with government, other industry and other sectors to address adaptation to climate change.

DERM recognises that predictions of climate change and its effects have inherent uncertainties, and that a balance must be found between the costs of preparing for climate change and the uncertainty of outcomes. However, proponents should use their best efforts to incorporate adaptation to climate change in their EIS and project design.

4.6 Noise and vibration

4.6.1 Description of environmental values

This section describes the existing environment values that may be affected by noise and vibration from the proposal.

If the proposed activity could adversely impact on the noise environment, baseline monitoring should be undertaken at a selection of sensitive sites affected by the proposal. Noise sensitive places are defined in the Environmental Protection (Noise) Policy 2008. Long-term measured background noise levels that take into account seasonal variations are required. The locations of sensitive sites should be identified on a suitably scaled map. The results of any baseline monitoring of noise and vibration in the proposed vicinity of the proposal should be described.

Sufficient data should be gathered to provide a baseline for later studies. The daily variation of background noise levels at nearby sensitive sites should be monitored and reported in the EIS, particularly detailing variations at different periods of the night. Monitoring methods should adhere to accepted best practice

methodologies, relevant Environmental Protection Agency guidelines and Australian Standards, and any relevant requirements of the Environmental Protection (Noise) Policy 2008.

Comment should be provided on any current activities near the proposal area that may cause a background level of ground vibration (e.g. major roads, quarrying activities, etc).

4.6.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for protecting or enhancing environmental values from impacts by noise and vibration; describes how nominated quantitative standards and indicators may be achieved for noise and vibration management; and how the achievement of the objectives will be monitored, audited and managed. The assessment of noise impacts should include matters raised in the document, *The health effects of environmental noise – other than hearing loss* published by the Health Council, 2004 (or later editions), ISBN 0 642 82304 9.

Information including mapped noise contours from a suitable acoustic model, and based on the proposed generation of noise, should be submitted. The potential environmental harm of noise and vibration at all potentially sensitive places, in particular any place of work or residence, should be quantified in terms of objectives, standards and indicators to be achieved. Particular consideration should be given to emissions of low-frequency noise, that is, noise with components below 200Hz. The assessment should also include environmental impacts on terrestrial and marine animals and avifauna, particularly migratory species. Proposed measures for the minimisation or elimination of impacts should be provided, including details and illustrations of any screening, lining, enclosing or bunding. A discussion should be provided of timing schedules for construction and operations with respect to minimising environmental nuisance and harm from noise.

Information should be supplied on blasting that might cause ground vibration or fly rock on, or adjacent to, the site, with particular attention given to places of work, residence, recreation, worship and general amenity. The magnitude, duration and frequency of any vibration should be discussed. A discussion of measures to prevent or minimise environmental nuisance and harm should be provided. Blasting noise and vibration limits are provided in the *Environmental Protection Regulation 2008*. Reference should also be made to the DERM Guideline: *Noise and vibration from blasting* and the *Environmental Protection (Noise) Policy 2008*.

The assessment should also address off-site noise and vibration impacts that could arise due to any increased road or rail transportation directly resulting from the project.

4.7 Nature conservation

4.7.1 Description of environmental values

This section describes the existing environmental values for nature conservation that may be affected by the proposal.

Describe the environmental values of nature conservation for the affected area in terms of:

- integrity of ecological processes, including habitats of rare and threatened species
- conservation of resources
- biological diversity, including habitats of rare and threatened species
- integrity of landscapes and places, including wilderness and similar natural places
- aquatic and terrestrial ecosystems.

A discussion should be presented on the nature conservation values of the areas likely to be affected by the proposal. The flora and fauna communities which are rare or threatened and environmentally sensitive localities should be described – these include the marine environment, waterways, wetlands, riparian zone, and littoral zone, rainforest remnants, old growth indigenous forests, wilderness and habitat corridors. The description should include a plant species list, an appropriately scaled vegetation map and an assessment of the significance of native vegetation, from a local, regional and state perspective. The description should indicate any areas of state or regional significance identified in an approved biodiversity planning assessment (BPA) produced by DERM (e.g. see the draft Regional Nature Conservation Strategy for SE Qld 2001-2006).

Survey effort should be sufficient to identify, or adequately extrapolate, the floral and faunal values over the range of seasons, particularly during and following a wet season. The survey should account for the ephemeral nature of watercourses traversing the proposal area, and seasonal variation in fauna populations.

The EIS should identify issues relevant to sensitive areas or areas that may have low resilience to environmental change. Areas of special sensitivity include: the marine environment and wetlands; wildlife breeding or roosting areas; any significant habitat or relevant bird flight paths for migratory species; bat roosting and breeding caves, including existing structures such as adits and shafts; and habitat of threatened plants, animals and communities. The capacity of the environment to assimilate discharges or emissions should be assessed. Proximity of the proposal to any biologically sensitive areas should be described.

Areas regarded as sensitive with respect to flora and fauna have one or more of the following features (and should be identified, mapped, avoided or effects minimised):

- important habitats of species listed under the *Nature Conservation Act 1992* and/or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as presumed extinct, endangered, vulnerable or rare
- regional ecosystems listed as 'endangered' or 'of concern' under State legislation, and/or ecosystems listed as presumed extinct, endangered or vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
- good representative examples of remnant regional ecosystems, or regional ecosystems that are described as having 'medium' or 'low' representation, in the protected area estate as defined in the Regional Ecosystem Description Database (REDD) available at DERM's website
- sites listed under international treaties, such as Ramsar wetlands and World Heritage areas
- sites containing near threatened or bio-regionally significant species, or essential, viable habitat for near threatened or bio-regionally significant species
- sites in, or adjacent to, areas containing important resting, feeding or breeding sites for migratory species of conservation concern listed under the Convention of Migratory Species of Wild Animals, and/or bilateral agreements between Australia and Japan (JAMBA) and between Australia and China (CAMBA)
- sites adjacent to nesting beaches, feeding, resting or calving areas of species of special interest, e.g. marine turtles and cetaceans
- sites containing common species that represent a distributional limit and are of scientific value, or that contain feeding, breeding and resting areas for populations of echidna, koala, platypus and other species of special cultural significance
- sites containing high biodiversity that are of a suitable size or with connectivity to corridors or protected areas to ensure survival in the longer term. This land may contain:
 - natural vegetation in good condition, or other habitats in good condition (e.g. wetlands)
 - degraded vegetation or other habitats that still support high levels of biodiversity, or acts as an important corridor for maintaining high levels of biodiversity in the area
- a site containing other special ecological values, e.g. high habitat diversity and areas of high endemism
- ecosystems that provide important ecological functions, such as wetlands of national, state and regional significance; coral reefs; riparian vegetation; important buffer to a protected area; or important habitat corridor between areas
- sites of palaeontologic significance, such as fossil sites
- sites of geomorphological significance, such as lava tubes or karst
- protected areas that have been proclaimed under the *Nature Conservation Act 1992* or are under consideration for proclamation
- areas of major interest, or critical habitat declared under the *Nature Conservation Act 1992*, or high nature conservation value areas or areas vulnerable to land degradation under the *Vegetation Management Act 1999*.

Reference should be made to both State and Commonwealth endangered species legislation and the proximity of the area to any World Heritage property.

The Queensland *Vegetation Management Act 1999* and the findings of any regional vegetation management plan should also be referenced.

The occurrence of pest plants and animals in the project area should be described.

Key flora and fauna indicators should be identified for future ongoing monitoring.

4.7.1.1 Terrestrial flora

For terrestrial vegetation a suitably scaled map, with descriptions of the units mapped, should be provided. Sensitive or important vegetation types should be highlighted. This should include any riparian vegetation and its value as habitat for fauna, and conservation of specific rare floral and faunal assemblages or community types. The existence of rare or threatened species should be specifically addressed. The surveys should include species structure, assemblage, diversity and abundance. The description should contain a review of published information about assessment of the significance of the vegetation to conservation, recreation, scientific, educational and historical interests.

The location of any horticultural crops in the vicinity of the site should be shown. The existence of important local and regional weed species should also be discussed.

Vegetation mapping should be provided for all relevant project sites including new transport infrastructure, port facilities and irrigation land, if relevant. Adjacent areas should also be mapped to illustrate interconnectivity. Mapping should illustrate any larger scale interconnections between areas of remnant or regrowth vegetation, where the project site includes a corridor connecting those other areas.

The terrestrial vegetation communities within the affected areas should be described at an appropriate scale (maximum 1:10,000) with mapping produced from aerial photographs and ground truthing. It should show:

- location and extent of vegetation types using DERM's regional ecosystem type descriptions in accordance with the REDD
- location of vegetation types of conservation significance based on DERM's regional ecosystem types, and the occurrence of species listed as protected plants under the *Nature Conservation (Wildlife) Regulation 1994* and subsequent amendments, as well as areas subject to the *Vegetation Management Act 1999*
- the current extent (bioregional and catchment) of protected vegetation types of conservation significance within the protected area estate (national parks, conservation parks, resource reserves, nature refuges)
- any plant communities of cultural, commercial or recreational significance, and identify them
- location and abundance of any exotic or weed species.

Within each defined (standard system) vegetation community, a minimum of three sites (numbers should be discussed with DERM) should be surveyed for plant species, preferably in both summer and winter, as follows:

- site data shall be recorded using the Queensland Herbarium methodology and proformas in the latest version of the *Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland*, (EPA, 2005)
- the minimum site size should be 10 by 50 metres
- a complete list of species present at each site should be recorded
- the relative abundance of plant species present should be recorded.

Any plant species of conservation, cultural, commercial or recreational significance should be identified. Specimens of species listed as protected plants under the *Nature Conservation (Wildlife) Regulation 1994*, other than common species, are to be submitted to the Queensland Herbarium for identification and entry into the HERBRECS database.

Existing information on plant species may be used instead of new survey work, provided that the data is derived from previous surveys at the site and is consistent with the above methodology. Methodology used for flora surveys should be specified in the appendices to the report.

4.7.1.2 Terrestrial fauna

The terrestrial and riparian fauna occurring in the areas affected by the proposal should be described, noting the broad distribution patterns in relation to vegetation, topography and substrate. The description of the fauna present or likely to be present in the area should include:

- species diversity (i.e. a species list) and abundance of animals including amphibians, birds, reptiles, mammals and bats
- any species that are poorly known but suspected of being rare or threatened
- habitat requirements and sensitivity to changes, including movement corridors and barriers to movement
- the existence of feral or exotic animals
- existence of any rare, threatened or otherwise noteworthy species or communities in the study area. This should include discussion of range, habitat, breeding, recruitment, feeding and movement requirements, and current level of protection (e.g. any requirements of protected area management plans)
- use of the area by migratory birds, nomadic birds, fish and terrestrial fauna.

A comprehensive vertebrate fauna survey of the project area should be undertaken at a sampling intensity that supports the scale of vegetation mapping (i.e. 1:10 000 or better). Apart from the species recorded in the survey, an indicative list of all known and potential species and threatened species in the project area should be provided. This should reference the regional ecosystems within the project area and a 10km buffer as well as knowledge of species present in the local bioregion. The occurrence of fauna of conservation significance should be geocoded to mapped vegetation units or habitats, which can then be used in section 4.7.2 to propose areas to be protected.

The EIS should indicate how well any affected communities are represented and protected elsewhere in the province where the site of the proposal occurs.

4.7.1.3 Aquatic biology

The aquatic flora and fauna occurring in the areas affected by the proposal should be described, noting the patterns and distribution in the waterways and any associated wetlands and lacustrine environments. The description of the fauna and flora present, or likely to be present, in the area should include:

- fish species, mammals, reptiles, amphibians, crustaceans and aquatic invertebrates occurring in the waterways within the affected area, and/or those in any associated lacustrine environment
- aquatic plants
- aquatic and benthic substrate
- groundwater dependent ecosystems (includes stygofauna, and groundwater fed springs and wetlands)
- stygofauna and troglifauna associated with groundwater and limestone formations.

4.7.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for protecting or enhancing nature conservation values; describes how nominated quantitative standards and indicators may be achieved for nature conservation management; and how the achievement of the objectives will be monitored, audited and managed.

The EIS should address any actions of the project or likely impacts that require an authority under the *Nature Conservation Act 1992*, and/or would be assessable development for the purposes of the *Vegetation Management Act 1999*.

The discussion should cover all likely direct and indirect environmental harm due to the project on flora and fauna, particularly sensitive areas. Terrestrial and aquatic (marine and freshwater) environments should also be covered. Also human impacts and the control of any domestic animals introduced to the area should be included.

Strategies for protecting the Great Barrier Reef Marine Park and World Heritage Property, and any rare or threatened species, should be described. Any obligations imposed by State or Commonwealth legislation or policy, or international treaty obligations (i.e. JAMBA, CAMBA, ROKAMBA) should be discussed.

Strategies for collecting and preserving any significant fossils should be described.

The potential environmental harm to the ecological values of the area arising from the construction, operation and decommissioning of the project, including clearing, salvaging or removal of vegetation, should be described and the indirect effects on remaining vegetation should be discussed. Short- and long-term effects should be considered with comment on whether the impacts are reversible or irreversible.

Mitigation measures and/or offsets should be proposed for adverse impacts. Any departure from no net loss of ecological values should be described.

The EIS should propose and describe in detail measures to be taken to avoid and minimise potential adverse impacts of the proposal on nature conservation and biodiversity values. Any potential net loss of environmental values should be identified and quantified. Environmental offsets that would counterbalance the remaining loss of environmental values should be described. Proposed environmental offsets should be consistent with the requirements set out in the specific-issue offset policies under the framework of the *Queensland Government Environmental Offset Policy (QGEOP) 2008*.

The potential environmental harm on flora and fauna due to any alterations to the local surface and ground water environment should be discussed. It should specifically reference environmental impacts on riparian vegetation or other sensitive vegetation communities. Measures to mitigate the environmental harm to habitat, or inhibit normal movement, propagation or feeding patterns, should be described along with change to food chains.

In any groundwater aquifers found to contain stygofauna, the potential impacts on stygofauna of any changes in the quality and quantity of the groundwater should be described. Mitigation measures that would be applied to demonstrate lack of threat in accordance with best practice, which at present is guided by the Western Australian Environmental Protection Authority – *Guidance for the Assessment of Environmental Factors No.54 (December 2003) and No.54a (August 2007)*, should also be described.

The provision of buffer zones and movement corridors, and strategies to minimise environmental harm on migratory, nomadic and aquatic animals, should be discussed.

Weed management strategies are required for containing existing weed species (e.g. parthenium and other declared plants) and ensuring no new declared plants are introduced to the area. Feral animal management strategies and practices should also be addressed. The study should develop strategies to ensure that the project does not contribute to increased encroachment of a feral animal species. Reference should be made to the local government authority's pest management plan when determining control strategies. The strategies for both flora and fauna should be discussed in the main body of the EIS and provided in a working form in a Pest Management Plan as part of the overall EM plan for the project.

Rehabilitation of disturbed areas should incorporate, where appropriate, provision of nest hollows and ground litter.

Relevant specific-issue policies that should be addressed are:

- Vegetation management – *Policy for Vegetation Management offsets*, September 2007, Department of Natural Resources and Water
- Koala habitat – *Offsets for Net Benefit to Koalas and Koala Habitat*, 2006, Environmental Protection Agency
- Offsets framework – *Queensland Government Environmental Offset Policy 2008*.

4.8 Cultural heritage

4.8.1 Description of environmental values

This section describes the existing cultural heritage values that may be affected by the proposal. It also describes the environmental values of the cultural landscapes of the affected area in terms of the physical and cultural integrity of the landforms.

An indigenous cultural heritage study must be undertaken in accordance with the requirements of Part 7 of the *Aboriginal Cultural Heritage Act 2003*.

An historical cultural heritage study of the known and potential historical cultural heritage values of the affected area should also be undertaken. The study will, as a minimum, include a desktop analysis and an archaeological investigation (i.e. a physical investigation) of the area potentially affected by the project.

This desktop component of the study should, as a minimum, review the following sources for information on historical cultural heritage values within the region of the project site:

- the Queensland Heritage Register for places already protected under the *Queensland Heritage Act 1992*
- local government heritage registers, lists or inventories
- the results of previous cultural heritage studies conducted within the region of the project.

The scope of the archaeological investigation should be based upon the results of the desktop analysis. The archaeological investigation is to be conducted by an appropriately qualified person, as required by the *Queensland Heritage Act 1992*, and should address all types of historical cultural heritage places located within the project area (i.e. built, archaeological and cultural landscape values).

The discovery and protection of any previously unidentified archaeological artefacts or archaeological places during the course of the historical cultural heritage study must comply with Part 9 of the *Queensland Heritage Act 1992*.

4.8.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for managing, protecting or enhancing cultural heritage values that may be affected by the proposal. It describes how practices may be implemented for the appropriate management of those values, and how the achievement of the objectives will be monitored, audited and managed.

4.8.2.1 Indigenous cultural heritage

The potential impacts on indigenous cultural heritage values in the vicinity of the project must be managed under a Cultural Heritage Management Plan (CHMP) developed and approved under Part 7 of the *Aboriginal Cultural Heritage Act 2003*. Development of the CHMP should follow the guidelines gazetted under section 85 of the *Aboriginal Cultural Heritage Act 2003*. The development of the CHMP should be negotiated with the lead agency for indigenous cultural heritage, DERM. DERM's EIS Coordinator must be made aware of the progress of the CHMP approval process and any related issues that should be addressed in the EIS assessment report.

4.8.2.2 Non-indigenous historical cultural heritage

The potential impacts on non-indigenous historical cultural heritage values, and their avoidance or mitigation, should also be addressed in a management plan. The historical heritage management plan will specifically address identified values and provide a process for managing yet undiscovered values, should they become apparent during development of the project.

If one is required, the development of a historical heritage management plan should be negotiated with the lead agency (the Cultural Heritage Branch, DERM) and any other relevant stakeholders.

The historical heritage management plan should, as a minimum, address the following issues:

- Processes for the mitigation, management and protection of identified historical cultural heritage values during excavations of the construction, operational, rehabilitation and decommissioning phases of the project
- Processes for reporting, as required by section 89 of the *Queensland Heritage Act 1992*, the discovery of any archaeological artefact not previously identified in the historical cultural heritage study
- Procedures for the collection of any artefact material, including appropriate storage and conservation
- Historical cultural heritage awareness training or programs for project staff.

The historical heritage management plan should be incorporated into the project's draft EM plan.

4.9 Social

4.9.1 Description of social and cultural values

This section of the EIS defines and describes the social and cultural area of influence of the project as well as any associated activities. This section also describes the community engagement process and present its findings to date.

The EIS should describe the current population and demographics of the potentially affected communities within the project's social and cultural area of influence. Such communities include all those likely to be impacted directly and indirectly by the project, such as the potential host communities and the source communities for the project workforce and their families.

The current employment patterns, rates and trends within the social and cultural area of influence for the indigenous and non-indigenous populations should be described and analysed.

The EIS should describe the settlement patterns and residential profile of communities within the social and cultural area of influence.

Social, economic and cultural values are not as easily separated as physical and ecological values. Therefore, it may be necessary for some material in this section to be cross-referenced with section 4.8 Cultural Heritage and section 4.11 Economy.

4.9.2 Potential impacts and mitigation measures

The assessment of impacts (both beneficial and adverse) must be supported by evidence-based discussions, and be developed in consultation with relevant government agencies and community groups. It should include information obtained so far through the project's community engagement process. A description of how consultation feedback has identified and informed the assessment of impacts and the development of mitigation measures should be described and analysed.

A description of the likely impacts on population numbers in the social and cultural area of influence and the associated demographic shifts should be included.

The EIS should address impacts of both construction and operational workforces, and associated contractors, on housing. This section of the EIS should discuss the capability of the existing housing stock, including rental accommodation, to meet any additional demands created by the project.

It should describe the social impacts of changes in land use, the alienation of property, and loss of connection with the land. It should also address the impacts and stresses associated with relocations.

Likely recruitment schedules and locations, and how recruitment during the various phases of the project will impact on employment patterns, rates, and trends within the social and cultural area of influence, should be described.

Likely lay-off schedules and how reductions in the workforce at various stages will impact on employment patterns in the social and cultural area of influence should be described. To the extent that information is available, the cumulative effects of other major employers in the area and their likely lay-off schedules should be included.

It should describe the training opportunities to be provided during the various phases of the project, particularly for indigenous people, or people from disadvantaged groups, and describe the provisions to be made for apprenticeship and worker training schemes.

Where staff and their immediate families are likely to reside during the construction and operational phases should be included, and also assess the likely impacts on housing availability and affordability.

An assessment of the likely adverse and beneficial social impacts of the project on local and regional service industries, and the families that depend in whole or part on the income that comes from those service industries (the financial effects should be discussed in the Economy section of the EIS), should be included.

The implications of the proposal for future developments in the social and cultural area of influence, including constraints on surrounding land uses, should be described.

The EIS should summarise the net adverse or beneficial social impacts of the proposed project with an estimation of the overall significance of those impacts.

For identified social impacts, social impact mitigation strategies and measures should be presented.

The proponent should describe any consultation with government agencies and the communities regarding the acceptability of proposed mitigation strategies, and the implementation of practical management and monitoring regimes. It should clearly indicate whether any nominated party other than the proponent accepts responsibility for implementing the measure(s).

4.10 Health and safety

4.10.1 Description of values

This section describes the existing community values for public health and safety that may be affected by the proposal. Projects that could discharge contaminants into water bodies (including groundwater), either directly, indirectly (e.g. from leachate) or accidentally, should identify and describe any downstream extraction for potable or other use. For projects proposing air emissions, and/or those with the potential to emit odours, nearby and other potentially affected populations should be identified and described. Particular attention should be given to those sections of the population, such as children and the elderly, which are especially sensitive to environmental health factors.

4.10.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for protecting or enhancing health and safety community values; describes how nominated quantitative standards and indicators may be achieved for health impacts management; and how the achievement of the objectives will be monitored, audited and managed.

The EIS should assess the impacts on the community from project operations and emissions. Impacts from factors such as air emissions, odour, dust and noise on the health and safety of any members of the community should be detailed in terms of health, safety, and quality of life.

The EIS should address the project's potential for providing disease vectors. Measures to control mosquito and biting midge breeding should be described. Any use of recycled water should be assessed for its potential to cause infection by the transmission of bacteria and/or viruses through contact, dispersion of aerosols and ingestion (e.g. via use on food crops). Similarly, the use of recycled water should be assessed for its potential to cause harm to health via the food chain, due to contaminants such as heavy metals and persistent organic chemicals. Practical monitoring regimes should also be recommended in this section.

4.11 Economy

4.11.1 Description of environmental values

This section describes the existing economic environment that may be affected by the proposal. The character and basis of the local and regional economies should be described including:

- economic viability (including economic base and economic activity, future economic opportunities, current local and regional economic trends, particularly drought and rural downturn, etc)
- historical descriptions of large-scale resource developments and their effects in the region.

The economic impact statement should include estimates of the opportunity cost of the project as well as the value of ecosystem services provided by natural or modified ecosystems that will be disturbed or removed during development.

4.11.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for protecting or enhancing economic values; describes how nominated quantitative standards and indicators may be achieved for economic management; and how the achievement of the objectives will be monitored, audited and managed.

An economic analysis, including a cost-benefit analysis, should be presented from national, state, regional and local perspectives, as appropriate to the scale of the project. The general economic benefits from the project should be described.

At a level of detail appropriate to the scale of the project, the analysis is to consider:

- the significance of this proposal on the local and regional economic context
- the short- and long-term beneficial (e.g. job creation) and adverse (e.g. competition with local small business) impacts that are likely to result from the development

- the potential, if any, for direct equity investment in the project by local businesses or communities
- the cost to all levels of government of any additional infrastructure provision
- implications for future development in the locality (including constraints on surrounding land uses and existing industry)
- the potential economic impact of any major hazard identified in section 4.13
- the distributional effects of the proposal, including proposals to mitigate any negative impact on disadvantaged groups
- the value of lost opportunities or gained opportunities for other economic activities anticipated in the future
- impacts on local property values.

Consideration of the impacts of the project in relation to energy self-sufficiency, security of supply and balance of payments benefits may be discussed. Attention should be directed to the short- and long-term effects of the project on the land-use of the surrounding area as well as existing industries, regional income and employment, and the state economy. Before undertaking any studies, the scope of the studies should be referred to the government for input.

For identified impacts to economic values, mitigation and enhancement strategies should be suggested and initial negotiations towards acceptance of these strategies should be facilitated. Practical monitoring regimes should also be recommended.

4.12 Hazard and risk

This section of the EIS describes the potential hazards and risk to people and property that may be associated with the proposal. This is distinct from hazards and risk to the natural environment, which should be addressed in other sections of the TOR.

4.12.1 Description of environmental values

Values related to people and property, that could be affected by any hazardous materials and actions incorporated in the proposal, should be detailed.

4.12.2 Potential impacts and mitigation measures

This section describes the potential hazards and risk that may be associated with the proposal, including consideration of both natural and man-made hazards. This section also defines and describes the objectives and practical measures for protecting people and places from hazards and risk; describes how nominated quantitative standards and indicators may be achieved for hazard and risk management; and how the achievement of the objectives will be monitored, audited and managed.

An analysis is to be conducted into the potential impacts of both natural and induced emergency situations and counter disaster and rescue procedures. These are on sensitive areas and resources such as forests, water reserves, State and local Government-controlled roads, places of residence and work, and recreational areas, as a result of the proposal. The degree and sensitivity of risk should be detailed.

The EIS should provide an inventory for each class of substances to be held on-site, as listed in the Australian Dangerous Goods Codes. This information should be presented by classes and should contain:

- chemical name
- concentration in raw material chemicals
- concentration in operation storage tank
- U.N. number
- packaging group
- correct shipping name
- maximum inventory of each substance.

Details should be provided for:

- safeguards proposed on the transport, storage, use, handling and on-site movement of the materials to be stored on-site
- the capacity and standard of bunds to be provided around the storage tanks for classified dangerous goods, and other goods likely to adversely impact upon the environment in the event of an accident
- the procedures to prevent spillages, and the emergency plans to manage hazardous situations.

The proponent should develop an integrated risk management plan for the whole of the life of the project including construction, operation and decommissioning phases. The plan should include a preliminary Hazard Analysis (PHA), conducted in accordance with appropriate guidelines for hazard analysis (e.g. HAZOP Guidelines, NSW Department of Urban Affairs and Planning (DUAP)). The assessment should outline the implications for, and the impact on, the surrounding land uses and should involve consultation with Department of Emergency Services, Queensland Fire and Rescue Authority and Queensland Ambulance Service. The preliminary hazard analysis should incorporate:

- all relevant major hazards, both technological and natural
- the possible frequency of potential hazards, accidents, spillages and abnormal events occurring
- indication of cumulative risk levels to surrounding land uses
- life of any identified hazards
- a list of all hazardous substances to be used, stored, processed, produced or transported
- the rate of usage
- description of processes, type of the machinery and equipment used
- potential wildlife hazards such as crocodiles, snakes, and disease vectors
- public liability of the State for private infrastructure and visitors on public land.

The integrated risk management plan should include the following components:

- operational hazard analysis
- regular hazard audits
- fire safety and emergency response plans
- qualitative risk assessment
- construction safety.

Where relevant, each of these components should be prepared in accordance with the relevant NSW DUAP Hazardous Industry Planning Advisory Paper (HIPAP).

4.13 Cross-reference with the terms of reference

This section provides a cross-reference of the findings of the relevant sections of the EIS (where the potential impacts and mitigation measures associated with the project are described) with the corresponding sections of the TOR.

5 Environmental management plan

The environmental management plan (EM plan) should be developed from the mitigation measures detailed in part 4 of the EIS. Its purpose is to set out the proponents' commitments to environmental management. That is, how environmental values will be protected and enhanced.

The EM plan is an integral part of the EIS, but should be capable of being read as a stand-alone document without reference to other parts of the EIS. For a mining project, the EM plan must meet the content requirements of section 203 of the *Environmental Protection Act 1994*. The general contents of the EM plan should comprise:

- the environmental values likely to be affected by the mining activities
- the potential adverse and beneficial impacts of the mining activities on the environmental values
- the proponents' commitments to acceptable levels of environmental performance including environmental objectives, i.e. levels of expected environmental harm, performance standards and associated measurable indicators, performance monitoring and reporting
- impact prevention or mitigation actions to implement the commitments
- corrective actions to rectify any deviation from performance standards.

Through the EM plan, commitments in the EIS made to environmental performance can be used as regulatory controls through conditions to comply with those commitments. Therefore, the EM plan is a relevant document for project approvals, environmental authorities and permits, and may be referenced by them. The EM plan may suggest conditions that will form the basis for developing the draft environmental authority.

6 References

All references consulted should be presented in the EIS in a recognised format.

7 Recommended appendices

A1. Final terms of reference for this EIS

A copy of the final TOR should be included in the EIS. Where it is intended to bind appendices in a separate volume from the main body of the EIS, the TOR should at least be bound with the main body of the EIS for ease of cross-referencing. A summary cross-referencing specific items of the TOR to the relevant section of the EIS, should also be provided in section 4.14 of the EIS. For this purpose, the TOR should be line numbered.

A2. Development approvals

A list of the development approvals required by the project should be presented.

A3. Study team

The qualifications and experience of the study team, and specialist sub-consultants and expert reviewers, should be provided.

A4. The standard criteria

A brief summary of the proposal's compatibility with the standard criteria as defined by the *Environmental Protection Act 1994*, which include the principles of ESD and other relevant policy instruments, should be presented. With regard to the principles of ESD (as listed in The National Strategy for Ecologically Sustainable Development, published by the Commonwealth Government in December 1992 and available from the Australian Government Publishing Service), each principle should be discussed and conclusions drawn as to how the proposal conforms. A life-of-project perspective should be shown.

A5. Consultation report

The summary Consultation Report appendix for an EIS under the EP Act should commence by including the details of affected and interested persons. It should also include the statement of planned consultation with those persons originally provided with the draft terms of reference. It should describe how 'interested' and 'affected persons', and any 'affected parties' as defined in the EPBC Act, were identified.

A further list should be provided that includes the Commonwealth, State and local government agencies consulted, and the individuals and groups of stakeholders consulted.

This appendix should summarise the results of the community consultation program, providing a summary of the groups and individuals consulted, the issues raised, and the means by which the issues were addressed. The discussion should include the methodology used in the community consultation program, including criteria for identifying stakeholders and the communication methods used.

A6. Specialist studies

All reports generated on specialist studies undertaken as part of the EIS are to be included as appendices. These may include:

- geology
- soil survey and land suitability studies
- waterway hydrology
- groundwater
- flora and fauna studies
- economic studies, CBA
- hazard and risk studies.

A7. Research

Any proposals for researching alternative environmental management strategies, or for obtaining any further necessary information, should be outlined in an appendix.

Disclaimer

While this document has been prepared with care, it contains general information and does not profess to offer legal, professional or commercial advice. The Queensland Government accepts no liability for any external decisions or actions taken on the basis of this document. Persons external to the Department of Environment and Resource Management should satisfy themselves independently and by consulting their own professional advisors before embarking on any proposed course of action.

Approved By



Signature

3rd December 2009

Date

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