

CHAPTER

09

INLAND  
RAIL 

# Rehabilitation Strategy

NORTH STAR TO NSW/QUEENSLAND BORDER ENVIRONMENTAL IMPACT STATEMENT

ARTC

The Australian Government is delivering  
Inland Rail through the Australian  
Rail Track Corporation (ARTC), in  
partnership with the private sector.

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## 9. Rehabilitation Strategy

### 9.1 Overview

The purpose of this chapter is to provide a strategy for rehabilitation of the proposed borrow sites to be used during the construction phase of the North Star to NSW/Queensland Border (NS2B) project (the proposal). This chapter has been developed to ensure that rehabilitation occurs in accordance with best practice and the relevant legislative, policy and management standards as detailed in Section 9.2. The proposal must propose rehabilitation actions with measurable criteria and clearly identified timeframes for their completion. It is highlighted that the rehabilitation strategy will focus only on disturbance related to Inland Rail Program requirements and will not explicitly be focused on rehabilitation of existing disturbance at the borrow areas.

#### 9.1.1 Secretary's Environmental Assessment Requirements

This chapter has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs), as shown in Table 9.1.

**TABLE 9.1 SECRETARY ENVIRONMENTAL ASSESSMENT REQUIREMENTS COMPLIANCE**

<b>Item 17: Rehabilitation</b>	
<b>Desired performance outcome</b>	The proposed borrow sites are rehabilitated at the conclusion of construction of the project. Rehabilitation should occur in accordance with the relevant strategic framework and best practice.
<b>Current guidelines</b>	<i>Mine Rehabilitation—Leading Practice Sustainable Development Program for the Mining Industry</i> (Commonwealth) <i>Mine Closure and Completion—Leading Practice Sustainable Development Program for the Mining Industry</i> (Commonwealth)
<b>SEARs requirement</b>	<b>EIS section</b>
<b>Item 17.1</b>	Chapter 9: Rehabilitation Strategy
The Proponent must provide a rehabilitation strategy for the borrow sites having regard to:	
a) Rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria	Section 9.3 Section 9.4 Section 9.5 Section 9.6
b) Nominated final land use and landform having regard to any relevant strategic land use planning or resource management plans or policies; and	Section 9.2
<b>Item 17.2</b>	Section 9.2.1
The potential for integrating this strategy with other rehabilitation and/or offset strategies in the region.	

#### 9.1.2 Scope

The Proponent is proposing to develop up to eleven borrow sites, currently comprising approximately 282.41 hectares (ha) total area, including both native vegetation and agricultural areas, to supply material to the proposal.

The scope of work for the borrow sites will include:

- ▶ Establishment and development of the borrow sites (locations shown in Chapter 7: Construction of the Proposal)
- ▶ Clearing and grubbing of the borrow site locations. Nine of the borrow sites appear to have some pre-existing areas of borrow or quarrying activities
- ▶ Construction proposed access roads and haul routes to enable the transport of equipment for borrow site construction and to transport excavated material to the proposal
- ▶ Installation of temporary infrastructure, likely to comprise a self-contained ablution facility, light vehicle parking and a site office covering no more than 1,000 m<sup>2</sup>. This temporary infrastructure will be placed within the development footprint of each borrow site
- ▶ Stripping topsoil and stockpiling, in accordance with good industry practice, for later reuse during rehabilitation

- ▶ Stripping unsuitable material will be used in accordance with the erosion control management plan, for traffic control or for later reuse during rehabilitation. Note: some borrow sites are located in areas of relatively low relief, with the exception of Site 1 and Site 2
- ▶ Installation of environmental controls such as erosion and sediment controls.

The landholdings that contain the eleven borrow sites are presented in Table 9.2. A locality map of the sites is shown in Chapter 7: Construction of the Proposal.

### 9.1.3 Key features of each borrow site

Table 9.2 outlines the key features for each borrow site, including site details of relevance to the rehabilitation strategy.

**TABLE 9.2 KEY FEATURES OF EACH BORROW SITE**

<b>Borrow site ID</b>	<b>Area/material to be disturbed</b>	<b>Lot and Plan details</b>	<b>Site details</b>
Site 4	9.99 ha (<240,000 m <sup>3</sup> )	<ul style="list-style-type: none"> <li>▶ Lot 2 DP1158789</li> <li>▶ Lot 5 DP755983</li> </ul>	Within an existing agricultural paddock (cropped). Existing borrow sites (and disturbance) in the centre of the footprint.
Site 5	27.79 ha (<200,000 m <sup>3</sup> )	<ul style="list-style-type: none"> <li>▶ Lot 16 DP756015</li> </ul>	Remnant/lightly wooded area, existing borrow sites (and disturbance) to the north.
Site 7	66.79 ha (<1,200,000 m <sup>3</sup> )	<ul style="list-style-type: none"> <li>▶ Lot 1011 DP1173424</li> <li>▶ Lot 18 DP756011</li> <li>▶ Lot 4908 DP1236542</li> <li>▶ Lot 3 DP850372</li> </ul>	Site is comprised of two separate areas: northern part is an existing cleared agricultural paddock and the southern part is remnant open vegetated, with an existing borrow area towards the south. Significantly disturbed site.
Site 8	23.92 ha (<500,000 m <sup>3</sup> )	<ul style="list-style-type: none"> <li>▶ Lot 14 DP756011</li> </ul>	Site contains open, shrubby vegetation, surrounded by cropped paddock areas. Existing disturbance/borrow area occurs to the south, with legacy borrow sites or void to the west of the footprint.
Site 9	54.57 ha (<500,000 m <sup>3</sup> )	<ul style="list-style-type: none"> <li>▶ Lot 12 DP755983</li> </ul>	Remnant vegetation with light to more heavy woodland, existing borrow sites/disturbance visible to the south.
Site 11	22.61 ha (<200,000 m <sup>3</sup> )	<ul style="list-style-type: none"> <li>▶ Lot 2 DP1037530</li> </ul>	Small footprint contains low and dense shrub cover/woodland, existing borrow sites (disturbance) visible to the east. Surrounded by agricultural land with an area of vegetation to the north.
Site 13	18.82 ha (<100,000 m <sup>3</sup> )	<ul style="list-style-type: none"> <li>▶ Lot 1 DP630301</li> <li>▶ Lot 9 DP756031</li> </ul>	Within an existing agricultural paddock (cropped, contoured). Existing borrow sites/disturbance is visible as a large portion of the footprint.
Site 25	25.66 ha (<140,000 m <sup>3</sup> )	<ul style="list-style-type: none"> <li>▶ Lot 18 DP755983</li> </ul>	Footprint is about 60% highly disturbed cropped agricultural land, with remainder as open, shrubby vegetation. Existing borrow is visible to the centre of the area and surrounded by paddocks on all sides.
Site 26	8.27 ha (<120,000 m <sup>3</sup> )	<ul style="list-style-type: none"> <li>▶ Lot 14 DP755993</li> <li>▶ Lot 15 DP755993</li> </ul>	Site is open, shrubby vegetation, as a vegetated portion adjacent to remnant road corridor. Small borrow site (ground disturbance) is visible to the north-west.
Site 1	5.24 ha (<240,000 m <sup>3</sup> )	<ul style="list-style-type: none"> <li>▶ Lot 11 DP755984</li> </ul>	Footprint is within a remnant but disturbed low and dense vegetated area. Surrounded by similar vegetation with moderate landscape connectivity. Small cleared area is visible in the centre of the footprint.
Site 2	18.75 ha (<175,000 m <sup>3</sup> )	<ul style="list-style-type: none"> <li>▶ Lot 8 DP755984</li> </ul>	Borrow site is within an isolated patch of open, shrubby vegetation, potentially a small hill feature. No existing borrow is evident within the footprint. Surrounded by agricultural land.

## 9.2 Relevant standards and requirements

The key legislative, policy and management standards and requirements for this rehabilitation strategy are described as follows:

- ▶ Relevant government and industry standards related to closure and rehabilitation, and outlining current guidance for leading practice, including:
  - ▶ *Mine rehabilitation: Leading Practice Sustainable Development Program for the mining Industry and Mine Closure and Completion* (Department of Industry Tourism and Resources, 2006)
  - ▶ *Mining Operations Plan Guidelines* (ESG3) (NSW Government, 2013)
  - ▶ *Guidance for the Assessment of Environmental Factors: Rehabilitation of Terrestrial Ecosystems* (Western Australia Environmental Protection Authority, 2006)
  - ▶ *Guidelines for Preparing Mine Closure Plans* (Western Australia Environmental Protection Authority, 2015)
  - ▶ *Rehabilitation requirements for mining resource activities* (ESR/2016/1875) (Queensland Department of Environment and Science, 2014)
  - ▶ *Strategic Framework for Mine Closure* (Australia and New Zealand Minerals and Energy Council and Minerals Council Australia, 2000)
- ▶ Relevant strategies, plans and guidelines for the region
- ▶ Relevant internal policies, procedures and plans developed by the ARTC.

### 9.2.1 Integration with other strategies

As well as considering compliance with the key legislative, policy and management standards and requirements, this rehabilitation strategy also investigated the potential for integration with other rehabilitation and/or offset strategies in the region. No other strategies for the region have been identified as relevant at this time.

Chapter 11: Biodiversity recommends that a Rehabilitation and Reinstatement Management Plan (RRMP) to be prepared for the proposal. A Construction Environmental Management Plan (CEMP) will also be prepared to detail mitigation measures and management actions for the proposal as it is executed. Further opportunities for integration and alignment of rehabilitation activities will be explored within these documents.

## 9.3 Rehabilitation objectives and targets

The principal objective for the rehabilitation of borrow sites associated with the proposal is that the land should be returned to a post-disturbance condition that will be safe, stable, non-polluting and able to sustain the proposed final land use with only minor maintenance required into perpetuity. A key objective for rehabilitation should also be the acceptability of each site to the future (or existing) underlying landowner.

More specific rehabilitation objectives and completion criteria specific to individual sites and domains may be prescribed by the conditions of the approval and will be included in site-specific rehabilitation management plans for each borrow site as they are developed.

Two major land uses relevant to the borrow sites are as native vegetation (e.g. conservation) and agricultural (e.g. grazing lands). Examples of more specific rehabilitation targets that are appropriate to this area, and may be developed in the future, are as follows:

- ▶ For native vegetation—an appropriate target may be to rehabilitate specific borrow sites to low-maintenance native vegetation, with composition, structure and function within an accepted range of the baseline values within the region, and with a stable landform and self-sustaining vegetation cover
- ▶ For grazing—an appropriate target may be to rehabilitate specific borrow sites to a grazing land use with acceptable carrying capacity, as compared to the surrounding region, with a stable landform and self-sustaining vegetation cover.

These objectives are discussed further below. Completion or success criteria (as detailed in Section 9.5) provide greater detail and focus to the rehabilitation objectives and provides a framework for the rehabilitation works to be completed within, to ensure it will achieve the range of objectives required. Further general detail to objectives for different aspects of the rehabilitation process are outlined below.

### 9.3.1 Safe and stable final landform

The reconstruction of the final landform is aimed at cost-effectively achieving a sustainable final land use, while managing risks and limiting the need for ongoing maintenance over the long term. The primary design objective is

the creation of a safe and stable final landform that is compatible with the proposed final land use. The final landform should be left in a condition that is safe and secure for humans and animals, and should not have any unstable slopes or cliffs remaining as part of the final landform. Landform stability modelling, informed by a direct understanding of the soils and residual geotechnical materials, may be required to inform slope angle, length and general design. The need for additional modelling should be considered in the RRMP, with soils assessment undertaken during construction.

The final landform should be made safe by leaving the borrow sites and battering back steeper slopes and blending spoil material into the natural landscape. To blend material into the surrounding landscape, surplus material from the borrow site's development should be used in preference to importing material, noting that topsoil needs to be reserved to re-spread on the surface to encourage germination.

The slopes of the final landform should aim to mimic natural landforms as much as possible.

It is acknowledged that backfilling quantities are dependent on the availability of suitable material, and noted that available volumes may be small, particularly if areas already have existing borrow activities occurring and holding water. ARTC have adopted an outcome-based approach and will complete what is required to achieve a stable landform.

Rainfall is likely to collect within excavated borrow sites, if not backfilled, and may create a permanent waterbody. Therefore, any surface or included materials into the landform must be benign and ensure no contaminated runoff occurs to surface or into any permanent waterbodies that may be created. If there are concerns about future water quality entering the void, water will be preferentially diverted away from the void area.

If further design of the borrow sites reveals that insufficient backfill is available to create a free-draining final landform, the RRMP must ensure compatible final land uses, consider landform-construction techniques and treatments to ensure suitable runoff water quality, and further specify requirements for the creation of a final void or wetland environment.

### **9.3.2 Non-polluting landform**

To be considered non-polluting, the borrow sites should not act as a source of contaminating material into the surrounding environment. The areas should be able to support the proposed land use and hold similar contaminant and environment values as surrounding areas of similar land use.

In practical terms, this means any surface water runoff or groundwater interactions should be comparable to surrounding areas, or within an acceptable quality range, and not exhibiting any trends of high salinity, metals or other contaminants entering the surrounding environment.

### **9.3.3 Self-sustaining final land use**

In general, the final land uses of rehabilitated borrow sites are anticipated to be either native vegetation, agriculture (predominantly grazing), as a final void/wetland, or stabilised and retained as a borrow site. Borrow sites to be retained by the proposal will gain appropriate approvals and agreements with the landowner. The final land use at each site will be detailed in the RRMP, to be developed, and the final landform will be developed in consultation with landowner and within the framework of relevant standards and guidelines. The landform vegetation should align with its proposed final land use (e.g. native vegetation land use provides appropriate habitat for fauna use). The rehabilitation should require minimal maintenance, including weed- and pest-control activities. The soils and growth media characteristics should support the final land use.

Unless specifically negotiated with landowners, no infrastructure is to be left onsite. Proposed final land uses will be determined and agreed in consultation with the landowners. Objectives for the proposed final land uses are included in Table 9.3 and will be further established as the proposal progresses.

**TABLE 9.3 REHABILITATION OBJECTIVES FOR A SELF-SUSTAINING FINAL LAND USE**

<b>Proposed final land use</b>	<b>Objective</b>
Native vegetation	The objective for native vegetation borrow sites is to re-establish native vegetation species to self-sustaining ecological communities, which are similar in extent (ha) and species composition of the pre-clearing vegetation community types, including reinstating fauna habitat features (e.g. salvaged tree hollows, fallen logs, rock outcrops, loose surface rocks). These areas would therefore be retained for conservation purposes.
Agricultural/grazing	The objective for agricultural borrow sites is to re-establish a self-sustaining pasture grassland, by using appropriate pasture species to reinstate the extent (ha) and species composition of the pre-clearing agricultural land use. The agricultural land use should hold acceptable production capacity to the anticipated future landowner and reflect the pre-clearing agricultural land use.
Final void/wetland	The objective for final void/wetland borrow site areas is to re-establish a safe, stable and non-polluting landform area that may fill with water over time. The void areas must not result in future contamination of the surface water runoff or groundwater and should continue to be safe and stable over time.
Retained as a borrow site	The objective for any 'retained' borrow sites is to continue to support ongoing quarrying or borrow activities. For this final land use, it is anticipated that the area would be retained as is, once the proposal has completed, in order to remain in an acceptable state to an anticipated future landowner.

## 9.4 Rehabilitation planning and methodology

Specific rehabilitation objectives and completion criteria specific to individual sites may be prescribed by the conditions of the approval and will be included in a specific prescription for each site within the detailed RRMP.

Rehabilitation planning and methodology for the sites include the following key principles:

- ▶ Planning is underpinned by site-based environmental rehabilitation risk analysis and draws on the environmental baseline established by other EIS chapters, including Chapter 11: Biodiversity and Chapter 15: Land Resources and Contamination, as well as the technical studies and reports underpinning these chapters
- ▶ Landform stability is required to achieve rehabilitation objectives and should be incorporated into the design phase of the proposal, to minimise costs
- ▶ Final surface preparation is also required, to address any surface compaction from borrow activities, and to spread topsoil and other ameliorants as required
- ▶ Topsoil must be carefully managed and stockpiled in accordance with Chapter 7: Construction of the Proposal
- ▶ Revegetation methods are carried out in accordance with the proposed final land uses
- ▶ An effective monitoring program in an adaptive management framework is implemented to track success.

### 9.4.1 Risk analysis and management

An environmental risk analysis should be undertaken for each borrow site, to identify and assess the site risks to effective and timely rehabilitation and identify and prioritise measures to minimise these risks. The risk assessment should identify a range of potential risks that require specific measures to be documented and implemented in the RRMP to mitigate the risks. Risks may include:

- ▶ Geology, geochemistry and soil chemistry risks, including material that may result in acidic or saline metalliferous conditions when exposed to air or water
- ▶ Soil structure risks, including susceptibility to compaction, erosion and sedimentation
- ▶ Availability of seeds and tubestock, including collection and propagation risks
- ▶ Drainage modification (e.g. voids created through extraction), water availability and susceptibility of the site to desiccation
- ▶ Presence of weeds and plant disease as well as associated vectors (e.g. machinery and livestock)
- ▶ Management of flora in relation to threatened species or communities, seed collection, and revegetation, weed and pest management
- ▶ Fauna habitat management (through clearing management and progressive rehabilitation), threatened species, and pest control.

## 9.4.2 Landform stability

Landform stability is required to maintain a site's current land use following material extraction. Earthworks should be completed with a view to ensuring long-term stability of the sites, and aim to re-establish acceptable surface drainage flows, as well as slope angles and lengths that are stable. These features should also be compatible with the proposed final land-use type, with the proposal risk assessment considering the risk of rehabilitated landforms failing in the future. Landform design should optimise post-use land capability, long-term stability and minimise the costs toward achieving optimal post-use land use.

The final landform should be developed to a safe, stable and non-erosive final landform in consideration of the following elements:

- ▶ Slope ranges
- ▶ Length of slopes (slope designs)
- ▶ Erosion control structures
- ▶ Drainage and water management design and features
- ▶ Cover design (if required for reactive materials)
- ▶ The size and location of any residual voids
- ▶ Landform evolution
- ▶ Construction method
- ▶ Final void rehabilitation and land use (i.e., native vegetation or agricultural land).

## 9.4.3 Topsoil management

The key to successful rehabilitation of native species and grazing land is the management of the topsoil seed resource. Stripped topsoil should be stockpiled in one location and reused immediately in previously disturbed areas requiring rehabilitation, following the completion of operations and consultation with the landowner.

Topsoil stripping should be undertaken in two stages, by stripping and stockpiling the A horizon (topsoil) separately from the B horizon (subsoil) to the correct depths. This will maintain the quality of the soil materials.

Topsoil stockpiles should be formed into low mounds no greater than 3 m high and should be kept covered to retain moisture as far as possible. Long-term stockpiles (longer than 3 months) should be revegetated with seed to protect and minimise loss of soil quality. Temporarily revegetating stockpiles with a sterile cover crop (i.e. rye grass, oats, millet), minimises weed infestation and soil erosion risks, while also maintaining soil organic matter levels, soil structure and microbial activity. Stockpiles should also be protected from wind and water erosion by covering (either with a vegetated top surface or temporary physical barrier if heavy rain is predicted) and placement (in areas with no surface runoff or high wind conditions).

Prior to stripping topsoil, a weed inspection should be conducted for all areas to inform topsoil management and prevent the spread of weed seed material. Such an inspection should then be used to determine if pre-stripping weed control is required, or even to opt not to strip very weed-infested area in order to prevent weed species spread.

Further, prior to re-spreading topsoil, another inspection/assessment of weed infestation should be undertaken to determine if individual stockpiles require surface scalping or burial to ensure material that is unsuitable due to weed infestation, is not used in rehabilitation. Topsoil placement inspections should also be undertaken after topsoil has been placed in rehabilitation areas, to ensure that the topsoil is applied in an appropriate manner.

Additional soil quality characterisation should be undertaken in any areas where the original surface is bare or vegetation does not appear to be in good condition, prior to re-using this material for rehabilitation. This may involve soil chemistry sampling of stripped and stockpiled materials. This will help identify any requirements for soil amelioration (e.g. pH adjustment) or modification of rehabilitation methods to address any limitations to plant growth in the future. The RRMP should identify any areas where the topsoil/growth media quality is of concern, present the results of sampling completed, outline ameliorants recipes and highlight local suppliers that could be used.

#### **9.4.4 Revegetation**

Achieving adequate vegetative cover quickly is a critical aspect of ensuring the long-term rehabilitation success, as well as re-establishing landform stability and minimising erosion risk during the establishment phase. Where possible, rehabilitation should be carried out progressively during extraction operations. This also assists in ongoing vegetation monitoring and enables an adaptive approach to be taken.

Initial revegetation activities should be undertaken during appropriate conditions throughout the year to ensure revegetation activities establish quickly and well and to provide stabilisation benefit during high-rainfall periods (late summer/early autumn); however, an initial protective cover of vegetation should be established within a month after excavation works cease, regardless of the time of year. This will protect the topsoil from desiccation and erosion.

The revegetation approach will further depend on the final land use, as follows.

##### **9.4.4.1 Native vegetation**

Native vegetation revegetation works will depend on the current condition of borrow areas. It may be that areas of native vegetation do not need supplementary planting; however, borrow areas that are disturbed by the proposal and to be reinstated as native vegetation will require stabilisation with vegetation. This may include direct seeding and/or tubestock planting, according to availability, timing and scale of works. Short-term stabilisation can also be achieved with surface layers, such as mulch, but long-term, stabilisation with vegetation is preferred.

Planting of tubestock is much more labour intensive and expensive but may be required in some situations (e.g. to supplement areas of low seed strike rate from the seed bank and direct seeding). For native vegetation land use, the seed mixes and tubestock should be comprised of locally occurring species, which are reflective of the pre-disturbance and surrounding native vegetation communities in the region. Certain species need to be treated for them to germinate (e.g. smoke or vernalisation).

Revegetation works are best carried out in late summer and autumn, when conditions are optimal. In the first instance, a protective groundcover or cover crop vegetation, should be established to prevent raindrop and sheet erosion from occurring. Native (e.g. native grasses or other colonising species) or sterile cultivars should be used to avoid future weed management problems. Natural seed germination from the soil seed bank will supplement direct seeding. Supplementary seed broadcasting may also be considered in areas where native regeneration is poor.

Watering of the rehabilitation areas may be required during dry conditions and fertilising using an appropriate native fertiliser may be undertaken at the time of seeding/planting or afterwards, as required.

In considering the plant species to be used for revegetation, the list of traditional foods and medicines that has been identified in the Appendix E: Aboriginal Cultural Heritage and Archaeological Assessment Technical Report should be used. Many of these species are known to be commercially available as seed and potentially also as tubestock.

##### **9.4.4.2 Agricultural (grazing)**

A seed mix containing native and/or exotic pasture grasses as appropriate to its original land use and surrounding areas should be used to establish a sustainable vegetation cover suitable for an agricultural grazing land use. If the pasture grass cover is initially insufficient to stabilise sloped areas due to slow growth rates, introduced sterile ground covers such as sterile Japanese millet or rye corn should be considered to supplement seed strike and plantings initially and ensure stabilisation of revegetated areas.

#### **9.4.5 Habitat features**

Where woody vegetation from the borrow sites is cleared, it should be retained and stockpiled for re-use in the rehabilitation, either as mulch or coarse woody debris. The use of mulch will enhance organic content in the topsoil, reduce the risk of soil erosion, improve rehabilitated vegetation establishment, increase soil moisture retention and minimise the risk of weed invasion. Larger woody debris should be retained to provide large (and possibly hollow) logs as fauna habitat features. Logs may need to be broken up for relocation and should be placed into rehabilitation areas after revegetation activities have been completed. Preference should be given to relocation into areas of proposed native vegetation land use.

## 9.5 Rehabilitation completion criteria

Completion criteria (also known as success criteria) are used as a qualitative or quantitative standard of performance, against which the rehabilitation will be held and subsequently measured. Over time, progress against these criteria will either indicate the success of the area in achieving the proposed final land use or else will require adaptive management to ensure the rehabilitation is on a trajectory to achieving the criteria.

The following high-level completion criteria have been proposed and relate to the rehabilitation objectives outlined in Section 9.3. These are intended to inform the specific site criteria in the RRMP and provide consistency in the approach across the borrow sites. It is expected that the completion criteria will apply to those areas of the borrow sites that are disturbed for the proposal, rather than the sites overall. Table 9.4 summarises the proposed completion criteria as well as showing links to the objectives, and further outlining a range of potential performance indicators to be included when designing a monitoring program.

The RRMP should further determine these criteria.

**TABLE 9.4 PROPOSED REHABILITATION COMPLETION CRITERIA**

Rehabilitation objectives	Rehabilitation completion criteria	Appropriate performance indicators
Safe and stable	Safe for humans and animals. Landform is integrated into the surrounding landscape, and erosion is within a range observed naturally.	<ul style="list-style-type: none"> <li>▶ Slope angles and length appropriate for soil/material type, and no vertical cliffs remaining</li> <li>▶ Accessible to humans and animals</li> <li>▶ No active erosion or landslip potential.</li> </ul>
Non-polluting	Landform is benign and does not act as a source of contamination or pollution to the surrounding landscape. Area can support the proposed final land use.	<ul style="list-style-type: none"> <li>▶ No residual contamination</li> <li>▶ No apparent geochemical issues</li> <li>▶ Surface water and groundwater quality is comparable to surrounding areas.</li> </ul>
Self-sustaining i.e. native vegetation	Final land use is integrated into the surrounding landscape and exhibits sustained growth and succession, is resilient to natural processes.	<ul style="list-style-type: none"> <li>▶ Weed cover and pest species abundance comparable to surrounding areas</li> <li>▶ Ground cover diversity and organic matter comparable to surrounding areas.</li> </ul>
Self-sustaining i.e. native vegetation	Supports a functional vegetation community and includes some structural elements seen in surrounding areas of native vegetation. Also supports fauna use by reinstating retained habitat features, such as logs. Land use is low maintenance and can be managed in a similar manner to surrounding landscape areas.	<ul style="list-style-type: none"> <li>▶ Species richness of at least 50% seen in surrounding areas</li> <li>▶ Recruitment and establishment observed</li> <li>▶ Native fauna habitat use.</li> </ul>
Self-sustaining (i.e., agricultural land)	Final land use is integrated into the surrounding landscape and exhibits sustained growth and succession and is resilient to natural processes. Supports a pasture community that can successfully provide for grazing operations to occur, with reference to surrounding areas of grazing land. Land use is low maintenance and can be managed in a similar manner to surrounding grazed areas.	<ul style="list-style-type: none"> <li>▶ Ground cover comparable to surrounding areas</li> <li>▶ Proportion of desirable pasture species comparable to surrounding areas</li> <li>▶ Weed cover and pest species abundance comparable to surrounding areas</li> <li>▶ Pasture yield and carrying capacity comparable to surrounding areas.</li> </ul>

## 9.6 Rehabilitation management and monitoring

Rehabilitation reference sites should be established in surrounding areas to provide a baseline to monitor the progress of rehabilitation and identify any intervention or changes to management that are required. Experimental design for rehabilitation monitoring should form a before/after and control/impact arrangement, as far as is possible, to ensure repeatability and robustness of all monitoring data collected and should also draw from existing established methods for monitoring vegetation in the region. Ideally, locations from which baseline information has already been collected to inform the proposal could be used as reference sites (representing 'before' and 'control' sites). Reference sites must be established prior to rehabilitation activities occurring; however, it should be noted that rehabilitated sites will typically never be the same as reference sites and this should be considered when determining completion criteria for the site.

A detailed rehabilitation monitoring program is to be developed as part of the RRMP for all areas subject to rehabilitation and include the borrow sites. Methods for monitoring should be specified for each of the completion criteria and may include some or all of the appropriate performance indicators. Consideration should be given to understanding the following aspects of the rehabilitation:

- ▶ Landform stability
- ▶ Land capability
- ▶ Soil analysis
- ▶ Flora, vegetation, pasture and fauna surveys
- ▶ Final void if relevant (water quality, safety, land use, native wetland or agricultural resource).

An indicative timeframe for the implementation of the monitoring program is also to be provided, with consideration of rehabilitation in early development and established mature rehabilitation. A monitoring program should be developed and implemented immediately on approval of the proposal (within the RRMP) to allow for establishment of reference sites prior to rehabilitation activities occurring. The monitoring program must be designed to demonstrate that the completion criteria have been met or else contain corrective actions, as required.

All rehabilitation monitoring reports should be developed with reference to the RRMP, approval conditions and established completion criteria. The monitoring report should outline the performance of the rehabilitation since the preceding monitoring event, and convey whether the sites are on a trajectory towards achieving completion criteria, or if a site requires further rehabilitation works to improve their likelihood of meeting its completion criteria.

## 9.7 Adaptive review and management

This rehabilitation strategy has been developed as a high-level document to provide guidance, as appropriate, to the current phase of the proposal. This strategy should continue to be reviewed and further detailed as the proposal progresses. Adaptive management tools, such as trigger action response plans, should be developed to establish a framework for response to 'non-normal' circumstances. These trigger action response plans will clearly identify when to trigger management response to unexpected events, such as a flood or drought, or poor rehabilitation performance.

The trigger action response plans will also outline management actions to be completed as required to address any issues of concern or identified unpredictable impacts, and may include a range of activities such as:

- ▶ Weed and feral animal control
- ▶ Repair of erosion features
- ▶ Maintenance of build structures (such as drainage features)
- ▶ Growth media amelioration and supplementary re-vegetation.

## 9.8 Conclusion

ARTC seeks planning approval for the temporary use of up to 11 borrow sites to extract and supply approximately 1,500,000 m<sup>3</sup> of material for the construction of the proposal over approximately 18 months, or until the material demand for the proposal ceases.

This rehabilitation strategy has been prepared to ensure that rehabilitation occurs in accordance with good industry practice. The strategy outlines the rehabilitation objectives, approach, monitoring and reporting requirements for each borrow site. As appropriate, ARTC will prepare a RRMP, including the borrow sites, which the Contractor would then have to implement and comply with.

The RRMP would include a discussion on the existing environment and presentation of baseline data, as well as further consideration of final land use and actions for achieving the final rehabilitated landform, revegetation recommendations, maintenance and management actions, monitoring and risk assessment. The RRMP should also include detail of the closure phase for the proposal, which links the rehabilitation activities to the success criteria, and outlines how the borrow sites will be returned to safe, stable, non-polluting and self-sustaining native vegetation or agricultural landscape, and/or to the satisfaction of the landowner.