



## APPENDIX J

# ARROW BOWEN PIPELINE – ENVIRONMENTAL MANAGEMENT PLAN

## OUTLINE SOIL MANAGEMENT PLAN



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# 1 INTRODUCTION

1.1 Purpose of the Soil Management Plan

1.2 Project description

1.3 Legislation and environmental guidelines

## 2 PRE-CONSTRUCTION SOIL ENVIRONMENT

### 2.1 Previous soil assessment

### 2.2 Baseline soil assessment and soil environment (pre-disturbance)

#### 2.2.1 Soil management units

### 3 SOILS MANAGEMENT PLAN FRAMEWORK

#### 3.1 Summary of management plan elements

Table X-X: Potential soil issues relevant to the Soil Management Plan

Issue	Potential occurrence	Site based management measures
Acid sulfate soils		
Sodic soils		
Saline soils		
Saline-sodic soils		
Non sodic soils of low cohesion		
Cropping soils and SCL		
Topsoil management		
Stockpile management		
Contaminated material management		
Waste/spoil management		
Dust		
Runoff/erosion		
Emergency management/unexpected conditions		
Worker safety		

## 3.2 Construction activities

3.2.1 Vegetation clearing

3.2.2 Topsoil stripping and management

3.2.3 Subsoil management

3.2.4 Stockpiling

3.2.5 Rehabilitation

3.2.6 Overland flow

3.2.7 Erosion and sediment control

3.2.8 Watercourse protection

## 3.3 Monitoring

3.3.1 During construction

3.3.2 Post construction/during operations

## 4 SOILS MANAGEMENT PLAN IMPLEMENTATION STRATEGIES

### 4.1 Contractor's Construction Management Plan

### 4.2 Organisational responsibilities

#### 4.2.1 On site training

#### 4.2.2 Monitoring and inspection

#### 4.2.3 Complaints management

#### 4.2.4 Emergency response

#### 4.2.5 Documentation and reporting

### 4.3 Staff responsibilities

## 5 MANAGEMENT PLAN ELEMENTS

Element 1: Acid sulfate soils	
Policy	
Background information and context	
Performance criteria	
Implementation strategy	
Monitoring	
Reporting	
Corrective actions	

Element 2: Sodic soils	
Policy	<p>To manage disturbed sodic soils in such a way that:</p> <ul style="list-style-type: none"> <li>▪ Erosion of stockpiled materials is minimised.</li> <li>▪ Subsoil erosion and insitu dispersion is minimised.</li> <li>▪ Toxicity effects on vegetation are minimised.</li> </ul>
Background information and context	<p>Sodic soils have been identified throughout the Project area, and where they must be disturbed management of physio-chemical properties will be required to negate long term impacts.</p> <p>Further works will be required to delineate sodic soils from non-sodic soils along the ROW.</p>
Performance criteria	<ul style="list-style-type: none"> <li>▪ Erosion minimised throughout the ROW. Suspended sediments in receiving water comparable to non-disturbed areas.</li> <li>▪ Pipeline integrity is not jeopardised by buried sodic material erosion/dispersion.</li> <li>▪ Comparable penetration resistance to pre-disturbance levels</li> <li>▪ Successful plant establishment and growth.</li> </ul>
Implementation strategy	<ul style="list-style-type: none"> <li>▪ Clearing restricted to essential areas only.</li> <li>▪ Minimise the length of time soils are exposed.</li> <li>▪ Divert runoff away from disturbed areas.</li> <li>▪ Sodic materials (topsoils and subsoils) will be stockpiled separately to non sodic materials.</li> <li>▪ Use non dispersive soils or physically cover material to stabilise slopes and top of stockpile.</li> <li>▪ Adequate erosion measures around stockpile to be in place (e.g. erosion netting, appropriate battering, locating stockpile outside of water flow path) in accordance with the ESC Plan.</li> <li>▪ Stockpiles will have adequate gaps between each for movement of workers and fauna.</li> <li>▪ Backfilling will occur progressively in as minimal time as practicable following disturbance.</li> <li>▪ Optimum moisture content for disturbance will be achieved where</li> </ul>

	<p>practical.</p> <ul style="list-style-type: none"> <li>▪ Construction using dozers to retain soil structure.</li> <li>▪ Amelioration using a soil conditioner (e.g. gypsum) to reduce dispersion potential.</li> <li>▪ Dispersive soils should be buried beneath component non-sodic soils, allowing a suitable depth of competent soils to be reinstated over the top.</li> </ul>
Monitoring	<p>Monitoring and auditing of this element will be conducted in accordance with (insert relevant EHSMS).</p> <p>Periodic inspection of stockpiles (including after rain events) to monitor erosion.</p> <p>Periodic inspection of backfilled areas with known sodic materials to monitor ground condition and erosion.</p> <p>Backfilled soils will be periodically tested after completion of reinstating activities to confirm depth to dispersive materials and post-reconstruction penetration resistance.</p> <p>Agronomic testing of the soil profile may be undertaken to confirm minimal change to the soil chemical profile has occurred.</p>
Reporting	<p>Reporting for this element will be conducted in accordance with (insert relevant EHSMS).</p>
Corrective actions	<p>Investigation and recording of corrective actions will be conducted in accordance with (insert relevant EHSMS).</p>

Element 3: Saline soils	
Policy	
Background information and context	
Performance criteria	
Implementation strategy	
Monitoring	
Reporting	
Corrective actions	

Element 4: Saline-sodic soils	
Policy	
Background Information and context	
Performance criteria	
Implementation strategy	

Monitoring	
Reporting	
Corrective actions	

Element 5: Non-sodic soils of low cohesion	
Policy	
Background information and context	
Performance criteria	
Implementation strategy	
Monitoring	
Reporting	
Corrective actions	

Element 6: Cropping soils and SCL	
Policy	<p>To manage cropping soils and SCL in such a way that there is minimal disturbance to land suitability, including:</p> <ul style="list-style-type: none"> <li>▪ Compaction hardpans are minimised.</li> <li>▪ The chemistry of backfilled soils is not changed notably from pre-construction profiles.</li> <li>▪ Cropping land use is able to continue across the ROW in these soils with comparable crop yield to pre-disturbance levels.</li> </ul>
Background information and context	<p>Where soils are currently cropped, consideration of soil profile reconstruction is integral to retaining land suitability. Management of cropping soils requires staged excavation and care taken in reinstatement to minimise changes to the soil chemical profile.</p>
Performance criteria	<ul style="list-style-type: none"> <li>▪ Cropping soils reinstated so that land suitability is not affected.</li> <li>▪ Pipeline installation does not affect land suitability.</li> </ul>
Implementation strategy	<ul style="list-style-type: none"> <li>▪ Activities will be conducted in accordance with (insert relevant EHSMS).</li> <li>▪ Soils will only be worked at their optimal water content.</li> <li>▪ Soils (both topsoils and subsoils) are to be sequentially stripped at incremental layers (according to soil physical and chemical properties) and stockpiled separately.</li> <li>▪ The pipeline is to be buried no less than 800mm to ground level.</li> <li>▪ Soils will be backfilled sequentially in order of excavation.</li> <li>▪ Soils will be compacted to a similar bulk density to pre-disturbance.</li> <li>▪ Adequate signage and landholder education will be undertaken to minimise risk of striking the pipeline during ripping.</li> </ul>

	<ul style="list-style-type: none"> <li>Weeds will be managed in accordance with the Weed Management Plan.</li> </ul>
Monitoring	<p>Monitoring and auditing of this element will be conducted in accordance with (insert relevant EHSMS).</p> <p>Backfilled soils will be periodically tested after completion of reinstating activities to confirm targeted bulk density has been achieved.</p> <p>Agronomic testing of the soil profile may be undertaken to confirm minimal change to the soil chemical profile has occurred.</p> <p>Crop yields pre disturbance will be compared to post disturbance levels in conjunction with control non-disturbed areas.</p>
Reporting	Reporting for this element will be conducted in accordance with (insert relevant EHSMS).
Corrective actions	Investigation and recording of corrective actions will be conducted in accordance with (insert relevant EHSMS).

Element 7: Topsoil management	
Policy	<p>To manage the excavation and replacement of topsoil resources such that:</p> <ul style="list-style-type: none"> <li>Impacts to topsoil quality are minimised.</li> <li>The natural seed bank capacity of topsoils is retained.</li> <li>Erosion of stockpiled topsoil is managed.</li> </ul>
Background information and context	Management of the topsoil resource during construction is important for determining success of long term vegetative rehabilitation across the ROW.
Performance criteria	<ul style="list-style-type: none"> <li>Topsoil stripped from subsoil material and stockpiled separately.</li> <li>Topsoil replaced at adequate thickness and correct bulk density.</li> <li>Revegetation from both residual seed bank and supplementary seeding.</li> <li>No evidence of topsoil loss from stockpiles.</li> </ul>
Implementation strategy	<ul style="list-style-type: none"> <li>Activities will be conducted in accordance with (insert relevant EHSMS).</li> <li>Topsoil thickness will be determined before stripping</li> <li>Topsoil will be stripped using a grader to the prescribed depth</li> <li>Topsoils should be wetted to reduce wind erosion and loss of structure during removal and reinstatement.</li> <li>Topsoil to be stockpiled separately to other soil materials and will be cleared of the majority of established vegetative material prior to stockpiling.</li> <li>Adequate erosion measures around stockpile to be in place (e.g. erosion netting, appropriate battering, locating stockpile outside of water flow path) in accordance with the ESC Plan.</li> <li>Stockpiles will have adequate gaps between each for movement of workers and fauna.</li> <li>Where there is an abrupt change in soil quality (including rock outcrop, salinity/sodicity, cracking clays), these materials will be stockpiled separately to facilitate accurate reinstatement of the local soil profile.</li> <li>Where the nature of the material may require further management (including contamination or PASS), these materials will be stockpiled separately to facilitate characterisation and rehabilitation (where required).</li> <li>Topsoil will not be used as backfill or padding or for any other use.</li> <li>Saline and/or sodic topsoils will be appropriately treated as encountered during disturbance.</li> </ul>

	<ul style="list-style-type: none"> <li>▪ The topsoil will be reinstated in the minimum time practicable.</li> <li>▪ Topsoil will be returned to a similar bulk density to undisturbed soils in the area.</li> <li>▪ Topsoil will be reseeded in accordance with the Revegetation Management Plan.</li> </ul>
Monitoring	<p>Monitoring and auditing of this element will be conducted in accordance with (insert relevant EHSMS).</p> <p>Stockpiles will be regularly inspected to assess the effectiveness of erosion control measures and stockpile management.</p> <p>Once reinstated, the ROW will be inspected to confirm revegetation. Vegetation should be confirmed as established prior to the commencement of the wet season.</p>
Reporting	Reporting for this element will be conducted in accordance with (insert relevant EHSMS).
Corrective actions	Investigation and recording of corrective actions will be conducted in accordance with (insert relevant EHSMS).

Element 8: Stockpile management	
Policy	
Background information and context	
Performance criteria	
Implementation strategy	
Monitoring	
Reporting	
Corrective actions	

Element 9: Contaminated material management	
Policy	
Background information and context	
Performance criteria	
Implementation strategy	
Monitoring	
Reporting	

Corrective actions	
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Element 10: Waste/spoil management	
Policy	
Background information and context	
Performance criteria	
Implementation strategy	
Monitoring	
Reporting	
Corrective actions	

Element 11: Dust	
Policy	
Background information and context	
Performance criteria	
Implementation strategy	
Monitoring	
Reporting	
Corrective actions	

Element 12: Runoff/erosion	
Policy	
Background information and context	
Performance criteria	

Implementation strategy	
Monitoring	
Reporting	
Corrective actions	

Element 13: Emergency management/unexpected conditions	
Policy	
Background information and context	
Performance criteria	
Implementation strategy	
Monitoring	
Reporting	
Corrective actions	

Element 14: Worker safety	
Policy	
Background information and context	
Performance criteria	
Implementation strategy	
Monitoring	
Reporting	
Corrective actions	

## 6 SUMMARY

## Appendix A. Supporting technical documents

## Appendix B. Standard reporting documentation