

Rehabilitation completion criteria

Dewhurst 22-31 Pilots and Dewhurst 13-18H Extension



1. Background

This plan is a requirement of the conditions of approval for the Dewhurst 22-25 and Dewhurst 26-29 Pilot Wells exploration program, granted by the NSW Office of Coal Seam Gas, dated 16 August 2013. The criteria for completion of rehabilitation works has also been developed for the Dewhurst 13-18H Extension and Dewhurst 30 and 31 Pilots. The relevant conditions of consent relating to well decommissioning and rehabilitation are stated below:

1.1. Dewhurst 22-25 and Dewhurst 26-29 - relevant approval conditions

General Conditions

2. *All works must be completed and the site fully rehabilitated by the end of the current term of PEL 238, being 2 August 2016, unless an extension to this period is approved by the Minister before this time.*

Rehabilitation

5. *Quantitative rehabilitation completion criteria for disturbed areas must be submitted to, and approved by the Minister within 3 months of the date of this approval. The licence holder must take account of the pre-disturbance vegetation characteristics (density and diversity) of the project area in the development of the rehabilitation completion criteria*

1.2. Dewhurst Gas Exploration Pilot Expansion (Dewhurst 13-18H Extension and Dewhurst 30 and 31 Pilots) - relevant approval conditions

Schedule 2: Administrative Conditions

Obligation to minimise harm to the Environment

1. *In addition to meeting the specific performance criteria established under this consent, the Applicant shall implement all reasonable and feasible measures to prevent and/or minimise any harm to the environment that may result from the construction, operation, or rehabilitation of the development.*

Limits on Consent

Resource appraisal

5. *Wells in the development may be operated for:*
 - a. *a period of 3 years from the date of consent, in the case of existing wells within the development; and*
 - b. *a period of 3 years from the date of well completion, in the case of the Dewhurst 30 and 31 Extension wells.*

Notes:

- *Under this consent, the Applicant is required to rehabilitate the site and perform additional undertakings to the satisfaction of the OCSG. Consequently this consent will continue to apply in all other respects other than the right to operate the development until the rehabilitation of the site and these additional undertakings have been carried out satisfactorily.*
- *The drilling and operation of petroleum exploration wells requires a Petroleum Exploration Licence or Petroleum Assessment Lease to be held under the Petroleum (Onshore) Act 1991.*

Schedule 3: Specific Environmental Conditions

Construction and Operation of Petroleum Wells

6. *The Applicant must ensure that all petroleum wells:*
 - a) *must be designed, constructed, maintained and abandoned in accordance with the Code of Practice for Coal Seam Gas – Well Integrity (DTIRIS 2012);*

Progressive Rehabilitation

28. *Unless otherwise agreed by the Secretary, the Applicant shall rehabilitate progressively, that is, as soon as reasonably practicable following disturbance, all surface borehole locations and any other parts of the site impacted by the development, to the satisfaction of the OCSG.*
29. *Prior to commencing construction of the Dewhurst 13-18H Extension and Dewhurst 30 and 31 Extension wells, the Applicant shall revise its Rehabilitation Management Plan to the satisfaction of the OCSG.*
30. *The Applicant shall fully seal and rehabilitate all boreholes, to the satisfaction of OCSG, no longer than 10 years after drilling of the Dewhurst 13-18H Extension and Dewhurst 30 and 31 Extension is completed, unless a development application related to gas production is submitted to the Department by that date.*

Schedule 5 Environmental Management, Reporting and Auditing

Annual Review

4. *By the end of March each year, or other timing as may be agreed by the Secretary, the Applicant shall review the environmental performance of the development to the satisfaction of the Secretary. This review must:*
 - a) *describe the development (including any rehabilitation) that was carried out in the past calendar year, and the development that is proposed to be carried out over the next year;*
 - b) *include a comprehensive review of the monitoring results and complaints records of the development over the past calendar year, which includes a comparison of these results against the:*
 - i. *relevant statutory requirements, limits or performance measures/criteria;*
 - ii. *requirements of any plan or program required under this consent;*
 - iii. *monitoring results of previous years; and*
 - iv. *relevant predictions in the EIS;*
 - c) *identify any non-compliance over the past calendar year, and describe what actions were (or are being) taken to ensure compliance;*
 - d) *identify any trends in the monitoring data over the life of the development;*
 - e) *identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and*
 - f) *describe what measures will be implemented over the current calendar year to improve the environmental performance of the development.*

2. Rehabilitation program

2.1. Approach

Rehabilitation of the well leases and gathering system corridors will occur in two stages as detailed in sections 2.7.4.5 and 2.7.9 of the *Dewhurst 22-25 Pilot Wells Review of Environmental Factors* (REF), sections 2.7.5.4 and 2.7.6 of the *Dewhurst 26-29 Petroleum Wells REF*, and sections 4.3.11 and sections 4.5 of the *Dewhurst Gas Exploration Pilot Expansion EIS*. The first stage will involve reducing the well lease area and gathering system corridor width through progressive rehabilitation following drilling activities, whilst enabling ongoing access and maintenance. The second stage is final rehabilitation and this will occur following decommissioning of the infrastructure.

Santos will undertake works to facilitate natural revegetation in both stages of rehabilitation. This will include reinstatement of the ground surface to mimic its natural state and spreading of retained woody material and/or mulched material. Natural revegetation is considered appropriate for this environment and this approach is supported by Forestry Corporation of NSW (Forestry NSW).

Eco Logical Australia recently conducted a review of the success of a natural revegetation approach to rehabilitation. As part of the review, six sites were identified along the Wilga Park Gas Flow Line route that was constructed in 2007/8. The effectiveness of rehabilitation was measured in 2012 and again in 2013 at six locations along the flow line. At all locations, the number of native species increased over the year and were generally within 30% of the numbers observed in the reference sites. Rehabilitation sites approximated 45% of the condition of reference sites, suggesting that successful rehabilitation can be achieved in relatively short timeframes using the methods proposed.

2.2. Methodology

Rehabilitation will include:

- removing perimeter fencing and all other infrastructure
- flushing and capping the gathering system at each end, and leaving *in situ* in the ground
- replacing sub-soil across the well leases, contouring to the landscape and partially compacting
- placing top-soil uniformly across the well leases, and grading to natural levels
- identifying suitable reference sites to assist in monitoring rehabilitation success
- revegetating well leases with native species from existing seed bank within top soil
- surface contouring, through ploughing and the creation of “hummock” and low relief features similar to the surrounding area
- spreading of retained woody material
- blocking of access tracks with timber to minimise disturbance of the site by vehicles and to maximise natural regeneration
- controlling weeds
- on-going monitoring of success through comparison to identified reference sites.

Assisted planting would be considered in the event that natural regeneration is unsuccessful, in accordance with the criteria in the table below. Any assisted revegetation will utilise species that:

- are locally available to eliminate the introduction and establishment of foreign species from other areas of the Pilliga and/or weeds
- reduce erosion of sediment by wind or water by root mass created in rehabilitated soils
- enhance the speed of plant colonisation of rehabilitated soils beyond that expected from surrounding areas alone

- provide microsites for further natural species ingress into the rehabilitated areas, especially tree species which require some immediate low-level shelter, soil moisture and organic content
- provide wildlife habitat in the rehabilitated areas.

2.3. Rehabilitation survey methodology

Ecological data collected as part of the Environmental Impact Statements for the Dewhurst 22-31 Pilots and Dewhurst 13-18H Extension followed the methods outlined in the Biobanking Assessment Methodology (BBAM).

To ensure consistency with existing datasets including undertaking accurate assessments against reference criteria it is recommended that a subset of the Biobanking Assessment Methodology survey methods are implemented for the monitoring the rehabilitation sites, specifically:

- A list of all plant species present in each structural layer (native and exotic) in a 20 x 20 m (0.04 ha) rehabilitation plot.
- Native canopy and mid-storey cover visually estimated at 10 points along a 50 m line transect and divided by 10 to provide an estimated projected foliage cover.
- Ground cover (categorised by native grasses, shrubs, other and exotic species), determined by recording their intersection at 50 points along a 50 m line transect and dividing the total number of hits by 50 to provide an estimated projected foliage cover.
- A photograph from a fixed point at the start point of each transect.

The layout for each 20 x 20 rehabilitation plot and 50 m line transect is shown in Figure 1. The location of each plot should be recorded with a hand-held GPS unit at the start of each transect.

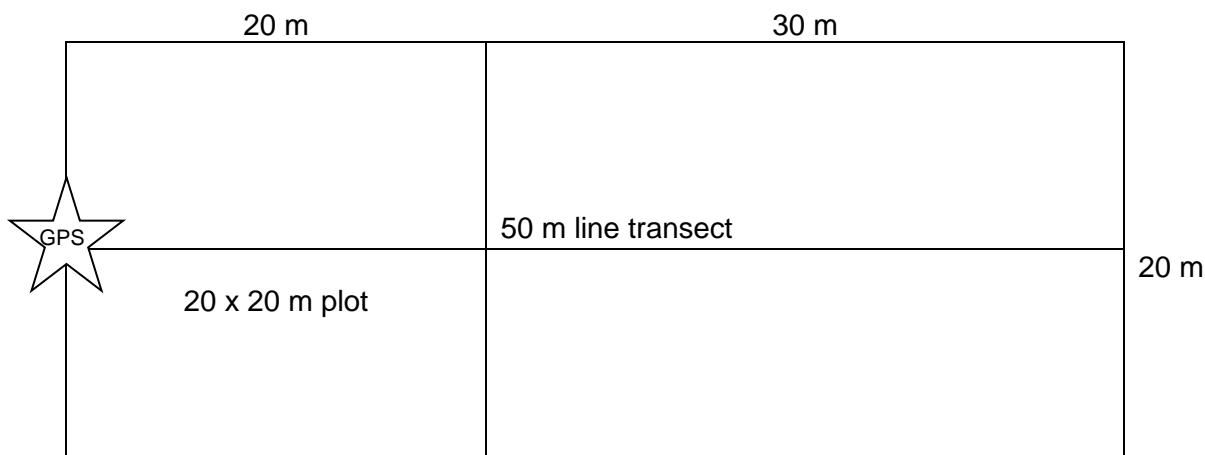


Figure 1 Rehabilitation Plot Layout

2.4. Quantitative rehabilitation completion criteria

Rehabilitation success will be assessed against the reference conditions outlined in **Table 1**. Reference conditions outlined in the respective Environmental Impact Statements for the Dewhurst 22-31 Pilots and Dewhurst 13-18H Extension are a summary of values observed during ecological assessment at each site. Due to natural variability and disturbance histories (forestry, bushfire etc.), data collected at individual sites is not representative of each vegetation community across their range.

In order to provide a more accurate representation of reference conditions for each vegetation community in the locality, data collected from 25 vegetation plots within 5 km of the Dewhurst 22-31 Pilots and Dewhurst 13-18H Extension was pooled and analysed. Vegetation plot data within 5 km was selected (rather than including the entire dataset) as this data is considered to accurately represent the condition of vegetation communities occurring in the vicinity of the Dewhurst 22-31

Dewhurst 22-31 Pilots and Dewhurst 13-18H Extension

Pilots and Dewhurst 13-18H Extension. This data was sourced from a broader dataset which allows assessment and characterisation of each vegetation community across the region.

From this data, the mean and 90% confidence intervals were determined for canopy, shrub/midstorey and groundcover for each vegetation community. Rehabilitation sites are expected to fall within these values 90% of the time, once the vegetation has returned to natural condition (>15 years). Regular monitoring of reference sites will be required to assess whether the vegetation is on a trajectory towards meeting these values.

Rehabilitation performance and completion criteria have been developed based on conditions of approval, Petroleum Exploration Licence (PEL 238) conditions and the Permit to Occupy issued by the Forestry Corporation of NSW and the State of NSW. These are summarised in **Table 2**.

Table 1 Reference conditions

VEGETATION COMMUNITY	CORRESPONDING CLASS (NAMOI RVC)	APPROXIMATE AREA OF REHABILITATION REQUIRED (HA)	REFERENCE CHARACTERISTICS ¹					
			CANOPY		SHRUB/MIDSTOREY ³		GROUNDCOVER ⁴	
			COVERAGE % (MEAN AND 90% CI) ²	SPECIES RICHNESS	COVERAGE % (MEAN AND 90% CI) ²	SPECIES RICHNESS	COVERAGE %(MEAN AND 90% CI) ²	SPECIES RICHNESS
DEWHURST 22-31 PILOTS AND DEWHURST 13-18H EXTENSION								
Narrow-leaved Ironbark - White Cypress Pine - Buloke tall open forest	Ironbark Shrubby Woodland of the Pilliga Area, Brigalow Belt South	13.16	11.31 \pm 4.07	1-5	12.52 \pm 7.52	1-5	19.08 \pm 5.96	>10
Rough-barked Apple - red gum - cypress pine woodland	Rough-barked Apple - Blakely's Red Gum riparian grassy woodlands, Brigalow Belt South and Nandewar	1.02	14.48 \pm 7.72	1-5	11.09 \pm 7.35	0-5	25.67 \pm 8.96	>10

Note: ¹.Reference characteristics have been determined for each vegetation community based on data collected from a regional pool of 25 located within 5 km of the Dewhurst 22-31 Pilots and Dewhurst 13-18H Extension. Rehabilitation is not expected to approximate these reference characteristics until well established (>15 years). Values recorded at rehabilitation sites outside of the confidence intervals does not necessarily reflect unsuccessful rehabilitation. Natural regeneration of native vegetation communities is dynamic and will fluctuate seasonally until the vegetation is well established. Careful analysis of rehabilitation site data against reference characteristics is required.

Note: ². 90% of values are expected within and 10% of values are expected outside of the 90% confidence intervals.

Note: ³. 'Midstorey' and 'ground cover shrub' values collected from rehabilitation plots need to be pooled to determine the shrub/midstorey cover.

Note: ⁴. 'Ground cover grasses' and 'ground cover other' values collected from rehabilitation plots need to be pooled to determine the groundcover.

Table 2: Rehabilitation performance and completion criteria

PHASE	DESCRIPTION	ACTIVITY	TIMING ¹	COMPLETION CRITERIA
Decommissioning of site infrastructure	Lease areas (including flare and water balance tank)	All plant, equipment, containers, waste materials and temporary buildings removed from the site. Fencing removed.	Within 6 months of abandonment.	Site cleared. Decommissioning of the wells in accordance with the NSW Code of Practice for Coal Seam Gas Well Integrity (DTIRIS, 2012b)
	Gathering system	Pipes flushed and capped each end, remain <i>in situ</i> .	Within 6 months of abandonment.	Decommissioning in accordance with <i>APIA Code of Practice, Upstream PE Gathering Networks – CSG Industry, Version 2.0</i> .
Landform establishment		Site graded and reshaped to reinstate, as far as practicable, the original contour and drainage. Erosion and sediment control implemented to minimise runoff channelling/erosion.	Within 6 months of abandonment.	No areas of instability or slumping. No areas of active erosion. Site landform established that is suitable for final land use and compatible with surrounding landscape.
Ecological restoration	Flora recolonisation	Restoration activities by natural recolonisation of plants. If required, assisted restoration by seeding and/or planting where natural recolonisation does not meet requirements within stated period.	Within 2 years of abandonment by natural recolonisation. Where natural recolonisation has produced no evidence of soil stabilisation after 6 months of rehabilitation, commence assisted restoration.	Moderate level of native species diversity restored. Groundcover restored to within 75% of reference condition.

Dewhurst 22-31 Pilots and Dewhurst 13-18H Extension

PHASE	DESCRIPTION	ACTIVITY	TIMING ¹	COMPLETION CRITERIA
	Fauna habitat restoration	Restore lengths of fallen logs and woody debris in accordance with advice from a suitably qualified ecologist.	Within 6 months of abandonment.	Fauna habitat complexity increased, leading to return and survival of established species.
Weed management		Infestations of noxious weeds in right of way and lease areas managed in accordance with requirements of <i>Noxious Weeds Act 1993</i> .	Until ground cover achieves completion criteria, as above.	Weeds do not dominate after disturbance or after rain.
Monitoring and reporting	Reporting to regulator	Annual review report prepared. Report to be submitted to OCSG within DTIRIS following the completion of all rehabilitation activities (civil works, waste removal, etc.) in accordance with condition 3 of PAL 2.	Annually and at completion of rehabilitation.	Report submitted.

Note: ¹. Rehabilitation works to be completed for Dewhurst 22-29 by 2 August 2016 unless an extension to PEL 238, or an appraisal or production lease over the area, is granted before this time. Rehabilitation works to be completed within 10 years after the Dewhurst 13-18H Extension, and drilling for the Dewhurst 30 and 31 wells is completed.