METROPOLITAN COAL
CONSTRUCTION MANAGEMENT PLAN

SURFACE WORKS ASSESSMENT FORM

SWAMP PIEZOMETER BOREHOLES

April 2012

Metropolitan Coal

Proposed Installation of Swamp Piezometer Boreholes

Background

The subject Surface Works Assessment (SWA) Form is submitted to DP&I and SCA for the proposed installation of piezometers to obtain required upland swamp groundwater monitoring data in accordance with the Metropolitan Coal Longwalls 20-22 Biodiversity Management Plan (BMP).

The SWA Form provides details of construction and environmental management to append the Construction Management Plan as approved by DP&I on 14 November 2011.

In accordance with the BMP, the collection of baseline data is required to be obtained for upland swamps overlying Longwalls 23-27.

Baseline data obtained for upland swamps overlying Longwalls 23-27 will include:

- information on swamp types (e.g. headwater, valley side or in-valley);
- swamp characterisation (e.g. vegetation, termination, substrates, photographs);
- baseline vegetation data collected at a selection of upland swamps overlying Longwalls 23-27 and at appropriate control sites; and
- groundwater monitoring data.

Information on swamp types and characterisation has been obtained as required, and swamp vegetation surveys commenced in 2010. The subject SWA Form is for the installation of swamp piezometers to satisfy the requirement for baseline groundwater monitoring data. The timing for the baseline data in relation to the next Extraction Plan (Longwalls 23-27) is to ensure that baseline data for the next upland swamps are collected before extraction occurs within 600 metres (m) of these features.

The swamps to be monitored have been selected in consideration of the Metropolitan Coal vegetation monitoring program and predicted subsidence impacts. The specific piezometer locations within the swamps were chosen based on swamp sediment depths, the geophysical characteristics of the swamps (e.g. elevation, slope, rockbars etc.) and constraints associated with vegetation monitoring sites identified during the inspections.

Site Locations

The sites are located within the Woronora Special Area in the local government area (LGA) of Wollongong City Council. The Woronora Special Area covers a region of approximately 75 square kilometres (km^2) and includes the catchment of Woronora Dam. SCA manages the Woronora Special Area and public access is restricted.

The proposed activities are situated within the Metropolitan Coal mining lease (Consolidated Coal Lease (CCL) 703). The township of Helensburgh is located approximately 5 km to the east.

The tables below detail the proposed piezometer installation sites (illustrated in Figure 1).

Swamp 28 – Banksia thicket (upper) and tea tree thicket (lower)

Sediment depth	> 2m in banksia thicket at western upper edge of swamp.
Proposed piezometer location	311003, 6214783. 5m in from southern edge of swamp.
Piezometer depths	One piezometer installed as deep as possible within the swamp sediments with a hand auger. A second piezometer installed at a depth of 10 m within the shallow groundwater (i.e. below the swamp sediment/sandstone interface; depth to be confirmed once drilling has established the sediment depth).
Other observations	Tea tree thicket section (in the northwest of the swamp) is only small and includes a lot of tagged plants – not enough room for installation of a piezometer.

Swamp 30 – Restioid heath

Sediment depth	Shallow (< 600mm) near downslope end, approx 1m deep further upslope.
Proposed piezometer location	311166, 6215123.
Piezometer depths	One piezometer within the swamp sediment at a depth of 1m. A second piezometer installed 10m deep, within the underlying sandstone/shallow groundwater system.
Other observations	Similar substrate depth characteristics to Swamp 35.

Swamp 33 – Side valley banksia thicket

Sediment depth	Sediment depth < 600mm across most of swamp. Deeper sediments (approx 1m) only found in one spot towards western edge of swamp, upslope of small patch of trees.
Proposed piezometer location	311587, 6214530. In western part of swamp.
Piezometer depths	One piezometer within the swamp sediment at a depth of 1m. A second piezometer installed 10m deep, within the underlying sandstone/shallow groundwater system.
Other observations	Steepest slope inspected. 5m cliff at downslope end of swamp.

Swamp 35 – Restioid heath

Sediment depth	Deeper sediments (approx 1m) found approx 10m upslope of rock bar.
Proposed piezometer location	311498, 6215153.
Piezometer depths	One piezometer within the swamp sediment at a depth of 1m. A second piezometer installed 10m deep, within the underlying sandstone/shallow groundwater system.
Other observations	Drainage channel at bottom of small drop-off downslope of rock bar.

Swamp 137a – Restioid heath (Control for Swamps 30 and 35)

Sediment depth	Sediment depth < 600mm across lower end of swamp. Deeper sediments (approx 1m) found approx 20m upslope of rockbar.
Proposed piezometer location	308461, 6217143.
Piezometer depths	One piezometer within the swamp sediment at a depth of 1m. A second piezometer installed 10m deep, within the

	underlying sandstone/shallow groundwater system.
Other observations	Access will have to be from upper end of swamp (from the east).

Swamp 137b – Side-valley banksia thicket (Control for Swamp 33)

Sediment depth	Sediment depth < 600mm across lower end of swamp. Deeper sediments (approx 1m) found approx 25m upslope of rockbar.
Proposed piezometer location	308393, 6216959.
Piezometer depths	One piezometer within the swamp sediment at a depth of 1m. A second piezometer installed 10m deep, within the underlying sandstone/shallow groundwater system.
Other observations	Access will have to be from upper end of swamp.

Bee Creek swamp – Banksia thicket (Control for Swamp 28)

Sediment depth	Sediment depth approximately 2m deep in less densely vegetated area, approx 10m south of small pool.
Proposed piezometer location	308724, 6218934
Piezometer depths	One piezometer installed as deep as possible within the swamp sediments with a hand auger. A second piezometer installed at a depth of 10 m within the shallow groundwater (i.e. below the swamp sediment/sandstone interface; depth to be confirmed once drilling has established the sediment depth).
Other observations	Small pool approx 0.5m deep located 10m to north of proposed piezometer site.

Figure 1 - Upland Swamp Piezometers

Construction Management Plan

Surface Works Assessment Form

Note, this form must be completed in full prior to the commencement of surface disturbance works

Date: *11 April 2012*

Name and position: *Ryan Pascoe, Manager – Environment & Community*

Register number (i.e. Number 1, 2, etc.): *4*

RMP register number: *4*

Site name:
Upland Swamp Piezometers – Woronora Special Area, Helensburgh:

Site Reference	*Swamp Name*	*Status*	*Swamp Vegetation*
S28	*Swamp 28*	*Longwall site*	*Banksia Thicket*
S30	*Swamp 30*	*Longwall site*	*Restioid Heath*
S33	*Swamp 33*	*Longwall site*	*Banksia Thicket*
S35	*Swamp 35*	*Longwall site*	*Restioid Heath*
S137a	*Swamp 137a*	*Control for Swamps 30 & 33*	*Restioid Heath*
S137b	*Swamp 137b*	*Control for Swamp 33*	*Banksia Thicket*
SBC	*Bee Creek Swamp*	*Control for Swamp 28*	*Banksia Thicket*

Site type:
Environmental monitoring sites – piezometers. Each piezometer will be equipped with a data logger for continuous water level monitoring. Following piezometer installation, a detailed survey of the piezometer locations will be conducted to an accuracy of ± 1 centimetre.

Site co-ordinates (easting/northing):

Site Reference	*Easting*	*Northing*
S28	*311003*	*6214783*
S30	*311166*	*6215123*
S33	*311587*	*6214530*
S35	*311498*	*6215153*
S137a	*308461*	*6217143*
S137b	*308393*	*6216959*
SBC	*308724*	*6218934*

Expected duration of works: *Approximately 4 Weeks (weather dependant)*

Works schedule:

- Describe the activities (including timing) to be conducted during construction works.

Drilling, installation and monitoring of piezometers in seven swamps. Two piezometers will be installed in each swamp – one to a depth of 10m and the other hand augured to the rock soil interface approximately 1m in depth.

Works on each of the sites will be conducted in succession over a 4 week time period, the detail of which has been provided below. Access and preparation will be followed by Drilling Operation, Equipment Installation and Operation, and then Rehabilitation as described below.

1. Access to Monitoring Sites and Site Preparation:

Access to the seven monitoring sites will be from established catchment access roads and a narrow walking track to be provided at each site. Track lengths and the relevant Fire Roads are provided in the below table. The tracks will be no greater than 1 m wide.

An area of 20 m^2 will be cleared in each swamp for the drilling activities. The works areas including access tracks will avoid threatened and rare plant species (further details provided below in relation to the flora survey).

The disturbance of soils at the monitoring sites will be limited to the minimum required for mobilization, placement and operation of the drilling equipment and for maintaining access to equipment.

Helicopters will be used to deliver equipment used in the drilling and installation of the piezometers. With respect to helicopter operation in the catchment, Metropolitan Coal commits to the following actions:

- *All bunds in the catchment will be covered to prevent rain water collection thereby minimising need for removal and transportation of collected rain water;*
- *Liquids will only be transported via helicopter when there is no other viable alternative;*
- *A training package will be developed and delivered to prospective helicopter transportation providers regarding safe and environmentally sound materials transportation prior to engagement of their services; and*
- *Metropolitan Coal's review of the helicopter company's SWMS will include checks to confirm appropriate systems (including mechanical controls) are in place to avoid inadvertent release of transported loads.*

Existing fire trails and small access trails will be used for walking in and out of the sites as required for their monitoring.

Vegetation disturbance/clearing will be kept to a minimum and will be limited where possible to the removal of saplings or slashing of vegetation. Where slashing of vegetation is required, soil disturbance will be minimized by cutting the vegetation at ground level and leaving the lower stem and roots in-situ to maximize the potential for natural regrowth. The removal of saplings, slashing of vegetation or lopping of branches will be conducted only where necessary. Vegetation cuttings will be placed in a random pattern to brush matt areas of disturbance.

Site Reference	***Track Length (m)***	***Track start location***
S28	*260*	*Fire Road No. 9J (Walking trail)*
S30	*490*	*Swamp 28 Access track*
S33	*415*	*Fire Road No. 9G*
S35	*210*	*Fire Road No. 9G*
S137a	*300*	*Fire Road No. 9*
S137b	*350*	*Fire Road No. 9*
SBC	*105*	*Fire Road No. 9*

2. Drilling Method (Approximately 2 days per borehole):

- *Boreholes will have a diameter of approximately 100 millimetres (mm) and will be drilled using a small trailer mounted rig.*

- *The 10 m boreholes will be core drilled and the 1 m borehole will be hand augured to the soil rock interface.*

3. Water Management and Cuttings Containment:

- *Drilling will occur during forecast dry weather wherever practicable. Water will be used to clear the drill cuttings.*

- *Boreholes will be drilled in Hawkesbury Sandstone which will negate the need for chemicals to reduce swelling clays. Swelling clays are typically found in the Stanwell Park Claystone and the Wombarra Shale. Metropolitan Coal has drilled approximately 300 holes of similar depth in the Hawkesbury Sandstone and only water has been used to remove cuttings.*

- *2 x 1,000 litre (L) containers will be used on each site for water storage.*

- *Boreholes will be core drilled which reduces sediment by approximately 65%. The collar of the drill hole will have a t section installed to allow sediment to be deposited directly into a baffled tank for collection with no need for a cellar. Water will be pumped into an empty 1,000 litre IBC and cuttings shovelled into sandbags for removal.*

- *Drill core would be placed in core trays and transported off-site at the completion of drilling.*

4. Borehole Casing:

- ***10 metre well installation**: PVC well screen would be installed to approximately 5 m below ground level (mbgl) with blank PVC casing from 5 mbgl to the surface. A sand gravel pack to 4 mbgl, a bentonite seal to 3 mbgl and a cement grout to the surface.*

- ***1 metre well installation**: PVC well screen will be installed to the full depth of the hole with a sand gravel pack to the surface.*

- *Blank PVC casing would extend to a height of up to 1 m above the ground for each piezometer.*

5. Installation and Operation of Equipment:

A Water level pressure sensor would be installed down the borehole. This sensor would be accessed once a month via the walking trail to download the data.

6. Site Rehabilitation:

The sites will be rehabilitated at the cessation of their use in accordance with Metropolitan Coal's Rehabilitation Management Plan.

7. Fuel Management:

Large quantities of fuel will not be stored on site. Fuel will be transported in a closed container (e.g. jerry can). 60 L plastic containers will be used to hold fuel cans after use. Re-fuelling will be conducted using an appropriate sized funnel. Care will be taken not to spill fuel. Oil/fuel absorbent materials or other containment materials will be made available at the site to prevent contact with the surrounding environment.

Equipment (e.g. drill rigs, pumps) will be regularly inspected for leaks of oil/fuel/coolant. Impervious bunding will be provided with greater than 110% of the capacity of the item being bunded. Spill containment/treatment resources (i.e. spill kits) will be provided and personnel will be trained in their use. The spill kits will include: absorbent material 40 L bag of Organic Oil/Fuel absorbent; absorbent pads: 20 of 480 X 430 mm pads; garbage bags; shovel; and a bag of rags.

Any spill that occurs will be immediately cleaned up and reported to:

- *The site supervisor;*
- *The MCPL Environment and Community Manager (Ryan Pascoe 0448 955 883); and*
- *The SCA (via the incident Management Number 1800 061 069).*

The site supervisor and the MCPL Environment and Community Manager will investigate any spills.

8. Human Waste Water:

A portable toilet serviced by South Cost Liquid Treatment Pty Ltd will be moved to each drill site. The toilet will be serviced fortnightly with a vacuum truck.

Review of baseline information - site features **(refer Section 5 of the ConMP)**

<u>Are any of the following features located within the proposed disturbance area or immediate surrounds?</u>

Are there occurrences of the Southern Sydney Sheltered Forest on Transitional Sandstone Soils EEC in the general area? No

Are there occurrences of the O'Hares Creek Shale Forest EEC in the general area? No

All sites and access routes (walking trails) were the subject of a flora survey (report attached) carried out by independent experts on 12 December 2011 and found to not be within the above EECs.

Are upland swamps located in the general area? Yes

As noted in the flora survey report, all proposed piezometer monitoring points are located within the coastal upland swamps vegetation complex which has been preliminarily listed as an EEC under the TSC Act. The installation of the proposed piezometers forms part of the Longwalls 23-27 integrated monitoring program designed to monitor impacts of longwall mining on swamp vegetation. Subsidence and warping of the land surface as a result of longwall mining has the potential to change the hydrological processes involving both ground water and surface water and may therefore impact the survival of swamp vegetation (NSW Scientific Committee 2011). Details of the monitoring program and performance measures are provided in the Metropolitan Coal Biodiversity Management Plan (2011).

In order to install piezometers to monitor ground and surface water, some swamp vegetation will require removal and or modification to provide access for staff and equipment. No swamps will be fragmented during this process, and it is unlikely that the ecological function of each of the swamps will be impacted by the installation of piezometers.

In addition, the following mitigation measures are provided to minimise impacts to the vegetation of these communities during the installation process and subsequent site visits:

- *Construction of access path to the proposed monitoring site to be undertaken with all due diligence and care to avoid unnecessary impacts to swamp vegetation;*
- *Place cleared vegetation material within footprint of access path and do not place on adjacent vegetation;*
- *Retain vegetative cover where possible to avoid potential localised erosion of swamp sediments;*
- *Placement of equipment and materials to be kept to a minimal area around the proposed monitoring point to avoid unnecessary impacts to adjacent swamp vegetation;*
- *When accessing sites for subsequent visits, field staff to access monitoring point via established access route only.*

Are there records of known threatened flora species in the general area? Yes

As identified in the flora survey, one threatened species listed as Vulnerable under the TSC Act and the EPBC Act was recorded within bushland areas adjacent to proposed access routes and monitoring sites as follows:

Pultenaea aristata at Swamp 33 and Swamp 35.

Individuals of threatened and significant species have been flagged with blue surveyors tape for easy identification so impacts can be avoided during the installation works. Additional mitigation measures are identified below.

Are there records of known threatened fauna species in the general area? No

Are existing (or proposed) monitoring sites located nearby? Yes

Existing vegetation monitoring transects are present at Swamps 28, 30, 33, 137a & 137b, however the proposed piezometers and access routes have been positioned to avoid these transects, which are also tagged for their identification. Further discussion is provided in the below table.

What vegetation type is present? Refer below table

(As per Flora Survey, Eco Logical Australia 2011)

Site	Mapped Vegetation Type	Comments
Swamp 28 - Access route	Exposed Sandstone Scribbly Gum Woodland; Sandstone Heath Woodland; Sandstone Gully Apple Peppermint Forest.	In general, the proposed access track to swamp 28 traverses Exposed Sandstone Scribbly Gum Woodland and Sandstone Heath Woodland dominated by *Eucalyptus racemosa* and *Corymbia gummifera* with an understorey dominated by Banksia *ericifolia subsp. ericifolia, Petrophile pulchella* and *Hakea teretifolia.* No threatened flora species, populations or ecological communities were recorded along and adjacent to the proposed access route.
Swamp 28 – Piezometer site	Banksia Thicket	The proposed location of the piezometer monitoring point is on the southern side of Swamp 28 and within the upslope section of the swamp between vegetation monitoring Transects 1 and 2

		where Banksia Thicket vegetation occurs. This vegetation is dominated by *Banksia ericifolia* subsp. *ericifolia* and *Hakea teretifolia* with an understorey dominated by *Empodisma minus* and *Leptocarpus tenax*. No threatened flora species, or populations were recorded within or adjacent to the proposed piezometer monitoring point.
Swamp 30 – Access route	Sandstone Heath Woodland; Sandstone Gully Apple Peppermint Forest	Access to Swamp 30 continues from Swamp 28 through bushland characterised generally by Sandstone Heath Woodland with small areas of wet heath where drainage is impeded, and areas of Sandstone Gully Apple Peppermint Forest where *Angophora costata* and *Eucalyptus piperita* occur. No threatened flora species, populations or ecological communities were recorded in the vicinity of the proposed access route.
Swamp 30 – Piezometer site	Restioid Heath	The proposed piezometer monitoring point is located within the upper section of Swamp 30 between Transects 2 and 3. One threatened species, *Pultenaea aristata* listed as Vulnerable under the TSC and EPBC Act, occurs at the southern end of this swamp. The proposed access route and piezometer monitoring point are located well away from these plants thus avoiding any impacts from the proposed works to these individuals.
Swamp 33 – Access route	Sandstone Heath Woodland, Woronora Tall Mallee Heath, Sandstone Gully Apple Peppermint Forest	Access to the Swamp 33 is through native bushland extending from Fire Road 9G to the proposed piezometer monitoring point. Bushland traversed along the proposed access track comprises Sandstone Heath Woodland, Woronora Tall Mallee Heath and a small area of Sandstone Gully Apple Peppermint Forest. One threatened species was recorded, *Pultenaea aristata* (listed as Vulnerable under the TSC and EPBC Act). An extensive population occurs within the Sandstone Heath Woodland and Woronora Tall Mallee Heath. Site inspection of the area has resulted in locating a suitable access route, flagged with pink surveyors tape, aimed at avoiding individuals of this species. Individuals of *Pultenaea aristata* located adjacent to the proposed access track have been flagged with blue surveyor's tape, for ease of location and identification purposes, to avoid any impacts during track construction and future inspections. Three Rare or Threatened Australian Plants (RoTAP; Briggs and Leigh 1995) species were also recorded within the vicinity of the proposed access route, these being *Eucalyptus luehmanniana, Darwnia diminuta,* and *Tetratheca neglecta* and individuals have been flagged with blue tape, for location and identification purposes during track construction.
Swamp 33 – Piezometer site	Banksia Thicket	The proposed site for the piezometer monitoring point is located between Transects 2 and 3, within the upslope section of the swamp. One threatened flora species, *Pultenaea aristata* (listed as Vulnerable under the TSC and EPBC Act), was recorded in the vicinity of the proposed monitoring point. Individuals of this species have been flagged with blue tape, for ease of location and identification purposes, to avoid any impacts during track construction and future inspections. Tagged plants also occur within the vicinity of the monitoring point but these are found beyond the footprint of the monitoring point and will be avoided during installation works.
Swamp 35 – Access route	Sandstone Heath Woodland, Woronora Tall Mallee Heath	Access to the Swamp 35 is through native bushland extending from Fire Road 9G west to the proposed piezometer monitoring point located at the lower end of the swamp. Bushland traversed along the proposed access track comprises Sandstone Heath Woodland and Woronora Tall Mallee Heath. A large area of

		exposed bedrock is also present providing ease of access to the swamp, and minimising the vegetation clearing required during track construction. One threatened species was recorded, *Pultenaea aristata* which is listed as Vulnerable under the TSC and EPBC Act. Individuals of this species occur within the Woronora Tall Mallee Heath adjacent to the edge of the swamp, and further individuals also occur within the swamp vegetation. Individuals have been flagged with blue tape for ease of location and identification purposes during track construction in order that they can be avoided. Despite detailed inspection for a clear access route, some individuals (<5) located at the edge of the swamp may be impacted by track works. However, the population of *Pultenaea aristata* within this swamp is widespread and in excess of 300 plants. The potential loss of several individuals is not considered to have a significant impact on the survival of this species at the location. Extensive populations also occur throughout other areas of the Metropolitan Catchment. One RoTAP* species (Briggs and Leigh 1995) was also recorded within the vicinity of the proposed access route, *Eucalyptus luehmanniana,* and will be avoided.
Swamp 35 - Piezometer site	Restioid Heath	Vegetation at the proposed site of the piezometer monitoring point comprises Restioid Heath and is dominated by *Banksia ericifolia subsp. ericifolia, Epacris obtusifolia, Sprengelia incarnata, Lepidosperma filiforme, Saropsis fastigiata*, and *Schoenus brevifolius.* One threatened species, *Pultenaea aristata* (listed as Vulnerable under the TSC and EPBC Act), is located within the vicinity of the proposed piezometer monitoring point. These individuals have been flagged with blue tape to identify their location. They are located outside the footprint of the monitoring point and will not be impacted by the works.
Swamp 137a – Access route	Sandstone Heath Woodland; Exposed Sandstone Scribbly Gum Woodland	Access to the Swamp 137a is through native bushland extending from Fire Road 9 west to the proposed piezometer monitoring point located at a mid-point within the swamp. Bushland traversed along the proposed access track comprises Exposed Sandstone Scribbly Gum Woodland and Sandstone Heath Woodland dominated by *Eucalyptus haemastoma, Eucalyptus racemosa, Eucalyptus oblonga, Eucalyptus sieberi* and *Corymbia gummifera* over a shrubby understorey dominated by *Banksia ericifolia* subsp. *ericifolia. Leptospermum trinervium, Persoonia pinifolia, Banksia serrata, Lambertia formosa, Petrophile pulchella* and *Dillwynia retorta.* No threatened flora species, populations or ecological communities were recorded within or adjacent to the proposed piezometer location. Occasional occurrences of the RoTAP species *Tetratheca neglecta* were observed adjacent to the proposed access route but these individuals will not be impacted by the proposed works.
Swamp 137a – Piezometer site	Restioid Heath	Vegetation at the proposed piezometer monitoring point is located between Transects 2 and 3 and comprises Restioid Heath dominated by *Banksia ericifolia* subsp. *ericifolia, Hakea teretifolia, Leptospermum squarrosum, Saropsis fastigiata, Lepyrodia scariosa* and *Lepidosperma filiforme.* No threatened flora species or populations were recorded within or adjacent to the proposed piezometer location.
Swamp 137b – Access route	Exposed Sandstone Scribbly Gum Woodland, Sandstone	Access to the Swamp 137b is through native bushland extending from Fire Road 9 west to the proposed piezometer monitoring point. The monitoring point is located towards the

	Heath Woodland	upper edge of the swamp between vegetation monitoring transects 2 and 3. Bushland traversed along the proposed access track comprises Exposed Sandstone Scribbly Gum Woodland and Sandstone Heath Woodland dominated by *Eucalyptus haemastoma, Eucalyptus racemosa, Eucalyptus oblonga, Eucalyptus sieberi* and *Corymbia gummifera* over a shrubby understorey dominated by *Banksia ericifolia* subsp. *ericifolia. Leptospermum trinervium, Persoonia pinifolia, Banksia serrata, Lambertia formosa, Petrophile pulchella* and *Dillwynia retorta.* No threatened flora species, populations or ecological communities were recorded within or adjacent to the proposed access route.
Swamp 137b – Piezometer site	Banksia Thicket	The proposed piezometer monitoring point is amongst tall Banksia Thicket vegetation dominated by *Banksia ericifolia subsp. ericifolia, Hakea teretifolia* and *Petrophile pulchella* over an understorey dominated by *Lepidosperma filiforme* and *Schoenus brevifolius.* No threatened flora species, or populations were recorded within or adjacent to the proposed piezometer monitoring point.
Bee Creek – Access route	Sandstone Heath Woodland	The proposed access track follows the edge of an existing drainage swale extending from the fire trail west through Sandstone Heath Woodland dominated by *Eucalyptus racemosa, Leptospermum trinervium, Banksia ericifolia* subsp. *ericifolia* and *Banksia serrata* to the swamp edge. No threatened flora species, populations or ecological communities were recorded within or adjacent to the proposed access route.
Bee Creek - Piezometer site	Banksia Thicket	The proposed piezometer location is amongst Banksia Thicket dominated by *Banksia ericifolia* subsp. *ericifolia* over an understorey dominated by *Empodisma minus* and *Gleichenia microphylla.* No threatened flora species populations were recorded within or adjacent to the proposed piezometer location.

Are known Aboriginal heritage sites present? **Yes**

A number of sites are known in the general surrounding area as identified in the baseline Aboriginal site survey for the project environmental assessment. One recorded site (AHIMS Ref. 52-2-0733) has been identified in the vicinity of the proposed works – within 50m of the proposed piezometer in Swamp 30. Due to the relatively close proximity of this site it will be ensured that the works do not encroach beyond the projected footprint.

Additionally, as a precautionary measure the Aboriginal site will be demarcated/flagged for avoidance.

Other than this site, no other Aboriginal heritage sites have been recorded within the proposed works areas or their immediate surrounds. An initial desktop risk assessment undertaken prior to the site survey indicated the proposed drill locations would avoid known Aboriginal sites

Furthermore, a pre-clearance survey/due diligence assessment was carried out for each of the sites and their access routes by an independent Aboriginal heritage consultant, Kayandel

Archaeological Services. The assessment report indicated that no Aboriginal objects were seen during the field inspection and that none were likely to be present.

Accordingly, it was „recommended that the proposed works be allowed to proceed without further Aboriginal heritage investigation being required' (Kayandel Archaeological Services, 2011).

Is this an area in which disturbance is to be avoided and/or limited? (refer Sections 6.1.1 and 6.1.2 of the ConMP) **Yes**

- **Southern Sydney Sheltered Forest on Transitional Sandstone Soils EEC**
- **O'Hares Creek Shale Forest EEC**
- **Upland swamps**
- **Environmental monitoring sites**

Upland swamps:

As identified above, all proposed piezometer monitoring points are located within the coastal upland swamps vegetation complex which has been preliminarily listed as an EEC under the TSC Act. The installation of the proposed piezometers forms part of the Longwalls 23-27 integrated monitoring program designed to monitor impacts of longwall mining on swamp vegetation. Subsidence and warping of the land surface as a result of longwall mining has the potential to change the hydrological processes involving both ground water and surface water and may therefore impact the survival of swamp vegetation (NSW Scientific Committee 2011). Details of the monitoring program and performance measures are provided in the Metropolitan Coal Biodiversity Management Plan (2011).

In order to install piezometers to monitor ground and surface water, some swamp vegetation will require removal and or modification to provide access for staff and equipment. No swamps will be fragmented during this process, and it is unlikely that the ecological function of each of the swamps will be impacted by the installation of piezometers.

In addition, the following mitigation measures are provided to minimise impacts to the vegetation of these communities during the installation process and subsequent site visits:

- *Construction of access path to the proposed monitoring site to be undertaken with all due diligence and care to avoid unnecessary impacts to swamp vegetation;*
- *Place cleared vegetation material within footprint of access path and do not place on adjacent vegetation;*
- *Retain vegetative cover where possible to avoid potential localised erosion of swamp sediments;*
- *Placement of equipment and materials to be kept to a minimal area around the proposed monitoring point to avoid unnecessary impacts to adjacent swamp vegetation;*
- *When accessing sites for subsequent visits, field staff to access monitoring point via established access route only.*

Environmental monitoring sites:

As discussed above, existing vegetation monitoring transects are present at Swamps 28, 30, 33, 137a & 137b, however the proposed piezometers and their access routes have been positioned to avoid these transects, which are also tagged for identification.

If the proposed disturbance area is located in an area to be avoided or limited, relocate site where appropriate in accordance with the requirements of the ConMP

Threatened flora survey (refer Section 6.1.3 of the ConMP)

Date of survey for threatened flora:
19th & 21st December 2011

Name of suitably qualified ecologist conducting survey:

Elizabeth Norris (Senior Ecologist, Eco Logical Australia) and Brian Towle (Ecologist, Eco Logical Australia).

Have any threatened flora been identified within the proposed disturbance area or immediate surrounds? **Yes**

Scientific names of threatened flora species recorded:
Pultenaea aristata at Swamp 33 and Swamp 35,

Will works be relocated to avoid or minimise impacts on the threatened flora species? **Yes**

Individuals of threatened and significant species have been flagged with blue surveyors tape for easy identification during the installation works. Mitigation measures to avoid impacts on these individuals include the following:

- *Avoidance of areas where threatened and significant species occur;*
- *Disturbance to be limited to flagged access points and exposed bedrock areas for track establishment;*
- *Avoidance of flagged threatened and significant species during placement of equipment and materials during the installation process; and*
- *All threatened and significant species to retain blue flagging, replaced when necessary, to allow for immediate location and identification during subsequent site visits.*

If it is not feasible to relocate the works, have the impacts of the proposed works on the population of the threatened flora species been assessed by a suitably qualified and experienced ecologist? **N/A**

(Works and site access routes have been located to avoid impacts to threatened flora as discussed above).

If No, do not proceed

Has the assessment concluded that the proposed surface activities are likely to have a significant impact on a population of the threatened flora species? **No**

If Yes, the proposed works are to be modified to avoid such an outcome

[Attach any relevant ecological reports to this assessment form] – *Refer attachment.*

Vegetation clearance and site access (refer Section 6.1.6 of ConMP)

Is vegetation clearing required for the construction works? If yes, describe extent (e.g. m^2) and method of clearing (e.g. slashing/lopping branches/removal)? **Yes**

Vegetation disturbance/clearing will be kept to a minimum and will be limited where possible to the removal of saplings or slashing of vegetation. An area of 20 m^2 will be cleared in each swamp for the drilling activities.

Where slashing of vegetation is required, soil disturbance will be minimized by cutting the vegetation at ground level and leaving the lower stem and roots in-situ to maximize the potential for natural regrowth. The removal of saplings, slashing of vegetation or lopping of branches will be conducted only where necessary. Vegetation cuttings will be placed in a random pattern to brush matt areas of disturbance.

Describe the access requirements for the construction site (e.g. vehicle/ pedestrian/ helicopter) and where the access will be from (e.g. which fire road).

Access to the seven monitoring sites will be from established catchment access roads and a narrow walking track (no greater than 1 m width) to be provided at each site with minimal environmental impact. The trails will avoid threatened and rare plant species as discussed above.

The disturbance of soils at the monitoring sites will be limited to the minimum required for mobilization, placement and operation of the drilling equipment and for maintaining access to equipment.

Helicopters will be used to deliver all equipment used in the drilling and installation of the piezometers. Existing fire trails and narrow access trails will be used for walking in and out of the sites as required for their monitoring.

Is vegetation clearing required for site access? If yes, describe the extent and method of clearing? **Yes**

As described above.

Vegetation management measures to be implemented (refer Section 6.1.4 of the ConMP)

As detailed above.

Site Layout Plan (refer Section 6.1.5 of ConMP)

Has a Site Layout Plan been prepared and attached to the Works Assessment Form? **Yes**

Have the following been indicated on the Site Layout Plan? **Yes**

- Site location

- Works design

- Management measures (e.g. erosion and sediment controls, spill kits)

- Access track/s (indicate type of access, e.g. pedestrian/vehicle. Also indicate location of nearest fire trail where access will be from)

- Areas of vegetation clearance

- Location of equipment (e.g. pump, generator, fuel storage, portable toilets)

- Equipment storage areas

- Safety equipment (e.g. fire extinguisher and first aid kit)

Refer Appendix 1.

Attach photographs, where appropriate

Refer Appendix 1.

Description of Photographs:

Refer Appendix 1.

Aboriginal heritage pre-clearance survey (refer Section 6.2 of the ConMP)

Date of pre-clearance survey for Aboriginal heritage sites.

19th & 21st December 2011

Name of qualified Archaeologist conducting survey:

Nicole Castle – Archaeologist (Kayandel Archaeological services)

Are any Aboriginal heritage sites identified within the proposed disturbance area or immediate surrounds? **Yes**

As discussed above, there is one known Aboriginal heritage site located within 50 m of the proposed piezometer at Swamp 30 however the site is outside of the works area and will not be affected. Additionally, as a precautionary measure the Aboriginal site will be demarcated/ flagged for avoidance.

Other than this site, no other Aboriginal heritage sites have been recorded within the proposed works areas or their immediate surrounds. Additionally, the Aboriginal pre-clearance survey found no Aboriginal objects during the field inspection and reported that none were likely to be present.

Accordingly, it was „recommended that the proposed works be allowed to proceed without further Aboriginal heritage investigation being required' (Kayandel Archaeological Services, 2011).

Description of recorded Aboriginal heritage sites:

AHIMS Site No. 52-2-0733. Description as per Site card:

"1 axe grinding groove on an area of sandstone 30m. x 2m. with water seepage over it. The sandstone outcrop runs N-S. Size of groove; 340mm. X 70mm. X 25mm. Water permanently at the site."

Will works be relocated to avoid impacts on the Aboriginal heritage site? **Yes**

The location of the piezometer site works at Swamp 30 is sufficiently removed from the above Aboriginal heritage site so as to avoid impacts, and the access track will be set back accordingly.

If it is not feasible to relocate the works to avoid impacts to the Aboriginal heritage site, management and/or mitigation measures to be implemented in accordance with the Metropolitan Mine Heritage Management Plan. Describe measures below.
(Impacts will be avoided) **N/A**

Where avoidance is not practicable, has a comprehensive baseline record been obtained and salvage considered in consultation with Aboriginal stakeholders prior to disturbance.

(Impacts will be avoided) **N/A**

[Attach any relevant archaeological reports to this assessment form] – *Aboriginal site survey attached*

Known Aboriginal heritage sites located close to surface disturbance works

Details of demarcation (e.g. fencing, sign-posting or temporary flagging) implemented to avoid accidental damage to known Aboriginal heritage sites located close to surface disturbance works.

The recorded site (Ref. 52-2-0733) in the vicinity of Swamp 30 will be demarcated by temporary flagging as a precautionary measure to avoid accidental damage during works. This will be carried out under the guidance of Kayandel Archaeological Services.

Erosion or sediment control measures required?

- **Is any erosion or sediment control required?** **Yes**

- **If yes, has an Erosion and Sediment Control Plan been prepared and attached to the Surface Works Assessment Form?** **Yes**

(Refer Appendix 2)

Fuel and spill management measures required?

- **Are compressors and pumps bunded and with sufficient capacity?** **Yes**

- **Where fuels are used, are spill kits available at the construction site?** **Yes**
- **Have personnel been trained in spill clean up procedures?** **Yes**

(As per JSEA)

List Hazardous Materials and Storage Requirements

- **What hazardous materials are required to be used and how will they be stored on site?**

Diesel, Petrol, Hydraulic Oil – Stored in bunded container on site.

- **Are Materials Safety Data Sheets (MSDS) for hazardous materials located at the construction site?** **Yes**

Bushfire Preparedness and Management

- **Have Metropolitan Coal staff and contractors been provided with fire awareness and fire safety training?** **Yes**

(*Metropolitan Coal Bushfire Preparedness Plan)*

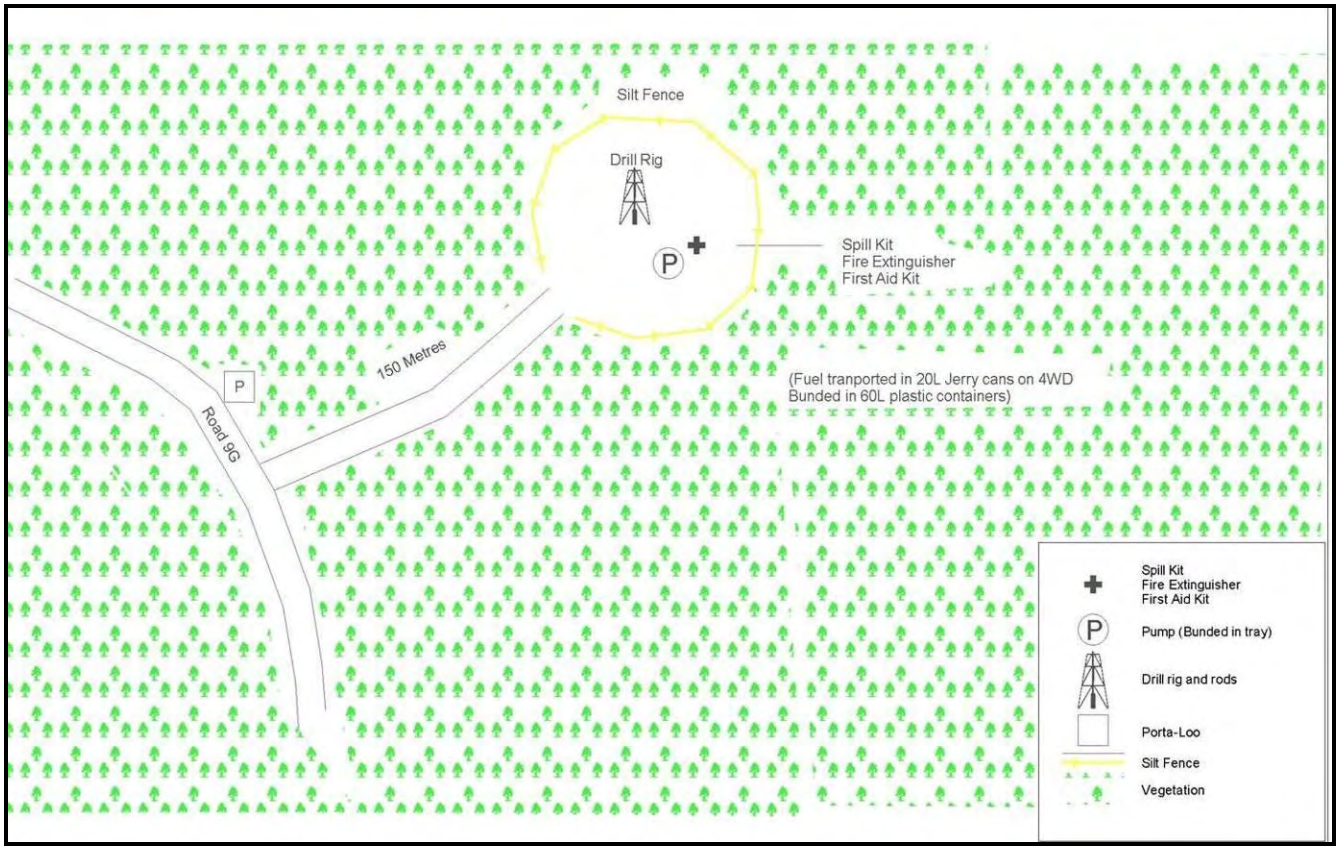
- **Has a Hot Work Permit been obtained from the SCA if required?** **Yes**

Metropolitan Coal's hot work permit has been approved by the SCA.

APPENDIX 1: SITE PLANS & PHOTOS

Figure A1: Proposed Piezometer Locations

Figure A2: Notional Site Layout Plan



Notes:

1. *Piezometer site works areas to be 20m^2.*
2. *Site preparation and access details including track dimensions are provided in above report.*
3. *Track routes are illustrated in Table A1 (below).*

Table A1: Site Photos and Track routes

Piezometer site	Access track aerial
Ref: S28 (Easting: 311003, Northing: 6214783)  Camera facing west. *Note: Pink and yellow tape indicates proposed piezometer location.* **Ref: S30 (Easting: 311166, Northing 6215123)**  Camera facing north. *Note: Yellow tape on right represents proposed piezometer location. Surrounding pink tape represents impact area.*	 *Proposed track lengths: S28 = 260m, S30 = 490m*

Piezometer site	Access track aerial

Ref: S33 (Easting: 311587, Northing: 6214530)

Camera facing west.
Note: Yellow tape on right represents proposed piezometer location. Pink tape in surrounding area represents impact area.

Proposed track length: 415m

Piezometer site	Access track aerial

Ref: S35 (Easting: 311498, Northing: 6215153)

Camera facing south.
Note: Surrounding pink tape represents impact area. Piezometer location will avoid endangered flora (blue tape).

Proposed track length: 210m

Piezometer site	Access track aerial

Ref: S137a (Easting: 308461, Northing: 6217143)

Camera facing north-east.
Note: Tape flagging location of proposed piezometer.

Ref: 137b (Easting: 308393, Northing: 6216959)

Camera facing east.
Note: Tape flagging location of proposed piezometer.

Proposed track length: 137a = 300m, 137b = 350m

Piezometer site	Access track aerial

Ref: SBC (Easting: 308724, Northing: 6218934)

Camera facing south.

Note: Proposed piezometer location marked on left. Red and white tape marks perimeter of impact area.

Proposed track length: 105m

APPENDIX 2: EROSION AND SEDIMENT CONTROL PLAN

Correct location, design of the work site and work practices will minimise the risk of erosion at each of the sites. Effectively managing this issue will be achieved by carrying out the following:

- Minimise the disturbance area of the access trails and work site, this will accordingly reduce the likelihood and severity of erosion needing to be controlled;
- Slashing or vegetation disturbance will be conducted following the strategies listed in the vegetation management section above;
- Correct aspect and site location. The sites have been selected in appropriate areas that will minimise the risk of erosion ie flat sites, not on hard rock;
- Sediment control will be managed in accordance with the Blue Book (Volume 1 and Volume 2E), including the installation of sediment fences as per the standard drawing 6-8 of the Blue Book Volume 1;
- Whilst drilling is being conducted, the collar of the drill hole will have a t section installed to allow sediment to be deposited directly into a baffled tank for collection. Water will be pumped into an empty 1,000 litre IBC and cuttings shovelled into sandbags for removal;
- All workers will be trained in the appropriate work practices and the drilling operation will be constantly manned whilst in operation.