Subsidence

NCOPL engaged Ditton Geotechnical Services Pty Ltd (DGS, 2009) to predict and report on the potential impacts from subsidence from longwall mining. In summary, DGS (2009) predicts that while subsidence would occur to varying degrees across the Mine Site the maximum predicted subsidence of 1.6m would occur towards the eastern section of the Mining Area, and up to 2.4m would occur in the western section (DGS, 2009).

The impacts from subsidence are likely to be two-fold: firstly there is the likelihood of differential lowering of the ground surface over large areas; and secondly there is the likelihood that cracking may occur both along the margins of the subsidence, above the line of longwall panels, and within the area of subsidence from differing degrees of subsidence. As a subsequent result of the cracking, further impacts may be caused if material is required to be transported to the location of the cracking to fill and repair the cracks.

The vertical displacement of an archaeological site from subsidence is unlikely to result in damage or alteration to most archaeological sites unless the site is a standing structure, however, any lateral displacement caused by variable subsidence across a site might have significant impact on the integrity of the site and cause displacement of relics within the assemblage. Any lateral movement or migration of drainage lines and creek resulting from variable subsidence also has the potential to impact on any standing structures along the creek banks that might be undermined by a change in channel profile.

In this instance, the frequency and location of gas drainage and ventilation infrastructure is dictated by a requirement to maintain the safety of the underground mine, ie. the coal seam gas poses an extremely high risk to the safety of mine personnel if not removed, and to effectively remove the gas and ventilate the mine requires the specific placement of boreholes for gas drainage or ventilation purposes. As a consequence it may not be possible to avoid impacting upon some sites, in which case it will be necessary to fully record those particular sites and where possible, to remove them to a more secure place.

2 THE ENVIRONMENTAL CONTEXT

To provide a basis of information on the environmental context for any structures or relics occurring within the Mining Area, it is necessary to briefly consider those factors that might contribute to the nature of, character or location of a structure or relic of heritage significance.

2.1 General Geology and Topography

The Mine Site is located within the Permo-Triassic Gunnedah Basin, which forms the central part of the north-south elongate Sydney-Gunnedah-Bowen Basin System. The Mining Area is located near to the northern and western boundaries of the Gunnedah Basin and the eastern margin of the Surat Basin, a sub-basin of the larger Great Artesian Basin (RWC, 2009).

The rocks of the Mine Site generally strike north-south and dip gently to the west. Minor variations to the north-south strike may be the result of variable thickness and compaction of the sedimentary units being draped over the faulted and uneven surface on the underlying Boggabri Volcanics. Undifferentiated Quaternary alluvial gravel, sand, silt and clay overlie the Jurassic and Triassic sediments (RWC, 2009) associated with the Namoi River.
The two formations of most relevance to the current archaeological investigation are the Pilliga Sandstone and the Purlawaugh Formation. The Pilliga Sandstone outcrops over the western half of the Mining Area. It consists of medium bedded, cross-bedded, well sorted fine to coarse grained quartz sandstone. The Purlawaugh Formation outcrops over the majority of the eastern half of the Mining Area, and consists of thinly bedded, generally fine grained, silty lithic sandstone, siltstone and minor claystone (RWC, 2009).

Elevations in the Panels 1 to 7 Survey Area descend from 330m AHD in the Pilliga in the south-western corner, and 300m AHD on the rise in the north-western corner, down to 276m AHD in the creek bed of Pine Creek 2 on the western boundary and 266m AHD where Pine Creek 2 crosses the eastern boundary (of longwall panel 1). In the south-eastern corner (of longwall panel 1) Pine Creek 1 descends to 272m AHD.

2.2 Vegetation

An ecological survey and assessment of the Mine Site and pipeline route corridor completed by Ecotone Ecological Consultants (2009) identified six natural or predominantly natural vegetation community types and one artificial vegetation community type occur within the Study Area as follows.

Natural Communities

1. Brown Bloodwood / Pilliga Grey Box / Red Ironbark Sandstone Slopes and Ridgetop Woodland
2. Inland Grey Box / Bimble Box / Blakely’s Red Gum Lower Flats and Floodplain Woodland
3. River She Oak / Belah / Inland Grey Box Riparian Forest
4. White Cypress Forest
5. River Red Gum Riparian Open Forest / Woodland
6. Weeping Myall Woodland

Artificial Community

7. Cleared open pasture with or without scattered native trees or cultivated cropland or gardens

Community 1 (locally referred to as Pilliga Scrub) generally occupies the western part of the Mine Site, whilst Communities 2, 3 and 4 occur in the eastern part of the Mine Site. Community 5 is the largest single community in area, and makes up the balance of the eastern part of the Mine Site.

Panels 1 to 7 Survey Area

Within the Panels 1 to 7 Survey Area, with the exception of the remnant woodland on the rise at the northern end (Community 2), the natural communities consists primarily of riparian ribbon-like woodland along the Buffer Zones and upper Bank Zones of both creeks (Community 3). Vegetation in these areas comprise a mixture of River Oak (Casuarina cunninghamiana), White Cedar (Melia azedarach), Rough-barked Apple (Angophora floribunda), White Box (Eucalyptus albens) – particularly along the upper reaches of Pine Creek 1, River Red Gum (E. Camaldulensis), Yellow Box (E. Melliodora), White Ribbon Gum (E. Viminalis), Western Rosewood, (Alectryon oleifolius), and minor Kurrajong (Brachychiton populneus). Acacia sp. dominate the understorey, which includes River Bottlebrush (Callistemon sieberi), and Blackthorn (Bursaria spinosa).
Cypress pine regrowth has recolonised the cleared upper slopes below the Pilliga boundary fence, and in some cropped areas along the upper drainage depressions of both creeks.

Panels 8 to 19 Survey Area

Panels LW8 to LW19 occur in Pilliga Forest (Community 1). Pilliga Forest typically contains Cypress Pine (Callitris spp.), and Casuarinas, while Eucalypts dominate the canopy throughout the forest.

Panels 20 to 26 Survey Area

LW20 to LW26 occur on cleared pasture land (Community 7) all but for ribbons of riparian vegetation (Community 3) along the creek banks, and for stands of Cypress Pine that have colonised a high knob in the northern ends of LW25 and LW26 (Community 4).

Brine Storage Pond Survey Area

With the exception of a small patch of the remnant woodland on a small rise to the immediate north of Kurrajong Creek Tributary 1 (Community 3), the vegetation of the Brine Storage Area is cleared paddocks with occasional and isolated mature trees (Community 7). Riparian ribbon-like woodland (Community 3) occurs along the banks of Kurrajong Creek Tributary 1 to the south of the Brine Storage Area and remnant woodland with the road easement to the east of the Brine Storage Area.

Water Pipeline Route Survey Area

The vegetation of the water pipeline route varies between remnant woodland dominated by Grey Box and Cypress Pine (Community 3), small patches of Weeping Myall community (Community 5), a small patch of River Red Gum Riparian Woodland (Community 6) and cleared areas dominated by exotic pasture and weeds (Community 7).

2.3 Water Resources

It should be noted that the depiction of drainage lines in blue on Figure 5 is not indicative of the water they contain. In fact, it is reasonable to conclude that all drainage lines indicated in blue where there is not a riparian strip of woodland, are merely shallow drainage depressions, barely visible in the field other than as shallow swales.

As described in Section 3.1, the Panels 1 to 7 Survey Area is bisected by the two major tributaries of Pine Creek, referred to in this report as Pine Creek 2 and Pine Creek 1. In effect, neither creek line retains water and any surface run-off is rapidly discharged downstream. However, it was observed during the investigation that took place after recent rain, that a minor waterhole had filled upstream of the tessellated platform in the minor tributary of Pine Creek 2, and that there was a second small water hole, probably created by wild pigs, in a tributary of Pine Creek 1. Similarly, no reliable water source was observed in the investigation of the Panels 8 to 19, nor Panels 20 to 26 Survey Areas.

The Brine Storage Area occurs adjacent to Kurrajong Tributary 1, however, it is unlikely that the creek ever contained potable water except for a few hours after a heavy downpour.

The Water Pipeline Route follows road easements, none of which cross a reliable water source. The Namoi River at the eastern end of the route would have been a reliable source, although the water would have required filtering before it could be drunk.
2.4 Previous Impacts

Panels 1 to 7 Survey Area

As the aerial photograph in Figure 4 shows, and as referred to in Section 3.2, the vast majority of the Survey Area has been cleared for pasture. However, the impact has not stopped there, as continuous grazing of poor grasses in an area of low rainfall has resulted in the active degradation and erosion of most if not all exposed surface deposits.

Other impacts have been caused by property tracks, dams, and active gullying in what were once only drainage depressions. Grazing along the creek banks has also caused massive gullying of the creek banks, bank-slumping, and significant wash outs, particularly along the southern bank of the upper reaches of Pine Creek 2, and a minor tributary of Pine Creek 1.

The fragility of the soils is also evident in several collapsed dam walls along Pine Creek 1 and the gullying of the drainage channel into one of the dams, and in the gullying of creek banks and extensive wash-out areas. Although a number of contour banks have been constructed across the slopes of the paddocks they have only served to channel the run-off into more concentrated and destructive drainage courses.

Panels 8 to 19 Survey Area

There have been only limited impacts in the Pilliga Forest in the Panels 8 to 19 Survey Area, most of which have been caused in the construction of dams, or in clearing access tracks to the dams and to fence-lines, however, it was clear from the tree stumps and the relatively open areas, particularly above LW9 to LW12 that there has been extensive tree-felling or logging in the past. And in the absence of tree toppings it would appear that the trees were felled for something other than fence-posts and strainer posts. Nor is it likely that the trees were felled for firewood. Similar logging has taken place above LW14 to LW17.

The presence of the dams might suggest that the logging was to open up the forest for pasture improvement, but there was no evidence of piles of ash of partly burnt logs that there would have been if the logging was merely to remove trees. It would seem more likely that the logging was to provide timber to the sawmill described later in this report.

Panels 20 to 26 Survey Area

Most of the vegetation in the Panels 20 to 26 Survey Area has been cleared for pasture, and in some places, such as on the crest of the rise above LW21 and LW22, the paddocks had been recently disc-ploughed to improve pasture growth. Similarly, above LW23 and LW24 had been disc-ploughed not quite so recently and were under new growth at the time of the survey.

Brine Storage Area Survey

The Brine Storage Area has been cleared for pasture. Currently impacts are occurring as scalding on the flat bottom of the basin, and bank-slumping and slope-wash around the rim. Unfortunately contour banking above the rim does not follow the natural contour, dipping slightly towards the east. As a consequence instead of the contour banking retaining the run-off to stimulate grass growth, the effect has been to channel the water to the eastern ends of the banks where the concentrated mass of water has discharged down-slope causing extensive gullying and scouring.
Water Pipeline Route Survey Area

For the most part, the proposed water pipeline route utilises either the road easement or the railway maintenance track. The road is a metalled surface with deep side drains and as a consequence the banks to either side are artefacts of drain shaping with battered slopes of 3m to 4m wide. The railway maintenance track at the higher elevations occurs on sandy deposits which have been graded to various depths but seldom more than 5cm to 10cm deep. At lower elevations the deposits are less sandy and grading has been mostly only to level the track.

East of Turrawan, Old Narrabri Road is sealed with deep side gutters, the outer batters of which have impacted on the natural profile for up to 10m to either side of the road. Between Old Narrabri Road and the Namoi River (on the “Broadwater” property), the land has been cleared and linear features marking subsurface irrigation pipes attest to the paddocks having once been used for crops, although currently the paddocks are carrying stock.

**3 METHODS**

**3.1 Desktop Assessment**

The following registers were searched for any reference to significant sites or structures within the survey areas on 24th August 2009.

- National Trust:
  No sites were listed for the Mine Site or along the water pipeline route.

- Heritage Council:
  No sites were listed for the Mine Site or along the water pipeline route.

- Narrabri Local Environment Plan 1992:
  No sites were listed for the Mine Site or along the water pipeline route.

**3.2 Field Surveys**

The investigation to record structures, places or relics of heritage significance was undertaken concurrently with a comprehensive survey of the survey areas for sites of Non-Indigenous cultural significance over 17 days during May to July 2009 (Appleton, 2009).

**3.3 Site Recording**

A comprehensive photographic record was made of the only structure of interest. To limit the size of this report, only a selection of the record is included in Appendix i. Dimensional details of the site were recorded using a 3m tape measure, a 5m tape measure, a 50m tape measure, 1m and 25cm scale bars and a compass.

**4 RESULTS**

As noted in Section 3.1, no items of heritage significance are identified for the survey areas on the various registers.

The only item of interest observed within the survey areas was a defunct sawmill (although for the reasons provided in Section 5, the site was assessed to be of no heritage significance). The sawmill occurs on the northern bank of “Pine Creek Tributary 1”, inside the eastern boundary fenceline on Lot 152, DP 816020 (see Figure 6).
As an Adjunct Senior Lecturer in archaeology at the University of New England (UNE) Appleton is well aware of the educational benefits of recording such a site, particularly as the UNE’s summer school field project for external students is to excavate a sawmill site with no standing structures on the “Newholme” property in Armidale. While there is no evidence that the two mills were similar nevertheless the extant physical remains of the sawmill provide an excellent example of the material and equipment, and the sequence and relationship of the equipment to the milling process, one might expect to find on a sawmill site.

A comprehensive photographic record was made of the sawmill site, a selection of which is included in Appendix 1. A site plan of the sawmill was also produced, a copy of which is included as Figure 7. A record of the various dimensions of the items within the sawmill site area as follows.

- Length of the site (from end of the log-trolley track to the end of the plank-trolley track): 20.1m.
- Width of site (from western end of log-rack to outer edge of belt cams): 6.48m.
- Log-rack rails:
  - Diameter: 23/23/24cm
  - Length (from the rear forwards): 427/428/424cm
- Squared-log rack rails:
  - Diameter: 17/16/16cm
  - Length (from the rear forwards): 424/429/426cm
- Plank-rack rails:
  - Diameter: 13/13/15cm
  - Length (from the rear forwards): 242/250/242cm
- Prop (upper rail): 15cm square, 68cm long
- Log-trolley track (inner width between rails):
- 53cm Sleepers (only one measured): 120cm x 21cm
- Plank-trolley track (inner width between rails): 77cm
- Rough saw: 90cm diameter.
- Rough saw belt cam:
  - Diameter: 26cm
  - Width: 15cm
- Fine saw belt cam:
  - Diameter: 20cm
  - Width: 17cm
- Fine saw approach roller (length): 92cm
- Fine saw roller leaving (length): 80cm
- Unsawn logs (diameter): 32-40cm
- Belt (canvas covered rubber belt) (width): 10cm
- Discarded planks of pine (various lengths of the following)
  - 10 cm wide x 3.5 cm thick (4” x 1 ½” allowing for shrinkage)
  - 8 cm wide x 5 cm thick (3¼” x 2”)
  - 10 cm wide x 2.5 cm thick (4” x 1”)
  - 14 cm wide x 3 cm thick (5½ x 1¼”)
  - 10 cm wide x 2.75 cm thick (4” x 1¼”).
Figure 7
PLAN OF THE SAWMILL SITE
An explanation of the terms used on Figure 7, and in the captions to the photographs in Appendix 1, is as follows.

Log-rack
The three rails at the northern end on which the logs were rolled to begin the milling process. The three rails were of natural uncut logs over which the logs to be cut were rolled onto the log-trolley. The first two rails were higher than the third, perhaps to assist in rolling the logs onto the log-trolley.

Log-trolley
The trolley used to transport the log to the rough saw. The log-trolley track: railway line track laid on sleepers. This had to be substantial to take the weight of a full log prior to the rough saw, and the squared log afterwards. The rails were held in place by square-headed bolt-screws in railway fashion.

Rough saw or log-saw
The large diameter saw used to square the log.

Squared-log rack
The three rails onto which the squared logs were stored. The rails were flat-topped to minimise the damage that would be caused to the squared logs from being laid onto rounded rails, i.e., to widen the impact zone and spread the load.

Fine saw or plank-saw
The small-toothed, small diameter saw used to produce the planks.

Plank-trolley
The trolley onto which the planks were removed from the fine saw.

Plank-trolley track
Angle-iron laid along longitudinally-laid parallel wooden supporting strips, the flange facing outwards, the angle-iron being held in place by bent spikes. The trolley and the track on which it ran was of only light construction as it only had to support the weight of one or two planks at a time.

Plank-rack
The rails onto which the sawn planks were stacked prior to removal.

Prop
A “T” shaped feature probably used to support the discarded linear off-cuts produced when cutting planks on the Fine saw or plank-saw.
5 ASSESSING HERITAGE SIGNIFICANCE

5.1 NSW Heritage Office Guidelines for Assessing Heritage Significance

Heritage assessments are undertaken to provide useful and appropriate information to the Heritage Branch of the Department of Planning, local government, owners of the subject properties, and the proposing developers, for the most appropriate and preferred further management and/or conservation of a site, in accordance with regulated guidelines.

The Sawmill Site is not listed on the registers of the National Trust or the Heritage Branch, nor is it on the Narrabri LEP 1992. But as an item of historic interest it warrants an assessment of its heritage significance.

In 2001, NSW Heritage Office issued revised guidelines for assessing heritage significance entitled “Assessing Heritage Significance” (NSW Heritage Office, 2001). Section 5.2 considers the identified sawmill against the seven criteria of this guideline document. Section 5.3 considers the identified sawmill against the preservation criterion of the Burra Charter.

5.2 SIGNIFICANCE ASSESSMENT: The Sawmill Site

Criterion (a) – an item is important in the course, or pattern, of NSW’s cultural or natural history (or the cultural or natural history of the local area).

Assessment: The sawmill does not meet this criterion. Nothing is known of the history of the sawmill and its role would only have been significant to the immediate local community.

Criterion (b) – an item has a strong or special association with the life or works of a person, or group of persons, of importance in NSW’s cultural or natural history (or the cultural or natural history of the local area).

Assessment: The sawmill does not meet this criterion.

Criterion (c) - an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).

Assessment: The sawmill does not meet this criterion. There is no evidence to suggest that the sawmill was unique or in any way technically different to others that might exist elsewhere in the Pilliga or on the adjacent properties.

Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.

Assessment: The sawmill does not meet this criterion.

Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW’s cultural or natural history (or the cultural or natural history of the local area).
Assessment: The sawmill does not meet this criterion. The information it provides is only of value to a specific application (i.e., a UNE field-school) and only then as an illustration of the milling process. It is probable that there are numerous other abandoned sawmill sites elsewhere and that the Mine Site sawmill is just one of many variations of the sawmilling process.

**Criterion (f)** – *an item possesses uncommon, rare or endangered aspects of NSW’s cultural or natural history (or the cultural or natural history of the local area).*

Assessment: The sawmill does not meet this criterion.

**Criterion (g)** – *an item is important in demonstrating the principal characteristics of a class of NSW’s: Cultural or natural places; or cultural or natural environments.*

Assessment: The sawmill does not meet this criterion.

### 5.3 “The Illustrated Burra Charter”

Within “The Illustrated Burra Charter”, Article 17: Preservation, which refers to the criteria under which preservation of a site is appropriate, states:

“Preservation is appropriate where the existing fabric or its condition constitutes evidence of cultural significance, or where insufficient evidence is available to allow other conservation processes to be carried out.”

When assessed against NSW Heritage Office (2001), the identified sawmill fails to meet the criterion that would warrant its preservation as defined by “The Illustrated Burra Charter”.

### 6 STATEMENT OF HERITAGE SIGNIFICANCE

As a consequence of considering the above criteria the heritage significance of the “Sawmill” on the Narrabri Coal Mine Site is assessed as follows.

“The Sawmill is assessed to be of no local historical interest, and of only low educational value, insufficient to warrant its classification as a structure of Heritage Significance”.

### 7 CONCLUSION

It is concluded that there are no constraints to the proposed development of the Narrabri Coal Mine on non-Indigenous heritage grounds.
Appendix 1

Photographic Record of the Sawmill

Please note this appendix has been printed in black and white. A colour copy is available on the digital version of this report provided on CD.
Plate 1 – View from the south

Plate 2 – View from the southwest.

Plate 3 – View from the southeast
Plate 4 – View showing the alignment of the saws and the trolley tracks.

Plate 5 – View from the opposite direction, with the fallen log-trolley on the right.

Plate 6 – View showing the alignment of the belt cams.
Plate 7 – View of the log-saw from the Southeast (scale 1m)

Plate 8 – The log-saw viewed from the east (scale 1m).

Plate 9 – The log-saw viewed from the north.
Plate 10 – Detail of the drive shaft and belt cam of the log-saw.

Plate 11 – Detail of the drive shaft and saw blade of the log-saw.

Plate 12 – Detail of the repair work to the log-saw support frame.
Plate 10 – Detail of the drive shaft and belt cam of the log-saw.

Plate 11 – Detail of the drive shaft and saw blade of the log-saw.

Plate 12 – Detail of the repair work to the log-saw support frame.
Plate 13 – Plank-saw viewed from the north.

Plate 14 – Plank-saw viewed from the west.

Plate 15 – Plank-saw viewed from the east.
Plate 16 – Plank-saw viewed from the south.

Plate 17 – Detail of the plank-saw blade attachment, minus the blade.

Plate 18 – Detail of plank-saw drive shaft bracket clamp.
Plate 19 – Bracket clamp viewed from above.

Plate 20 – Plank-saw belt cam and bearing (scale 25cm).

Plate 21 – Detail of the bearing housing.
Plate 22 – Detail of western end of plank-out roller (plank-saw).

Plate 23 – Detail of eastern end of plank-out roller (plank-saw).

Plate 24 – Detail of western end of log-in roller (plank-saw).
Plate 25 – Detail of frame above plank-saw bench (of unknown function).

Plate 26 – Saw gauge on the plank-saw in an open (wide plank) setting.

Plate 27 – Saw gauge in a closed (narrow plank) setting.
Plate 28 – Detail of the south-western corner of the plank-saw bench, showing the evidence of recycled timber and repairs.

Plate 29 – View of the plank-saw from the west, showing the sawdust chamber beneath the bench.

Plate 30 – The log trolley on its side to the north of the log-saw.
Plate 31 – The log trolley in the vertical position (scale 1m).

Plate 32 – View showing the length of railway-track rail attached to the base of the trolley to act as a counter-weight to that of the log.

Plate 33 – View showing the construction of the base of the trolley.
Plate 34 – Aspect showing the width of the log-trolley (on its side).

Plate 35 – The scale bar is supporting the log-holder (to hold the log in place).

Plate 36 – Wheels to the log-trolley
Plate 37 – A section of log-trolley track.

Plate 38 – Detail of the track fastenings for the log-trolley (scale 25cm).

Plate 39 – Plank trolley.
Plate 40 – Frontal aspect of the plank trolley.

Plate 41 – Side view of the plank trolley. (scale bars 1m).

Plate 42 – View showing the angle-iron tracks of the plank trolley (scale 1m).
Plate 43 – Detail of the plank-trolley track. The hook spike is clamping the flange of the angle iron to the longitudinal timber sleeper (scale segments 1 cm).

Plate 44 – Site View from the southwest. Showing the three log racks on the left and the squared-log racks on the right.

Plate 45 – The log racks.
Plate 46 – Detail of the fastening to the western end of the first log in the log rack.

Plate 47 – Detail of the fastening to the eastern end of the first log in the log rack.

Plate 48 – The discarded drive belt and the central fastening to the third log in the log rack (scale segments on belt 1cm).
Plate 49 – View showing a large log placed under the damaged third log of the log rack.

Plate 50 – View showing the differences in height between the first two rails and the third rail in the log rack (scales 1m).

Plate 51 – The three racks that comprise the squared-log rack, viewed from the northwest.
Plate 52 – Detail of the fastening in the squared-log rack. Note the flat top to the rail.

Plate 53 – Detail of the end of one of the rails in the squared-log rail, showing that it was hand-sawn. Note also the flat top.

Plate 54 – The three rails of the plank-rack viewed from the southwest.
Plate 58 – Pine tops, and off-cuts dump.

Plate 59 – Petrol drum indicating a petrol driven power source for the saws.

Plate 60 – Much more recent drum that indicates that the mill operated for some time.