Macquarie Generation

Part 3A Environmental Assessment (Project Application 08_0061)

Gas Pipeline (North-South Route), Liddell Power Station

Appendix D

HERITAGE STUDY

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Aboriginal Archaeological Assessment
Macquarie Generation Proposed Gas Pipeline
North-South Route

Report to:
CDB Environmental

November 2008

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Executive Summary

Insite Heritage Pty Ltd have been commissioned by CDB Environmental Pty Ltd to conduct an Aboriginal archaeological assessment for the proposed Liddell gas pipeline north south route to be constructed by Macquarie Generation.

The proposed pipeline route is approximately 50km in length and aims to capture coal seam gases from adjoining mining operations in order to assist in power generation at Liddell Power Station and reduce emissions generated by traditional coal burning methods. The route takes in a variety of environmental contexts, including mine land over which AHIP's (Aboriginal Heritage Impact Permit) have been issued, road corridors and agricultural land adjacent to the Hunter River and Wollombi Brook.

The Aboriginal archaeological assessment identified 4 previously recorded archaeological sites and 30 new archaeological sites in the vicinity of the proposed pipeline route, as well of areas of archaeological sensitivity which will require mitigation measures should the project proceed.

The proposed route has been designated into areas of archaeological sensitivity (refer to Figures 16-20). The classification of the route into areas of low – moderate or moderate – high archaeological sensitivity was based on the archaeological potential of landform units, surface visibility, the level of disturbance, and site types identified in the area.

The mitigation measures recommended are based upon the perceived archaeological sensitivity of the various sections of the route. Where the sensitivity is low to moderate this generally indicates that the sites are in a disturbed context and/ or shallow A1 soil horizons. In these areas the appropriate mitigation measure is considered to be a combination of artefact collection and community monitoring in a structured program that ensures recording of activities undertaken.

Areas of high sensitivity include the sensitive Wollombi Brook and Hunter River terraces some of which may be Pleistocene in origin. In these areas mitigation measures considered appropriate are sampling of the route to determine the most sensitive loci of deposits, the salvage of these loci and the monitoring of earthworks. In order to effectively target these measures the advice of a geomorphologist should be sought.

There are site specific mitigation measures such as Liddell NS 19 where grinding grooves on a large rock outcrop were located. Here it is essential to under-bore at sufficient depth to ensure that no impact at the time of installation or in the course of pipeline maintenance activities or pipeline removal will occur.

This report does not cover any deviation in the proposed pipeline route outside of the area surveyed. Any additional changes to the route, not covered by the survey would require an additional assessment

The authors of this report are Angela Besant and Elizabeth Wyatt of Insite Heritage Pty Ltd.

1.0 Project Overview

1.1 Location

The proposed north south pipeline route is located in the Upper Hunter Valley of NSW. The route of the proposed north pipeline is approximately 50km in length and will traverse the townships of Broke, Bulga, Warkworth, Jerrys Plains and Liddell. Sections of the proposed route will run adjacent to the Hunter River, Wollombi Brook, and the Golden Highway in these areas.

1.2 Project Details

The proposed north south pipeline will be approximately 50km in length and will capture excess methane gas from adjoining coal mines in the vicinity of Broke, Bulga and Warkworth via a low pressure underground pipeline which will run to Liddell Power Station where the methane will be used in electricity generation. The proposed north south route will be developed in conjunction with the proposed east west route gas pipeline, currently under submission, which will collect methane gas from adjoining mines in the Liddell to Camberwell areas. The project is subject to approval under Part 3(A) of the *EPA Act 1979* as amended.

The specifications for the pipeline, including the detailed surveying/pegging out of the route, are yet to be finalised. In general the proposed works will initially involve the excavation of a trench for the emplacement of the gas pipeline. The trench will be approximately 1.5m deep and 1m wide. The area adjacent to the pipeline will be used for service vehicles etc during the construction of the pipeline and for ongoing maintenance. In areas where the pipeline will be under-bored, such as river and road crossings, an area of approximately 20m-35m^2 will be required on either side of the designated location for under boring to allow for the installation and operation of the boring rig.

In some sections of the proposed route the pipeline may also need to be “snaked”. This involves the curving of the pipeline to ensure correct pressure and constant gas flow. This process results in the widening of the impact width of the trenching to accommodate broad curves in the pipeline of wavelengths up to 3m.

1.3 Description of Route

At Liddell, in land owned by Macquarie Generation, the proposed north south route joins with the proposed east west route to run north under the New England Highway to Liddell Power Station. From the junction of the two pipeline routes, the north south route continues south east, near the eastern boundary of the Fly Ash Dam of Bayswater Power Station. The proposed pipeline route then continues around the southern boundary of the Fly Ash Dam, westwards to The River Road. At the intersection of The River Rd in the vicinity of Wisemans Creek, the route proceeds south westwards in between the eastern road easement and the Jerrys Plains water pipeline across Plashett Reservoir. The proposed route then continues southwards passing the western side of the water pumping station at Parnells Creek and crossing under the water canal, south into Wondewoi Farm.

At Wondewoi Farm the route continues in a southerly direction following the eastern side of the Hunter River to Lemington Road where the route turns south west and continues to the Golden Highway. At the intersection of the Golden Highway the route then proceeds south in the road easement thence crossing to the west side of the highway and continuing the road easement and adjacent land owned by Wambo Coal Mine. In the vicinity of a tributary of Waterfall Creek to the south of the property “Montrose” the route then re-enters the RTA owned easement of the highway and continues south to the junction of the highway and Wambo Coals Heavy Vehicle Mine Access Road. The proposed route will then conitinue along the southern edge of the road heading east, where it will then veer west following the western bank of Wollombi Brook to the main entry road for Wambo Mine.

The proposed route then continues along the southern edge of the entry road, south westwards then following the western bank of the Wollombi Brook southwards to Bulga. From Bulga the route continues in the road easement of the Inlet Road on the eastern side and into land owned by Xstrata Coal. Approximately 2km from Bulga, the proposed route will then proceed eastwards continuing in Xstrata owned land, crossing the Wollombi Brook and continuing east to Charlton Road. At Charlton Road the route follows the eastern side of Charlton Road in the adjacent land owned by Xstrata Coal for approximately 1.5km (refer to Figures 1-5 below)

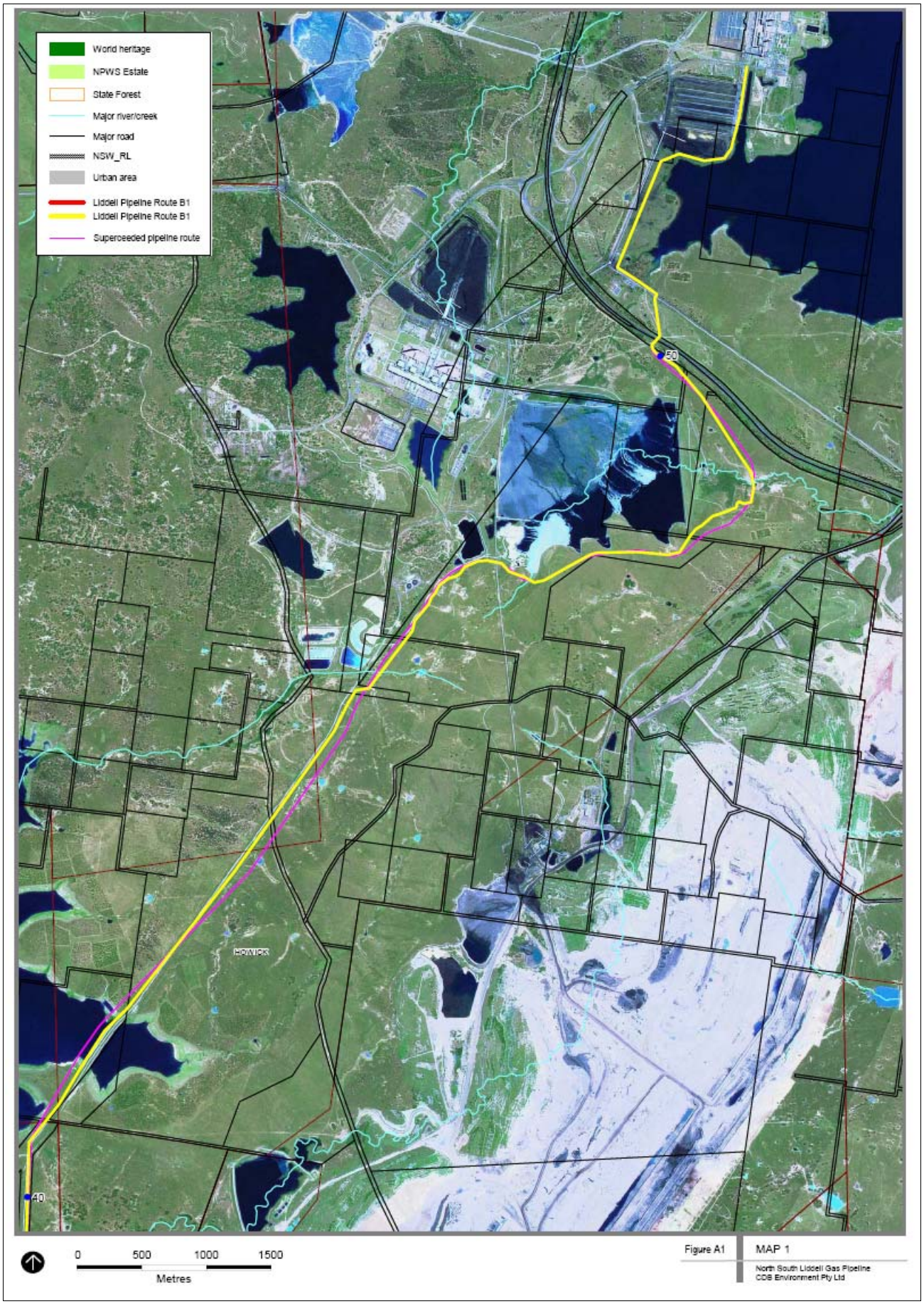

Figure 1 Plan of proposed N-S Liddell pipeline route Map 1.

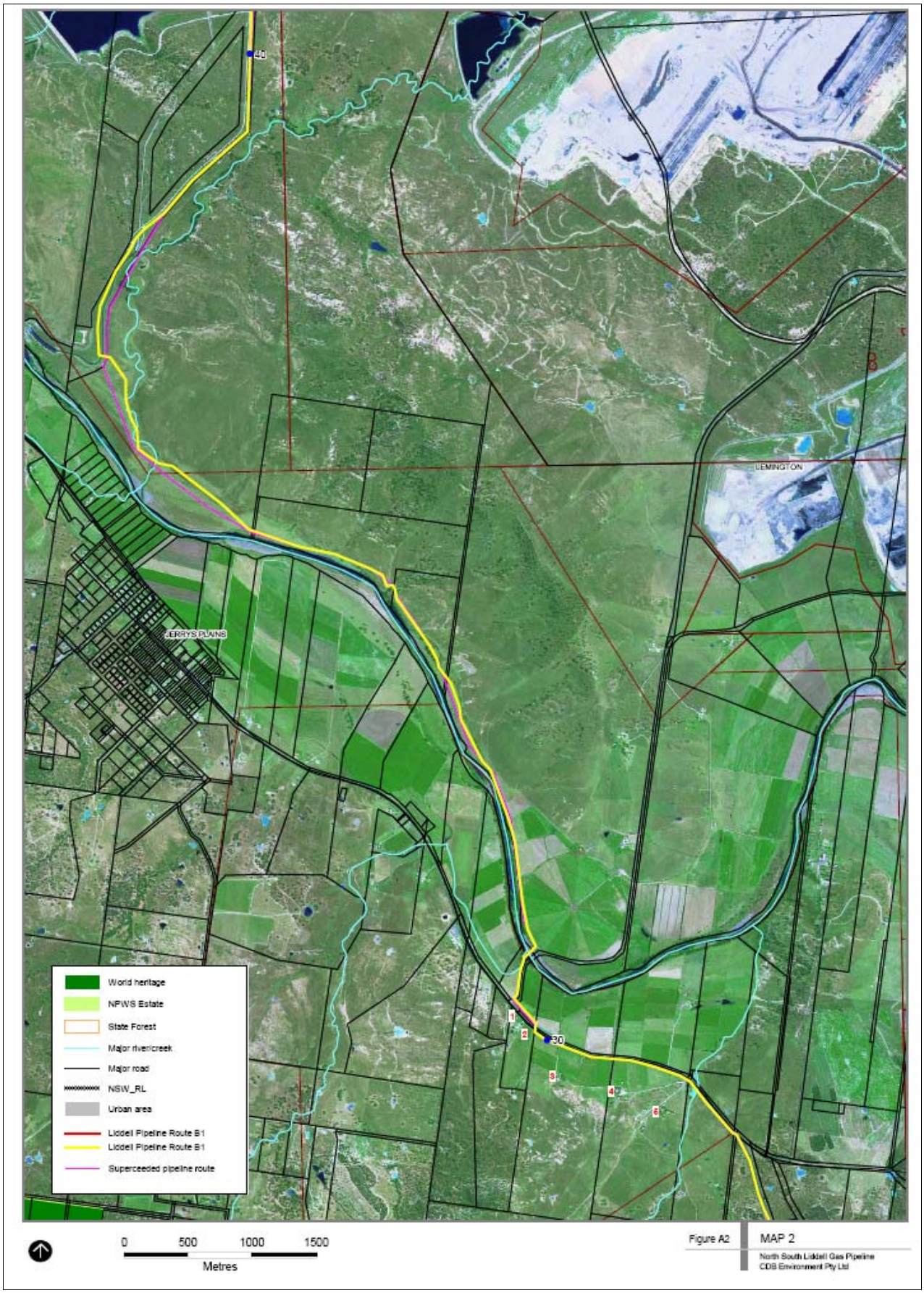

Figure 2 Plan of proposed route Map 2

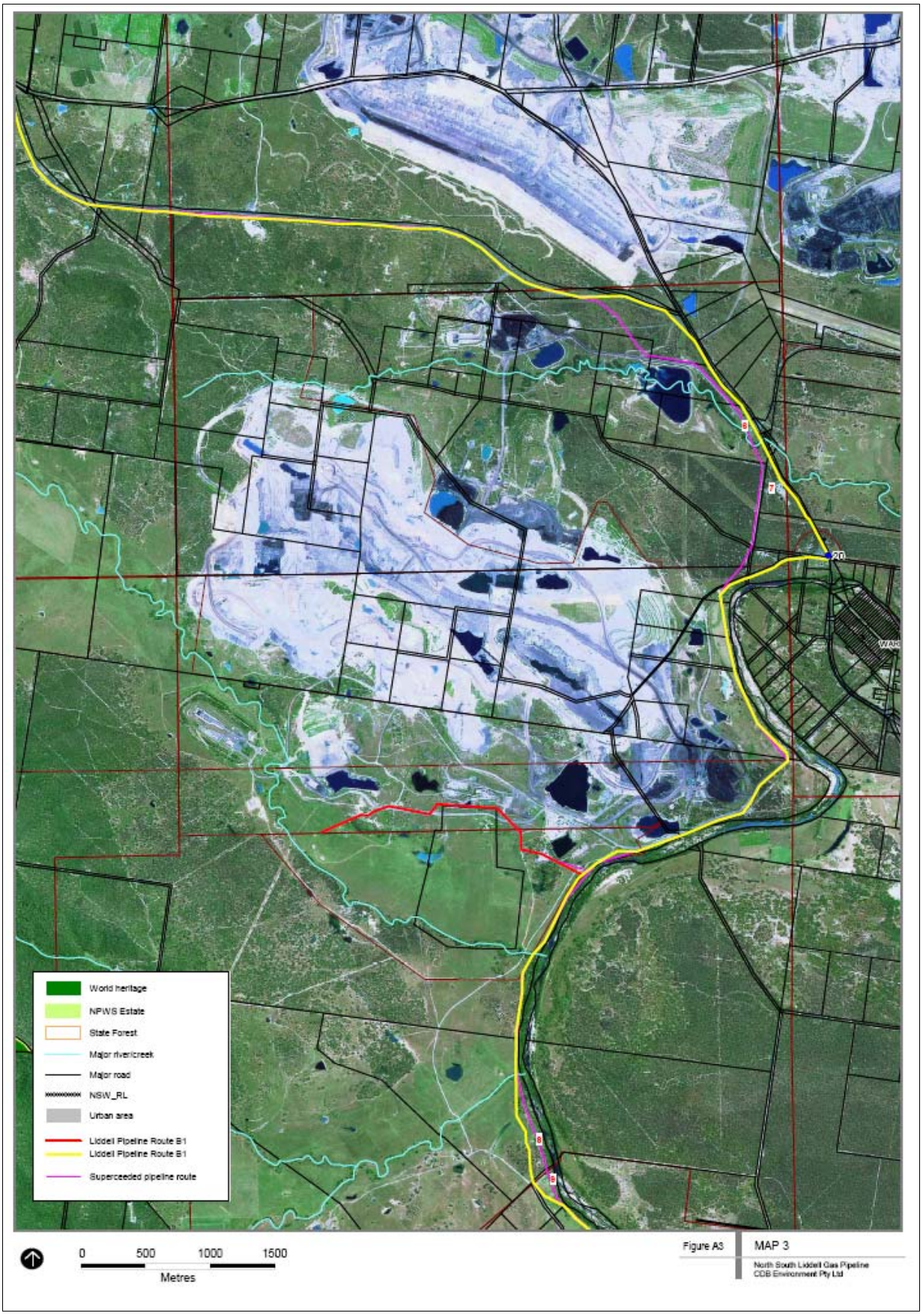

Figure 3 Plan of proposed route Map 3

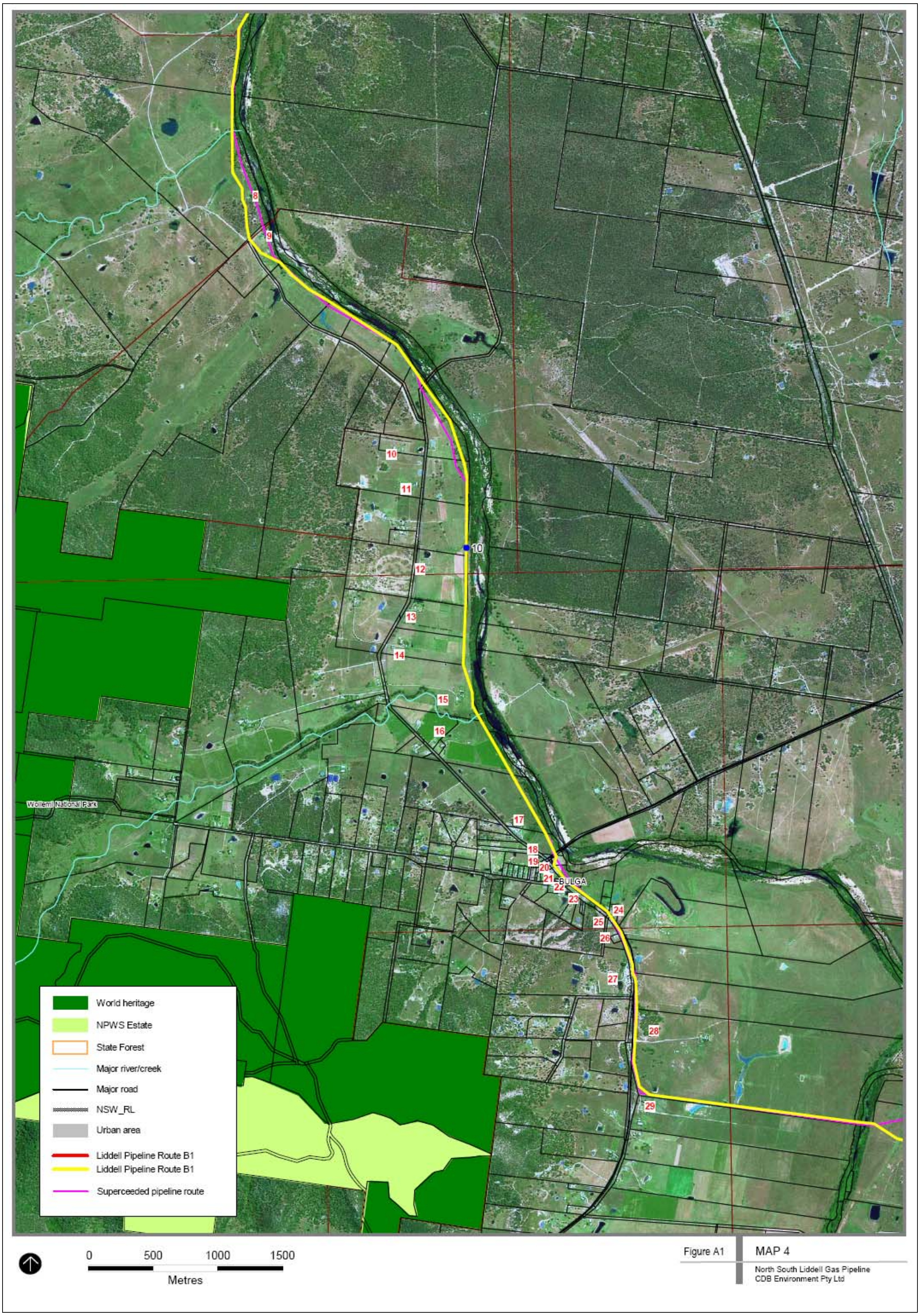

Figure 4 Plan of proposed route Map 4

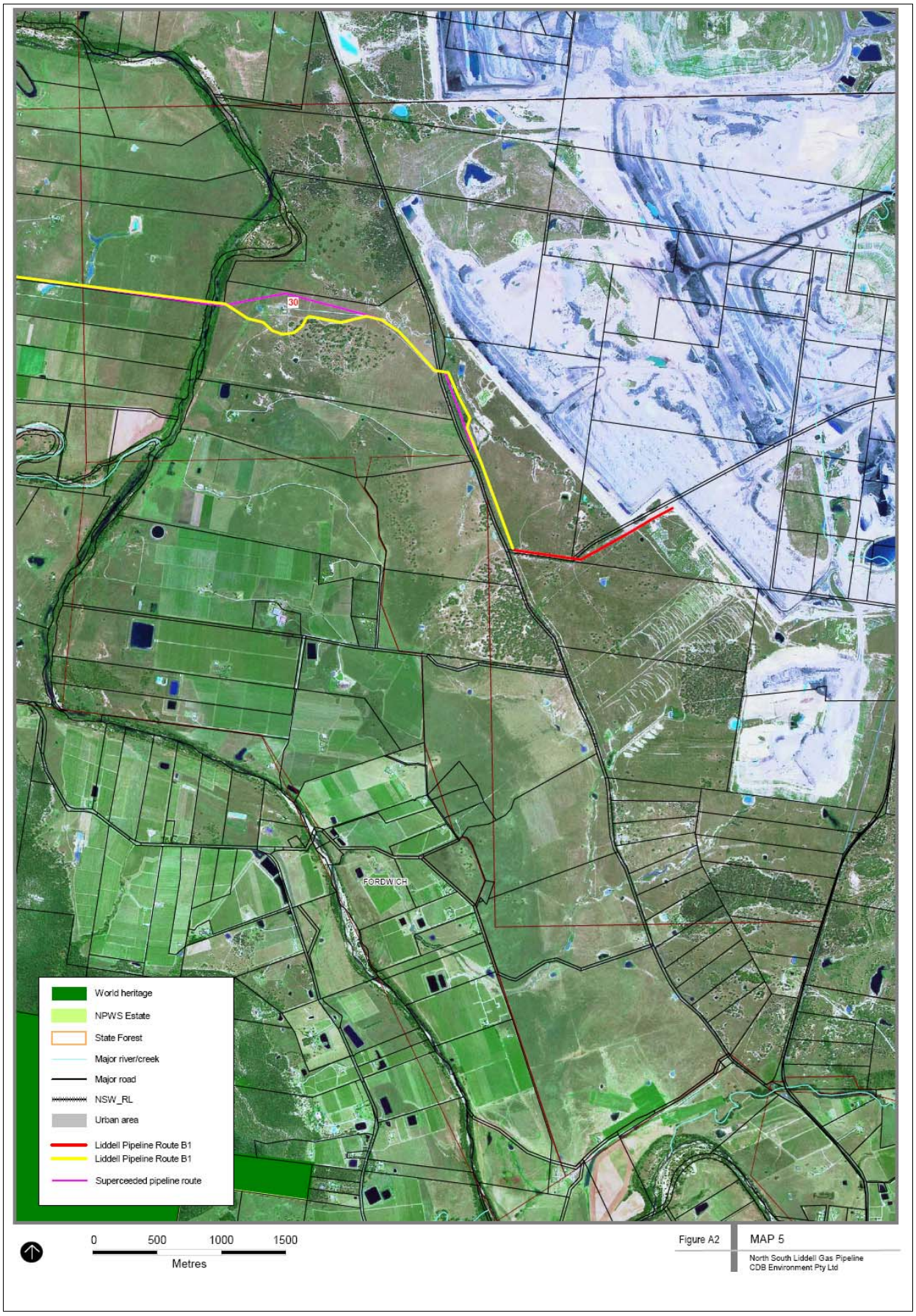

Figure 5 Plan of proposed route Map 5

1.4 Community Consultation

Letters of notification of the project and a request for the contact details of Aboriginal stakeholder groups who may have an interest in the project were sent to DECC (Department of Environment & Climate Change), NSW Native Title Services, Office of the Registrar, Muswellbrook Council and Singleton Council.

Letters of invitation to register an interest in the project were sent to:

Wanaruah Local Aboriginal Land Council
Junburra Consultants
Barkuma Neighbourhood Centre / Gidawaa Walang
Aboriginal Native Title Elders Consultants
Black Creek Aboriginal Corporation
Darrel Mathews Heritage Consultants
Giwiir Consultants
Hunter Valley Aboriginal Corporation
Lower Hunter Wonnarua Council
Lower Wonnaruah Tribal Consultancy Pty Ltd
St Clair Singleton Aboriginal Corporation
Ungooroo Aboriginal Corporation
Wonnaruah Elders Council
Valley Culture
Wanaruah Custodians
Wattaka Wonnaruah Cultural Consultants Services
Wonnarua Culture Heritage
Wonnaruah Tribal Council inc./Wonnaruah Elders Council
Yarrawalk Enterprises
Ms B Foot

An advertisement of the project inviting registrations of interest from community stakeholder groups with a two week registration period was placed in the Singleton Argus on the 20.07.2007. Due to delays in the commencement of the assessment an additional advertisement inviting registrations of interest, with a two week registration period was placed in the Singleton Argus on the 04.07.2008. Further consultation detail can be seen in Appendix A.

The following groups registered their interest in the project:

Wannaruah Local Aboriginal Land Council (WLALC)
Wattaka Wonnarua Cultural Consultants Services (WWCCS)
Hunter Valley Aboriginal Corporation (HVAC)
Giwiir Consultants
Barkuma Neighbourhood Centre Inc/Gidawaa Walang.
Aboriginal Native Title Heritage & Cultural Consultants (ANTHCCS)
Mingga Consultants
Wonnarua Culture Heritage
Yarrawalk Enterprises
Upper Hunter Wonnarua Council (UHWC)

Upper Hunter Heritage Consultants (UHHC)
Ungooroo Aboriginal Corporation (UAC)
Hunter Valley Cultural Survey (HVCS)

Community involvement in the field work was set by Macquarie Generation who requested that the survey be attended by one community group per day. This was due to a single vehicle access to much of the route and the requirement for a Macquarie Generation representative to be present, in addition to the flora and fauna consultant.

A fax was then sent out to all registered groups outlining field work details and inviting them to choose a day to participate in the survey with places allocated by order of response. Table 1 below lists the groups who registered for the field work.

Table 1 Community Field Work Participants

Group	Date	Field Officer
Gidawaa Walang	04.08.08	Ann Marie Hickey
WLALC	05.08.08	Steven Boney
HVAC	06.08.08	Julie Griffiths (unable to attend on the day)
UAC	07.08.08	Alan Paget
Mingga Consultants	08.08.08	Michael Stair
ANTHCC	26.08.08	Margaret Mathews (unable to attend due to illness)
UHWC	27.08.08	Unable to attend on the day*
ANTHCC	03.09.08	Michael Stair

*Unfortunately due to scheduling of the fieldwork UHWC were not able to be offered a replacement fieldwork day.

All registered stakeholder groups were forwarded a copy of the draft report for their review and comment. A twenty one day period was allowed for comments to be received. Additional comments received after this date have also been included in the consultation log. Community feedback received has been incorporated into the management recommendations.

See Appendices A and B for community consultation log and project advertisement.

1.5 Environmental Context

The proposed North South pipeline route traverses the following Soil Landscapes (Kovac 1991):

Bayswater (bz)
Brays Hill (br),
Branxton (bx)
Bulga (bu)
Hunter (hu)
Jerrys Plains (jp)
Liddell (ld)
Wollombi (wo)

The following tables summarise the underlying geology and characteristic soil types and the landform and main native vegetation types for each of the soil landscapes, (from Kovac & Lawrie 1991 and Kovac:1991).

Geology & Soils

Table 2 Geology & Soil Types

Soil Landscape	Underlying Geology	Soil Types
Bayswater	Permain sandstone, shale, mudstone, conglomerate and coal.	Yellow Solodic soils on slopes, with Alluvial Soils in drainage lines. Intergrades of Yellow Solodic Soil-Red-brown Earths. Brown and Yellow Earths and Prarie Soils in some drainage lines. Red, Yellow & Brown Podzolic Soils on slopes.
Branxton	Permain sandstone, shale, mudstone, siltstone, tuff and coal seams	Yellow Podzolic Soils on mid slopes, Red Podzolic Soils on crests. Yellow Soloths on lower slopes and in drainage lines . Alluvial Soils in some creeks.
Brays Hill	Permian calcareous shale and sandstone, Tertiary basalt.	Red clays on mid slopes with Black Earths on steeper slopes. Grey and Brown Clays and yellow Solodic Soils on some lower slopes,. Alluvial soils in drainage lines. Red-brown Earths on some crests and upper slopes.
Bulga	Permian sandstone, conglomerate, claystone, shale, mudstone and coal seams.	Yellow Soloths on upper to mid slopes with Brown Earths on lower slopes.
Hunter	Alluvial plains and terraces of the Hunter River and its tributaries.	Brown Clays and Black Earths on prior stream channels and tributary flats. Chernozems on former channels adjacent to Dartbrook and Brays Hill soil landscape . Alluvial Soils on levees and flats adjacent to the current channel. Red Podzolic Soils and Lateritic Podzolic Soils on old terraces. Non-calcic Brown Soils on terraces with Yellow Solodic soils in drainage lines.
Jerrys PLains	Permian lithic sandstone, mudstone, siltstone and conglomerate.	Soloths on crests to midslopes with Solodic Soils on lower slopes and in drainage lines. Brown clays in midslopes and depressions. Red Earths on some upper slopes.
Liddell	Permian sandstone, shale, mudstone, conglomerate and coal.	Yellow Soloths an Yellow Solodic Soils on slopes. Earthy and Siliceous Sands on slopes on siliceous parent rock.
Wollombi	Alluvium	Layered Alluvial Soils.

Landform & Topography

Table 3 Landform & Topography Types by Soil Landscape

Soil Landscape	Landform	Elevations	Slope Gradients
Bayswater	Undulating low hills	40-60m	3-10%
Branxton	Undulating rises – low hills	10-40m	Up to 5%
Brays Hill	Undulating low hills	60-120m	6-10%
Bulga	Smooth slopes with sandstone colluvium	20-40m	Slopes to 10%
Hunter	Alluvial plains and terraces	To 10m	Up to 3%
Jerrys Plains	Undulating low hills	60m	2-10%
Liddell	Undulating low hills – undulating hills	60-120m	4-7%
Wollombi	Alluvial flats and undulating rises	To 20m	To 3%

Vegetation

Table 4 Vegetation Types

Soil Landscape	Vegetation Type	Predominant Species
Bayswater	Predominant cleared woodland	Remnants of forest red gum, and forest oak occur with some Broad-leaved red ironbark, narrow-leaved red ironbark, bull oak, grey box and swamp oak
Branxton	Mainly cleared for grazing. Some areas of uncleared native bushland	Spotted gum, red ironbark, narrow leaved red ironbark, swamp oak in drainage lines.
Brays Hill	Savannah woodlands, largely cleared.	White box, yellow box and kurrajong.
Bulga	Woodland. Much of landscape cleared for grazing /horticulture.	Yellow box, forest red gum, narrow-leaved red ironbark. Also some rough barked apple, cabbage gum and deans gum.
Hunter	Cleared for intensive agriculture	No native vegetation remaining.
Jerrys Plains	Woodland	Narrow-leaved red ironbark with forest red gum, grey gum and bull oak in drainage lines.
Liddell	Open-woodland	Narrow-leaved red ironbark, yellow box, white box, spotted gum. Minor blakelys red gum, roughed barked apple, kurrajong and bull and swamp oak.
Wollombi	Some cleared for grazing on unimproved pastures.	Forest oak with some river oak

Hydrology

Approximately 5km of the proposed route runs on the eastern side of the Hunter River at Jerrys Plains. In the vicinity of Warkworth and Bulga the proposed pipeline route runs immediately adjacent to the western side of Wollombi Brook for approximately 10km. Other creek lines which the proposed route crosses or runs adjacent to include: Redbank Creek and Hobden Gully at Warkworth, Waterfall Creek at Jerrys Plains, and Parnells, Wisemans and Pikes Creek in the Macquarie Generation owned land at Liddell as well as numerous small tributaries and drainage lines.

2.0 Archaeological Context

2.1 Regional Indigenous Archaeological Context

Aboriginal occupation within the Central Lowlands of the Lower Hunter Valley occurred over 20,000 years ago. Koettig (1986) recorded a date of 20,200 BP from a hearth at Glennies Creek to the north of Singleton. An Aboriginal site on the Liverpool Plains has been dated to at least 19,000 BP (Gorecki *et al,* 1984). The majority of dated sites within the Hunter Valley are less than 4,000 years old (Brayshaw 1994).

The study area is located within the boundaries of the Wonnarua tribes. European settlement of the Hunter Valley commenced in the early 1800's which in turn had a catastrophic impact on the local Wonnarua peoples and their traditional culture.

2.2 AHIMS Search

A search of the AHIMS (Aboriginal Heritage Information Management System) register was conducted for a minimum of a 1km and up to 5km either side of the proposed route. The search identified 950 sites, with some sites being located up to 3km away from the proposed route. Figures 6-10 below, display the location of recorded sites identified by the search. The route depicted in the figures has altered slightly since the compilation of the figure; the route alterations are shown Figures1-5.

44 of the sites identified by the AHIMS search are located within 200m of the proposed pipeline route. Of these 44 sites, the majority of sites types recorded comprise of artefact scatters (50%), seven of which contained over 100 artefacts, with one (37-6-0966) site having over 2000 artefacts. Isolated artefacts were the next common site type (30%). Three locations of axe grinding grooves, one with 39 sets, and two scared trees are also recorded in the vicinity. The main raw material types recorded at these sites were Mudstone, silcrete chert and rhyolite with minor quartzite, quartz, basalt and tuff also recorded.

The GIS layers presented below were plotted using the GDA 94 datum. There is a discrepancy of up to 190m (Northings) and 105m (Eastings) between this datum and earlier co-ordinate systems (AGD 66). As not of all of the sites from the search were recorded using the GDA 94 datum, the site cards for each of the sites which plotted

up to 200m distance from the route were analysed in order to ascertain their impact potential.

2.3 Recorded site which may be impacted by the proposed pipeline

Following comparison of the GIS map and the site cards the following sites may be impacted, or a located in the vicinity of the proposed route:

37-2-0048 – Recorded by Dyall (1979). Dyall noted that scatters of artefacts were noted along both banks of Pikes Gully. This site card was for artefacts located on the southern bank of the gully. Although Dyall states that another site card has been lodged for sites on the north bank, it does not appear on the register. Disturbances noted included ploughing and grazing. A collection of cores was made at this site.

37-2-0035 – Recorded by Dyall (1976). Recorded as a thin artefact scatter in eroded ground along the creek flat of Parnells Creek. Collection was made of 86 artefacts.

37-2-0190 – Recorded by Dyall (1983). Site described as being located on both banks of Parnells Creek, in a narrow creek valley. The scatter extends for approximately 100m on both banks. 86 artefacts were collected from the site. This card may be a re-recording of 37-2-0035. Site card noted there is a continuous stream of artefacts upstream of the site as far as The Mitchell Line road.

37-5-0248 – Recorded by ERM (1997) as HVS 24. Site located on access track below a 320kv power line, 1km south of the former Jerrys Plains Rd. Site consists of one chert flake (four conjoins).

37-5-0249 – Located by ERM (1997) as HVS 25. One mudstone blade core and one silcrete flake core were identified on a power line easement on a ridge.

37-6-0134 – Recorded by Dyall (1980) as a scatter of 20 flakes on heavily eroded ground at the junction of a spur creek with Redbank Creek, immediately west of the Warkworth - Jerrys Plains road.

37-6-0133 – Identified by Dyall (1980) as a scatter of over 100 flakes on a low ridge situated on a seasonal spur creek, back from Redbank Creek. Site unlikely to be impacted by the proposed pipeline.

37-6-0990 – Recorded by Silcox (1997). Site located approx. 100m north of the Wambo Access Road. Six (5 x tuff, 1 x silcrete), artefacts identified around a recently excavated basin on an alluvial terrace of Wollombi Brook.

37-6-0595 –Recorded by Envirosciences (1992). Site plots to the south of Wambo Access Rd and Wollombi Brook. Sites comprises of an artefact scatter with possible sub surface deposits.

37-5-0034 – Site initially recorded by Dyall (1981) and re recorded by White (2002). Site located in the northwest side of the junction of North Wambo Creek and Wollombi Brook. Site situated in erosion scars on a sand dune. The sand body is considered to have considerable research potential. Artefacts are visible on a graded track 5-14m wide and in erosion scars on the north end of the dune.

37-5-0188 – Identified by Rich (1990). Scarred tree located 10m west of a track running south, approximately 300m from the confluence of North Wambo Ck and Wollombi Brook.

37-6-1105 – Site card describes the site as located on the west side of Wollombi Brook and is therefore outside of the study area.

37-6-1404 - Umwelt (2002), Site Name:BCO12. Isolated artefact.

37-6-1401 - Umwelt (2002),BCO10. Large site extending along a drainage line. Site contains over 2000 artefacts.

37-6-0429 – Brayshaw (1988). Bulga 7 - Artefact scatter located along an un named tributary approx. 400m west of Charlton Road.

37-6-0965 – Umwelt (2002) BMU 3 is located in the pipeline route on the east side of Charlton Rd. Artefact scatter adjacent to an un named creek, adjacent to two bund walls.

37-6-0547 – (Koettig 1991). B71 located in the vicinity of the pipeline route on the east side of Charlton Road. Artefact scatter at the confluence of two un named creeks.

37-6-0967 – Umwelt (2002). BMU1 Large site containing 39 Axe Grinding Grooves. Recommended site be preserved. Located to the west of the proposed pipeline route.

37-6-0142 – Recorded by Dyall (1981).Located in the pipeline route on the east side of Charlton Road. Artefact scatter of about 50 artefacts on west side of eroded creek bank.

37-6-0428 – Brayshaw (1988). Bulga 6 - Scarred Tree. Located to the north of proposed route.

2.4 Local Indigenous Archaeological Context

A review of previous archaeological assessments was conducted in proximity to the proposed pipeline route in order to place the study area into an archaeological context. A more comprehensive review of previous studies in the area was unable to be undertaken as the report library at AHIMS was closed for upgrading during the compilation of this report.

Koettig & Hughes (1983) conducted an archaeological assessment for the United Collieries Lease Area. A total of 62 sites were identified by the survey inclusive of eight sites previously identified by Dyall. The majority of sites were located within 50m from watercourses, in erosion scours and areas of exposure. Surface salvage collections and subsurface investigations were undertaken along Redbank Creek at sites RBC 5, 12 and 13. Subsurface testing revealed that the majority of artefacts were recovered from lower levels of the 'A' horizon with no evidence of artefacts from the 'B' horizon, although only a small number of deposits were excavated from the 'B' horizon (Koettig & Hughes 1983:54). The main artefact types identified included cores, retouched flakes and flaked pieces with dominant raw material types of mudstone and silcrete with chert, quartz, quartzite and volcanics also recorded. With the exception of RBC 13, Koettig and Hughes concluded that all of the sites to be impacted by development were 'relatively minor sites'. The report recommended Consents to Destroy be sought from NPWS for the majority of sites to be impacted by development and that impact on sites 5 and 59 be avoided (Koettig & Hughes 1983:60).

Brayshaw & Associates (1984) carried out an archaeological survey for land at Warkworth for Wambo Mining Corporation Pty Ltd which adjoined the southern boundary of United's lease (Brayshaw 1984:1). Three sites, artefact scatters, were identified by the survey and previously recorded sites 37-6-135 and 37-6-136 revisited. Mudstone and silcrete was the dominant raw material identified, with artefacts types comprising of flakes and cores. Brayshaw recommended a mitigation be sought for the three newly identified sites.

Rich (1991) undertook an archaeological survey on behalf of Wambo Mining Corporation for proposed extension to their existing underground and open cut mining operations. The survey was conducted in two survey areas in the vicinity of North Wambo and Stony Creeks. The survey identified seventeen sites located along North Wambo Creek and a further three sites and four isolated finds in the survey area along Stony Creek. The majority of identified sites comprised of artefact scatters. Rich notes, that eroding hearths were identified at two sites with a possible destroyed hearth at a third. A possible heat treatment oven was also identified and knapping floors were identified and five sites. Numerous axe grinding grooves were identified along North Wambo Creek and a possible scarred tree adjacent to Wollombi Brook was also recorded.

Kuskie (1998) conducted an archaeological survey for proposed mine conveyor and haul road for CMPS&F Pty Ltd. The main artefact types recorded included cores and core fragments and flake and flake fragments of rhyolitic tuff and silcrete.

Kuskie (2000) performed an archaeological assessment for proposed haul road routes from the United and Wambo leases to Lemington colliery as part of the proposed Jerrys Plains Coal Terminal and Rail Line project. Five artefact scatters and one isolated find were recorded. Kuskie notes that site 37-5-1033 is an extensive artefact scatter which may relate to previously recorded sites (37-6-131, 37-6-132, 37-6-272, 37-6-275 and 37-6-330. Site 37-5-1010 was also considered to possibly relate to the more extensive site 37-6-136 located across the drainage channel.

AMBS Pty Ltd (2002) conducted an archaeological survey and test excavations for Coal & Allied Ltd at their Warkworth Mine Lease. The archaeological survey identified over 100 Aboriginal archaeological sites, the majority comprising of artefact scatters and isolated finds. Two locations of axe grinding groove were also recorded. The highest concentrations of arteafcts were recorded at locations associated with drainage lines. High densities of artefacts were also recorded on the surface of the sand sheet deposits associated with Sandy Hollow Creek. Subsequent subsurface testing of the sand sheet deposits revealed concentrations of artefacts below the surface, some at depth.

White (2003) undertook and archaeological assessment for Wambo Coal Pty Ltd for expansion of their mining operations. The survey identified 292 sites, of which most comprised of artefact scatters. Grinding grooves, a possible scarred trees and a possible contact sites were also noted.

McCardle Cultural Heritage Pty Ltd (2006) carried out an indigenous archaeological assessment for the Bayswater Power Station River Intake Project. The study area covered a proposed water pipeline route, approximately 3km in length from the southern edge of Plashette Reservoir to the Hunter River. The survey identified one isolated artefact.

2.5 Predictive Model of Archaeological Potential

The archaeological record of the Hunter Valley has revealed a distinct site patterning for the region. Previous archaeological investigations have shown that archaeological sites are more prevalent in areas in close proximity to water sources with the number and density of archaeological sites increasing with the permanence of the water resource. Investigations have shown that artefact densities are greatest at sites located within 50m of a water source. Areas surrounding creek confluences have also been shown to be of importance in the region and potentially contain larger and more complex archaeological sites. River terraces have also been noted to have been favoured areas for Aboriginal encampments. The preference for occupation close to water resources may also lead to the re-deposition of artefacts in alluvial sediments and the exposure of subsurface archaeological material as a result of geomorphological processes. Large artefact densities have also been recorded in elevated landfroms situated over 100m from a water source. Whilst these areas can be favoured for larger camp sites, smaller artefact scatters may occur in all landscapes, resulting from movement between areas and the procuring of resources.

An analysis of previous studies conducted in proximity to the study area has shown that the most likely site types which may occur are: Open Campsites/Artefact Scatters, Isolated Artefacts and areas of PAD (Potential Archaeological Deposit). Axe Grinding Grooves are also likely to be present if suitable rock outcrops occur along watercourses. Burials may also be present if suitable soil types are identified.

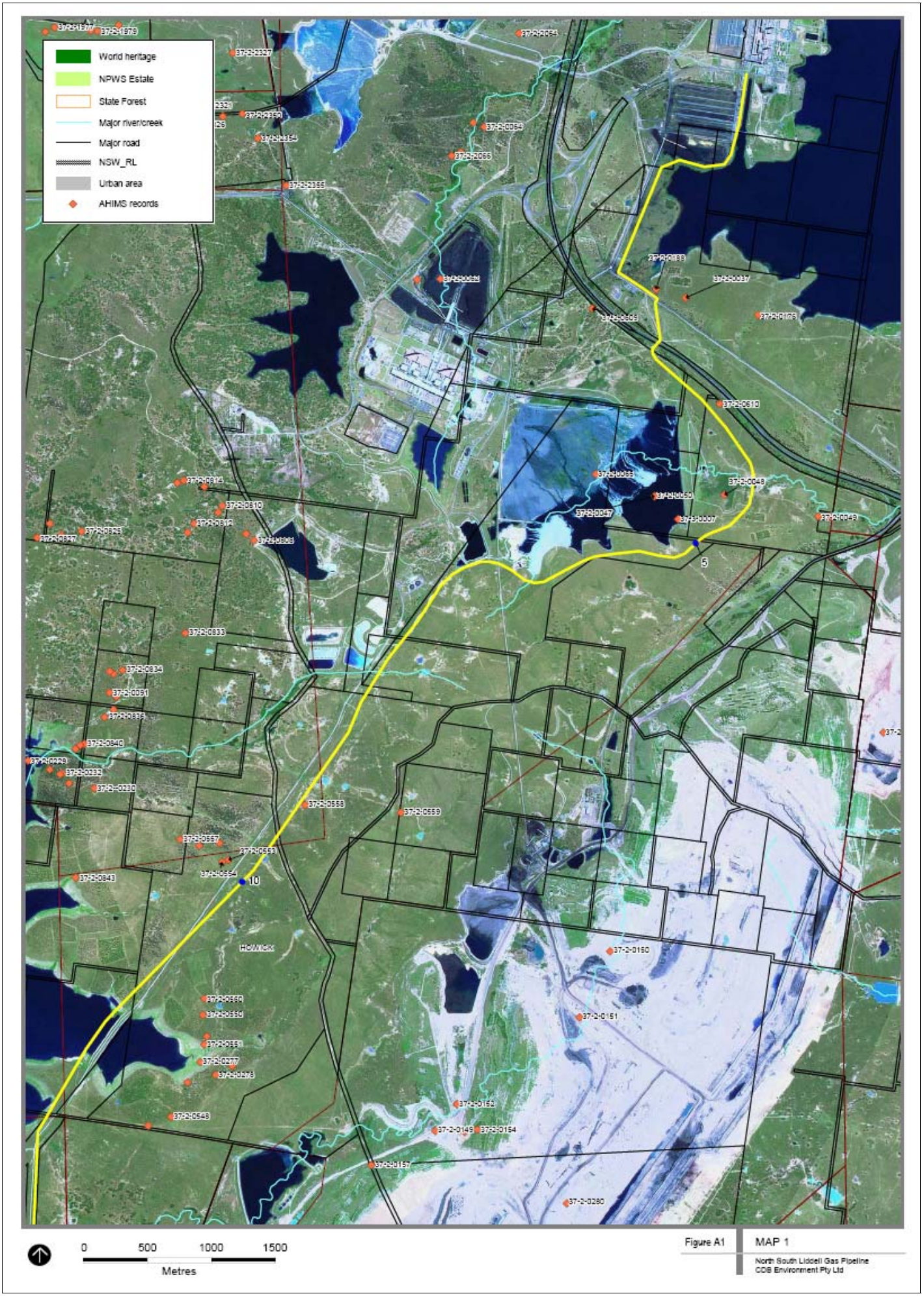

Figure 6 Location of recorded archaeological sites in proximity to the proposed pipeline route.

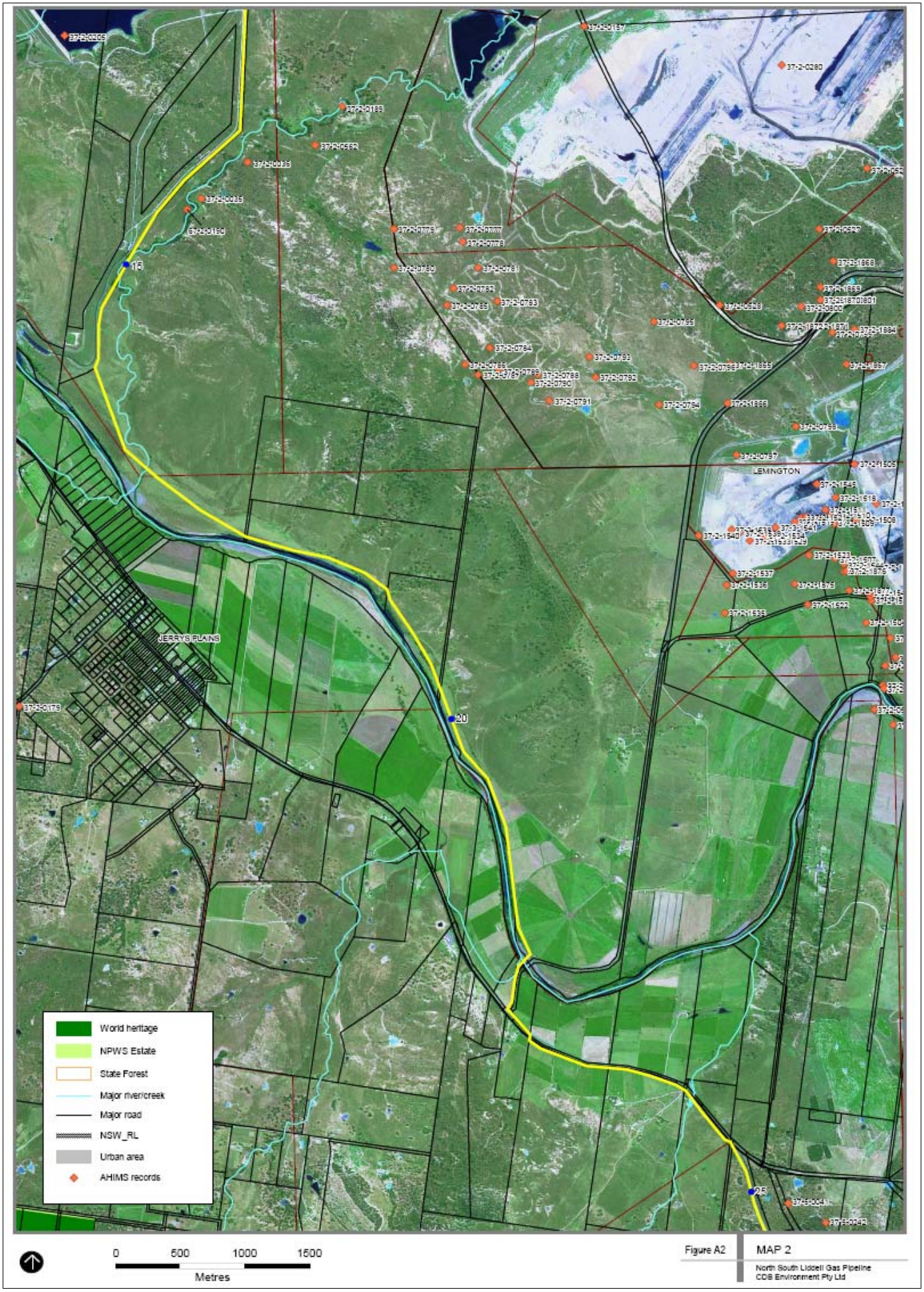

Figure 7 Location of recorded sites in proximity to the proposed pipeline Map 2.

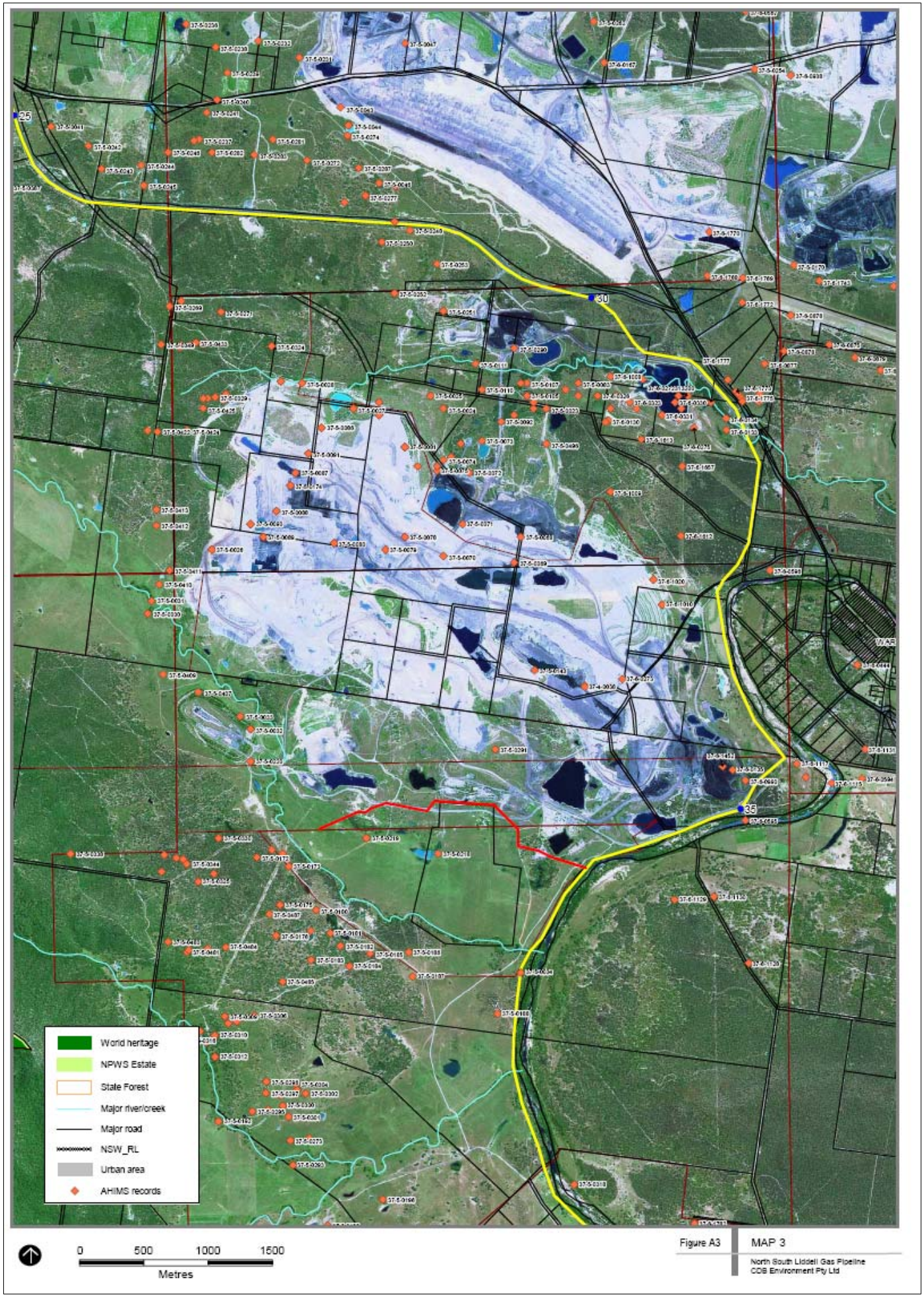

Figure 8 Location of recorded sites in proximity to the proposed pipeline Map 3

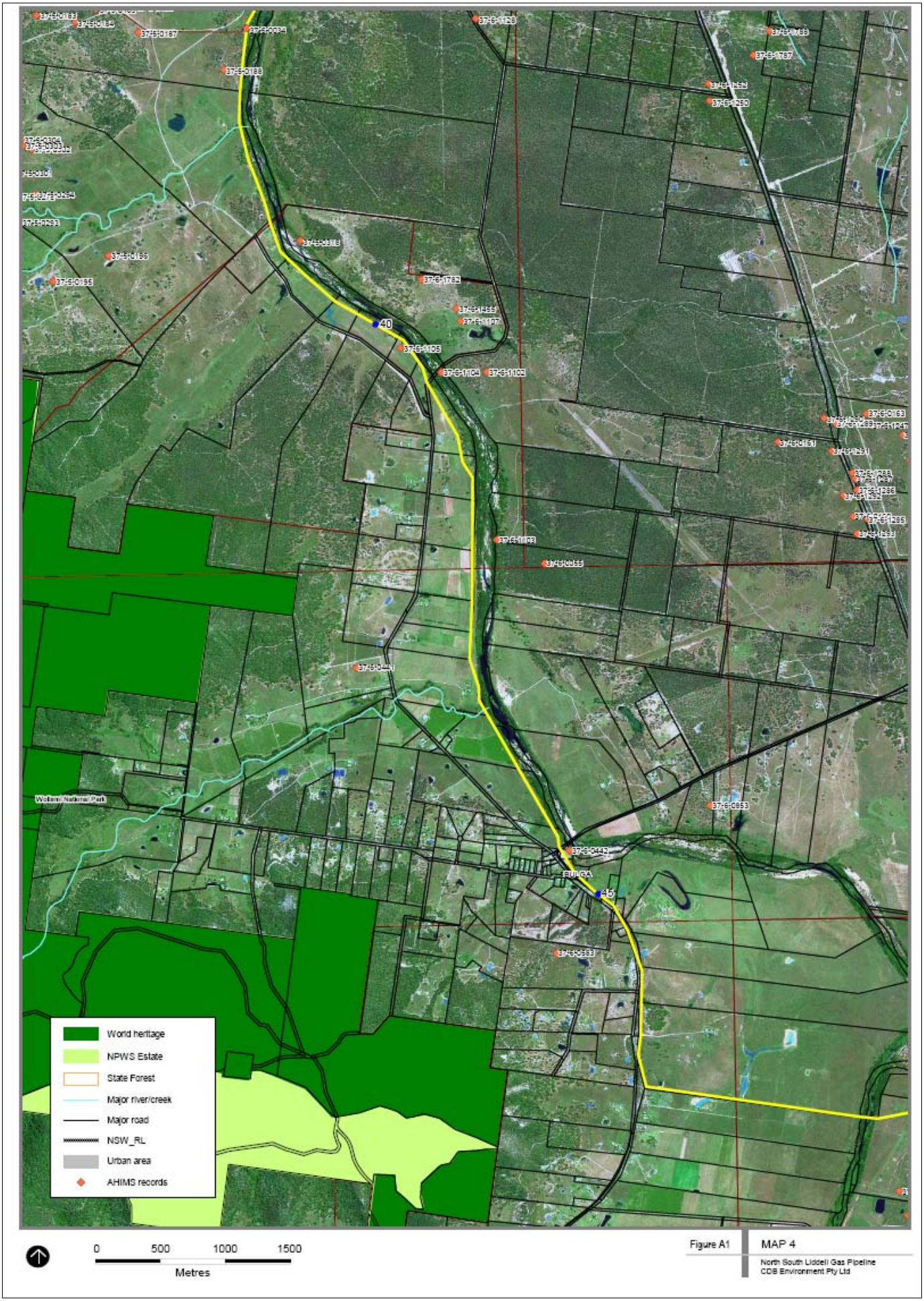

Figure 9 Location of recorded sites in proximity to the proposed pipeline Map 4

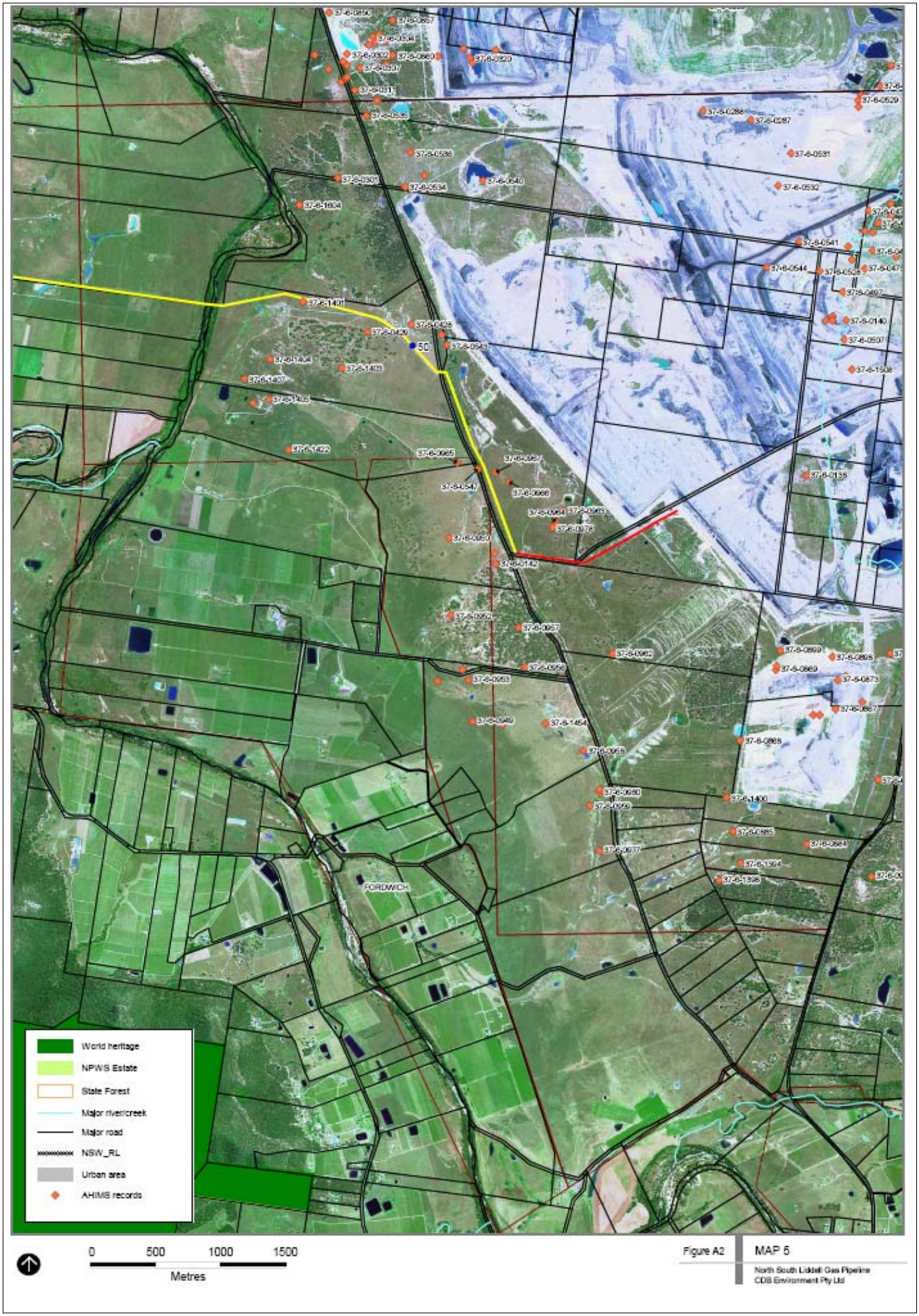

Figure 10 Location of recorded sites in proximity to the proposed pipeline Map 5

3.0 Archaeological Survey

3.1 Survey Objective

The aim of the survey was to identify any Aboriginal sites or areas of potential archaeological deposit which may be impacted by the proposed pipeline. The survey was conducted on the 4th-8th, 26 and 27th August and the 3rd September 2008. The survey was attended by Field Officers from community stakeholder groups who registered interest in the project (see Section 1.4), Glenn Keevers – Project Manager for Macquarie Generation, Alison Hunt – Ecologist and Elizabeth Wyatt of Insite Heritage Pty Ltd

3.2 Survey Details

For the purposes of this report, the proposed pipeline route was subdivided into a series of Survey Sections. The details of the assessment conducted in each of the Survey Sections along the proposed route are presented in Table 5 below with the designated sections outlined in Figures 11-15.

Table 5 Survey Details

Survey Section	Location	Landform	Survey Type (Vehicle or Foot)	Surface Visibility (SV)	Arch. Visibility (AV)	Surveyed Area (approx.)	Effective Coverage[1] (%)	Sites	Survey Notes
1.	**Macquarie Generation Land Bayswater Power Station – Wondewoi Farm**								
1.1	Junction with Proposed EW route – Pikes Creek	Gentle slope	Foot	80-10%	60-80%	1.5km x 20m	24.5%	Liddell NS 1 Liddell NS 2	S-SE up slope following vehicle track approx 8m wide, SV 80%. Tracked pugged by cattle hooves. Declining visibility from crest of hill, pasture cover ect. From top of hill head SE along crest and down slope (SV 10%) joining vehicle track at base of slope – increase in visibility along track and adjacent to Pikes Creek (60%). Area disturbed by earthworks, vehicle track way, pumping station, rubbish
1.2	Pikes Creek – Trig Station/ SE end of Bayswater Ash Dam	Gentle slope – Undulating Hills	Foot	80-20%	60-80%	600m x 20m	21%	Liddell NS 4 Liddell NS 5	From Pikes Creek, route to stay in road or immediately east of as follows vehicle track up slope, route then deviates from track , heading up slope SW to trig station located at the SE end of the fly ash dam. Visibility in vehicle track way good 80%, adjacent to vehicle track approx 20%, some additional exposures on ants nests adjacent. @ 6412833, 309458 surveyed route left road and headed up slope westward toward dam embankment. Visibility 20-10%, cleared former grazing
1.3	Trig Station – Conveyor SW end of Bayswater Ash Dam	Gentle slope –Undulating hills	Foot	100-0%	90-20%	1.6km x 20m	17.5%	Liddell NS 6	Continued SW-W from trig station around southern edges of Bayswater Ash Dam. Land cleared former grazing, introduced grasses, disturbed. Large erosion scour following contour of dam visibility up to 100% in scour. Route continues to follow S edge of dam. Visibility declines 0-10% due to ground cover. @ 6412342, 307818 large dozed, cleared area SW corner of dam. One isolated artefact identified. Large disturbed area 15 x 20 and 20 x 30m approx. Disturbed by clearing, and large earthmoving equipment. From SW corner of dam follow small track to conveyor. Pipeline to under bore conveyor
1.4	W side of Conveyor – River Road	Undulating hills	Foot	60-0%	80-0%	1.5km x 20m	12%	Liddell NS 7 Liddell	From W side of conveyor climbed up to top of embankment and continued along S side of fence, mid slope. Eroded exposures mid slope, route then veered

[1] Where a range given for SV or AV, median of range used in calculating EC

Survey Section	Location	Landform	Survey Type (Vehicle or Foot)	Surface Visibility (SV)	Arch. Visibility (AV)	Surveyed Area (approx.)	Effective Coverage[1] (%)	Sites	Survey Notes
								NS 8 Liddell NS 9	S. From 6413220 307231 head S following power line to E, down slope where it crosses tributary of Wisemans Ck to River Rd.
1.5	River Rd Easement – Plashett Reservoir	Undulating hills	Vehicle	0-60%	80-0%	3km x 20m	12%	Liddell NS 10	From 6411258 306545 cross under water pipeline into road reserve on east side of River Rd and follow road reserve between River Rd and Jerrys Plains water pipeline SW to causeway across Plashett Reservoir . Vehicle survey stopping at areas of exposure. Proposed route to run parallel to and on the W side of the Jerrys Plains water pipeline on the E of River Rd.
1.6	Plashett Reservoir, River Rd Easement – Water Pumping Station	Undulating hills	Vehicle	0-50%	0-60%	3km x 20m	7.5%	Liddell NS 11 Liddell NS 12	Route to continue along E side of causeway across Plashett Reservoir then continue in the E side road reserve to Water pumping station. Vehicle survey conducted stopping at areas of exposure.
1.7	Water Pumping Station – Wondewoi Farm	Undulating hills	Vehicle	0%	0%	1km x 20m	0%		Continue around W side of pumping station between road and W side of canal then cross E into Wondewoi farm. Visibility low due to pasture cover. Section between Pumping Station and Wondewoi Farm observed from road only. Thick ground cover noted. Area disturbed from water pipeline, road, and water canal. Pipeline will cross into Wondewoi
2	**Wondewoi Farm**	Terrace, Tow slope, Lower slope	Vehicle	0-50%	0-60%	7km x 10m	7.5%	Liddell NS 13 Liddell NS 14	In Wondewoi Farm vehicle survey conducted in area of proposed route. Route yet to be defined in this area but will follow E side of Hunter River SE to Lemington Rd predominantly along the tow slope/upper terrace margin. Some sections of the route in Wondewoi Farm will be located on the upper terrace. Vehicle survey accompanied by property owners. Visibility across majority of surveyed area 0% due to pasture cover in the terrace and tow slopes. Some visibility in vehicle tracks and adjacent exposures (up to 50%). Disturbance from vehicle track, farming/ploughing
3	**Lemington Road – Golden Highway**	Terrace – Lower slopes	Vehicle	0%	0%	500m	0%		From S boundary of Wondewoi farm pipeline to underbore to the W side of the Hunter River and continue in paddock area adjacent to Lemington Rd to the Golden Highway. On W side of river, heavily grassed paddock, no visibility.
4	**Golden Highway RTA Reserve - Wambo Mine**	Lower slopes, undulating hills							RTA road reserve land to Wambo access road, Warkworth
4.1	Golden Highway,	Lower slopes	Vehicle	0-60%	0-80%	1.25km	12%		From Lemington Rd for approx. 250m continue on the N

Survey Section	Location	Landform	Survey Type (Vehicle or Foot)	Surface Visibility (SV)	Arch. Visibility (AV)	Surveyed Area (approx.)	Effective Coverage[1] (%)	Sites	Survey Notes
	RTA Reserve /Wambo Mine Land		Foot			500m			side of highway in road reserve before under boring to S side. Area heavily grassed, disturbed road reserve, little visibility, vehicle survey. Pipeline to continue in Road land owned by Wambo Mine adjacent to road reserve on SW side (approx 1.5km). Land in Wambo Mine covered by Foot (500m approx.) and vehicle survey (1km approx.). Predominantly heavily grassed grazing/paddock area with little visibility. Recently ploughed areas and exposures around Dams provided some visibility (up to 60%).
4.2	Golden Highway RTA Reserve Land – Pine Grove Rd	Undulating hills	Vehicle Foot	0-50% 50-80%	0-60% 80%	1km 750m	7.5% 52%	Liddell NS 26 Liddell NS 32 Liddell NS 33	@ 6399033 307783 route leaves Wambo mine land and returns to RTA reserve on SW side of highway. At junction of Wambo and RTA land route crosses small creek line where L NS 26 located. From this location survey followed proposed route S SE in reserve to junction with Pine grove Rd. Area covered by vehicle survey followed road reserve land heavily grassed with little visibility. Areas of exposure inspected. Disturbances included concrete channel and disturbances assoc. with Hwy construction. Foot survey conducted in large area of good exposure following former mid slope of low hills now cut by Hwy N of Pinegrove Rd. SV in foot survey 50-80%, AV 80%. Down slope from Liddell NS 33 near small drainage line small fragments of oyster shell noted, likely to be dumped due to proximity to road and condition.
4.3	Golden Highway RTA Road Reserve Pinegrove Rd – Hwy Rest Area	Undulating low hills	Foot	0-50%	0-60%	1.2km x 5-10m	7.5%	Liddell NS 15 Liddell NS 16 Liddell NS 17	From Pinegrove Rd continue in road reserve eastwards on S side Hwy. Road reserve in this section of variable width, but generally narrow, approx 7m. From 308547 6398027 at Pinegrove Rd heavily vegetated 0-10% visibility, exposures increasing as head E, with visibility up to 50%. Disturbed by Hwy construction, drainage channels, erosion, power lines as well as concrete drainage channel running down slope and parallel to fenceline/ proposed pipeline route. Visibility increases as heading up slope, but AV affected by back ground gravels. Disturbance to sites could be avoided if pipeline followed base of embankments adjacent to road.
4.4	RTA Road Reserve Rest Area – Wambo Heavy Vehicle Access Road	Undulating low hills - Plain	Vehicle & Foot	20-50%	50-80%	5.5km x 20m	22.75%	Liddell NS 30 Liddell NS 31	Pipeline to continue in road reserve on S side of hwy E-SE to junction with Wambo Mine heavy vehicle access road. Vehicle survey conducted stopping at areas of exposure for inspection. Reserve variable 10m-20m. Trackways adjacent to Hwy provided visibility and

Survey Section	Location	Landform	Survey Type (Vehicle or Foot)	Surface Visibility (SV)	Arch. Visibility (AV)	Surveyed Area (approx.)	Effective Coverage[1] (%)	Sites	Survey Notes
									opportunity for foot survey. Track ways up to 3m wide and variable lengths (30m). SV in tracks 80%, AV 60% disturbed by erosion and vehicles.
5	**Xstrata United Collieries/ Peabody Wambo Mine Heavy Vehicle Access Rd**	Plain	Foot	20-80%	60%	1km x 20m	18%		@ 6395242 314267 proposed route to follow S side of Wambo Mine Heavy Vehicle Access Rd W to Wambo Mine. Pipeline required to be on S side due to fibre optic cable on N side of road. SV at road reser5ve hindered by grass and disturbances from earthworks ect Pipeline to run along S side of fence in Wambo land. Survey was conducted on the N side of fence looking across. SV variable to due variations in ground cover, heavily grassed at W end of road adjacent to Brook. Area at end of Access road not surveyed due to restricted acess, but appeared heavily grassed with little visibility. Along the road visibility hindered by leaf litter, rubbish, ground cover but was up to 80% in sections.
6	**Wambo Mine - Bulga**								
6.1	Heavy Vehicle Access Rd to Wambo Mine Entry Rd	Terrace of Wollombi Brook	Foot	0-50%	0-80%	1.2km x 20m	10%	Liddell NS 25	Pipeline to follow edge of brook on terrace adjacent to E fence line. Visibility variable then cross under coal conveyor to entry road. Higher visibility in area of Warkworth Sands. Area to S of heavy vehicle access road low visibility due to ground cover.
6.2	Wambo Main Entry Rd	Terrace	Foot	50%	0-20%	1.5km x variable <10m.	5%		Highly disturbed and modified area. Due to constraints pipeline to run on southern side of main entry road to mine between road and metal barrier. Located in highly disturbed area, built up embankment for road, introduced gravel fill.
6.3	Wambo Mine Entry Rd – Farmstead on Wambo land	Undulating Plain - Terrace	Foot	0-60	0-80%	2.5km x 20m	12%	Liddell NS 19 - 24	Route to continue along edge of brook to "South Wambo" homestead. Billabong area noted S side of Wambo Ck. Recommended to avoid Billabong area. Pipeline will be trenched across Wambo and North Wambo Creeks. Pipeline to cross area where these two creeks flow into Wollombi Brook. Sandstone outcrops in bed of Wambo Crk inspected for grinding grooves. Tractor scour also noted and concrete dump. Visibilty in track ways, areas of exposure, creeklines. Also area low vis due to grass cover. @ 6392594 312211 North of Nth Wambo Ck pipeline to run along top of slope and avoid terrace of brook, following fence line.
6.4	Farmstead on Wambo land – Private Property	Terrace – Undulating Plain	Foot	0-30%	0-80%	2.2km x 20-50m	6%	Liddell NS 18	Pipeline to run on E side of gravel drive (approx 500m) for homestead. Pipeline encroach on 5m of drive. SV in gravel Rd 100%, AV 50-60% due to imported gravels.

Survey Section	Location	Landform	Survey Type (Vehicle or Foot)	Surface Visibility (SV)	Arch. Visibility (AV)	Surveyed Area (approx.)	Effective Coverage[1] (%)	Sites	Survey Notes
	Wambo Mine								On E side of road visibility variable 0-50% due to ground cover/leaf litter. Pipeline also diverts around southern homestead then continuing SE back toward edge of Wollombi Brook following W side of fenceline adjacent to creek bank. Some exposure in paddock adjacent to house, otherwise predominantly grassed paddock with low 0%. Wombat burrows and ants nest also provide some SV. Brown sandy alluvium. Billabong area located at 6389589 313075 adjacent to Brook, recommend pipeline avoid area.
7.0	**North Bulga - Bulga**								
7.1	Private Residences Adjacent to Wollombi Brook - Bulga	Terrace of Wollombi Brook (Heavily grassed grazing paddocks)	Foot	0-20%	0-50%	4km x 20m	2.5%		Start at N boundary of Lambkin property and Head S. 15m from boundary cross small tributary running into Wollombi Brook. Following property fence lines adjacent to creek. @ 6389000 313563 S end of Lambkins property, some exposure, SV 20%. Cross into property owned by Lepista. Continue to follow fence line adjacent to creek. 0% SV, heavily grassed paddock. @ 6388816 313546 proposed route veers around W side of tree line. Recommended to stay W of tree line. @ 6388722 313539 head into land owned by Circosta. Access denied, survey conducted on edge of Brook on E side of fence. Billabong area with sandy hummocky deposits observed. Recommended to avoid impacting billabong area. Adjoining landholder to the S, Merrick, access also denied. Pipeline to continue in paddock. @ 6387539 313697 cross into land owned by Dunn & Erwin. Pipeline to continue to follow W side of fenceline southwards. SV 30%, light brown sandy soil noted. Disturbances from Wombat burrows. In Cabans property @ 6386726 313717 cuts across tributary flowing E into Brook. Some exposure noted in bed of tributary and adjacent banks but no artefacts identified. Continue S along grassed paddock. Another small tributary @ 6386278 313997. @ 6385871 314192 boundary of Bartholemew & Gregory properties pipeline to cross another tributary of Wollombi Brook. Area heavily vegetated, SV on eroding banks 20-30%. Some visibility provided in large ants nest exposure. Pipeline then continue across paddock S and under bore Putty Road.
7.2	Putty Rd-Inlet Rd	Terrace	Foot	0-80%	0-80%	2.2km x	16%		From S side of Putty Rd continue in Paddock E side of

Survey Section	Location	Landform	Survey Type (Vehicle or Foot)	Surface Visibility (SV)	Arch. Visibility (AV)	Surveyed Area (approx.)	Effective Coverage[1] (%)	Sites	Survey Notes
	Reserve Bulga		Vehicle			20m			Inlet Rd to road reserve of Inlet Road (surveyed on foot). Visibility in paddock good 80% but AV low due to imported gravels. Pipeline to continue in road reserve along Inlet Road. Vehicle survey conducted stopping at areas of exposure. Road easement predominantly grassed with low visibility and highly disturbed. Gravel and stone dumps also noted, cutting & fill for road. SV low due to grass in reserve.
8	**Bulga – Xstrata Beltana Mine Land – Wollombi Brook & Charlton Rd**								
8.1	Xstrata Land Bulga Adjacent to Inlet Rd	Undulating plain	Foot	60%	70-80%	500m x 20m	45%		Pipeline to cross into Xstrata owned land @ 6384684 314966 and continue parallel to road reserve adjacent to fence line. Cleared former grazing, visibility good background gravel include FGS, silcrete.
8.2	Xstrata Land Bulga Adjacent to Inlet Rd	Undulating plain	Vehicle			500m			Route veers away from road easement along top of small rise although may actually avoid embankment and continue in road reserve, yet to be decided.
8.3	Xstrata Land To W Bank of Wollombi Brook	Undulating Plain - Terrace	Foot	0-70%	0-80%	1.7 x 20m	14%	Liddell NS 29	Pipeline to head east to Wollombi Brook where it will under bore brook to E side. Surveyed area followed S property boundary fence through grassed grazing paddock to terrace at edge of Wollombi Brook. Some exposure visible around dam edge where ground pugged by livestock, and animal track ways (up to 0.5m wide) following fence line. Survey section commenced @ 6383735 314968 and ended at fence line at 6383545 316603 on W side of Brook. Area at this point also inspected for pad for under boring machine. SV in track way 60-70%, AV 80% but track only approx. 0.5m wide.
8.4	Xstrata Beltana Mine E Wollombi Brook – Charlton Rd	Terrace – Undulating Plain	Foot	0-20%	0-80%	500m x 20m	8%	Liddell NS 27	Commenced survey area E bank of Wollombi Brook @ 6383546 316787. Pad for under boring rig approx 35m² to be located in vicinity. Pipeline to be under bored at this location or within 50m of. On terrace brown sandy alluvium, low SV 20%. @ 6383459 316993 cross n-s tributary (bed dry), SV0% due to grass cover. @ 6383440 317063 on S edge of dam vehicle track and adjacent exposure provide some visibility. Track approx 2.5m wide, SV 30-90 continuing E up low rise adjacent to house. From homestead E to Charlton Rd pipeline to veer around S side of house and then continue along S side of access road to Charlton Rd. From homestead to

Survey Section	Location	Landform	Survey Type (Vehicle or Foot)	Surface Visibility (SV)	Arch. Visibility (AV)	Surveyed Area (approx.)	Effective Coverage[1] (%)	Sites	Survey Notes
									Charlton Rd archaeological survey not conducted by request of Beltana who provided results of recent archaeological survey conducted over the area.
8.5	Xstrata Beltana Mine – Charlton Rd		Foot	0-90%	0-60%	1.5km x 20m	13.5%		Began survey in this section heading W on N side of Charlton Rd in Beltana Mine Land @ 6381896 318900. Cleared grassed area adjacent to E side of Rd. @ 6382658 318633 cross small creek line. May have to divert pipeline around creek line to cross to run E side of creek and W side of bund wall. Space for pipeline at this point narrow as approximately 3m clearance between base of bund wall and edge of creek line. It is possible that the pipeline may need to follow the E side of the bund wall, however this option was not covered by the survey and would require an additional assessment if necessary. Survey section end at billabong/oxbow area of creek line @6382993 318569 where it will cross into Charlton RD. On W side of bund wall visibility low 0-10%due to heavy grass cover