



SoilFutures Consulting Pty Ltd

**REVIEW OF SOIL CONSERVATION SERVICE SITE
ASSESSMENT “BARANA”
&
ASSESSMENT OF WESTERN LIVERPOOL PLAINS
AREA WITH RESPECT TO RISKS ASSOCIATED
WITH PROPOSED BURIED
GAS PIPELINE INSTALLATION**



Prepared for the
MULLALEY GAS AND PIPELINE ACCORD
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The findings and opinions in this report are based on research undertaken by Robert Banks (BSc Hons, Certified Professional Soil Scientist, Dip Bus) of SoilFutures Consulting Pty Ltd, independent consultants, and do not purport to be those of the client.



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1. Introduction

1.1 Background

This report has been prepared in response to a request from the Mullaley Gas and Pipeline Accord to review a Soil Conservation Service Document (SCS) and to comment on the suitability or appropriateness of the western Liverpool Plains area for the laying of a coal seam gas pipeline.

The review covers a brief assessment of the validity of the claims made in the *Site Assessment & Plan of Works for Aggressive Gully Erosion Control at "Barana", North of Coolah SCS (2011)* and supplies additional information and science to aid in assessing the risks associated with the proposed placement of a buried gas pipeline through the western Liverpool Plains.

The SCS document has been used by proponents of coal seam gas development as an explanation of the relative suitability and safety of the area for gas pipeline emplacement. As the SCS document is in fact a very site specific assessment, written as part of a costing for remedial works, it has limited applicability to any other area.

A site visit to the Gully at "Barana" was carried out on Thursday, 1st September, 2011.

Mr Kevin Anderson, NSW State Member of Parliament has requested that the Mullaley Gas Pipeline Accord, provide scientifically valid evidence with the suitability or otherwise for buried gas pipeline emplacement in the western Liverpool Plains.

Eastern Star Gas through the NSW Department of Planning has met with individual landholders to discuss the location of a proposed gas pipeline through the western Liverpool Plains. Individual landholders have been given copies of maps of the proposed pipeline route(s). No clear indication of a particular pipeline route has been provided to the clients by the gas company or its agents. The clients have sited at least three maps with four different potential routes for a pipeline through the western Liverpool Plains. As such, the pipeline suitability study presented in this document has been made over a wide ranging area of the western Liverpool Plains.

Landholders within the Liverpool Plains community have been informed by Eastern Star that part of the follow up management of the proposed gas pipeline will be to remove deep rooted pastures (such as *Stipa aristiglumis*) from along the length of the pipe as the roots interfere with the integrity of the pipe.

The assessment of gas pipeline suitability in this report has been done using NSW Government held soil information, which the NSW Government has at its disposal to undertake its own studies in this regard and check the validity of data presented in this document. The government agencies which hold this information are the Namoi Catchment Management Authority (NCMA) and the NSW Office of Environment and Heritage (OEH).



1.2 Report Objectives

The main objectives of this report are to:

1. Critically review the *Site Assessment & Plan of Works for Aggressive Gully Erosion Control at "Barana", North of Coolah SCS* (2011).
2. Use NSW State Government owned soil data and soil landscape mapping which has been collected according to both State and National Standards, to assess the western Liverpool Plains area for gas pipeline emplacement.

1.3 Conclusions and recommendations

The Vertosols of the Liverpool Plains and the climate of the area make it a key area for agricultural production in Australia, both in terms of yields and its disproportionately large contribution to the Australian agricultural economy.

This report demonstrates that there are **significant risks associated with placement of a buried gas pipeline in the study area** incorporating the western Liverpool Plains. The **potential for pipe failure is exacerbated by the extremely deep, highly expansive soils** that dominate the area. Given that the Vertosols within the mapped area are all highly or very highly expansive, the risk of failure is much greater than that quoted in overseas literature.

It should be noted that soil information from the published soil landscape series and the CMA reconnaissance soil landscapes are both held by the NSW government. This data is freely available for appropriate experts within NSW government to assess the validity of statements and maps presented in this document pertaining to the type and extent of soils, and their associated hazards for gas pipe emplacement.

An alternative route such as that proposed to parallel the Newell Highway within the existing easment, where soils are mostly sandstone derived and generally not expansive, would be a safe, cost effective and logical way to avoid the risks demonstrated in this report.



2. Stepwise Review of Soil Conservation Service Document

The following is a review by page number of the Main Report for the Environmental Assessment.

Page 4 Summary: It must be made clear that this summary indicates that this assessment is for one site where a gully has exposed a pipe, and has limited applicability beyond the summary details provided. It is supplementary information for a costing and design of remedial works with some explanatory detail on gully erosion. This section states clearly that the document is about protecting the gas pipeline from the effects of erosion.

Page 4 Introduction, Para 1: The statement re Central Ranges Pipeline (CRP) being a functional part of Australia's energy infrastructure is irrelevant to an onsite study, and unusual that it should be inserted into a government costing and design for remedial soil conservation works.

Page 4 Introduction, Paras 2–3: There is little argument to be had with the intensive rainfall event and subsequent severe gully erosion. However, there is no assessment of the impact of the turbulent flow which resulted from the exposure and subsequent sand bagging of the pipeline. This will be discussed further below.

Page 5 Paras 3–4: Whilst the mechanism by which gullies form and expand is not in question here, it appears that the extreme widening of the gully at the point where the pipeline crosses the gully has not been properly addressed. In normal circumstances, the gully may well have extended in such a heavy rainfall event. However the width of the gully would have been similar to the pre-existing gully below the failure site, which was already partly stabilised and capable of carrying all the water from the gully's catchment.

Page 6: The description of Vertosol soils is apt and brief. Note that rigid structure placement is mentioned here as being difficult due to the shrink swell capacity of the soils at the site of the gully.

Pages 7–12: Covers legislative responsibilities and design of remediation works as are appropriate for the remediation of a gully which has exposed a pipeline. The only practical comment that can be made on this section is that lucerne is generally inappropriate for stabilisation of Black Vertosols on slopes as it tends to make the soils shrink by intensely dehydrating the soil, which will encourage further cracking than would otherwise occur at the site.

Page 13 Concluding remarks: Whilst the reasons for the sudden extension of the gully are sensible, there is no indication given of the effects of turbulent flow caused by the pipeline as it was exposed. The extension of the gully following the rainfall event is not unexpected; however the excessive width at the point where the pipeline crosses is significant and unexplained.



2.1 Review of “Barana” Gully Erosion Site Photographs

Photographs of the gully at “Barana” following being sand bagged and re-eroded were provided to SoilFutures Consulting Pty Ltd by the clients.

Photo 1 shows that a north eastern flowing spur of the gully had formed which followed the pipeline uphill, during the second erosion event. This photograph also shows that there has been some degree of turbulent flow where the pipe was sandbagged to support it between erosion events. The extension of the spur of the gully along the pipeline is significant, as the gully certainly follows the pipe in both directions.



Photo 1: Gully and exposed pipe at Barana with spur gully following pipeline



Photo 2: Gully and exposed pipe at Barana with failed sand bag supports



Photo 2 shows evidence of turbulent flow caused firstly by the presence of the pipe in the gully floor and secondly by the sand bagging of the pipe. The subsequent failure of the sand bags appears to have further exacerbated the extent of the erosion.

Photos 3 and 4 show the reshaped gully as it was during the site visit by SoilFutures Consulting Pty Ltd. The site of the pipe should now be relatively stable following these works. It is interesting to note that the width of the natural gully (downhill middle right of photo 4) which reflects the capacity of the gully to carry the run-on from the catchment above, is quite narrow relative to the site of the rehabilitation works. As such, the natural expansion of the gully uphill would have resulted in a gully of only a few metres width, not the width of at least 8 m which has occurred at the site of the pipe emplacement.



Photo 3: Looking uphill along rehabilitated pipe crossing failure at gully at “Barana”



Photo 4: Looking downhill along rehabilitated pipe crossing failure at gully at “Barana”. Note natural gully width in right of mid ground.



2.2 Concluding remarks to SCS Document Review, Site Visit and Site Photograph Review

The SCS document is part of a costing and design of remedial gully stabilisation works and should be read as such. The author has tried to cover some background information on soil, legislative requirements and what he thinks are the processes going on at the gullied site at “Barana”.

The actual reasons for the extension of the gully across the pipeline site may well be attributable to an intensely erosive rainfall event. However, the excessive width of the gully at the point where the pipe was exposed, cannot be explained using this argument.

Following a visit to the rehabilitated site, and examination of photographs of:

- (i) the pipeline exposed in the gully,
- (ii) the pipeline being sand bagged to give it support, and
- (iii) subsequent re-exposure of the pipeline in another erosive rainfall event,

it is clear that the presence of the pipeline at right angles to the gully created a turbulent flow effect causing scouring at the edges of the exposed pipe. This has caused significant widening of the gully beyond the width that the gully would naturally attain. This has resulted in the alienation from agricultural use of more land than would have happened if the pipeline was not emplaced at this point and the gully had extended purely in response to intense rainfall induced run-on.

Similar erosion to that which has occurred at Coolah along gas pipeline emplacements is commonly reported (Kazakov and Geniorovskii, 2007; Sidorchuk and Grigor’ev, 1998), with the erosion being directly attributable to the emplacement of the gas pipeline. Actual failures of gas pipelines due to expansive soils are reported in Gould et al (2000). Gould et al (2000) also reports that pipeline failures are most common in summer when high temperatures ensure rapid shrinkage of the Vertosol soils.

The SCS document is clearly primarily a costing or design document for the site specific purpose of designing remedial works to protect the gas pipe that was exposed at “Berana” during the gully erosion events of late 2010. It does not adequately explain the turbulent flow caused by the exposure of the pipe, which caused the gully to be unusually wide at this point. Clearly the presence of the pipe has resulted in a wider erosion gully than would have otherwise formed in response to an intensely erosive rainfall event.

It should be noted that the geomorphology of the site is incorrectly described as alluvial. In terms of soil landscapes, it would be a Transferral Soil Landscape (Banks, 1998), where the landscape is a footslope or fan, and is derived from the co-dominance of erosion and deposition. It is actually a colluvial fan system, which has been built up by the natural erosion and deposition caused by relatively shallow gullies meandering across the landscape and depositing clay sediments. As such, the sudden appearance of a gully due to unusually heavy rain, even in conditions of high groundcover is not unusual and indeed, part of the evolutionary process of this type of landscape.



3. Soil Attributes and Gas Pipeline Emplacement

3.1 Introductory Remarks

Vertosols as described in Isbell (2002) as soils with the following properties:

(i) A clay field texture of 20% or more clay throughout the solum (soil mass) except for thin, surface crusty horizons less than 0.03 m thick; and

(ii) When dry, open cracks occur at some time in most years. These are at least 5 mm wide and extend upwards to the surface or to the base of any plough layer, self-mulching horizon or thin surface crust horizon; and

(iii) Slickensides and/or lenticular peds occur at some depth in the solum.

Slickensides are shiny coatings which occur on natural clay soil aggregates called peds. These coatings form because the soil aggregates stay stable when wet, but shrink and swell intensely when wetting or drying. The rubbing motion caused by this action tends to leave a polished surface on adjacent peds or soil structures. Active, lenticular ped structures with slickensides have been observed by the author of this review at depths exceeding 80 m, in the geological core library held by NSW Geological Survey in Gunnedah. These cores came from the central and southern Liverpool Plains. The alluvial geomorphology, of deep valley infilling with clay rich sediments at the core sites is the same as that of the western Liverpool Plains. This means that these deep soils and sediments have active shrink and swell properties to great depths.

The dark Vertosols (Black Earths) of the Liverpool Plains are renowned for their very high water holding capacity, high fertility and their productivity. It should be noted that the area referred to as the Liverpool Plains is a regional name, and not just descriptive of the flat plains themselves. Landforms of the western Liverpool Plains to which this document refers, include: floodplains, alluvial fans, footslopes, low hills, hills and some mountains. Vertosols dominate a large portion of the western Liverpool Plains area across this range of landforms. This is because the dominant geology of the western Liverpool Plains is Tertiary and Jurassic basalt. These soils, whilst not unique in Australia, represent less than one percent of Australia's cultivation and crop production lands, however are responsible for an enormous contribution to Australia's agricultural productivity and economy.

The Liverpool Plains has remained generally climatically stable relative to the rest of Australia over the past 15 years, when much land in the Darling Downs (Australia's only other temperate area of similar soils and landforms) was out of production for ten years due to intense drought.

3.2 Soil Landscape Mapping

The NSW government has had a program of Soil Landscape mapping in the Liverpool Plains which was completed in the early 2000s. The soil landscape mapping program collected detailed information on eastern NSW's important soil resources where none had existed previously. The mapping was carried out according to State and National standards (McDonald et al, 1984; now revised slightly and available as National Committee on Soil and Terrain (NCST), 2009) and is held by the NSW OEH as spatial data (Maps with associated reports), as well as having permanent records of soil profile



data with associated laboratory data in the NSW Soil and Land Information System (SALIS).

The predecessors of OEH, have failed to publish *Soil Landscapes of the Tambar Springs 1:100 000 Sheet* (Townsend and Pengelly, unpub) and *Soil Landscapes of the Coolah 1:100 000 Sheet* Townsend (unpub) which form the south western Liverpool Plains. The *Soil Landscapes of the Baan Baa 1:100 000 Sheet map and report* (Pengelly, 2010) which covers the north western Liverpool Plains was released last year.

The Namoi Catchment Management Authority (NCMA), having a need to access soil data for the entire Namoi catchment, have collated and incorporated all of the mapped soil landscape data listed above for the western Liverpool Plains, which should have been published by OEH and its predecessors, into the “Reconnaissance Soil Landscapes of the Namoi Catchment (NCMA, 2009).

The NCMA (2009) soil landscape mapping is generally at a reconnaissance scale, however for the whole Liverpool Plains it was done at the 1:100 000 publication standard. Soil Landscapes were mapped onto either 1:25 000 scale or 1:50 000 base maps, and as such are precise in the definition of soil landscape boundaries.

The importance of the soil landscape mapping is that it contains much of the data required to assess soils and landscapes for general suitability for a wide ranges of purposes and potential developments.

3.3 Literature Review – Buried Pipelines and Expansive Soils

A literature review of the factors influencing the suitability of soils for gas pipelines was undertaken to investigate limitations to gas pipeline placement.

The following extract is taken from Hudak et al (2000) with respect to large water pipe breaks in the USA:

Though less dramatic than other geologic events, expansive soils are among the world's most costly hazards Each year in the United States, expansive soils cause over \$2 billion in damage to roads, buildings and other structures (Keller, 1996; Montgomery, 1997). Some estimates are as high as \$6 billion/year (Pipkin and Trent, 1994). Financial losses from expansive soils are approximately equal to those from all other geologic hazards combined (Montgomery, 1997).....

Montmorillonite is associated with most expansive soils. With the addition of water, this clay mineral may expand 15 to 20 times its dry volume (Brown, 1979). However, 25 to 50 percent expansion is more common in soils that contain various minerals and organic matter (Keller, 1996). Unfortunately, a volume increase of only 3 percent is potentially dangerous and requires special design considerations (Brown, 1979). A confined clay deposit containing montmorillonite can exert pressures of several tons per square meter (Brown, 1979).

As stated above, Gould et al (2000) report that gas pipelines failures in Australia are mostly attributable to the presence of expansive soils. Chaminda et al (2008) demonstrate that reactive (or expansive) soils can significantly deflect and break both gas and water pipelines, and documents that pipeline failures in expansive soil landscapes are common when they dry out.

American Lifelines Alliance (ALA) (2005), report that buried oil and natural gas pipelines within areas of expansive soils could constitute a hazard to human life. ALA (2001) report that the expansive soils need special attention with the laying of steel gas pipe,



and that deep burial (often to bedrock) and complex geotechnical stabilisation often need to be carried out to reduce the risk of pipe failure.

Although an Australian Standard (AS 2885) was found for Gas Pipelines, a review of the summary of the standard revealed it to set standards regarding the nature of pipes and welding technique, safe working practices etc to construct a gas pipeline. There appears to be no detailed information on buried gas pipeline placement.

3.4 Soil Properties from Literature relevant to the Liverpool Plains

The shrink and swell properties (or expansive properties) reported in Pengelly (2010) Townsend (In Press) and Townsend and Pengelly (In Press) for the Vertosols on the western Liverpool Plains are amongst the highest in the world. Expansive clay contents for the study area which is detailed below are very high, ranging from 45 – 75%. Values for volume expansion are up to 76%. Volume expansion values greater than 30% are considered high (Hazelton and Murphy, 2009). Timms et al (2002) report large cracks in Vertosols of the Liverpool Plains to extend to a depth of up to 6 m, indicating the zone in which strongly expansive forces operate within these soils. As noted above, lenticular ped structures with slickenside coatings occur at extreme depths in the alluvial landscapes of the Liverpool Plains, indicating active soil movement at great depth.

As such, the Liverpool Plains Local Government authorities insist on engineering tests for new houses, structures and roads. The rule of thumb used by many planners in the district is that if a building site has highly expansive soils, then the cost of the structure increases by about 40%, due to increased footing or foundation strength requirements.

The high shrink swell capacity of many of the basaltic footslope and plain margin soil landscapes in the western Liverpool Plains causes many areas to exhibit gilgai (NCMA 2009). According to NCST (2009), gilgai is

“surface microrelief associated with soils containing shrink-swell clays.....Gilgai consists of mounds and depressions showing varying degrees of order, sometimes separated by a planar or slightly undulating surface”.

Three types of gilgai are commonly encountered in the western Liverpool Plains. These are normal gilgai (small mounds and depressions generally on flat or low sloping lands), Linear gilgai (long narrow, parallel elongate mounds at right angles to the contour, found on lands with slopes up to 12%), and Lattice gilgai (interwoven linear gilgai, which generally occur on slopes of 0.5 – 3%). Examples of the latter two types of gilgai relief can easily be observed from the Black Stump Way on the footslopes and drainage plains of Bando Station. The linear and lattice gilgai appear as long linear or braided patterns in the grasslands near the road as the tussock grasses preferentially grow on the raised mounds of the gilgai.

The presence of gilgai, and the deep, regular linear cracking associated with them have a tendency to cause a relatively unique form of erosion, which is only common on very high clay content Vertosols, such as are occur widely in the Western Liverpool Plains. The interconnected deep cracking associated with linear and lattice gilgai, forms downhill preferential flow paths for water in intense storms, which cause tunnel erosion at the base of the cracks. This results in the soil collapsing into a the tunnels or voids, creating what is known locally known as “honeycomb erosion” where large holes



suddenly open up in soils following heavy rain. This phenomenon only occurs when soils are dry and cracked initially, and bypass flow occurs, as described in Timms et al (2002). When the soil is already swollen and wet, intense storms result in runoff instead of the “subsoil runoff” which results in tunnelling.

If a buried pipe is placed running down slope, or even obliquely running down slope in this type of soil environment, then surface collapse of tunnel erosion along the pipeline may well cause severe and rapid gully erosion.

3.5 Use of Soil Landscape Maps to predict Hazards to Buried Gas Pipeline Emplacement in Western Liverpool Plains.

A subset of the soil landscapes of the Liverpool Plains (NCMA, 2009) was created to reflect the range of areas which the clients thought covered the various proposed routes of the gas pipeline. This amounted to 72 soil landscapes and soil landscape variants covering a total study area of 362 768 Ha. Descriptions of soil landscapes in the study area are given in Appendix 1 and are from NCMA (2009).

Field and laboratory data for this subset of soil landscapes from Pengelly (2010) Townsend (In Press) and Townsend and Pengelly (In Press) was converted into soil engineering hazard, run on hazard and erosion hazard rankings in NCMA (2009). The laboratory data for the area represents detailed soil engineering and agronomic test results for 670 soil profiles. The resulting table of landscape limitations is given in Appendix 2 of this document (from NCMA, 2009).

The landscape limitations table data was used to create maps of the study area which reflect some of the hazards to gas pipeline emplacement which have been detailed in the literature review above.

Figure 1 (below) shows the extent of soil landscapes in the study area dominated by soils with high shrink swell subsoils which would constitute a significant risk to placement of a gas pipeline.

Figure 2 (below) shows the extent of soil landscapes in the study area which exhibit gully erosion hazard, which may be exacerbated by the placement of a gas pipeline.

Figure 3 (below) shows the extent of soil landscapes in the study area which receive high run-on from other landscapes. Given the highly expansive soils on site and the need to access a pipeline for safety and maintenance, the issue of prolonged run-on and subsequent flooding may represent a hazard.



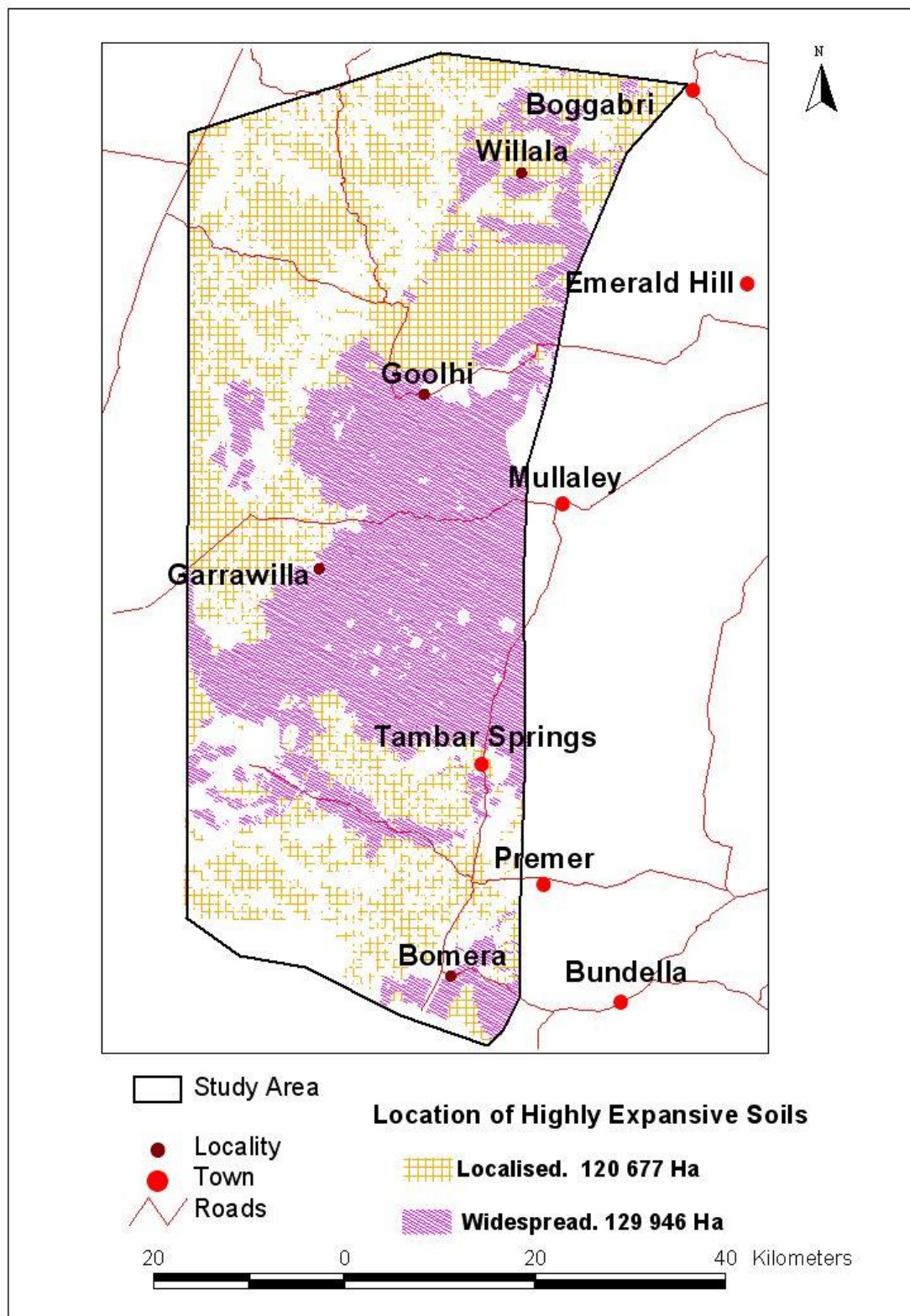


Figure 1: Location of Highly Expansive subsoils in the Study Area. Adapted from NCMA (2009)



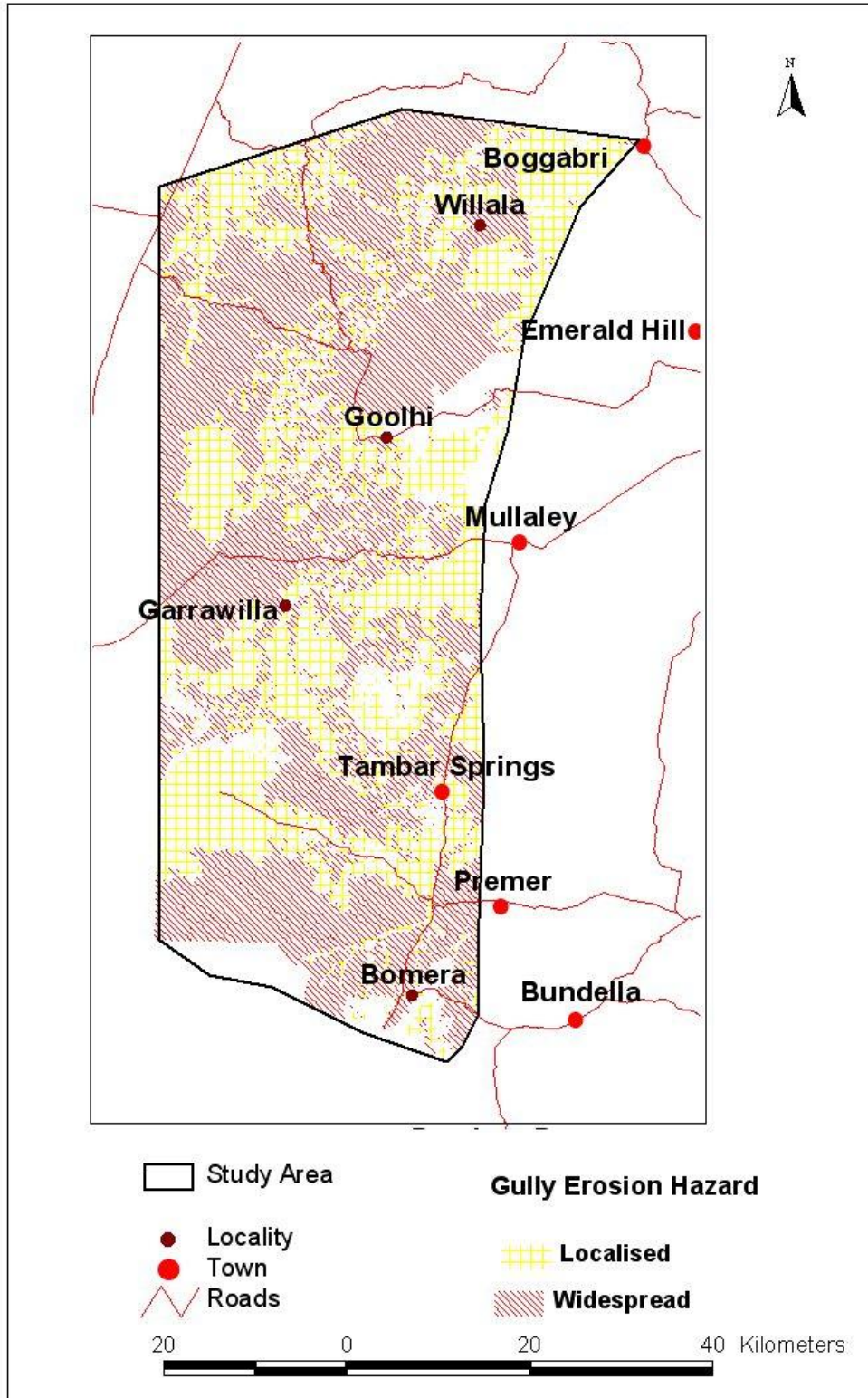


Figure 2: Soil Landscapes with Gully Erosion Hazard in study area. Adapted from NCMA (2009)



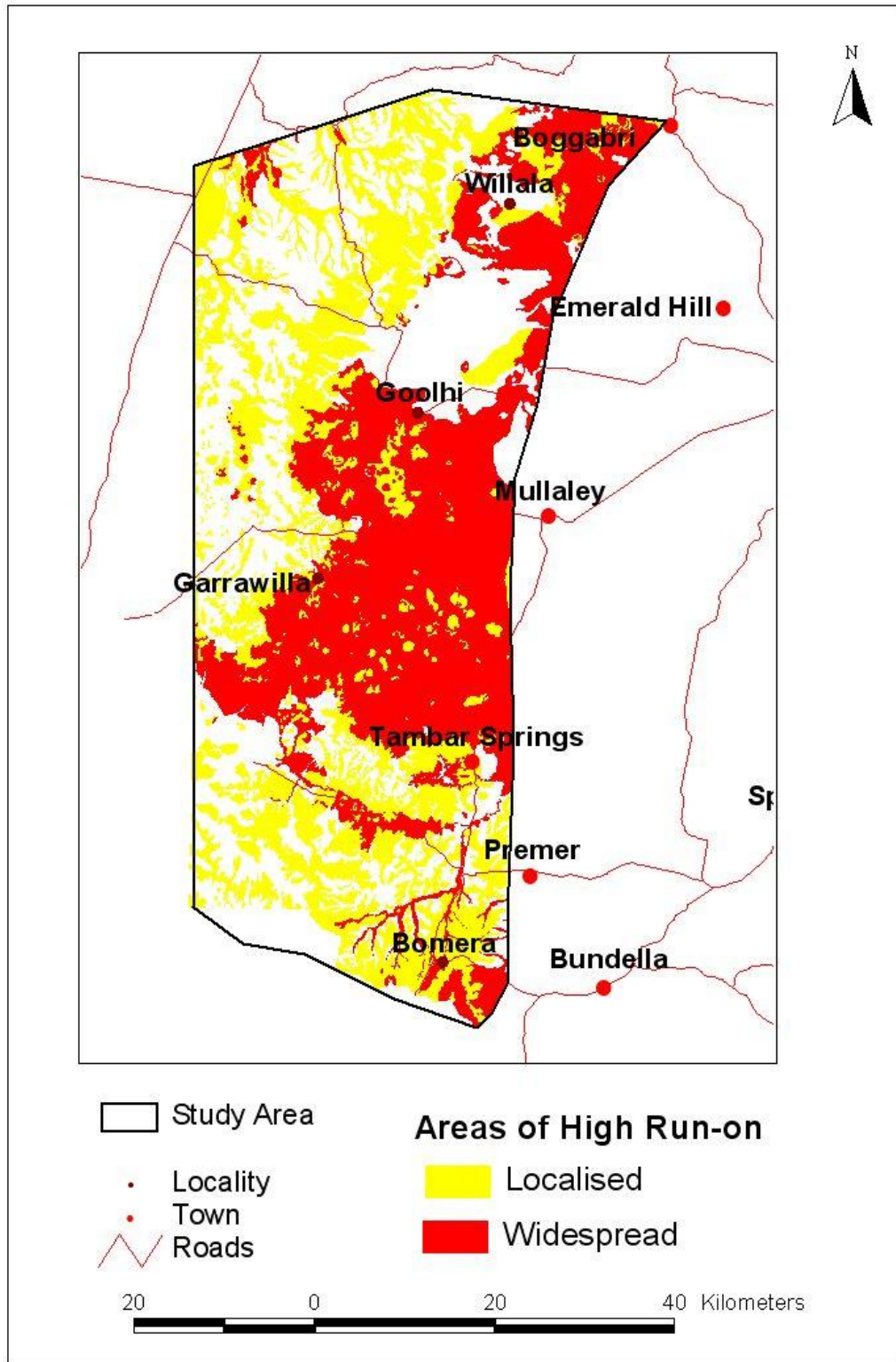


Figure 3: Soil Landscapes which receive high run-on. Adapted from NCMA (2009)



4. Discussion of Maps

Figure 1 demonstrates that the study area in which the pipeline route is proposed is dominated by soils with highly expansive zones which will lead to any pipeline placement within the expansive zone having a high risk of failure according to available literature.

Figures 2 and 3 demonstrate that gully erosion risk is high in any of the sloping Vertisol dominated landscapes of the study area, and further that lower soil landscapes receive high amounts of run on. In terms of the discussion of the depths of cracking, slickenside coatings on ped structures, and the propensity for many of the sloping Vertisol dominated soil landscapes to exhibit tunnel erosion or “honeycomb erosion”, these maps indicate that pipeline placement within these soils may represent a significant erosion hazard as well as pipe failure hazard.



5. Conclusions and Recommendations

5.1 Review of SCS (2011) document

The SCS report reviewed in section 2 of this report does not adequately explain the width of the gully erosion experienced at “Barana”. This review concludes that, whilst the cause of the gully erosion may be difficult to establish with respect to the presence of the pipeline, the width of the erosion caused was exacerbated by turbulent flow caused by the exposure of the pipeline. Clearly the pipeline was buried at too shallow a depth to avoid exposure at the natural incised depth of a gully in this landscape.

The SCS document is mostly preamble to a design of remedial works to stabilise the pipe crossing of the gully at “Barana” and should be viewed as such. It is not a conclusive document and does not present any information which can be used elsewhere in the Liverpool Plains.

5.2 Comment on Intent to Sterilise Deep Rooted Perennial Native Pastures

As mentioned in the introduction to this report, individuals from the community have been informed of a plan to sterilise deep rooted native tussock grasslands (generally dominated by *Stipa aristiglumis*) within the easement of the proposed pipeline, to assist in the control of corrosive forces along the pipe. Permanent, deep rooted perennial vegetation (particularly tussock grasses) is recognised as the only way to maintain a stable soil environment in Vertosols. Given the propensity for these soils to erode the mapped risks of both high run on and gully erosion along much of the study area this practice would increase erosion hazard particularly in any landscape with slopes of greater than 0.5%.

5.3 Risks Associated with Buried Gas Pipeline emplacement in the Liverpool Plains

As demonstrated in the literature review, there are many limitations to placement of buried gas pipelines in Vertosols on both flat and hilly terrain types. In the consideration of the abundance of expansive Vertosol soils, the study area presents a series of very significant issues for the emplacement of a buried gas pipeline. The depth of cracking of these soils extending to 6 m as given by Timms et al (2002) indicates that the soils move significantly down to at least that depth. Further to this, extensive slickenside ped coating occur at depths far greater than 6 m, indicating that soil movement is active even at these depths.

Given the high erosion hazard associated with the soils in the study area, and the tunnel erosion associated with expansive soils in areas of gilgai, there is significant risk of exacerbation of this type of erosion through the emplacement of a pipe within the zone of cracking. Additionally, exacerbating tunnel erosion or “honeycomb erosion” may result in the merging sinkholes to produce gully erosion along a buried structure.

The literature reviewed suggests that Vertosols or expansive soils with a high shrink swell capacity should be avoided if possible for buried gas pipelines. Given that the shrink swell capacity and the clay contents of the Vertosols in the western Liverpool Plains are amongst the highest in the world, it is logical to increase the degree of caution taken with these soils.



Some literature suggests complex geotechnical stabilisation of expansive clays, but this generally results in “stabilised” area being moved by the expansive soils adjacent to it. This can be widely observed in practice in the road surfaces of the Liverpool Plains, which have been emplaced on a deep, lime stabilised base.

It is clearly impractical to place a safe and stable gas pipeline through the Vertosol dominated landscapes of the western Liverpool Plains.

5.4 Concluding Remarks

The Vertosols of the Liverpool Plains and the climate of the area make it a key area for agricultural production in Australia, both in terms of yields and its disproportionately large contribution to the Australian agricultural economy.

This report demonstrates that there are significant risks associated with placement of a buried gas pipeline in the study area incorporating the western Liverpool Plains. The potential for pipe failure is exacerbated by the extremely deep, highly expansive soils that dominate the area. Given that the Vertosols within the mapped area are all highly or very highly expansive, the risk of failure is much greater than that quoted in overseas literature.

It should be noted that soil information from the published soil landscape series and the CMA reconnaissance soil landscapes are both held by the NSW government. This data is freely available for appropriate experts within NSW government to assess the validity of statements and maps presented in this document pertaining to the type and extent of soils, and their associated hazards for gas pipe emplacement.

An alternative route such as that proposed to parallel the Newell Highway within the existing easement, where soils are mostly sandstone derived and generally not expansive, would be a safe, cost effective and logical way to avoid the risks demonstrated in this report.



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7. Appendices

Appendix 7.1 Brief Soil Landscape Descriptions (From NCMA, 2009)

bck	BARRADINE CREEK ALLUVIALS	Alluvial (Stagnant Alluvial)
Summary		
Landscape	Extensive alluvial floodplain system starting in the upper pilliga outwash and pilliga south and east, extending and broadening into complex alluvial plains and stagnant alluvial plains on the northern margins of the Pilliga outwash.	
Soils	Dominated by very deep to giant imperfectly to poorly drained Brown Kurosol and Sodosols (Solodic and Podzolic Soils), with minor Red-Orthic, Tenosols (Earthy Sands) in upper reaches where landscape is confined. Lower reaches of the landscape where it is very broad range from giant poorly Episodic-Endocalcareous, Epipedal, Grey Vertosols (Grey Clays), to giant poorly drained crusty, Brown and Red Vertosols (Scalded Red and Brown Clays), with minor areas of imperfectly drained, giant, Episodic-Endoacidic, Self-mulching, Grey Vertosol (Grey Clay) and Brown Sodosols (Solodic Soils). Type Profiles are profiles 9 (Brown Kurosol), 73 (Scalded Brown Vertosol) and 80 (Grey Vertosol). Profiles in this soil landscape: 9,18,22,23,24,25,32,73,74,79,80,84	
Geology and Regolith	Qacs1, unnamed geological unit, which includes, Unconsolidated silt and clay, minor sand. Commonly carbonaceous and flat to cross laminated., clastic sediment, silt, clay; Minor components of the following: Qamv2, unnamed geological unit, which includes, Unconsolidated to semi-consolidated silt, silty clay and fine sand. Sorting poor to very poor. Minor medium sand, ferromagnesian nodules, charcoal and salts. Strongly modified by pedogenesis., clastic sediment, silt, clay, sand; Qfpl2, unnamed geological unit, which includes, Texture contrast soils with sand Predominating at the surface (39-43ka)., clastic sediment, sand: Qfpm2, unnamed geological unit, which includes, Texture contrast soils with sand Predominating at the surface (39-43ka)., clastic sediment, sand: Qfps1, unnamed geological unit, which includes, Texture contrast soils with sand Predominating at the surface (39-43ka)., clastic sediment, sand; Qrhs3, unnamed geological unit, which includes, Clayey alluvium often gilgaid (>88ka)., clastic sediment, and alluvium.	
Vegetation	Owing to the extensive nature of this landscape and its diversity of soils it is characterised by a large mosaic of vegetation including the following: Western grassy box woodland, usually <i>Callitris glaucophylla</i> and <i>Eucalyptus populnea</i> subsp. <i>bimbil</i> , occasionally <i>E. pilligaensis</i> , <i>Allocasuarina luehmannii</i> , <i>E. crebra</i> ; infrequently <i>E. microcarpa</i> , <i>E. conica</i> , <i>Casuarina cristata</i> , <i>E. chloroclada</i> , <i>E. dealbata</i> , <i>E. camaldulensis</i> , <i>E. melliodora</i> ; Pilliga cypress/box herb woodland, usually <i>Callitris glaucophylla</i> with <i>Eucalyptus populnea</i> subsp. <i>bimbil</i> or <i>E. pilligaensis</i> and occasionally <i>Allocasuarina luehmannii</i> ; sometimes <i>Casuarina cristata</i> may be locally dominant; rarely <i>E. blakelyi</i> ; Pilliga ironbark/bull oak woodland, mostly <i>Eucalyptus crebra</i> and <i>Callitris glaucophylla</i> with a subcanopy of <i>Allocasuarina luehmannii</i> ; occasionally <i>E. chloroclada</i> , <i>Callitris endlicheri</i> , <i>E. blakelyi</i> ; infrequently <i>E. pilligaensis</i> , <i>E. melliodora</i> , <i>E. melanophloia</i> ; Riparian red gum woodland, mostly <i>Eucalyptus blakelyi</i> and <i>Angophora floribunda</i> ; occasionally <i>E. crebra</i> ; infrequently <i>E. populnea</i> subsp. <i>bimbil</i> , <i>Casuarina cristata</i> , <i>E. sideroxylon</i> , <i>E. dealbata</i> , <i>E. nubila</i> ; Pilliga cypress/bull oak woodland, mostly <i>Callitris glaucophylla</i> and <i>Eucalyptus crebra</i> with a subcanopy of <i>Allocasuarina luehmannii</i> ; occasionally <i>E. pilligaensis</i> , <i>E. sideroxylon</i> or <i>E. blakelyi</i> may be locally common; infrequently <i>Callitris endlicheri</i> , <i>E. conica</i> , <i>Angophora floribunda</i> , <i>E. fibrosa</i> , <i>Casuarina cristata</i> or <i>E. melliodora</i> ; Northern floodplain woodland, dominated by <i>Eucalyptus camaldulensis</i> , occasionally with <i>Callitris glaucophylla</i> , <i>Casuarina cunninghamiana</i> , <i>E. melliodora</i> , <i>Corymbia tessellaris</i> ; rarely <i>Allocasuarina luehmannii</i> , <i>Angophora floribunda</i> , <i>E. chloroclada</i> ; Pilliga heathy woodland	



1, Various Corymbia trachyphloia, Callitris endlicheri and Eucalyptus fibrosa; occasionally Callitris glaucophylla E. chloroclada, E. dwyeri, E. crebra; infrequently E. blakelyi, E. macrorhyncha, Angophora floribunda, E. rossii; Riparian angophora woodland, mostly Angophora floribunda with Eucalyptus blakelyi or Callitris glaucophylla; occasionally Callitris endlicheri, E. chloroclada, E. melliodora, E. crebra; Pilliga cypress grass/herb woodland, usually Callitris glaucophylla with Eucalyptus albens or occasionally E. crebra. A very wide range of other species may occur locally and may sometimes be locally dominant, including E. melanophloia, E. chloroclada, Angophora floribunda, E. blakelyi, E. melliodora, E. pilligaensis and E. conica; Pilliga grassy cypress woodland, usually dominated by Callitris glaucophylla, often with Eucalyptus crebra and a subcanopy of Allocasuarina luehmannii; occasionally Callitris endlicheri, E. albens, E. blakelyi, E. conica; infrequently E. populnea subsp. bimbil, E. fibrosa, E. pilligaensis; bcaz, Pilliga ironbark woodland, usually Eucalyptus fibrosa and E. trachyphloia with Callitris glaucophylla, occasionally Eucalyptus viridis; Northern cypress grass/shrub woodland, Various Callitris endlicheri, Callitris glaucophylla, Angophora leiocarpa, Eucalyptus chloroclada, Corymbia trachyphloia; occasionally E. crebra, E. dealbata; infrequently Corymbia dolichocarpa, E. melanophloia, E. sideroxylon.

Land use	not recorded		
Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	low to moderate
Cultivation limitation	moderate to very high	Fertility	variable
Qualities and limitations			
<i>Landscape</i>			
Steep slopes	not assessed	Mass movement hazard	not assessed
Rock outcrop hazard	not assessed	Rockfall hazard	not assessed
Foundation hazard	localised	Woody weeds	localised
Complex terrain	not assessed	Dieback	localised
Productive arable land	not assessed		
<i>Hydrology</i>			
Poor moisture availability	localised	Shallow soils	not assessed
High watertables	localised	Waterlogging	localised
Seasonal waterlogging	localised	Groundwater pollution hazard	not assessed
Flood hazard	widespread	Recharge zone	localised
Discharge zone	localised		
<i>Erosion</i>			
Wind erosion hazard	localised	Wave erosion hazard	not assessed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	localised		
<i>Salinity</i>			
Salinity hazard	localised	Seepage scalds	localised



Summary

Landscape

Extensive alluvial plain system along mid Cox’s Creek in the Liverpool Plains. Local relief <3 m, elevation ??? - ??? m, slope <1%. Ephemeral creeks and prior stream systems occur throughout. Originally grassland and pockets of woodland, 95% removed for cropping and grazing.

Soils

Soils types are extensive. Giant, imperfectly drained calcareous Self-mulching Black Vertosols (Black Earths) are dominant, with Self-mulching Grey Vertosols (Grey Clays) in poorly drained areas. Pockets of Self-mulching Brown Vertosols (Brown Clays) occur adjacent to footslopes and isolated rises

Geology and Regolith

Predominantly basaltic Quaternary alluvium from the surrounding Jurassic Garrawilla Volcanics and the Tertiary Liverpool Ranges to the south. There is also a minor mixed sediment influence of Jurassic Pilliga and Purlewaugh sandstones, shales, and basalts from Bomera Creek near Tambar Springs, Garrawilla Creek near Mullaley Mountain, and Trinkey State Forest. Alluvium depth often exceeds 100 m. The plains slope inward towards Cox’s Creek from the surrounding Mullaley Hills, suggesting that the current alluvial plains occur on the now relict drainage plains of these hills. These areas still supply some sediment to the floodplains. The occurrence of both the alluvial processes of Cox’s Creek and the depositional processes from the Mullaley Hills has resulted in an extensive plain system where creeks and drainage lines may appear to flow perpendicular to the slope of the land.

Vegetation

Predominantly grassland with clumps of open woodland, 95% cleared for cropping and grazing. Major tree species include Eucalyptus camaldulensis (river red gum), Eucalyptus populnea (bimble box), Eucalyptus melliodora (yellow box), Acacia pendula (weeping myall), and Alectryon oleifolius (western rosewood/ bonaree). Groundcover is dominated by Austrostipa aristiglumis (plains grass), Dichanthium sericeum (Queensland bluegrass), Bothriochloa macra (red grass/ red-leg grass), Chloris truncata (windmill grass), Panicum spp. (panics), Austrodanthonia spp. (wallaby grasses), and Juncus spp. (rushes).

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low

Cultivation limitation

low

Fertility

high

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

not observed

Rockfall hazard

not observed

Foundation hazard

widespread

Woody weeds

not observed

Complex terrain

not assessed

Dieback

widespread

Productive arable land

not assessed

Hydrology

Poor moisture availability

not assessed

Shallow soils

not observed

High watertables

localised

Waterlogging

localised

Seasonal waterlogging

widespread

Groundwater pollution hazard

widespread

Flood hazard

widespread

Recharge zone

widespread

Discharge zone

widespread



Erosion

Wind erosion hazard not observed
Gully erosion hazard widespread
Streambank erosion hazard not assessed

Wave erosion hazard not observed
Sheet erosion hazard widespread

Salinity

Salinity hazard widespread

Seepage scalds localised



bil	BURMA HILLS		Residual (Transferral)
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Summary

Landscape

Gently undulating rises to undulating hills on Pilliga and associated sandstones of the central and eastern Pilliga. Slopes range 0 - 6% with local relief ranging 30 - 200 m. Predominantly uncleared woodland and open forest, used as National Park and State Forest, with minor cleared areas used for grazing on native or improved pastures.

Soils

Upper slope and hillcrests dominated by well drained, very deep, Acidic, Red-Orthic, Tenosols (Earthy Sands); and well drained, deep, Basic, Lithic, Leptic, Tenosols (Lithosols); with mid to lower slopes having very poorly drained to poorly drained, moderately deep to very deep, Grey or Yellow Sodosols (Solodic Soils) and minor ; rapidly drained, very deep, Acidic, Arenic, Brown-Orthic, Tenosols (Siliceous Sands). Type profiles are 1, 2, 4 and 20. Profiles in this soil landscape: 1, 2, 3, 4,5, 12, 20, 75, 76, 78.

Geology and Regolith

Jps, Pilliga Sandstone, which includes medium to very coarse grained, well sorted, angular to subangular quartzose sandstone. Minor interbeds of mudstone, siltstone and fine grained sandstone and coal. Common carbonaceous fragments and iron staining. Rare lithic fragments. Large scale tabular, clastic sediment, sandstone; Qrxs1/JKlk, Keelindi beds, which includes, Colluvial polymictic gravel, sand, silt and clay; may include some eluvial in situ regolith deposits OVERLIES Off-White, fine to coarse grained, poorly to well sorted, quartzose sandstone, pebbly sandstone and conglomerate interbedded with minor shale, s, clastic sediment, sandstone, and conglomerate.

Vegetation

Pilliga heathy woodland 1, Variously *Corymbia trachyphloia*, *Callitris endlicheri* and *Eucalyptus fibrosa*; occasionally *Callitris glaucophylla*, *E. chloroclada*, *E. dwyeri*, *E. crebra*; infrequently *E. blakelyi*, *E. macrorhyncha*, *Angophora floribunda*, *E. rossii*; Pilliga ironbark/bull oak woodland, mostly *Eucalyptus crebra* and *Callitris glaucophylla* with a subcanopy of *Allocasuarina luehmannii*; occasionally *E. chloroclada*, *Callitris endlicheri*, *E. blakelyi*; infrequently *E. pilligaensis*, *E. melliodora*, *E. melanophloia*; Pilliga ironbark woodland, usually *Eucalyptus fibrosa* and *E. trachyphloia* with *Callitris glaucophylla*, occasionally *Eucalyptus viridis*; Pilliga NR heathy woodland, Variously *Callitris endlicheri*, *Corymbia trachyphloia*, *Eucalyptus crebra* and *E. chloroclada*; occasionally *E. blakelyi*, *E. melanophloia*, *E. dealbata*, *E. macrorhyncha*, *Callitris glaucophylla* or *E. fibrosa*; Pilliga NR heathy woodland, Variously *Corymbia trachyphloia*, *Eucalyptus fibrosa*, *Callitris endlicheri*, *E. dwyeri*, *E. crebra*; occasionally *Callitris glaucophylla*, *E. macrorhyncha*; rarely *E. chloroclada*; Pilliga heath, Usually a shrubland, but often with patches dominated by *Acacia burrowii*.

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low to moderate

Cultivation limitation

high to extreme

Fertility

low

Qualities and limitations

Landscape

Steep slopes

not assessed

Mass movement hazard

not assessed

Rock outcrop hazard

localised

Rockfall hazard

not assessed

Foundation hazard

localised

Woody weeds

localised

Complex terrain

not assessed

Dieback

localised



Productive arable land not assessed

Hydrology

Poor moisture availability widespread
High watertables localised
Seasonal waterlogging localised
Flood hazard not assessed
Discharge zone localised

Shallow soils localised
Waterlogging not assessed
Groundwater pollution hazard not assessed
Recharge zone widespread

Erosion

Wind erosion hazard localised
Gully erosion hazard widespread
Streambank erosion hazard localised

Wave erosion hazard not assessed
Sheet erosion hazard widespread

Salinity

Salinity hazard localised

Seepage scalds localised



Summary

Landscape

Llevel to very gently inclined alluvial plains associated with the Bullum Bulla, Washpen, and Curricaroo Creeks on Quaternary volcanic alluvium. Local relief less than 3 m, slopes less than 2%. Grassland and open woodland, 95% cleared for grazing and cropping. Small outliers of this landscape occur in the Narabri district.

Soils

Giant, poorly drained Self-mulching Grey Vertosols (Grey Clays) dominate the mid and lower plains, with giant, moderately well drained Self-mulching Brown Vertosols (Brown Clays) also present. Very deep to giant, Stratic Rudosols (Alluvial Soils) are present on upper plains and along major streamlines. Giant, imperfectly drained Self-mulching Black Vertosols also occur throughout the landscape.

Geology and Regolith

Quaternary alluvium derived from the Jurassic Garrawilla Volcanics. The alluvium overlies basalt hills, evident as outcrops similar to Round Hill, which impede groundwater movement. Groundwater in upper plains is also affected by sub-surface Triassic sedimentary formations, generally Narrabeen sandstone or Digby conglomerate. Alluvium depth ranges from approximately 5 m in upper areas to over 20 m on lower plains.

Vegetation

Open woodland and grassland, 95% cleared for cropping and grazing. Eucalyptus populnea (bimble box), Eucalyptus albens (white box), Alectryon oleifolius (western rosewood/ bonaree), Casuarina cristata (belah), Acacia pendula (weeping myall), Geijera parviflora (wilga), and Acacia homalophylla (yarran) dominate the upper strata. Eucalyptus camaldulensis (river red gum) and Eucalyptus melliodora (yellow box) are found along drainage lines. Groundcover is dominated by Austrostipa aristiglumis (plains grass), with Dichanthium sericeum (Queensland bluegrass), Chloris spp. (windmill grasses), Bothriochloa macra (red grass/ red-leg grass), Panicum spp. (panics), Aristida spp. (wiregrasses/ threeawn grasses/ kerosene grasses), Austrodanthonia spp. (wallaby grasses) and Marsillea drummondii (common nardoo) also present. Juncus spp. (rushes) occurs in waterlogged areas.

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	low to moderate
Cultivation limitation	low to moderate	Fertility	high

Qualities and limitations

Landscape

Steep slopes	not observed	Mass movement hazard	not observed
Rock outcrop hazard	not observed	Rockfall hazard	not observed
Foundation hazard	widespread	Woody weeds	not observed
Complex terrain	not assessed	Dieback	not assessed
Productive arable land	localised		

Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
High watertables	localised	Waterlogging	localised
Seasonal waterlogging	localised	Groundwater pollution hazard	not observed
Flood hazard	widespread	Recharge zone	widespread
Discharge zone	localised		



Erosion

Wind erosion hazard not observed
Gully erosion hazard localised
Streambank erosion hazard localised

Wave erosion hazard not observed
Sheet erosion hazard localised

Salinity

Salinity hazard localised

Seepage scalds localised



Summary

Landscape Very broad, level to gently undulating complex drainage plains comprised of coalescing alluvial fans on Quaternary alluvium derived from mixed sandstone/conglomerate and basaltic catchments. Local relief normally <10 m, slopes 0 - 3%, elevation 260 - 350 m. Mostly cleared open-woodland and grassland land used for cropping and pasture.

Soils Very deep (>150 cm) Red-brown Earths (Red Chromosols), Red Earths (Red Kandosols), Black and Brown Clays (Black and Brown Vertosols).

Geology and Regolith Quaternary alluvium derived from mixed sandstone/conglomerate and basalt dominated catchments. The alluvium in these drainage plains masks basalt dykes which appear to play a major role in controlling aquifers. Prior ground surface drainage lines (i.e., gravel filled gullies buried deep under alluvium) have been observed to be major flow paths for ground water east of Black Jack Mountain, and it is probable that this also is the case elsewhere (Thomson, W., pers. comm.).

Vegetation Open-woodland with a grass understorey and patches of closed-grassland mostly cleared for agriculture. Woodland species include Eucalyptus albens (white box), Eucalyptus populnea (bimble box), Eucalyptus camaldulensis (river red gum), Eucalyptus melliodora (yellow box), Eucalyptus pilligaensis (pillaga box), Acacia pendula (myall), Geijera parviflora (wilga), Angophora floribunda (rough-barked apple), Heterodendron oleifolium (rosewood) and Casuarina cristata (belah).

Ground cover species include Stipa spp. (spear grasses), Aristida spp. (wire grasses), Marsilea drummondii (nardoo), Juncus spp. (rushes) and Cyperus spp. (sedges).

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	low
Cultivation limitation	low to moderate	Fertility	not recorded

Qualities and limitations

Landscape

Steep slopes	not observed	Mass movement hazard	not observed
Rock outcrop hazard	not observed	Rockfall hazard	not observed
Foundation hazard	widespread	Woody weeds	not observed
Complex terrain	not assessed	Dieback	not assessed
Productive arable land	not assessed		

Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
High watertables	widespread	Waterlogging	not observed
Seasonal waterlogging	localised	Groundwater pollution hazard	not observed
Flood hazard	localised	Recharge zone	widespread
Discharge zone	localised		

Erosion

Wind erosion hazard	localised	Wave erosion hazard	not observed
Gully erosion hazard	not observed	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		



Salinity

Salinity hazard

widespread

Seepage scalds

not observed



bvy	BLUE VALE	Residual
Summary		
Landscape	84.8 km ² ; Undulating low hills and hills on Permian sandstones and conglomerates of the Curlewis Hills. Local relief 70 m; elevation 250 - 420 m; slopes 1 - 10%. Woodland and grassland, in State Forests or cleared for grazing.	
Soils	Soils vary little across the landscape. Brown Chromosols (Non-calcic Brown Soils) and Brown Sodosols (Solonetz) are dominant, with Bleached Brown Chromosols (Non-calcic Brown Soils) occasionally present. Profiles in this soil landscape: sites 710, 711, 712, 713, 714, 715	
Geology and Regolith	Early Permian sandstone and claystone of the Maules Creek Formation. Conglomerate was observed at several locations within the landscape.	
Vegetation	<p>The landscape has been extensively cleared for cropping and grazing. No good examples of native vegetation were found: It is likely that the dominant community would have been a grassy multi-layered woodland/open forest. Trees are now restricted to isolated trees, small clumps, and linear strips along roadsides and drainage lines. This community varies between northern and southern areas, the difference being the sandstone influence in the Bullawa Creek valley. The dominant canopy species of the Bullawa Creek valley include Yellow box (<i>E. melliodora</i>), Blakely's Red gum (<i>E. blakelyi</i>), and Rough-barked apple (<i>Angophora floribunda</i>), with occasional White cypress (<i>Callitris glaucophylla</i>), White box (<i>E. albens</i>), and Kurrajong (<i>Brachychiton populneus</i>). River oak (<i>Casuarina cunninghamiana</i>), River Red gum (<i>E. camaldulensis</i>), and the White cloud tree (<i>Melaleuca bracteata</i>) occur along drainage lines. The dominant canopy species of the Horsearm Creek valley include White cypress (<i>Callitris glaucophylla</i>) and White box (<i>E. albens</i>), with occasional Kurrajong (<i>Brachychiton populneus</i>). River oak (<i>Casuarina cunninghamiana</i>), Yellow box (<i>E. melliodora</i>), Blakely's Red gum (<i>E. blakelyi</i>), Rough-barked apple (<i>Angophora floribunda</i>) and the White cloud tree (<i>Melaleuca bracteata</i>) occur along drainage lines. Likewise, the shrub understorey varied between northern and southern areas. The shrub understorey of the Bullawa Creek valley varied from isolated plants to three defined layers (< 1, < 3m & < 6 m tall) in less disturbed areas. Common species include Wilga (<i>Geijera parviflora</i>), Native olive (<i>Notelaea microcarpa</i>), Western Golden wattle (<i>Acacia decora</i>), Cooba wattle (<i>Acacia salicina</i>), Green wattle (<i>Acacia deanei</i>), Hop Bush (<i>Dodonaea viscosa</i> subsp. <i>angustifolia</i>), Butterbush (<i>Pittosporum phylliraeoides</i>), Poison pimelea (<i>Pimelea neo-anglica</i>), and Hovea lanceolata. The shrub understorey of the Horsearm Creek valley also varied from isolated plants to three defined layers (< 1, < 3m & < 6 m tall) in less disturbed areas. Common species include Wilga (<i>Geijera parviflora</i>), Western rosewood (<i>Alectryon oleifolius</i>), Budda (<i>Eremophila mitchellii</i>), Green wattle (<i>Acacia deanei</i>), Cassia sp, Yarran (<i>Acacia homalophylla</i>), Western Golden wattle (<i>Acacia decora</i>), Hop Bush (<i>Dodonaea viscosa</i> subsp. <i>angustifolia</i>), Wild Orange (<i>Capparis mitchellii</i>), and Quinine Bush (<i>Alstonia constricta</i>). Common grasses of the southern area include Queensland blue grass (<i>Dicanthium sericeum</i>), Spear grass (<i>Austrostipa</i> sp.), Red grass (<i>Bothriochloa macra</i>), Pitted Red Grass (<i>Bothriochloa decipiens</i>), Wire grass (<i>Aristida</i> sp.), and Slender Bamboo grass (<i>Austrostipa verticillata</i>).</p>	
	Common grasses of the northern area include Red grass (<i>Bothriochloa macra</i>), Wire grass (<i>Aristida</i> sp.), and Slender Bamboo grass (<i>Austrostipa verticillata</i>). Exotic plants have a med to high infestation in both areas. Common species include Pepper tree (<i>Schinus areira</i>), Cotton Bush (<i>Gomphocarpus</i> sp.), White Cedar (<i>Melia azedarach</i>), Purple-top (<i>Verbena bonariensis</i>), and Prickly pear (<i>Opuntia</i> sp.).	
Land use	not recorded	



Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	low to moderate
Cultivation limitation	moderate to high	Fertility	moderate
Qualities and limitations			
<i>Landscape</i>			
Steep slopes	not observed	Mass movement hazard	not observed
Rock outcrop hazard	not observed	Rockfall hazard	not observed
Foundation hazard	not assessed	Woody weeds	not assessed
Complex terrain	not observed	Dieback	not assessed
Productive arable land	widespread		
<i>Hydrology</i>			
Poor moisture availability	localised	Shallow soils	localised
High watertables	not observed	Waterlogging	not observed
Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
Flood hazard	localised	Recharge zone	localised
Discharge zone	not observed		
<i>Erosion</i>			
Wind erosion hazard	localised	Wave erosion hazard	not assessed
Gully erosion hazard	widespread	Sheet erosion hazard	widespread
Streambank erosion hazard	not observed		
<i>Salinity</i>			
Salinity hazard	not observed	Seepage scalds	not assessed



Summary

Landscape Variant of Borah soil landscape comprised of extremely low residual rises of Jurassic sandstone within the Cox's Creek alluvium.

Soils not recorded

Geology and Regolith Jpu_BRI

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	not observed	Mass movement hazard	not observed
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Rock outcrop hazard	not observed	Rockfall hazard	not observed
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Foundation hazard	not observed	Woody weeds	localised
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Complex terrain	not assessed	Dieback	not assessed
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Productive arable land	not assessed		
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Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
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High watertables	not observed	Waterlogging	not observed
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Seasonal waterlogging	localised	Groundwater pollution hazard	not observed
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Flood hazard	not observed	Recharge zone	not assessed
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Discharge zone	localised		
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Erosion

Wind erosion hazard	widespread	Wave erosion hazard	not observed
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Gully erosion hazard	not observed	Sheet erosion hazard	widespread
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Streambank erosion hazard	not assessed		
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Salinity

Salinity hazard	widespread	Seepage scalds	not observed
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Summary

Landscape

Level plain to gently undulating plain with level and very gently inclined slopes and extremely low to very low relief on Quaternary clastic sediments of sand, silt and clay. Local relief is 0 to 10m, slopes 1 to 3m and elevation 260 to 300m. Red Chromosols dominate and Brown Dermosols may be present in drainage depressions. Landscape limitations include localised seasonal waterlogging and flooding.

Soils

Red Chromosols on gently undulating plains and Brown Dermosols in drainage depressions. Banks and King (in press) reports the following for this landscape. Soils on footslope positions in this landscape vary according to local sediment source. Some footslopes are dominated by very deep gravelly imperfectly drained loamy Grey Chromosols (Solodic Soils), with others by giant moderately well drained loamy Brown Sodosols (Red-brown Earths/Solodic Soils). Gilgai variant bya is dominated by very poorly drained giant Grey or Brown Vertosols (Grey and Brown Clays). The plain elements of the landscape are dominated by giant very poorly drained Brown Vertosols (Brown Clays) and imperfectly to poorly drained deep to giant loamy Brown Sodosols (Solodic Soils and Solodized Solonetz). Some locations near rhyolite have Vertic Red Chromosols with a silica hardpan. Although these are limited in distribution, they are significant because they topsoils are cemented together by silica and these locations tend to be of limited productivity as ploughing only makes the pan break into hard, cemented lumps. Red Chromosols on gently undulating plains and Brown Dermosols in drainage depressions. Profiles in this soil landscape: 690, 691, 692

Geology and Regolith

Quaternary clastic sediments of sand, silt and clay

Vegetation

This small landscape has been extensively cleared for cropping and grazing. No good examples of native vegetation were found, although the vulnerable tree species, Ooline (*Cadellia pentastylis*), was found to be common. It is likely that the dominant community would have been a grassy multi-layered woodland/open forest. Trees are now restricted to isolated trees, small clumps, and linear strips along roadsides and drainage lines. The dominant canopy species include White cypress (*Callitris glaucophylla*), Grey box (*E. moluccana*), Western grey box (*E. microcarpa*), White box (*E. albens*), and occasional Ooline (*Cadellia pentastylis*), Bimble box (*E. populnea*), Belah (*Casuarina cristata*), and Kurrajong (*Brachychiton populneus*).

Yellow box (*E. melliodora*), Blakely's Red gum (*E. blakelyi*), Rough-barked apple (*Angophora floribunda*) and the White cloud tree (*Melaleuca bracteata*) occur along drainage lines. Shrub understorey varies from isolated plants to three defined layers (< 1, < 3m & < 6 m tall) in less disturbed areas. Common species include Wilga (*Geijera parviflora*), Native olive (*Notelaea microcarpa*), Green wattle (*Acacia deanei*), Yarran (*Acacia homalophylla*), Western rosewood (*Alectryon oleifolius*), Budda (*Eremophila mitchellii*), Quinine Bush (*Alstonia constricta*), Warrior Bush (*Apophyllum anomalum*), Butterbush, (*Pittosporum phylliraeoides*), Western boobialla (*Myoporum montanum*), Cooba (*Acacia salicina*), Cassia sp, Eastern cottonbush (*Maireana microphylla*), and Galvanised burr (*Sclerolaena birchii*). Common grasses include Plains grass (*Austrostipa aristiglumis*), Red grass (*Bothriochloa macra*), Pitted Red Grass (*Bothriochloa decipiens*), Queensland blue grass (*Dicanthium sericeum*), Wire grass (*Aristida* sp.), and Slender Bamboo grass (*Austrostipa verticillata*). This landscape has a high infestation of exotic plants. Common species include Paterson's Curse (*Echium* sp.), Wild turnip (*Brassica* sp.), Horehound (*Marrubium vulgare*), Mallow (*Malva* sp.), Clovers (*Trifolium* sp.), and thistles.

Land use

not recorded



Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	low
Cultivation limitation	moderate to high	Fertility	moderate
Qualities and limitations			
<i>Landscape</i>			
Steep slopes	not observed	Mass movement hazard	not observed
Rock outcrop hazard	not observed	Rockfall hazard	not observed
Foundation hazard	localised	Woody weeds	localised
Complex terrain	not observed	Dieback	localised
Productive arable land	widespread		
<i>Hydrology</i>			
Poor moisture availability	localised	Shallow soils	not observed
High watertables	localised	Waterlogging	not observed
Seasonal waterlogging	localised	Groundwater pollution hazard	not assessed
Flood hazard	localised	Recharge zone	not assessed
Discharge zone	localised		
<i>Erosion</i>			
Wind erosion hazard	localised	Wave erosion hazard	not observed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	not observed		
<i>Salinity</i>			
Salinity hazard	widespread	Seepage scalds	localised



Summary

Landscape

Open depressions and floodplains on mixed alluvium derived from Jurassic sandstones and Tertiary basalts in the Trinkey Hills. Local relief less than 5 m; elevation # - # m; slopes less than 3%. Open and closed woodland and grassland, approximately 40% cleared or thinned on floodplains for cropping and grazing.

Soils

Individual soil types are broad, varying with catchment and landscape position, and alluvium type. On floodplains and minor streams of sedimentary-derived alluvium, shallow to deep, imperfectly drained Grey Kurosols (Soloths), Grey, Brown and Yellow Sodosols (Solodic Soils and Solodized Solonetz), and occasional rapidly drained Lithic Orthic Tenosols (Earthy Sands) are present, with giant, moderately well drained Brown Chromosols (Solodic Soils) in streamlines in upper catchments. Giant, imperfectly drained Self-mulching Black and Grey Vertosols (Black Earths and Grey Clays), Black and Grey Dermosols (Alluvial Soils) and Stratic Rudosols (Alluvial Soils) occur on basalt-derived alluvial floodplains and streamlines.

Geology and Regolith

Mixed Quaternary alluvium derived from Jurassic Pilliga sandstones and Tertiary basalts of the Liverpool Range. Soil types suggest that upper to mid landscape sections have varied amounts of influence from Tertiary basalts and Jurassic Pilliga sandstone, changing between streams and catchment areas. Mid catchment areas are strongly influenced by the Tertiary basalts, with equal influence from sandstone and basalt sources in lower landscape sections below the Saltwater Creek junction. Near-surface travertine deposits are common in downstream sections, particularly in association with heavy clay soils. Depth to bedrock, particularly in the mid to upper catchment, is generally less than 5 m. Alluvium north of the Tambar Springs-Premier road are heavily influenced by Cox's Creek basaltic alluvium, which originates from the Tertiary basalt of the Liverpool Range. Alluvium depths in this area can be greater than 40 m.

Vegetation

Open and closed woodland, with grassland on floodplains of basaltic alluvium, 40% thinned or cleared. Much of this clearing has occurred on basaltic floodplains. Tree species on heavier soils include Angophora floribunda (rough-barked apple), Eucalyptus melliodora (yellow box), and Eucalyptus camaldulensis (river red gum). On sandstone-derived soils, Callitris glaucophylla (white cypress pine), Callitris endlicheri (black cypress pine), Brachychiton populneus (kurrajong), Eucalyptus dealbata (tumbledown gum/ hill red gum), Eucalyptus macroryncha (red stringybark), Eucalyptus laevopinea (silver-top stringybark) and Geijera parviflora (wilga) are dominant, with Cassinia laevis (cough bush) and Daviesia sp. (bitter pea/ bacon and egg plant) present as a sporadic mid-storey shrub layer. Eucalyptus albens (white box) and Eucalyptus blakelyi (blakely's red gum) occur on all soil types. Austrostipa aristiglumis (plains grass) is the main groundcover on heavy soils. Bothriochloa spp. (red grasses/ bluegrasses) and Austrodanthonia spp. (wallaby grasses) occur throughout the landscape, with Austrostipa verticillata (slender bamboo grass), Aristida vagans (threeawn speargrass), Themeda australis (kangaroo grass), Eragrostis spp. (love grasses), Austrostipa spp. (speargrasses) and Dianella sp. (flax lily/ blue flax lily/ blueberry lily) on sandstone-derived soils. A number of forb and legume species occur also in this landscape.

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low

Cultivation limitation

high to extreme

Fertility

variable

Qualities and limitations



Landscape

Steep slopes not assessed
Rock outcrop hazard not assessed
Foundation hazard localised
Complex terrain not assessed
Productive arable land not assessed

Mass movement hazard not assessed
Rockfall hazard not assessed
Woody weeds localised
Dieback localised

Hydrology

Poor moisture availability not assessed
High watertables not assessed
Seasonal waterlogging widespread
Flood hazard widespread
Discharge zone widespread

Shallow soils not assessed
Waterlogging localised
Groundwater pollution hazard not assessed
Recharge zone widespread

Erosion

Wind erosion hazard not assessed
Gully erosion hazard localised
Streambank erosion hazard not assessed

Wave erosion hazard not assessed
Sheet erosion hazard localised

Salinity

Salinity hazard localised

Seepage scalds localised



Summary

Landscape Variant of Corronation Flat Soil Landscape comprised of lower alluvial unit with predominantly sedimentary-derived soils.

Soils not recorded

Geology and Regolith Qa_LNE

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	not observed	Mass movement hazard	not observed
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Rock outcrop hazard	not observed	Rockfall hazard	not observed
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Foundation hazard	not observed	Woody weeds	widespread
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Complex terrain	not assessed	Dieback	not assessed
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Productive arable land	not assessed		
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Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
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High watertables	localised	Waterlogging	widespread
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Seasonal waterlogging	widespread	Groundwater pollution hazard	not observed
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Flood hazard	widespread	Recharge zone	not assessed
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Discharge zone	widespread		
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Erosion

Wind erosion hazard	localised	Wave erosion hazard	not observed
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Gully erosion hazard	widespread	Sheet erosion hazard	widespread
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Streambank erosion hazard	not assessed		
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Salinity

Salinity hazard	widespread	Seepage scalds	not observed
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ctu	CUTTABRI ALLUVIALS	Stagnant Alluvial (Alluvial)
Summary		
Landscape	<p>Broad stagnant alluvial plains of the Pilliga Outwash on older alluvium than the more recent landscapes such as the Baradine Creek Alluvials (bcaz). Level to very gently undulating plain with slopes generally less than 2% and ill-defined drainage lines. Predominantly uncleared woodland and open forest, used for National Parks and State Forests with some clearing in the north and west of the landscape where grazing is generally carried out on native or improved pastures. Some cropping occurs on the margins of the West Pilliga.</p>	
Soils	<p>Upper and central parts of the landscape dominated by various giant Grey, Yellow and Brown Sodosols (Solodic Soils), with minor sandy Tenosols (Earthy Sands). Along the western margins of the Pilliga Forest Red Kandosols (Red Earths) tend to become common and these areas are generally cleared for grazing with some cropping. The northern terminal ends of this system are dominated by a mixed of Sodosols (Solodic Soils) and Red and Grey Vertosols (Red and Grey Clays). The Red Vertosols are often scalded and highly saline. Type profiles are 26, 31, 33 and 35. Profiles in this soil landscape: 7, 8, 19, 26, 28, 29, 30, 31, 33, 34, 35, 36, 42, 43, 44, 70, 72, 77, 81, 83, 85- 90 and 97 - 100.</p>	
Geology and Regolith	<p>Jps, Pilliga Sandstone, which includes, Medium to very coarse grained, well sorted, angular to subangular quartzose sandstone. Minor interbeds of mudstone, siltstone and fine grained sandstone and coal. Common carbonaceous fragments and iron staining. Rare lithic fragments. Large scale tabular, clastic sediment, sandstone; Qamv2, unnamed geological unit, which includes, Unconsolidated to semi-consolidated silt, silty clay and fine sand. Sorting poor to very poor. Minor medium sand, ferromagnesian nodules, charcoal and salts. Strongly modified by pedogenesis., clastic sediment, silt, clay, sand; Qasl2, unnamed geological unit, which includes, Unconsolidated sand, clastic sediment, sand; Qfpl2, unnamed geological unit, which includes, Texture contrast soils with sand Predominating at the surface (39-43ka)., clastic sediment, sand; Qfps2, unnamed geological unit, which includes, Texture contrast soils with sand Predominating at the surface (39-43ka)., clastic sediment, sand; Qrhs3, unnamed geological unit, which includes, Clayey alluvium often gilgaid (>88ka)., clastic sediment, alluvium; Qrxs1/JKlk, Keelindi beds, which includes, Colluvial polymictic gravel, sand, silt and clay; may include some eluvial in situ regolith deposits OVERLIES Off-White, fine to coarse grained, poorly to well sorted, quartzose sandstone, pebbly sandstone and conglomerate interbedded with minor shale, clastic sediment, sandstone and conglomerate.</p>	
Vegetation	<p>Pilliga cypress/bull oak woodland, mostly <i>Callitris glaucophylla</i> and <i>Eucalyptus crebra</i> with a subcanopy of <i>Allocasuarina luehmannii</i>; occasionally <i>E. pilligaensis</i>, <i>E. sideroxylon</i> or <i>E. blakelyi</i> may be locally common; infrequently <i>Callitris endlicheri</i>, <i>E. conica</i>, <i>Angophora floribunda</i>, <i>E. fibrosa</i>, <i>Casuarina cristata</i> or <i>E. melliadora</i>; calz, Pilliga west grass/herb cypress woodland, usually <i>Callitris glaucophylla</i> with <i>Eucalyptus crebra</i>, <i>E. populnea</i> subsp. <i>bimil</i> or <i>E. pilligaensis</i> and often a subcanopy of <i>Allocasuarina luehmannii</i>; occasionally <i>E. chloroclada</i> or <i>E. blakelyi</i>; rarely <i>E. melanophloia</i>, <i>Casuarina cristata</i> or <i>E. camaldulensis</i>; Pilliga ironbark/bull oak woodland, mostly <i>Eucalyptus crebra</i> and <i>Callitris glaucophylla</i> with a subcanopy of <i>Allocasuarina luehmannii</i>; occasionally <i>E. chloroclada</i>, <i>Callitris endlicheri</i>, <i>E. blakelyi</i>; infrequently <i>E. pilligaensis</i>, <i>E. melliadora</i>, <i>E. melanophloia</i>; Pilliga cypress/box herb woodland, usually <i>Callitris glaucophylla</i> with <i>Eucalyptus populnea</i> subsp. <i>bimil</i> or <i>E. pilligaensis</i> and occasionally <i>Allocasuarina luehmannii</i>; sometimes <i>Casuarina cristata</i> may be locally dominant; rarely <i>E. blakelyi</i>; Pilliga grassy cypress woodland, usually dominated by <i>Callitris glaucophylla</i>, often with <i>Eucalyptus crebra</i> and a subcanopy of <i>Allocasuarina luehmannii</i>; occasionally <i>Callitris endlicheri</i>, <i>E. albens</i>, <i>E. blakelyi</i>, <i>E. conica</i>;</p>	



infrequently *E. populnea* subsp. *bimbil*, *E. fibrosa*, *E. pilligaensis*; Northern Pilliga box woodland, mostly dominated by *Eucalyptus pilligaensis*, with *Allocasuarina luehmannii*, *E. crebra* or *E. populnea* subsp. *bimbil*; Pilliga heathy woodland 1, Various *Corymbia trachyphloia*, *Callitris endlicheri* and *Eucalyptus fibrosa*; occasionally *Callitris glaucophylla*, *E. chloroclada*, *E. dwyeri*, *E. crebra*; infrequently *E. blakelyi*, *E. macrorhyncha*, *Angophora floribunda*, *E. rossii*; Pilliga heathy woodland 2, Various *Eucalyptus fibrosa*, *Callitris glaucophylla*, *E. crebra*, *Callitris endlicheri* or *Corymbia trachyphloia*; occasionally *E. blakelyi*, *E. chloroclada*, *Angophora floribunda* or *Allocasuarina luehmannii*; rarely *Angophora leiocarpa*, *E. dealbata*; Pilliga heath, Usually a shrubland, but often with patches dominated by *Acacia burrowii*; Pilliga cypress grass/herb woodland, usually *Callitris glaucophylla* with *Eucalyptus albens* or occasionally *E. crebra*. A very wide range of other species may occur locally and may sometimes be locally dominant, including *E. melanophloia*, *E. chloroclada*, *Angophora floribunda*, *E. blakelyi*, *E. melliadora*, *E. pilligaensis* and *E. conica*; Western floodplain woodland, mostly *Eucalyptus largiflorens*. / *E. largiflorens* / *Eleocharis pallens*; Riparian angophora woodland, mostly *Angophora floribunda* with *Eucalyptus blakelyi* or *Callitris glaucophylla*; occasionally *Callitris endlicheri*, *E. chloroclada*, *E. melliadora*, *E. crebra*; Eastern clay grassland, Typically a grassland, but sometimes with scattered trees or rarely a woodland overstorey. The most frequent tree species are *Callitris glaucophylla*, *Eucalyptus albens* and *E. populnea* subsp. *bimbil*. Much less frequent are *E. melliadora*, *E. melanophloia*, *E. camaldulensis*, *Corymbia tessellaris* and *E. crebra*.

Land use	not recorded		
Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	low to moderate
Cultivation limitation	moderate to extreme	Fertility	variable
Qualities and limitations			
<i>Landscape</i>			
Steep slopes	not assessed	Mass movement hazard	not assessed
Rock outcrop hazard	not assessed	Rockfall hazard	not assessed
Foundation hazard	localised	Woody weeds	localised
Complex terrain	not assessed	Dieback	localised
Productive arable land	not assessed		
<i>Hydrology</i>			
Poor moisture availability	widespread	Shallow soils	not assessed
High watertables	localised	Waterlogging	not assessed
Seasonal waterlogging	localised	Groundwater pollution hazard	not assessed
Flood hazard	localised	Recharge zone	widespread
Discharge zone	localised		
<i>Erosion</i>			
Wind erosion hazard	localised	Wave erosion hazard	not assessed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	localised		
<i>Salinity</i>			
Salinity hazard	localised	Seepage scalds	localised



Summary

Landscape

Level floodplains and stagnant alluvial plains; gently inclined drainage plains and alluvial fans on mixed sandstone and basalt alluvium of the Curlewis Hills. Local relief <10 m, elevation 250 - 330 m, slopes <2%. Main landform elements include floodplains, channels, fans, and small swamps. Woodland and open woodland with some grassland patches 75% cleared for grazing and cultivation.

Soils

Generally Vertosols dominate the landscape, with well drained Red Vertosols (Red Clays) dominating the upper 60% of the catchment with most of the lower catchment dominated by Black and Grey Vertosols (Black and Grey Clays). Red and Brown Sodosols (Red-brown Earths/Solodic Soils) occur on the flanks of, or extending onto the floodplain in some mid to upper catchment locations.

Geology and Regolith

Quaternary alluvium derived from Jurassic and Tertiary basalts and Triassic-Permian sedimentary rocks in the Curlewis Hills. Depth of alluvium is usually less than 30 m, overlying various basement materials.

Vegetation

Open woodland and grassland, 90% cleared for cropping and grazing. Eucalyptus populnea (bimble box) dominates the plain, with Alectryon oleifolius (western rosewood), Casuarina cristata (belah), Acacia pendula (weeping myall), Geijera parviflora (wilga) and Callitris glaucophylla (white cypress pine) also present. Eucalyptus camaldulensis (river red gum) and Eucalyptus melliodora (yellow box) and occasional Casuarina cunninghamiana (river oak) are found along drainage lines. Allocasuarina luehmannii (bull oak) occurs on local areas of hardsetting soils. Groundcover consists of Austrostipa aristiglumis (plains grass), Dichanthium sericeum (Queensland bluegrass), Chloris spp. (windmill grass) Aristida spp. (wire grasses), Aristida leptopoda (white wiregrass), Oxalis perennans (sorrel), Chloris truncata (windmill grass), Sclerolaena muricata (copper burr) and Marsillea drummondii (common nardoo).

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low

Cultivation limitation

low to moderate

Fertility

variable

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

not observed

Rockfall hazard

not observed

Foundation hazard

widespread

Woody weeds

not observed

Complex terrain

not assessed

Dieback

not assessed

Productive arable land

not assessed

Hydrology

Poor moisture availability

not assessed

Shallow soils

not observed

High watertables

localised

Waterlogging

localised

Seasonal waterlogging

localised

Groundwater pollution hazard

not observed

Flood hazard

widespread

Recharge zone

localised

Discharge zone

localised

Erosion

Wind erosion hazard

not observed

Wave erosion hazard

not observed



Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	localised		
<i>Salinity</i>			
Salinity hazard	widespread	Seepage scalds	localised



Summary

Landscape

Level floodplains and stagnant alluvial plains; gently inclined drainage plains and alluvial fans on mixed sandstone and basalt alluvium of the Curlewis Hills. Local relief <10 m, elevation 250 - 330 m, slopes <2%. Main landform elements include floodplains, channels, fans, and small swamps. Woodland and open woodland with some grassland patches 75% cleared for grazing and cultivation.

Soils

Generally Vertosols dominate the landscape, with well drained Red Vertosols (Red Clays) dominating the upper 60% of the catchment with most of the lower catchment dominated by Black and Grey Vertosols (Black and Grey Clays). Red and Brown Sodosols (Red-brown Earths/Solodic Soils) occur on the flanks of, or extending onto the floodplain in some mid to upper catchment locations.

Geology and Regolith

Quaternary alluvium derived from Jurassic and Tertiary basalts and Triassic-Permian sedimentary rocks in the Curlewis Hills. Depth of alluvium is usually less than 30 m, overlying various basement materials.

Vegetation

Open woodland and grassland, 90% cleared for cropping and grazing. Eucalyptus populnea (bimble box) dominates the plain, with Alectryon oleifolius (western rosewood), Casuarina cristata (belah), Acacia pendula (weeping myall), Geijera parviflora (wilga) and Callitris glaucophylla (white cypress pine) also present. Eucalyptus camaldulensis (river red gum) and Eucalyptus melliodora (yellow box) and occasional Casuarina cunninghamiana (river oak) are found along drainage lines. Allocasuarina luehmannii (bull oak) occurs on local areas of hardsetting soils. Groundcover consists of Austrostipa aristiglumis (plains grass), Dichanthium sericeum (Queensland bluegrass), Chloris spp. (windmill grass) Aristida spp. (wire grasses), Aristida leptopoda (white wiregrass), Oxalis perennans (sorrel), Chloris truncata (windmill grass), Sclerolaena muricata (copper burr) and Marsillea drummondii (common nardoo).

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low

Cultivation limitation

low to moderate

Fertility

variable

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

not observed

Rockfall hazard

not observed

Foundation hazard

widespread

Woody weeds

not observed

Complex terrain

not assessed

Dieback

not assessed

Productive arable land

not assessed

Hydrology

Poor moisture availability

not assessed

Shallow soils

not observed

High watertables

localised

Waterlogging

localised

Seasonal waterlogging

localised

Groundwater pollution hazard

not observed

Flood hazard

widespread

Recharge zone

localised

Discharge zone

localised

Erosion

Wind erosion hazard

not observed

Wave erosion hazard

not observed



Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	localised		
<i>Salinity</i>			
Salinity hazard	widespread	Seepage scalds	localised



cqy	CUBBO CREEK TERRACES	Alluvial
Summary		
Landscape	Generally narrow alluvial terraces on Quaternary sheetwash alluvium. Landscape varies from level plain to gently undulating plain, with slopes 0 - 2%. Largely uncleared woodland in the south with mixed cropping and grazing in northerly areas.	
Soils	Dominated by poorly drained, very deep to giant, Grey and Brown Sodosols (Solodic Soils); with minor occurrences of Red Dermosols (Red-brown Earths); self-mulching Grey Vertosols (Grey Clays); and Tenosols (Siliceous and Earthy Sands). Type profile is profile 16. Profiles in this soil landscape: 16, 17, 60 - 65.	
Geology and Regolith	Qatl1, unnamed geological unit, which includes, Interpreted clay, silt, sand, gravel., clastic sediment, clay, silt, sand, gravel; Qavl1, unnamed geological unit, which includes, Interpreted clay, silt, sand, gravel., clastic sediment, clay, silt, sand, gravel; Qfpl2, unnamed geological unit, which includes, Texture contrast soils with sand Predominating at the surface (39-43ka)., clastic sediment, sand; Qrhs3, unnamed geological unit, which includes, Clayey alluvium often gilgaid (>88ka)., clastic sediment, alluvium; Qrxs1/JKlk, Keelindi beds, which includes, Colluvial polymictic gravel, sand, silt and clay; may include some eluvial in situ regolith deposits OVERLIES Off-White, fine to coarse grained, poorly to well sorted, quartzose sandstone, pebbly sandstone and conglomerate interbedded with minor shale, s, clastic sediment, sandstone, and conglomerate.	
Vegetation	Western grassy box woodland, usually <i>Callitris glaucophylla</i> and <i>Eucalyptus populnea</i> subsp. <i>bimbil</i> , occasionally <i>E. pilligaensis</i> , <i>Allocasuarina luehmannii</i> , <i>E. crebra</i> ; infrequently <i>E. microcarpa</i> , <i>E. conica</i> , <i>Casuarina cristata</i> , <i>E. chloroclada</i> , <i>E. dealbata</i> , <i>E. camaldulensis</i> , <i>E. melliodora</i> ; Pilliga cypress/box herb woodland, usually <i>Callitris glaucophylla</i> with <i>Eucalyptus populnea</i> subsp. <i>bimbil</i> or <i>E. pilligaensis</i> and occasionally <i>Allocasuarina luehmannii</i> ; sometimes <i>Casuarina cristata</i> may be locally dominant; rarely <i>E. blakelyi</i> ; Pilliga ironbark/bull oak woodland, mostly <i>Eucalyptus crebra</i> and <i>Callitris glaucophylla</i> with a subcanopy of <i>Allocasuarina luehmannii</i> ; occasionally <i>E. chloroclada</i> , <i>Callitris endlicheri</i> , <i>E. blakelyi</i> ; infrequently <i>E. pilligaensis</i> , <i>E. melliodora</i> , <i>E. melanophloia</i> ; Riparian red gum woodland, mostly <i>Eucalyptus blakelyi</i> and <i>Angophora floribunda</i> ; occasionally <i>E. crebra</i> ; infrequently <i>E. populnea</i> subsp. <i>bimbil</i> , <i>Casuarina cristata</i> , <i>E. sideroxylon</i> , <i>E. dealbata</i> , <i>E. nubila</i> ; Pilliga cypress/bull oak woodland, mostly <i>Callitris glaucophylla</i> and <i>Eucalyptus crebra</i> with a subcanopy of <i>Allocasuarina luehmannii</i> ; occasionally <i>E. pilligaensis</i> , <i>E. sideroxylon</i> or <i>E. blakelyi</i> may be locally common; infrequently <i>Callitris endlicheri</i> , <i>E. conica</i> , <i>Angophora floribunda</i> , <i>E. fibrosa</i> , <i>Casuarina cristata</i> or <i>E. melliodora</i> ; Northern floodplain woodland, dominated by <i>Eucalyptus camaldulensis</i> , occasionally with <i>Callitris glaucophylla</i> , <i>Casuarina cunninghamiana</i> , <i>E. melliodora</i> , <i>Corymbia tessellaris</i> ; rarely <i>Allocasuarina luehmannii</i> , <i>Angophora floribunda</i> , <i>E. chloroclada</i> ; Pilliga heathy woodland 1, Variously <i>Corymbia trachyphloia</i> , <i>Callitris endlicheri</i> and <i>Eucalyptus fibrosa</i> ; occasionally <i>Callitris glaucophylla</i> , <i>E. chloroclada</i> , <i>E. dwyeri</i> , <i>E. crebra</i> ; infrequently <i>E. blakelyi</i> , <i>E. macrorhyncha</i> , <i>Angophora floribunda</i> , <i>E. rossii</i> ; Riparian angophora woodland, mostly <i>Angophora floribunda</i> with <i>Eucalyptus blakelyi</i> or <i>Callitris glaucophylla</i> ; occasionally <i>Callitris endlicheri</i> , <i>E. chloroclada</i> , <i>E. melliodora</i> , <i>E. crebra</i> ; Pilliga cypress grass/herb woodland, usually <i>Callitris glaucophylla</i> with <i>Eucalyptus albens</i> or occasionally <i>E. crebra</i> . A very wide range of other species may occur locally and may sometimes be locally dominant, including <i>E. melanophloia</i> , <i>E. chloroclada</i> , <i>Angophora floribunda</i> , <i>E. blakelyi</i> , <i>E. melliodora</i> , <i>E. pilligaensis</i> and <i>E. conica</i> ; Pilliga grassy cypress woodland, usually dominated by <i>Callitris glaucophylla</i> , often with <i>Eucalyptus crebra</i> and a subcanopy of <i>Allocasuarina luehmannii</i> ; occasionally <i>Callitris endlicheri</i> , <i>E. albens</i> , <i>E. blakelyi</i> , <i>E. conica</i> ; infrequently <i>E. populnea</i> subsp. <i>bimbil</i> , <i>E. fibrosa</i> , <i>E. pilligaensis</i> ; bcz, Pilliga ironbark woodland, usually <i>Eucalyptus fibrosa</i> and <i>E. trachyphloia</i> with <i>Callitris glaucophylla</i> ,	



occasionally *Eucalyptus viridis*; Northern cypress grass/shrub woodland, Various *Callitris endlicheri*, *Callitris glaucophylla*, *Angophora leiocarpa*, *Eucalyptus chloroclada*, *Corymbia trachyphloia*; occasionally *E. crebra*, *E. dealbata*; infrequently *Corymbia dolichocarpa*, *E. melanophloia*, *E. sideroxylon*.

Land use	not recorded		
Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	low to moderate
Cultivation limitation	moderate to high	Fertility	low
Qualities and limitations			
<i>Landscape</i>			
Steep slopes	not assessed	Mass movement hazard	not assessed
Rock outcrop hazard	not assessed	Rockfall hazard	not assessed
Foundation hazard	not assessed	Woody weeds	localised
Complex terrain	not assessed	Dieback	localised
Productive arable land	not assessed		
<i>Hydrology</i>			
Poor moisture availability	widespread	Shallow soils	not observed
High watertables	not observed	Waterlogging	not observed
Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
Flood hazard	localised	Recharge zone	widespread
Discharge zone	not observed		
<i>Erosion</i>			
Wind erosion hazard	localised	Wave erosion hazard	not assessed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	localised		
<i>Salinity</i>			
Salinity hazard	localised	Seepage scalds	not observed



Summary

Landscape

Level stagnant alluvial plain of Quaternary alluvium from outcrops of Jurassic Garrawilla basalt and minor Cox’s Creek alluvium in the Mullaley Hills. Local relief less than 3m, slopes <1%. Elevation ranges from 255 – 340 m. Mostly open woodland, 95% cleared for cultivation and grazing.

Soils

giant, moderately well to imperfectly drained, calcareous Epipedal Black Vertosols (Black Earths) in upper and midplain areas, with giant, imperfectly drained, Epipedal Brown Vertosols (Brown Clays) and giant, poorly drained, calcareous Self mulching Grey Vertosols (Grey Clays) in lower areas and near drainage lines.

Geology and Regolith

Quaternary alluvium derived from of the Jurassic Garrawilla Volcanics near the Pilliga State Forest and, in lower plain areas, from basaltic Cox’s Creek floodplain alluvium, deposited when flow rates in Cox’s Creek were greater. Pilliga Outwash material has covered much of the original plain area, including many of the stream lines which once deposited alluvium on the plain. Alluvium depth ranges from less than 10 m on the upper Willala Watercourse up to 100 m near Cox’s Creek.

Vegetation

Open and closed woodland and grassland 90% cleared for agriculture. Eucalyptus populnea (bimble box), E. pilligaensis (pilliga grey box/ narrow-leaved grey box), Alectryon oleifolius (western rosewood), Geijera parviflora (wilga), Acacia homalophylla (yarran), and Acacia pendula (weeping myall) are dominant. E. camaldulensis (river red gum) and E. melliodora (yellow box) are present near major stream lines. Groundcover species include Austrostipa aristiglumis (plains grass), Dichanthium sericeum (Queensland bluegrass), Chloris truncata (windmill grass), Chloris ventricosa (tall windmill grass), Austrostipa setacea (corkscrew grass), Aristida vagans (threeawn speargrass), Austrodanthonia spp. (wallaby grasses) and Juncus spp. (rushes). Pandorea pandorana (wonga wonga vine) occurs along fencelines throughout the area.

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

not recorded

Cultivation limitation

not recorded

Fertility

not recorded

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

not observed

Rockfall hazard

not observed

Foundation hazard

not observed

Woody weeds

not observed

Complex terrain

not assessed

Dieback

not assessed

Productive arable land

not assessed

Hydrology

Poor moisture availability

not assessed

Shallow soils

not observed

High watertables

not observed

Waterlogging

not observed

Seasonal waterlogging

not observed

Groundwater pollution hazard

not observed

Flood hazard

not observed

Recharge zone

not assessed

Discharge zone

not observed

Erosion

Wind erosion hazard

widespread

Wave erosion hazard

not observed



Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		
<i>Salinity</i>			
Salinity hazard	not observed	Seepage scalds	not observed



Summary

Landscape

Moderately to steeply inclined midslopes below Triassic and Jurassic sandstone escarpments on large hills and mountains. Local relief ranges from 80 - 120 m, slope range predominantly 32 - 56% but some areas ranging from 12 - 80% occur, elevation range 260 - 560 m. Largely uncleared open-forest and woodland with relict rainforest species along deeply incised drainage lines.

Soils

Deep (>150 cm) to extremely shallow (<10 cm) soils which are extremely variable. Some soil types encountered include Earthy Sands (Sandy Tenosols and Rudosols), Yellow Earths (Yellow Kandosols) and Red Podzolics (Red Chromosols and Kurosols).

Geology and Regolith

Colluvium derived from lithic and quartzose sandstones, conglomerates, and shales from Permian, Triassic and Jurassic sandstone cliffs. All exhibit extreme variation from lithic to quartzose phases. The lithic and quartzose phases of the Digby Beds (Triassic) can be seen reflected in the shape of the cliffs skirting Long Mountain.

Vegetation

Varied, but commonly occurs as largely uncleared open-woodland, with pockets of open-forest. Species location is dependent largely on microhabitat along the slope. Species encountered include *Ficus rubiginosa* (port jackson fig), *Angophora floribunda* (rough-barked apple), *Eucalyptus blakelyi* (blakely's red gum), *Eucalyptus albens* (white box), *Eucalyptus pilligaensis* (pilliga box), *Eucalyptus trachyphloia* (brown bloodwood--Pilliga sandstone only), *Macrozamia* spp. (cycads--Pilliga Sandstone only), *Brachychiton populneus* (kurrajong), *Heterodendron oleifolium* (rosewood), *Notelaea microcarpa* (native olive), *Alphitonia excelsa* (red ash), *Callitris glaucophylla* (white cypress pine), *Callitris endlicheri* (black cypress pine), *Geijera parviflora* (wilga), *Dodonea viscosa* (giant hopbush), *Eremophila mitchellii* (budda), *Acacia cheelii* (motherumbah), *Rhagodia parabollica* (fragrant saltbush), *Ehretia membranifolia* (peach bush), *Leichhardtia australis* (native pear), *Cassia nemophila* var. *nemophila* (desert cassia), *Clematis microphylla* var. *microphylla* (small-leaf clematis) and *Pandorea pandorana* (wonga wonga vine). Ground cover species include *Aristida* spp. (wire grasses), *Danthonia* spp. (wallaby grasses), *Abutilon oxycarpum* (flannel weed), *Cantium odoratum* (iamboto), *Capillipedium spicigerum* (scented-top grass) and *Stipa* spp. (spear grasses).

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

moderate to extreme

Cultivation limitation

extreme

Fertility

low

Qualities and limitations

Landscape

Steep slopes

widespread

Mass movement hazard

widespread

Rock outcrop hazard

localised

Rockfall hazard

widespread

Foundation hazard

not observed

Woody weeds

localised

Complex terrain

not assessed

Dieback

not assessed

Productive arable land

not assessed

Hydrology

Poor moisture availability

widespread

Shallow soils

widespread

High watertables

not observed

Waterlogging

not observed

Seasonal waterlogging

not observed

Groundwater pollution hazard

not observed



Flood hazard	not observed	Recharge zone	localised
Discharge zone	not observed		
<i>Erosion</i>			
Wind erosion hazard	not observed	Wave erosion hazard	not observed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		
<i>Salinity</i>			
Salinity hazard	not observed	Seepage scalds	not observed



Summary

Landscape

Alluvial plains, confined floodplains, incised floodplains, and alluvial fan complexes on Quaternary basaltic alluvium from Jurassic Garrawilla Basalts of the Mullaley Hills, with minor Jurassic Pilliga and Purlewaugh sandstone influences. Local relief less than 3 m; elevation 300 - 320 m; slopes less than 2%. Woodland and grassland 95% cleared for cultivation.

Soils

Soils types are locally extensive, with changes occurring across 100's of metres, and vary with plain position. Soil are generally giant and have calcareous subsoils. Moderately well drained Self-mulching Red Vertosols (Red Clays) are present on upper plain sections, with Self-mulching Brown Vertosols (Brown Clays) on mid to upper plains. Imperfectly drained Self-mulching Black Vertosols (Black Earths) are found on mid – to lower plains. Poorly drained Self-mulching Grey Vertosols are found on lower plains, particularly adjacent to streamlines and landscape boundaries where waterlogging occurs. Imperfectly drained Stratic Rudosols (Alluvial Soils) with varving and gravel layers are present along streamlines.

Geology and Regolith

Alluvial plains and alluvial fan complexes formed on Quaternary alluvium from the Jurassic Garrawilla Volcanics present on the eastern edge of the Pilliga Nature Reserve, with minor influence from Jurassic Pilliga and Purlewaugh sandstone and mudstone beds. Groundwater seeps are present in localised areas where sub-surface flow is impeded by basaltic rises. Alluvium depth is greater than 5 m.

Vegetation

Open woodland and grassland, 95% cleared for cropping and grazing. Eucalyptus populnea (bimble box), Eucalyptus albens (white box), Alectryon oleifolius (western rosewood), Casuarina cristata (belah), Acacia pendula (weeping myall), Geijera parviflora (wilga), and Acacia homalophylla (yarran) dominate the upper strata. Eucalyptus camaldulensis (river red gum) and Eucalyptus melliodora (yellow box) are found along drainage lines. Groundcover consists of Austrostipa aristiglumis (plains grass) dominates the grasslands, with Dichanthium sericeum (Queensland bluegrass), Chloris spp. (windmill grass), Bothriochloa macra (red grass), Panicum spp. (panics), Aristida spp. (wiregrasses), Austrodanthonia spp. (wallaby grasses) and Marsilea drummondii (common nardoo) present.

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low

Cultivation limitation

low to moderate

Fertility

high

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

not observed

Rockfall hazard

not observed

Foundation hazard

widespread

Woody weeds

not observed

Complex terrain

not assessed

Dieback

not assessed

Productive arable land

localised

Hydrology

Poor moisture availability

not assessed

Shallow soils

not observed

High watertables

localised

Waterlogging

localised

Seasonal waterlogging

localised

Groundwater pollution hazard

not observed

Flood hazard

widespread

Recharge zone

widespread



Discharge zone localised

Erosion

Wind erosion hazard not observed

Wave erosion hazard not observed

Gully erosion hazard localised

Sheet erosion hazard localised

Streambank erosion hazard localised

Salinity

Salinity hazard localised

Seepage scalds localised



Summary

Landscape

Broad (>500 m), very gently to gently inclined drainage plains and alluvial fans below footslopes of Permian and Triassic lithic and quartzose sandstone hills. Local relief to 60 m, slopes 1 - 5%, elevation range 290 - 380 m. Woodland and open-forest about 50% cleared for grazing and occasional cultivation.

Soils

Soils highly variable and dependent largely on lithology of catchment from which fan material has been derived. Predominantly deep (>1.5 m) yellow Solodic Soils (Sodosols), Red-brown Earths (Brwon Chromosols²), Earthy Sands (Sandy Tenosols) and deep Alluvial Soils (Dermosols). These soils are often underlain by buried soils indicating a repetitive cycle of denudation of landscapes in the surrounding catchments.

Geology and Regolith

Quaternary alluvium derived from Triassic and Permian sandstones. This alluvium is deposited as a series of interlocking alluvial fans below true footslope units.

Vegetation

Open-woodland and woodland approximately 50% cleared for grazing. Species present include Eucalyptus populnea (bimble box), Eucalyptus pilligaensis (pilliga box), Eucalyptus melliodora (yellow box), Eucalyptus blakelyi (blakely's red gum), Eucalyptus albens (white box), Eucalyptus crebra (narrow-leaved ironbark - Triassic sandstone derived sediments), Casuarina cristata (belah), Pittosporum phillyreoides (bitterbush), Brachychiton populneus (kurrajong), Notelaea microcarpa (native olive), Heterodendron oleifolium (western rosewood) and Dodonea viscosa (giant hopbush). Ground cover species include Stipa verticillata (slender bamboo grass), Aristida spp. (wire grasses), Cymbopogon refractus (barbed-wire grass), Eragrostis spp. (love grasses), and Bothriochloa decipiens (red grass).

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

moderate to low

Cultivation limitation

moderate to high

Fertility

variable

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

not observed

Rockfall hazard

not observed

Foundation hazard

localised

Woody weeds

localised

Complex terrain

not assessed

Dieback

localised

Productive arable land

not assessed

Hydrology

Poor moisture availability

localised

Shallow soils

not observed

High watertables

localised

Waterlogging

not observed

Seasonal waterlogging

localised

Groundwater pollution hazard

not observed

Flood hazard

localised

Recharge zone

widespread

Discharge zone

localised

Erosion

Wind erosion hazard

not observed

Wave erosion hazard

not observed

Gully erosion hazard

localised

Sheet erosion hazard

widespread

Streambank erosion hazard

not assessed



Salinity

Salinity hazard

localised

Seepage scalds

localised



Summary

Landscape Erosional midslopes on undulating rises and low hills of Jurassic Garrawilla Volcanics in the Mullaley Hills. Local relief 10 – 100 m; elevation ???m; slopes 3 – 10%. Linear gilgai are occasionally present. Open woodland, 95% cleared for cultivation and grazing.

Soils Soils vary with slope position. Moderately deep, rapidly drained Red Ferrosols and Dermosols (Euchrozems) occur on crests and upper slopes. Moderate to very deep, well drained Red Vertosols (Red Clays) occur on upper and midslopes. Deep, moderately well drained Brown Vertosols (Brown Clays), imperfectly drained Self-mulching Black Vertosols (Black Earths) and poorly drained Self-mulching Grey Vertosols (Grey Clays) occur in progressively lower positions on midslopes.

Geology and Regolith not recorded

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	low
Cultivation limitation	moderate to high	Fertility	variable

Qualities and limitations

Landscape

Steep slopes	not assessed	Mass movement hazard	not assessed
Rock outcrop hazard	not assessed	Rockfall hazard	not assessed
Foundation hazard	widespread	Woody weeds	not assessed
Complex terrain	not assessed	Dieback	localised
Productive arable land	not assessed		

Hydrology

Poor moisture availability	localised	Shallow soils	not assessed
High watertables	not assessed	Waterlogging	not assessed
Seasonal waterlogging	not assessed	Groundwater pollution hazard	not assessed
Flood hazard	not assessed	Recharge zone	widespread
Discharge zone	not assessed		

Erosion

Wind erosion hazard	not assessed	Wave erosion hazard	not assessed
Gully erosion hazard	widespread	Sheet erosion hazard	widespread
Streambank erosion hazard	localised		

Salinity

Salinity hazard	localised	Seepage scalds	not observed
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gyu	GOALLY	Erosional
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Summary

Landscape

Erosional midslopes on undulating rises and low hills of Jurassic Garrawilla Volcanics in the Mullaley Hills. Local relief 10 – 100 m; elevation ???m; slopes 3 – 10%. Linear gilgai are occasionally present. Open woodland, 95% cleared for cultivation and grazing.

Soils

Soils vary with slope position. Moderately deep, rapidly drained Red Ferrosols and Dermosols (Euchrozems) occur on crests and upper slopes. Moderate to very deep, well drained Red Vertosols (Red Clays) occur on upper and midslopes. Deep, moderately well drained Brown Vertosols (Brown Clays), imperfectly drained Self-mulching Black Vertosols (Black Earths) and poorly drained Self-mulching Grey Vertosols (Grey Clays) occur in progressively lower positions on midslopes.

Geology and Regolith

not recorded

Vegetation

not recorded

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low

Cultivation limitation

moderate to high

Fertility

variable

Qualities and limitations

Landscape

Steep slopes

not assessed

Mass movement hazard

not assessed

Rock outcrop hazard

not assessed

Rockfall hazard

not assessed

Foundation hazard

widespread

Woody weeds

not assessed

Complex terrain

not assessed

Dieback

localised

Productive arable land

not assessed

Hydrology

Poor moisture availability

localised

Shallow soils

not assessed

High watertables

not assessed

Waterlogging

not assessed

Seasonal waterlogging

not assessed

Groundwater pollution hazard

not assessed

Flood hazard

not assessed

Recharge zone

widespread

Discharge zone

not assessed

Erosion

Wind erosion hazard

not assessed

Wave erosion hazard

not assessed

Gully erosion hazard

widespread

Sheet erosion hazard

widespread

Streambank erosion hazard

localised

Salinity

Salinity hazard

localised

Seepage scalds

not observed



Summary

Landscape Steep variant of Kamilaroi Soil Landscape with slopes above 8%.

Soils not recorded

Geology and Regolith Rn_GIL

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	localised	Mass movement hazard	not observed
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Rock outcrop hazard	not observed	Rockfall hazard	not observed
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Foundation hazard	not observed	Woody weeds	localised
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Complex terrain	not assessed	Dieback	not assessed
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Productive arable land	not assessed		
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Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
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High watertables	not observed	Waterlogging	not observed
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Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
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Flood hazard	not observed	Recharge zone	not assessed
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Discharge zone	not observed		
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Erosion

Wind erosion hazard	localised	Wave erosion hazard	not observed
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Gully erosion hazard	widespread	Sheet erosion hazard	widespread
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Streambank erosion hazard	not assessed		
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Salinity

Salinity hazard	not observed	Seepage scalds	not observed
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Summary**Landscape**

Level to gently inclined lower footslopes, drainage plains, and alluvial fans on Quaternary alluvium derived from Jurassic and minor Tertiary basalts of the Mullaley Hills and Liverpool Plains. Local relief <3 m, slopes 0–2%, elevation range 259–300 m. Closed-grassland mostly cleared for agriculture.

Soils

Soils vary across the landscape with slope position. Giant, imperfectly drained calcareous Self-mulching Black Vertosols (Black Earths) dominate the landscape. Giant, well drained calcareous Self-mulching Brown and occasional Red Vertosols (Brown and Red Clays) are present on lower footslopes and upper drainage plains, and adjacent to basalt and sandstone rises. Giant, poorly drained calcareous Self-mulching Grey Vertosols (Grey Clays) occur in slow-draining areas, often on lower drainage plains.

Geology and Regolith

Fine Quaternary alluvium derived from the Jurassic Garrawilla basalts, with influences from Tertiary volcanics along the Cox's Creek floodplain. The dominant soil parent materials are clays and fine silts, with small amounts of sand. This alluvium varies greatly in depth but is generally between 40 and 100 m deep near the Cox's Creek floodplain (Broughton, 1994) and overlying Jurassic Garrawilla basalts and Triassic sandstone. In contrast, soil depths on lower footslopes and upper drainage plains have been observed as low as 0.3 m over weathered basalt and occasional travertine deposits (Pengelly, 2003a). The travertine is thought to have precipitated from groundwater escaping from fractured volcanic rock aquifers.

Vegetation

Open woodland and grassland, 95% cleared for cropping and grazing. Eucalyptus populnea (bimble box), Eucalyptus albens (white box), Alectryon oleifolius (western rosewood/ bonaree), Casuarina cristata (belah), Geijera parviflora (wilga), Acacia pendula (weeping myall), and Acacia homalophylla (yarran) dominate the upper strata. Eucalyptus camaldulensis (river red gum) and Eucalyptus melliodora (yellow box) are found along drainage lines, with Callitris glaucophylla (white cypress pine) and Brachychiton populneus (kurrajong) on well drained soils. Cymbidium sp. (black orchid) is found on Eucalyptus spp. (Eucalypts). Groundcover on dark cracking clay soils consists of Austrostipa aristiglumis (plains grass), Dichanthium sericeum (Queensland bluegrass), Panicum spp. (panics), and Marsillea drummondii (common nardoo). Bothriochloa macra (red grass/ red-leg grass), Austrodanthonia spp. (wallaby grasses) and Chloris spp. (windmill grasses) are found on all soil types, with Aristida spp. (wiregrasses/ threeawn grasses/ kerosene grasses) on lower fertility soils. Juncus sp. (rush) occurs in waterlogged or poorly drained positions.

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low

Cultivation limitation

low

Fertility

high

Qualities and limitations**Landscape**

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

not observed

Rockfall hazard

not observed

Foundation hazard

widespread

Woody weeds

not observed

Complex terrain

not assessed

Dieback

widespread

Productive arable land

widespread

Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
High watertables	localised	Waterlogging	not observed
Seasonal waterlogging	localised	Groundwater pollution hazard	not observed
Flood hazard	widespread	Recharge zone	widespread
Discharge zone	localised		
<i>Erosion</i>			
Wind erosion hazard	widespread	Wave erosion hazard	not observed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		
<i>Salinity</i>			
Salinity hazard	widespread	Seepage scalds	localised



Irxa	LESLIES ROAD VARIANT A	Not recorded
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Summary

Landscape Variant of Leslie Road soil landscape which is an older alluvial landscape north east of Mullaley with little recent alluvium and low flood frequency.

Soils not recorded

Geology and Regolith not recorded

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	not recorded	Mass movement hazard	not recorded
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Rock outcrop hazard	not recorded	Rockfall hazard	not recorded
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Foundation hazard	not recorded	Woody weeds	not recorded
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Complex terrain	not recorded	Dieback	not recorded
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Productive arable land	not recorded		
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Hydrology

Poor moisture availability	not recorded	Shallow soils	not recorded
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High watertables	not recorded	Waterlogging	not recorded
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Seasonal waterlogging	not recorded	Groundwater pollution hazard	not recorded
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Flood hazard	not recorded	Recharge zone	not recorded
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Discharge zone	not recorded		
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Erosion

Wind erosion hazard	not recorded	Wave erosion hazard	not recorded
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Gully erosion hazard	not recorded	Sheet erosion hazard	not recorded
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Streambank erosion hazard	not recorded		
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Salinity

Salinity hazard	not recorded	Seepage scalds	not recorded
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Summary

Landscape

Gently to moderately inclined, very long (1 000 - 5 000 m) footslopes and drainage plains of the Liverpool Ranges. Derived from Tertiary basalt, dolerite and tuff alluvium of the Liverpool Range Beds. Local relief <90 m, slopes 2 - 8%, rock outcrop <5%, elevation range 320 - 680 m. Open-woodland with patches of closed-grassland and isolated trees mostly cleared for grazing and cultivation.

Soils

Individual soil types are generally extensive and related to position on footslope. The footslopes and drainage plains that dominate this landscape are characterised by deep, imperfectly to poorly drained calcareous Self-mulching Black Vertosols (Black Earths). Where bedrock is close to the surface, moderately deep, moderately well drained Epicalcareous Self-mulching Red and Brown Vertosols (Red and Brown Clays) can occur. Red Vertosols (Red Clays) also occur on alluvium and coluvium derived from red basaltic breccia. Saline, poorly drained Self-mulching Grey Vertosols (Grey Clays) are common at footslope-plain junctions and areas of constricted groundwater flow.

Geology and Regolith

Tertiary basalts of the Liverpool Range Beds. The dominant components are basalts, dolerites and tuffs. Mid to lower footslopes are covered with Quaternary alluvium derived from these materials. Soil depths are generally >200 cm, increasing to >500 cm on long lower footslopes. Depth to strongly weathered basaltic bedrock on upper slopes and in upper catchments is generally <300 cm. On lower footslopes, particularly on the margins of the plains, soil and unconsolidated material depth may exceed 10 m before encountering strongly weathered fractured bedrock.

Vegetation

Open-woodland with patches of closed grassland 70% cleared for grazing and cultivation. Dominant tree species is Eucalyptus albens (white box), with some Brachychiton populneus (kurrajong), Acacia pendula (weeping myall), Acacia decora (western golden wattle/ graceful wattle), Geijera parviflora (wilga), Alectryon oleifolius (western rosewood/ bonaree), Casuarina sp. (casuarina/ oak) and Notelaea microcarpa (native olive). Ground cover species include Austrostipa aristiglumis (plains grass), Austrostipa spp. (speargrasses), Panicum spp. (panics), Chloris spp. (windmill grasses), and Austrodanthonia spp. (wallaby grasses).

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low

Cultivation limitation

low to moderate

Fertility

high

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

localised

Rockfall hazard

not observed

Foundation hazard

widespread

Woody weeds

not observed

Complex terrain

not assessed

Dieback

localised

Productive arable land

localised

Hydrology

Poor moisture availability

not assessed

Shallow soils

localised

High watertables

localised

Waterlogging

not observed

Seasonal waterlogging

widespread

Groundwater pollution hazard

not observed



Flood hazard	localised	Recharge zone	widespread
Discharge zone	widespread		
<i>Erosion</i>			
Wind erosion hazard	localised	Wave erosion hazard	not observed
Gully erosion hazard	widespread	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		
<i>Salinity</i>			
Salinity hazard	widespread	Seepage scalds	localised



Ics	LOWER COXS	Alluvial
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Summary

Landscape

Extensive level alluvial plains, localised stagnant alluvial plains, and inset flood plains on Cox’s Creek Quaternary basaltic alluvium in the Liverpool Plains. Local relief <5 m; elevation 235 – 275 m; slopes <1%. Prior streams and very shallow drainage lines are also present. Native grassland and woodland mostly cleared for agriculture.

Soils

Giant, moderately well drained Self-mulching Black Vertosols (Black Earths) are dominant, with giant, moderately well drained Self-mulching Grey Vertosols (Grey Clays) present along drainage lines, and giant, well drained Epipedal Brown Vertosols (Brown Clays) in isolated pockets throughout the landscape.

Geology and Regolith

Quaternary volcanic alluvium derived from the Liverpool Range Tertiary Basalts and Jurassic Garrawilla Volcanics. The Cox’s Creek catchment has a higher sand and gravel content in the deeper aquifers than many of the other catchments within the Liverpool Plains (Ringrose-Voase et al, 2000). Sodic and saline layers are common within 2 m of the soil surface. Unconsolidated alluvium depths exceed 100 m in some areas (Broughton, 1994). The floodplain is currently being eroded down from a previously higher elevation, creating inset floodplains along stream channels, and elevated plains and stranded alluvial terraces in areas outside the current floodplain. The presence of a sandstone ridge under the alluvium surface and running along a line from Red Hill to “Red Knob” affects subsurface drainage and the availability of groundwater in plain sections to the east of this line. The ridge’s highest points are currently visible as the sandstone “islands” within the plain, such as Red Hill.

Vegetation

Original vegetation community types are controlled by flood height and frequency, with most removed for cropping. Extensive grasslands are dominant, with areas of open woodland in areas of less frequent flooding. Eucalyptus populnea (bimble box) is the dominant tree species, with Angophora floribunda (rough-barked apple) and E. microcarpa (western grey box) also present, and E. melliodora (yellow box) where drainage is impeded. E. camaldulensis (river red gum), E. camaldulensis var. obtusa (river red gum) and Casuarina cunninghamiana (river oak) are dominant in areas of high flood frequency. Major groundcover species include Austrostipa aristiglumis (plains grass), Dichanthium sericeum (Queensland bluegrass), Austrostipa setacea (corkscrew grass), Chloris truncata (windmill grass), and Marsilea drummondii (common nardoo), with Juncus spp. (rushes) in periodically waterlogged areas.

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low to moderate

Cultivation limitation

low

Fertility

high

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

not observed

Rockfall hazard

not observed

Foundation hazard

widespread

Woody weeds

not observed

Complex terrain

not assessed

Dieback

widespread

Productive arable land

widespread

Hydrology



Poor moisture availability	not assessed	Shallow soils	not observed
High watertables	localised	Waterlogging	localised
Seasonal waterlogging	localised	Groundwater pollution hazard	not observed
Flood hazard	widespread	Recharge zone	widespread
Discharge zone	localised		
<i>Erosion</i>			
Wind erosion hazard	not observed	Wave erosion hazard	not observed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	localised		
<i>Salinity</i>			
Salinity hazard	localised	Seepage scalds	localised



Summary

Landscape Inset floodplains of Cox’s Creek and Quia Creek with increased flooding hazard.

Soils not recorded

Geology and Regolith Quaternary volcanic alluvium derived from the Liverpool Range Tertiary Basalts and Jurassic Garrawilla Volcanics. The Cox’s Creek catchment has a higher sand and gravel content in the deeper aquifers than many of the other catchments within the Liverpool Plains (Ringrose-Voase et al, 2000). Sodic and saline layers are common within 2 m of the soil surface. Unconsolidated alluvium depths exceed 100 m in some areas (Broughton, 1994). The floodplain is currently being eroded down from a previously higher elevation, creating inset floodplains along stream channels, and elevated plains and stranded alluvial terraces in areas outside the current floodplain. The presence of a sandstone ridge under the alluvium surface and running along a line from Red Hill to “Red Knob” affects subsurface drainage and the availability of groundwater in plain sections to the east of this line. The ridge’s highest points are currently visible as the sandstone “islands” within the plain, such as Red Hill.

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	not observed	Mass movement hazard	not observed
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Rock outcrop hazard	not observed	Rockfall hazard	not observed
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Foundation hazard	not observed	Woody weeds	not observed
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Complex terrain	not assessed	Dieback	not assessed
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Productive arable land	not assessed		
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Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
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High watertables	not observed	Waterlogging	localised
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Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
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Flood hazard	widespread	Recharge zone	not assessed
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Discharge zone	not observed		
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Erosion

Wind erosion hazard	not observed	Wave erosion hazard	not observed
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Gully erosion hazard	localised	Sheet erosion hazard	not observed
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Streambank erosion hazard	not assessed		
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Salinity

Salinity hazard	localised	Seepage scalds	not observed
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Summary

Landscape Prior stream channel element variant of Cox's Creek soil landscape, generally of relatively poor drainage and lower fertility.

Soils not recorded

Geology and Regolith Qa_LNE

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	not observed	Mass movement hazard	not observed
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Rock outcrop hazard	not observed	Rockfall hazard	not observed
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Foundation hazard	not observed	Woody weeds	not observed
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Complex terrain	not assessed	Dieback	not assessed
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Productive arable land	not assessed		
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Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
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High watertables	not observed	Waterlogging	localised
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Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
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Flood hazard	widespread	Recharge zone	not assessed
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Discharge zone	not observed		
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Erosion

Wind erosion hazard	not observed	Wave erosion hazard	not observed
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Gully erosion hazard	localised	Sheet erosion hazard	not observed
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Streambank erosion hazard	not assessed		
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Salinity

Salinity hazard	localised	Seepage scalds	not observed
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mmv	MOUNT MILBULLA	Erosional
Summary		
Landscape	Steep rises and hills on Jurassic basalts and dolerites of the Garrawilla Volcanics. Local relief to 90 m, slopes 10 - 85%, elevation range 260 - 379 m, up to 50% rock outcrop. Open woodland, mostly cleared or thinned for grazing.	
Soils	Soils vary with landscape position and are typically gravelly. Shallow, well drained Orthic Tenosols and Leptic Rudosols (Lithosols) occur in exposed positions. Rapidly drained Red Ferrosols and Dermosols (Euchrozems and Lithosols) occur on weathered basalt outcrops. Shallow to moderately deep Black Vertosols and Dermosols (Black Earths and Prairie Soils) and Brown Dermosols (Brown Clays and Prairie Soils) occur throughout the landscape.	
Geology and Regolith	The geological information for the Mount Milbulla soil landscape is predominantly from Bean (1974) which contains a detailed study of the igneous geologies across much of the Tambar Springs 1:100 000 Map Sheet. Residual weathered basalt flows and sills of the Jurassic Garrawilla Volcanics and weathered fine- to coarse-grained dolerite and basalt plugs, sills, and minor flows of the Jurassic Glenrowan Intrusives. Isolated occurrences of fine-grained, olivine-rich Limburgite of the Jurassic Napperby Limburgite is also included. Sideslopes are a mixture of bare rock and basalt colluvial material. Often present as rock outcrops above Triassic sandstones in the Goolhi and Mary's Mount districts. The Garrawilla Volcanics occur throughout the Tambar Springs 1:100 000 Map Sheet, whilst the Glenrowan Intrusives are concentrated around "Cambewarra" and Picnic Hill, southwest of Goolhi, and are often associated with the Kamilaroi (km) soil landscape. There is only one occurrence of Napperby Limburgite, near the "Napperby" homestead. The Glenrowan Intrusives and the Napperby Limburgites have been included in the Mount Milbulla soil landscape due to their similar landform, soil, and colluvium characteristics. These hills and outcrops are commonly sites for fractured rock aquifer recharge. Multiple flow faces can be seen at some locations, such as "Kilchurn". Exposed rock outcrops and stones are often coated with iron. Soil depth varies from 0.1 – 1 m, with weakly to strongly weathered basalt bedrock encountered below this. A thin (<0.3 m) layer of basaltic saprolite is occasionally present below the solum.	
Vegetation	Mostly cleared woodland with mixed shrub and grass understorey. Tree and shrub species include <i>Eucalyptus blakelyi</i> (blakely's red gum), <i>Eucalyptus dealbata</i> (tumbledown gum/ hill red gum), <i>Eucalyptus populnea</i> (bimble box), <i>Eucalyptus melanophloia</i> (silver-leaved ironbark), <i>Eucalyptus albens</i> (white box), <i>Eucalyptus melliodora</i> (yellow box), <i>Angophora floribunda</i> (rough-barked apple), <i>Callitris glaucophylla</i> (white cypress pine), <i>Callitris endlicheri</i> (black cypress pine), <i>Eremophylla mitchellii</i> (budda), <i>Geijera parviflora</i> (wilga), <i>Alectryon oleifolius</i> (western rosewood/ bonaree), <i>Brachychiton populneus</i> (kurrajong), <i>Acacia pendula</i> (weeping myall), <i>Notelaea microcarpa</i> (native olive) and <i>Capparis mitchellii</i> (native orange/ wild orange). Major grass species include <i>Austrostipa aristiglumis</i> (plains grass), <i>Austrostipa</i> spp. (speargrasses), <i>Aristida vagans</i> (threeawn speargrass), and <i>Aristida</i> spp. (wiregrasses/ threeawn grasses/ kerosene grasses). <i>Bothriochloa macra</i> (red grass/ red-leg grass), <i>Dicanthium sericeum</i> (Queensland bluegrass), <i>Cymbopogon refractus</i> (barbed wire grass), <i>Themeda australis</i> (kangaroo grass), <i>Eragrostis</i> spp. (love grasses), <i>Austrodanthonia</i> spp. (wallaby grasses), <i>Panicum</i> spp. (panics), <i>Wahlenbergia gracilis</i> (Australian bluebell/ sprawling bluebell) and <i>Lomandra filiformis</i> (wattle mat-rush/ lomandra) also occur in localised areas.	
Land use	not recorded	
Land degradation	not recorded	
Land capability		



Rural land capability	not recorded	Grazing limitations	moderate to extreme
Cultivation limitation	very high to extreme	Fertility	variable
Qualities and limitations			
<i>Landscape</i>			
Steep slopes	widespread	Mass movement hazard	localised
Rock outcrop hazard	localised	Rockfall hazard	localised
Foundation hazard	widespread	Woody weeds	localised
Complex terrain	not assessed	Dieback	not assessed
Productive arable land	not assessed		
<i>Hydrology</i>			
Poor moisture availability	localised	Shallow soils	localised
High watertables	not observed	Waterlogging	not observed
Seasonal waterlogging	not observed	Groundwater pollution hazard	localised
Flood hazard	not observed	Recharge zone	localised
Discharge zone	not observed		
<i>Erosion</i>			
Wind erosion hazard	localised	Wave erosion hazard	not observed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		
<i>Salinity</i>			
Salinity hazard	not observed	Seepage scalds	not observed



mnz	MOAN		Erosional
Summary			
Landscape	Rolling hills, low hills and hill slopes on Tertiary basalts of the Liverpool Ranges. Total relief < 280 m, local relief 40 - 90 m, elevation 400 - 800 m, slopes 10 - 33 %. Slopes are benched, crests are convex, drainage lines are predominantly unidirectional, mostly cleared woodland with occasional open forest at higher elevations.		
Soils	Very shallow to moderately deep (15 - >70 cm), well to moderately well drained Black Dermosols (Chocolate Soils and Black Earths) on mid to lower slopes. Shallow to moderately deep (20 - > 60 cm), moderately well drained, Red Dermosols (Red Clays and Euchrozems) on crests, upper and midslopes. Very shallow (<20 cm), moderately well drained, Leptic Tenosols (Lithosols) on crests, upper slopes, leading edges of flow benches and areas associated with rock outcrop. Shallow (40 cm), moderately well drained, Red Dermosols (Chocolate Soils) in drainage lines. Occasional deep (>110 cm), moderately well drained, Brown Vertosols (Brown Clays) in mid slope positions.		
Geology and Regolith	Liverpool Range Beds (T1)--Tertiary (Eocene) basalts, dolerites tuffs and boles. Depth to bedrock is generally < 2m. Soil is often underlain by a layer of basaltic saprolite (generally < 1m) before encountering faintly weathered fractured basalt.		
Vegetation	Open-woodland and woodland mostly cleared for grazing. The dominant species in this landscape is <i>Eucalyptus albens</i> (white box). Other common tree species include <i>Angophora floribunda</i> (rough-barked apple), <i>Eucalyptus tereticornis</i> (forest red gum), <i>Eucalyptus blakelyi</i> (blakely's red gum), <i>Eucalyptus melliodora</i> (yellow box), <i>Eucalyptus macrorrhyncha</i> subsp. <i>macrorrhyncha</i> (red stringybark), <i>Brachychiton populneus</i> (kurrajong), and <i>Notelaea microcarpa</i> (native olive). Occasional <i>Callitris glaucophylla</i> (white cypress pine), <i>Eucalyptus populnea</i> (poplar box), <i>Eucalyptus sideroxylon</i> (mugga ironbark) and <i>Eucalyptus moluccana</i> (grey box) may be found. Common understorey species include <i>Hymenanthera dentata</i> (tree violet), <i>Cassinia laevis</i> (cough bush) and localised <i>Xanthorrhoea</i> sp. (grass tree) on rocky sites. <i>Eucalyptus laevopinea</i> (silvertop stringybark) may be found in areas of cold air drainage. Common native grasses include <i>Stipa aristiglumis</i> (plains grass), <i>Aristida ramosa</i> (three-awn spear grass), <i>Dicanthium sericium</i> (queensland blue grass), <i>Stipa</i> sp. (spear grass), <i>Themeda australis</i> (kangaroo grass), <i>Stipa verticillata</i> (slender bamboo grass), <i>Danthonia</i> sp. (wallaby grass) <i>Chloris truncata</i> (couch grass) and <i>Chloris ventricosa</i> (tall windmill grass). Other herbs include <i>Swainsonia galegifolia</i> (smooth darling pea), <i>Pimela</i> sp. (rice flower) and <i>Urtica incisa</i> (stinging nettle).		
Land use	not recorded		
Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	low to high
Cultivation limitation	very high to extreme	Fertility	moderate
Qualities and limitations			
<i>Landscape</i>			
Steep slopes	localised	Mass movement hazard	localised
Rock outcrop hazard	localised	Rockfall hazard	localised
Foundation hazard	localised	Woody weeds	localised
Complex terrain	not observed	Dieback	not observed
Productive arable land	not observed		
<i>Hydrology</i>			



Poor moisture availability	localised	Shallow soils	localised
High watertables	not observed	Waterlogging	not observed
Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
Flood hazard	not observed	Recharge zone	widespread
Discharge zone	not observed		
<i>Erosion</i>			
Wind erosion hazard	not observed	Wave erosion hazard	not observed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	not observed		
<i>Salinity</i>			
Salinity hazard	not observed	Seepage scalds	not observed



Summary

Landscape

Broad, very gently to gently inclined, very long (500 – 2 000 m) footslopes on alluvium and colluvium from the Jurassic basalts of the Garrawilla Volcanics in the Mullaley Hills. Landscape is composed mainly of coalescing alluvial fans. Local relief to 80 m; slopes 0 - 8%; elevation 250 - 400 m. Closed- grassland with scattered trees and open-woodland on upper footslopes mostly cleared for agriculture.

Soils

very shallow, well drained Inceptic Orthic Tenosols (Lithosols) are present in steep, upper sections. Moderately shallow to deep, rapidly drained Red Ferrosols (Euchrozems) can be found on isolated rises and upper footslopes. Very deep, well drained calcareous Red Vertosols (Red Clays) are present in upper to mid slope areas, with very deep, moderately well drained Self-mulching and Epipedal Grey, Brown and Black Vertosols (Grey Clays, Brown Clays and Black Earths) throughout. Grey Vertosols (Grey Clays) are often associated with calcareous marls at seepage points.

Geology and Regolith

Jurassic basalts, dolerites, and tuffs of the Garrawilla Volcanics, and associated alluvium. The fractured basalts and dolerites of this group are important saline aquifers and recharge areas. Exposed (such as that present at “Quia”) and near-surface dykes and sills can be found in isolated areas. The highly weathered state of the basalts in some areas are likely to give rise to the Ferrosol (Euchrozem) soils associated with these geologies (Shafer, 1973). Bedrock is often within 20 cm on upper footslopes, however lower footslopes often have over 10 m of alluvium. Solum depth exceeds 5 m on these lower positions. Some small benches are present where Triassic Narrabeen sandstone and Digby conglomerate beds occur close to the soil surface below basalt hills, such as at Bald Hill. These are a common cause of springs where groundwater flow is impeded.

Vegetation

Closed-grassland with scattered trees on darker soils, and open-woodland on well drained or shallow slopes. Mostly cleared for agriculture. Dominant tree and shrub species present on shallow or well drained soils such as Red Ferrosols (Euchrozems) and Red Vertosols (Red Clays) include *Callitris glaucophylla* (white cypress pine), *Callitris endlicheri* (black cypress pine), *Brachychiton populneus* (kurrajong), *Geijera parviflora* (wilga), *Eucalyptus melanophloia* (silver-leaved ironbark), *E. albens* (white box), *Capparis mitchellii* (native orange/ wild orange) and *Notelaea microcarpa* (native olive). *E. melliodora* (yellow box) is also present on these soils near junctions with soils of poorer drainage. Groundcover consists of *Aristida vagans* (threeawn speargrass), *Austrostipa verticillata* (slender bamboo grass), *Bothriochloa macra* (red grass) and *Austrostipa setacea* (corkscrew grass). On darker soils, upper strata are dominated by *Eucalyptus albens* (white box), *E. melliodora* (yellow box), *E. populnea* (bimble box), *Acacia pendula* (weeping myall), *Alectryon oleifolius* (western rosewood), *Geijera parviflora* (wilga) and *Casuarina cristata* (belah). The dominant ground cover species is *Austrostipa aristiglumis* (plains grass). Other common ground cover species include *Panicum* spp. (panics), *Dicanthium sericeum* (Queensland bluegrass), *Chloris* spp. (windmill grasses), *Aristida* spp. (wiregrasses), *Austrostipa* spp. (speargrasses) and *Austrodanthonia* spp. (wallaby grasses).

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low

Cultivation limitation

low to moderate

Fertility

high



Qualities and limitations

Landscape

Steep slopes	not observed	Mass movement hazard	not observed
Rock outcrop hazard	not observed	Rockfall hazard	not observed
Foundation hazard	widespread	Woody weeds	not observed
Complex terrain	not assessed	Dieback	localised
Productive arable land	not assessed		

Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
High watertables	localised	Waterlogging	not observed
Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
Flood hazard	not observed	Recharge zone	widespread
Discharge zone	not observed		

Erosion

Wind erosion hazard	widespread	Wave erosion hazard	not observed
Gully erosion hazard	widespread	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		

Salinity

Salinity hazard	widespread	Seepage scalds	localised
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Summary

Landscape Red clayey variant of Noojee soil landscape comprised of Footslopes and alluvial fans comprised of a high proportion of Red Ferrosols (Euchrozems).

Soils not recorded

Geology and Regolith Jg_GIL

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	not observed	Mass movement hazard	not observed
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Rock outcrop hazard	not observed	Rockfall hazard	not observed
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Foundation hazard	not observed	Woody weeds	not observed
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Complex terrain	not assessed	Dieback	not assessed
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Productive arable land	not assessed		
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Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
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High watertables	localised	Waterlogging	not observed
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Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
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Flood hazard	not observed	Recharge zone	not assessed
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Discharge zone	not observed		
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Erosion

Wind erosion hazard	widespread	Wave erosion hazard	not observed
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Gully erosion hazard	not observed	Sheet erosion hazard	not observed
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Streambank erosion hazard	not assessed		
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Salinity

Salinity hazard	widespread	Seepage scalds	not observed
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Summary

Landscape Gilgai variant of Noojee soil landscape comprised of footslopes dominated by linear gilgai.

Soils not recorded

Geology and Regolith Jg_GIL

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	not observed	Mass movement hazard	not observed
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Rock outcrop hazard	not observed	Rockfall hazard	not observed
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Foundation hazard	not observed	Woody weeds	not observed
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Complex terrain	not assessed	Dieback	not assessed
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Productive arable land	not assessed		
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Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
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High watertables	localised	Waterlogging	not observed
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Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
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Flood hazard	not observed	Recharge zone	not assessed
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Discharge zone	not observed		
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Erosion

Wind erosion hazard	widespread	Wave erosion hazard	not observed
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Gully erosion hazard	not observed	Sheet erosion hazard	not observed
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Streambank erosion hazard	not assessed		
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Salinity

Salinity hazard	widespread	Seepage scalds	not observed
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Summary

Landscape

Rolling to precipitous low hills and mountains of the Jurassic Nombi extrusives in the Mullaley Hills, often conical in shape. Local relief 30 – 330 m; elevation 700-1000m; slopes 10 - >100%; rock outcrop generally >50%. Predominantly closed woodland, with occasional dry rainforest communities in sheltered gullies, approximately 20% cleared for grazing on lower slopes.

Soils

Very shallow, rapidly drained Leptic Rudosols (Lithosols) dominate crests, upper slopes and plugs, grading into shallow, moderately well drained Red Dermosols (Chocolate Soils) on lower slopes.

Geology and Regolith

Jurassic Nombi extrusives of the Bulga Complex, comprising phonolite and trachyte and occasional trachyandesite. These rock formations generally have larger crystals due to the slow extrusion process from which they were formed. This slow extrusion from a central vent has given these hills their characteristic conical shape. Steep-sided occurrences are examples of exposure of the volcanic plugs that occur below the lava flows on these hills. The extrusion of these volcanics occurred after the more violent formation of the Jurassic Garrawilla Volcanics. Subsequent erosion of the Garrawilla basalts has exposed the more resistant Bulga Complex flows and plugs (Nombi extrusives), which project over 100 m above the surrounding landscape. The extrusion process caused localised disruption of the surrounding sedimentary hills. Tilting, uplifting, and overturning of these geologies is common adjacent to Bulga complex members. Several examples, such as Ratz Castle Mountain, have Triassic Digby conglomerate “collars”, which are many metres higher than unaffected Digby beds (Bean, 1974). Some aeolian dust deposition has occurred on localised exposed slopes, giving topsoils a higher than expected silt content.

Vegetation

Closed woodland and occasional dry rainforest communities in sheltered areas, approximately 20% cleared for grazing purposes. Lower slopes are dominated by *Eucalyptus albens* (white box), with groundcover consisting of *Austrostipa aristiglumis* (plains grass), *Austrostipa* spp. (speargrasses), *Austrodanthonia* spp. (wallaby grasses), *Bothriochloa* sp. (red grass/ bluegrass), *Dichanthium sericeum* (Queensland bluegrass), and *Cyperus* spp. (sedges). Upper slopes and crests have less fertile soils and are dominated by *Callitris* spp. (cypress pines) and *Geijera parviflora* (wilga). Groundcover species include *Austrostipa verticillata* (slender bamboo grass), *Aristida vagans* (threeawn speargrass) and *Cymbopogon refractus* (barbed wire grass), with occasional *Lomandra filiformis* (wattle mat-rush/ lomandra). *Eucalyptus dealbata* (tumbledown gum/ hill red gum), *Alectryon oleifolius* (western rosewood/ bonaree), *Brachychiton populneus* (kurrajong) and *Wahlenbergia gracilis* (Australian bluebell/ sprawling bluebell) are found throughout the landscape. Species such as *Ficus* spp. (figs), *Alphitonia excelsa* (red ash), *Canthium oleifolium* (wild lemon/ native lemon) and *Ataylaya hemiglauca* (whitewood) are present in dry rainforest areas and on rock outcrops. A number of forb and legume species were identified in this landscape, and are listed in Bean and Whalley (2001).

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

not recorded

Cultivation limitation

not recorded

Fertility

not recorded

Qualities and limitations



Landscape

Steep slopes	widespread	Mass movement hazard	widespread
Rock outcrop hazard	widespread	Rockfall hazard	widespread
Foundation hazard	not observed	Woody weeds	not observed
Complex terrain	not assessed	Dieback	not assessed
Productive arable land	not assessed		

Hydrology

Poor moisture availability	not assessed	Shallow soils	localised
High watertables	not observed	Waterlogging	not observed
Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
Flood hazard	not observed	Recharge zone	not assessed
Discharge zone	not observed		

Erosion

Wind erosion hazard	not observed	Wave erosion hazard	not observed
Gully erosion hazard	not observed	Sheet erosion hazard	not observed
Streambank erosion hazard	not assessed		

Salinity

Salinity hazard	not observed	Seepage scalds	not observed
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Summary

Landscape Rocky variant of Nombi Soil Landscape with greater than 70% rock outcrop.

Soils not recorded

Geology and Regolith p_GIL

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	widespread	Mass movement hazard	widespread
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Rock outcrop hazard	widespread	Rockfall hazard	widespread
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Foundation hazard	not observed	Woody weeds	widespread
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Complex terrain	not assessed	Dieback	not assessed
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Productive arable land	not assessed		
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Hydrology

Poor moisture availability	not assessed	Shallow soils	widespread
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High watertables	not observed	Waterlogging	not observed
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Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
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Flood hazard	not observed	Recharge zone	not assessed
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Discharge zone	not observed		
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Erosion

Wind erosion hazard	widespread	Wave erosion hazard	not observed
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Gully erosion hazard	not observed	Sheet erosion hazard	widespread
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Streambank erosion hazard	not assessed		
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Salinity

Salinity hazard	not observed	Seepage scalds	not observed
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Summary

Landscape Variant of Nobi Soil Landscape comprised of spines of phonolyte and trachyte with slopes greater than 100% and rock outcrop greater than 80%.

Soils not recorded

Geology and Regolith p_GIL

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	widespread	Mass movement hazard	widespread
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Rock outcrop hazard	widespread	Rockfall hazard	widespread
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Foundation hazard	not observed	Woody weeds	localised
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Complex terrain	not assessed	Dieback	not assessed
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Productive arable land	not assessed		
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Hydrology

Poor moisture availability	not assessed	Shallow soils	widespread
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High watertables	not observed	Waterlogging	not observed
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Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
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Flood hazard	not observed	Recharge zone	not assessed
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Discharge zone	not observed		
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Erosion

Wind erosion hazard	localised	Wave erosion hazard	not observed
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Gully erosion hazard	not observed	Sheet erosion hazard	not observed
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Streambank erosion hazard	not assessed		
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Salinity

Salinity hazard	not observed	Seepage scalds	not observed
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Summary

Landscape Low rises variant of Nombi soil landscape comprised of phonolyte and trachyte with similar shapes to the larger occurrences of Nombi (nb) soil landscape.

Soils not recorded

Geology and Regolith not recorded

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	not recorded	Mass movement hazard	not recorded
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Rock outcrop hazard	not recorded	Rockfall hazard	not recorded
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Foundation hazard	not recorded	Woody weeds	not recorded
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Complex terrain	not recorded	Dieback	not recorded
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Productive arable land	not recorded		
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Hydrology

Poor moisture availability	not recorded	Shallow soils	not recorded
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High watertables	not recorded	Waterlogging	not recorded
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Seasonal waterlogging	not recorded	Groundwater pollution hazard	not recorded
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Flood hazard	not recorded	Recharge zone	not recorded
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Discharge zone	not recorded		
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Erosion

Wind erosion hazard	not recorded	Wave erosion hazard	not recorded
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Gully erosion hazard	not recorded	Sheet erosion hazard	not recorded
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Streambank erosion hazard	not recorded		
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Salinity

Salinity hazard	not recorded	Seepage scalds	not recorded
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Summary

Landscape

Alluvial floodplains, open depressions, oxbows, raised alluvial terraces and stagnant alluvial plains on Quaternary alluvium derived from Jurassic Garrawilla Volcanics in the Mullaley Hills. Local relief less than 10 m; elevation 340 - 460m; slopes less than 2%. Levees are commonly present in mid and lower plain areas. Grassland and occasional woodland, predominantly cleared for agriculture.

Soils

Soils are locally extensive and vary with catchment position. Giant, well drained calcareous Self-mulching Red Vertosols (Red Clays) occur on lower plains, with giant, moderately well to imperfectly drained Self-mulching Black Vertosols (Black Earths) in mid and upper plain positions. Giant, moderately well drained calcareous Stratic Rudosols (Alluvial Soils) occur along streamlines.

Geology and Regolith

Quaternary alluvium and gravel derived from Jurassic Garrawilla basalts. Depth to basalt bedrock often exceeds 15 m on mid to lower plains, with less than 5 m in upper catchment areas. Gravel layers often line streambeds. This is a major recharge zone for the fractured volcanic rock aquifers that underlie the alluvium.

Vegetation

Grassland and woodland, approximately 60% cleared or thinned for grazing. Dominant tree species include Angophora floribunda (rough-barked apple), Eucalyptus blakelyi (blakely's red gum), Eucalyptus camaldulensis (river red gum), Eucalyptus melliodora (yellow box), Eucalyptus albens (white box), Acacia pendula (weeping myall), Alectryon oleifolius (western rosewood/ bonaree), Brachychiton populneus (kurrajong), and Casuarina cristata (belah). Austrostipa aristiglumis (plains grass) dominates groundcover in grasslands and woodlands, with Chloris truncata (windmill grass), Dichanthium sericeum (Queensland bluegrass), Austrodanthonia spp. (wallaby grasses), and Enneapogon nigricans (niggerheads) also.

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low

Cultivation limitation

moderate to high

Fertility

high

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

localised

Rockfall hazard

not observed

Foundation hazard

widespread

Woody weeds

localised

Complex terrain

not assessed

Dieback

localised

Productive arable land

not assessed

Hydrology

Poor moisture availability

not assessed

Shallow soils

localised

High watertables

localised

Waterlogging

not observed

Seasonal waterlogging

localised

Groundwater pollution hazard

not observed

Flood hazard

widespread

Recharge zone

widespread

Discharge zone

localised

Erosion



Wind erosion hazard	not observed	Wave erosion hazard	not observed
Gully erosion hazard	widespread	Sheet erosion hazard	widespread
Streambank erosion hazard	localised		
<i>Salinity</i>			
Salinity hazard	localised	Seepage scalds	localised



Summary

Landscape

Long (500 – 3000 m) gently inclined footslopes and alluvial fans derived from Triassic Narrabeen sandstone and Digby conglomerate rises and low hills of the Curlewis Hills. Local relief 10 – 50 m; elevation range 240 – 360; slopes 0.5 – 8%. Woodland and open-woodland, 85% cleared or for grazing and cropping.

Soils

Upper footslopes are dominated by well drained deep Red Kandosols (Red Earths). The dominant soils on the footslopes are deep to very deep well drained Red Chromosols (Red-brown Earths), with occasional Red Dermosols (Euchrozems) occurring where there is a basalt influence on the slope. Lower footslope positions tend to be dominated by poorly drained very deep Brown Sodosols (Solodic Soils). Some Vertosols occur in the landscape along the western map margin, but these are unusual and very small in extent.

Geology and Regolith

Quaternary alluvium and colluvium from Triassic lithic sandstones, conglomerates and mudstone. Alluvium and colluvium overlies unweathered sandstone and mudstones at up to 5 m depth. Small volcanic sills and dykes can interrupt some parts of this landscape such as adjacent to the Goolhi Road at “Collygra” where the extent of a dyke is shown by a line of greener pastures or crops during dry periods.

Vegetation

Woodland and open-woodland, 85% cleared for grazing and cultivation. Upper strata species include Eucalyptus melanophloia (silver-leaf ironbark), Eucalyptus populnea (bimble box), Eucalyptus albens (white box), Eucalyptus dealbata (tumbledown gum/hill red gum), Eucalyptus melliodora (yellow box), Eucalyptus microcarpa (western grey box), Eucalyptus pilligaensis (pilliga grey box), Brachychiton populneus (kurrajong), Geijera parviflora (wilga), Callitris glaucophylla (white cypress pine), Notelaea microcarpa (native olive), Casuarina cristata (belah), Casuarina luehmannii (bull oak), Acacia hakeoides (western black wattle), and Cassinia laevis (cough-bush). Dominant groundcover species include Austrostipa verticillata (slender bamboo grass), Chloris spp. (windmill grass), Austrodanthonia spp. (wallaby grass), Bothriochloa macra (red grass), and Dicanthium sericeum (Queensland blue grass). Hyparrhenia hirta (coolatai grass), is spreading throughout the area, and could potentially become a major environmental and agricultural weed. Regrowth of Callitris glaucophylla (white cypress pine) and Cassinia laevis (cough bush) is common in the landscape. Of note is the presence of Cymbidium sp. (black orchid), growing as an epiphyte on the trunks and branches of Eucalyptus spp, and isolated clumps of Acacia harpophylla (brigalow) on lower footslopes.

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low

Cultivation limitation

moderate to high

Fertility

moderate

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

not observed

Rockfall hazard

not observed

Foundation hazard

localised

Woody weeds

localised

Complex terrain

not assessed

Dieback

localised

Productive arable land

not assessed

Hydrology



Poor moisture availability	not assessed	Shallow soils	not observed
High watertables	localised	Waterlogging	localised
Seasonal waterlogging	localised	Groundwater pollution hazard	not observed
Flood hazard	localised	Recharge zone	localised
Discharge zone	localised		
<i>Erosion</i>			
Wind erosion hazard	localised	Wave erosion hazard	not observed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		
<i>Salinity</i>			
Salinity hazard	localised	Seepage scalds	localised



Summary

Landscape

Meandering streamlines, narrow floodplains, and oxbows of Saltwater Creek on mixed alluvium derived from predominantly Jurassic Garrawilla basalts and some Jurassic Purlewaugh and Pilliga sandstones and shales in the Mullaley Hills and Trinkey Hills. Local relief less than 10 m; elevation 380 – 540 m; slopes less than 3%. High salt levels are common. Open grassland on floodplains, and open woodland along streamlines, approximately 80% cleared or thinned for grazing and occasional cultivation.

Soils

Soils are locally extensive and vary with landscape position. Deep to giant, imperfectly drained Stratic Rudosols (Alluvial Soils) occur along streams, with deep to giant, imperfectly drained Self-mulching Black and Red Vertosols (Black Earths and Red Clays) and occasional Brown Vertosols (Brown Clays) on floodplains. Rare deep, poorly drained Sodosols (Solodic Soils and Soloths) may occur sporadically on floodplains adjacent to sedimentary hills and footslopes.

Geology and Regolith

Mixed Quaternary alluvium derived from mainly Jurassic Garrawilla basalts, with variable Jurassic Purlewaugh and Pilliga sandstone and shale influences. Depth of alluvium is variable, but can be less than 2 m where Saltwater Creek flows near volcanic rises and hills, evidenced by the presence of bedrock in streams. Generally alluvium depth ranges from 2 m in upper sections to greater than 10 m on lower plains, and overlies both basalt and sedimentary material. Gravel and sand lenses occur within the soil. These rock types often have high salt levels, which greatly contribute to the salt loads in Saltwater Creek. The salts are generally transported via groundwater flows to the creek, which is significantly lower than any other area in the landscape. Shallow groundwater tables are common, being recorded within 55 cm of the soil surface. Scarps are occasionally present along Saltwater Creek, and are a combination of basalt flow edges and incision of the creek bed. These scarps are over 5 m high in some cases, such as 1 km east of “Mentone”.

Vegetation

Grassland and open woodland, 80% cleared or thinned. Dominant tree species include Angophora floribunda (rough-barked apple), Eucalyptus melliodora (yellow box), E. camaldulensis (river red gum), E. blakelyi (blakely’s red gum) and Casuarina spp. (casuarinas/ oaks) near streamlines, with Brachychiton populneus (kurrajong), Geijera parviflora (wilga), E. albens (white box), and Schinus areira (pepper tree) throughout. Ground cover is dominated by Austrostipa aristiglumis (plains grass). Dichanthium sericeum (Queensland bluegrass), Bothriochloa macra (red grass/ red-leg grass), and Chloris truncata (windmill grass) are also present. Pennisetum clandestinum (kikuyu) and Juncus spp. (rushes) occur in saline or waterlogged areas.

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low to moderate

Cultivation limitation

high to very high

Fertility

variable

Qualities and limitations

Landscape

Steep slopes

not assessed

Mass movement hazard

not assessed

Rock outcrop hazard

not assessed

Rockfall hazard

not assessed

Foundation hazard

widespread

Woody weeds

not assessed

Complex terrain

not assessed

Dieback

localised



Productive arable land not assessed

Hydrology

Poor moisture availability localised
High watertables widespread
Seasonal waterlogging widespread
Flood hazard widespread
Discharge zone widespread

Shallow soils localised
Waterlogging localised
Groundwater pollution hazard not assessed
Recharge zone widespread

Erosion

Wind erosion hazard not assessed
Gully erosion hazard localised
Streambank erosion hazard widespread

Wave erosion hazard not assessed
Sheet erosion hazard widespread

Salinity

Salinity hazard widespread

Seepage scalds localised



sgz	STAFFORD GAP		Erosional
Summary			
Landscape	Undulating rises to rolling low hills on Triassic lithic and quartz sandstones and conglomerates of the Narrabeen and Digby formations. Local relief to 160 m; slopes 3 - 20%; elevation range 250 - 760 m; rock outcrop <20%. Low scarps (< 10 m) are present in association with bedding planes. Open- and closed-woodland approximately 80% cleared for grazing and agriculture.		
Soils	Pengelly and King (in press) state the following for this landscape. Shallow to moderately deep, moderately well drained Red and Brown Chromosols (Non-calcic Brown Soils) and Red and Brown Sodosols (Solonetz) occupy crests. Moderately to very deep, moderately well drained Red and Brown Chromosols (Red-brown Earths and Non-calcic Brown Soils); Red, Brown, and Grey Sodosols (Solonetz, Red-brown Earths and Non-calcic Brown Soils); and localised well drained Red Ferrosols (Euchrozems) occur on upper and midslopes. Very deep, moderately well drained Brown Dermosols (affinity Red-brown Earths) produced by severe sheet erosion are also found in these areas. Localised very deep, moderately well drained Brown Vertosols (Brown Clays) are present at junctions with alluvial plains. Localised very deep, imperfectly drained gravelly Self-mulching Black and Grey Vertosols (Black Earths) and friable, very gravelly, rapidly drained Brown Chromosols (Non-calcic Brown Soils) are found on isolated upper hillslopes and benches in association with fine grained conglomerate beds. Moderately deep, well drained Orthic Tenosols (Earthy Sands) are present in small areas throughout the landscape, with very shallow, rapidly drained Leptic Rudosols (Lithosols) on steep slopes and rock outcrops. Profiles in this soil landscape: sites 698, 699		
Geology and Regolith	Rns, Napperby Formation, (sandstone, siltstone), Pps, Porcupine Formation, (conglomerate, sandstone), minor occurrences of Tnt1, unnamed, (hawaiite, andesite, tristanite, trachyte).		
Vegetation	The majority of this landscape is a species diverse multi-layered woodland, much of which has been logged. A smaller area has been cleared for cropping and grazing. A good example of native vegetation in this landscape was found in Deriah Community Conservation Area. The multi-layered woodlands are dominated by White box (<i>Eucalyptus albens</i>), and White cypress (<i>Callitris glaucophylla</i>). Subdominant species include Narrow-leaved ironbark (<i>E. crebra</i>), Kurrajong (<i>Brachychiton populneus</i>), Rough-bark Apple (<i>Angophora floribunda</i>), and the vulnerable tree Ooline (<i>Cadellia pentastylis</i>). There are two shrub layers < 2m & < 5m tall. The dominant shrubs are Hop Bush (<i>Dodonaea viscosa</i> subsp. <i>angustifolia</i>), and Sticky wallaby bush (<i>Beyeria viscosa</i>). Occasional species are: Sticky daisy bush (<i>Olearia elliptica</i>), Native Olive (<i>Notelaea microcarpa</i>), Curracabah (<i>Acacia leiocalyx</i>), Western Golden wattle (<i>Acacia decora</i>), Native cherry (<i>Exocarpos cupressiformis</i>), Wilga (<i>Geijera parviflora</i>), Cassia sp., Iamboto (<i>Canthium odoratum</i>), Whitewood (<i>Atalaya hemiglauca</i>), Poison pimelea (<i>Pimelea neo-anglica</i>), and Urn heath (<i>Melichrus urceolatus</i>). Ground cover vegetation is sparse; litter and bare soil dominate the surface, cryptogamic algae and lichen are common. Common plants include Rock fern (<i>Cheilanthes sieberi</i> ssp <i>sieberi</i>), <i>Desmodium</i> sp., Wire grass (<i>Aristida ramosa</i>), Wallaby grass (<i>Austrodanthonia</i> sp.), Snow grass (<i>Poa sieberiana</i>), Barbwire grass (<i>Cymbopogon refractus</i>), <i>Aristida</i> sp., Tall Windmill grass (<i>Chloris ventricosa</i>), Blue -flax lily (<i>Dianella revoluta</i> var <i>revoluta</i>), and <i>Lomandra</i> sp. Remnants in this landscape have few weeds present.		
Land use	not recorded		
Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	low to moderate



Cultivation limitation	moderate to extreme	Fertility	variable
Qualities and limitations			
<i>Landscape</i>			
Steep slopes	localised	Mass movement hazard	localised
Rock outcrop hazard	widespread	Rockfall hazard	widespread
Foundation hazard	not observed	Woody weeds	localised
Complex terrain	not observed	Dieback	not observed
Productive arable land	not observed		
<i>Hydrology</i>			
Poor moisture availability	widespread	Shallow soils	widespread
High watertables	localised	Waterlogging	not observed
Seasonal waterlogging	localised	Groundwater pollution hazard	not observed
Flood hazard	localised	Recharge zone	widespread
Discharge zone	localised		
<i>Erosion</i>			
Wind erosion hazard	localised	Wave erosion hazard	not observed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	not observed		
<i>Salinity</i>			
Salinity hazard	localised	Seepage scalds	localised



Summary

Landscape Residual plateaux variant of Stafford Gap Soil Landscape with slopes less than 3%

Soils not recorded

Geology and Regolith not recorded

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	not observed	Mass movement hazard	not observed
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Rock outcrop hazard	not observed	Rockfall hazard	not observed
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Foundation hazard	not observed	Woody weeds	localised
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Complex terrain	not assessed	Dieback	not assessed
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Productive arable land	not assessed		
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Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
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High watertables	not observed	Waterlogging	not observed
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Seasonal waterlogging	widespread	Groundwater pollution hazard	not observed
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Flood hazard	not observed	Recharge zone	not assessed
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Discharge zone	widespread		
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Erosion

Wind erosion hazard	localised	Wave erosion hazard	not observed
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Gully erosion hazard	localised	Sheet erosion hazard	widespread
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Streambank erosion hazard	not assessed		
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Salinity

Salinity hazard	not observed	Seepage scalds	not observed
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Summary

Landscape Colluvial variant of Stafford Gap Soil Landscape with slopes greater than 20% and >20% rock outcrop, including scarps. .

Soils not recorded

Geology and Regolith not recorded

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	widespread	Mass movement hazard	widespread
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Rock outcrop hazard	widespread	Rockfall hazard	widespread
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Foundation hazard	widespread	Woody weeds	widespread
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Complex terrain	not assessed	Dieback	not assessed
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Productive arable land	not assessed		
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Hydrology

Poor moisture availability	not assessed	Shallow soils	widespread
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High watertables	not observed	Waterlogging	not observed
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Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
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Flood hazard	not observed	Recharge zone	not assessed
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Discharge zone	not observed		
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Erosion

Wind erosion hazard	widespread	Wave erosion hazard	not observed
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Gully erosion hazard	not observed	Sheet erosion hazard	widespread
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Streambank erosion hazard	not assessed		
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Salinity

Salinity hazard	not observed	Seepage scalds	not observed
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Summary

Landscape

Broad drainage plains and fans on mixed Quaternary alluvium derived from Jurassic Pilliga sandstones and Tertiary basalts in the Trinkey Hills. Local relief less than 10 m; elevation 380 - 500 m; slopes less than 5%. Shallow groundwater is common on lower slopes. Open woodland and grassland, 90% cleared for grazing and occasional cropping.

Soils

individual soil types are extensive. Deep to giant, imperfectly drained Self-mulching Black Vertosols (Black Earths) and poorly drained Self-mulching Grey Vertosols (Grey Clays) are present on basaltic alluvium. Moderately deep to giant, imperfectly drained Brown and Yellow Sodosols and Chromosols (Solonetz) occur on sedimentary alluvium, with deep to giant, imperfectly drained Stratic Rudosols (Alluvial Soils) on mixed alluvium.

Geology and Regolith

Mixed Quaternary alluvium derived from Jurassic Pilliga sandstone beds and Tertiary basalts, overlying Jurassic sandstone and shale. Alluvium depths range from less than 1 m in upper plains to over 5 m on lower fans. These sediment types are not strongly hydraulically connected, and waterlogging may occur where they meet.

Vegetation

Open woodland and grassland, approximately 90% cleared. Tree species include Eucalyptus melliodora (yellow box), E. albens (white box), E.spp. (red gums), Casuarina cristata (belah), and Brachychiton populneus (kurrajong), with Angophora floribunda (rough-barked apple) near drainage lines. Groundcover species include Aristida vagans (threeawn speargrass), Chloris truncata (windmill grass), Austrostipa spp. (speargrasses) and Eragrostis spp. (love grasses), with Aristida aristiglumis (plains grass) on heavy clay soils. Eleocharis sp. (spike-rush) occurs along stream lines, with Juncus spp. (rushes) in poorly drained areas.

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low to moderate

Cultivation limitation

low to high

Fertility

variable

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

not observed

Rockfall hazard

not observed

Foundation hazard

widespread

Woody weeds

not observed

Complex terrain

not assessed

Dieback

localised

Productive arable land

not assessed

Hydrology

Poor moisture availability

localised

Shallow soils

not observed

High watertables

not observed

Waterlogging

not observed

Seasonal waterlogging

localised

Groundwater pollution hazard

not observed

Flood hazard

localised

Recharge zone

widespread

Discharge zone

localised

Erosion

Wind erosion hazard

localised

Wave erosion hazard

not observed

Gully erosion hazard

localised

Sheet erosion hazard

widespread



Streambank erosion hazard not assessed

Salinity

Salinity hazard localised

Seepage scalds

localised



Summary

Landscape

gently undulating rises on Triassic Narrabeen Sandstones with heavy clay soils of the Curlewis Hills. Local relief 20 - 40 m; elevation 280 - 300 m; slopes 1 -3%. Gently inclined simple slopes 600 – 3000 m long and crests 200m wide. Woodland with grass understorey, mostly cleared for cropping and improved pasture.

Soils

shallow to moderately deep, rapidly drained Eutrophic Red Ferrosols (Euchrozems) on hill crests and upper slopes; with very deep, well drained Epipedal Red Vertosols (Red Clays) on midslopes. Moderately deep, imperfectly drained Black and Grey Vertosols (Black Earths and Grey Clays) are occasionally present on some crests.

Geology and Regolith

Triassic Narrabeen lithic sandstone, shale, silcrete, and jasper and Digby conglomerate of the Gunnedah Basin. Obsidian (volcanic glass) has also been found in localised areas, indicating a volcanic influence in the region, possibly when the landscape was part of lacustrine (still water) environment. Depth to bedrock is generally less than 2m.

Vegetation

Originally open woodland, selectively cleared for cultivation and improved and native pasture. *Brachychiton populneus* (kurrajong) is the main tree species remaining due to its value as fodder for stock, with *Callitris glaucophylla* (white cypress pine), *Eucalyptus melanophloia* (silver-leaved ironbark), *E. populnea* (bimble box), *E. blakelyi* (Blakely’s red gum), *E. albens* (white box), *Casuarina cristata* (belah), *Angophora floribunda* (rough-barked apple), *Geijera parviflora* (wilga), and *Acacia homalophylla* (yarran) also present. Groundcover consists of *Austrostipa verticillata* (slender bamboo grass), *Aristida vagans* (threeawn speargrass), *Chloris truncata* (windmill grass), *Austrostipa setacea* (corkscrew grass), *Austrostipa scabra* (rough speargrass), *Austrodanthonia* spp. (wallaby grasses), *Themeda australis* (kangaroo grass). *Bothriochloa macra* (red grass), and *Eragrostis* spp. (lovegrasses).

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low to moderate

Cultivation limitation

moderate to high

Fertility

variable

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

not observed

Rockfall hazard

not observed

Foundation hazard

widespread

Woody weeds

not observed

Complex terrain

not assessed

Dieback

not assessed

Productive arable land

not assessed

Hydrology

Poor moisture availability

localised

Shallow soils

localised

High watertables

not observed

Waterlogging

not observed

Seasonal waterlogging

localised

Groundwater pollution hazard

not observed

Flood hazard

not observed

Recharge zone

localised

Discharge zone

localised

Erosion

Wind erosion hazard

widespread

Wave erosion hazard

not observed



Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		
<i>Salinity</i>			
Salinity hazard	localised	Seepage scalds	localised



stv	SCRATCH ROAD	Erosional
Summary		
Landscape	Midslopes on undulating rises and low hills of Jurassic Pilliga and occasional Purlewaugh sedimentary beds of the Eastern Pilliga. Slopes 1 – 8%; elevation 320 – 500 m; local relief 10 – 60 m. Open and closed woodlands, and dry sclerophyll forests, with little clearing within the Pilliga East State Forest and Pilliga Nature Reserve.	
Soils	Moderately deep to very deep, well drained to rapidly drained Arenic Orthic Tenosols and Lithic Orthic Tenosols (Earthy Sands) dominate the landscape. Small occurrences of very deep, moderately well drained silty Black Vertosols (No Suitable Group) are present below weathered Purlewaugh shale and sandstone beds.	
Geology and Regolith	Predominantly Jurassic Pilliga quartz and lithic sandstones, with isolated occurrences of Jurassic Purlewaugh sandstones, shales and mudstones. These sediments are easily weathered, leading to moderately deep (>1 m) soils overlying non-weathered sandstone, even on upper midslopes. Depth to bedrock is generally more than 200 cm, although can occur within 100 cm.	
Vegetation	Vegetation communities vary throughout the landscape, which is 10% cleared for grazing. A complete listing of Pilliga vegetation species can be found in Beckers and Binns, 2000. Pengelley and King (In Press) found the following species: Dominant tree species include <i>Eucalyptus pilligaensis</i> (pilliga grey box/ narrow-leaved grey box), <i>E. blakelyi</i> (Blakely's red gum) <i>E. crebra</i> (narrow-leaved ironbark), <i>E. fibrosa</i> (broad-leaved ironbark/ red ironbark), <i>E. dealbata</i> (tumbledown gum/ hill red gum), <i>E. sideroxylon</i> (mugga/ red ironbark), <i>E. microcarpa</i> (western grey box), <i>E. macrorhyncha</i> (red stringybark), <i>Angophora floribunda</i> (rough-barked apple), <i>Alphitonia excelsa</i> (red ash), <i>Callitris glaucophylla</i> (white cypress pine), <i>Callitris endlicheri</i> (black cypress pine), <i>Acacia cheelii</i> (motherumbah), <i>Acacia piligera</i> (wattle), <i>Acacia subulata</i> (awl-leaved wattle), <i>Acacia</i> spp. (wattles), <i>Corymbia trachyphloia</i> (brown bloodwood/ red bloodwood), <i>Casuarina cristata</i> (belah), <i>Allocasuarina luehmannii</i> (bulloak), <i>Allocasuarina distyla</i> (scrub she-oak), <i>Notelaea microcarpa</i> (native olive), and <i>Dodonea viscosa</i> (sticky hop bush). Mid strata species include <i>Cassinia laevis</i> (cough bush), <i>Cassinia arcuata</i> (sifton bush/ chinese shrub), <i>Grevillea floribunda</i> (rusty spider-flower/ seven dwarfs grevillea), <i>Grevillea</i> spp. (Grevilleas), and <i>Xanthorrhoea</i> spp. (grass tree). Groundcover is often sparse, comprising <i>Cymbopogon refractus</i> (barbed wire grass), <i>Poa sieberiana</i> var. <i>hirtella</i> (fine-leaf tussock grass), <i>Poa sieberiana</i> var. <i>sieberiana</i> (fine-leaf tussock grass), <i>Austrostipa setacea</i> (corkscrew grass), <i>Austrodanthonia</i> spp. (wallaby grasses), <i>Aristida vagans</i> (threeawn speargrass), <i>Aristida</i> spp. (wiregrasses), <i>Bothriochloa</i> spp. (bluegrass and red grass), <i>Digitaria</i> spp. (digit grasses), <i>Eragrostis</i> spp (lovegrasses), <i>Themeda australis</i> (kangaroo grass), and <i>Helichrysum bracteatum</i> (golden paper daisy). <i>Chloris truncata</i> (windmill grass) is found in cleared areas utilised for grazing. Of note is the occurrence of <i>Macrozamia</i> sp. (zamia-palm/ cycad), which occur as low fern-like plants with little basal development, and <i>Dianella</i> spp. (flax lilies). Disturbed areas may become overgrown with <i>Acacia triptera</i> (spurwing wattle), a sharp-leaved shrub, which grows in dense thickets. As this landscape extends far into the east pilliga and becomes more diverse, more species than are above listed are encountered including: Pilliga NR heathy woodland, Variously <i>Callitris endlicheri</i> , <i>Corymbia trachyphloia</i> , <i>Eucalyptus crebra</i> and <i>E. chloroclada</i> ; occasionally <i>E. blakelyi</i> , <i>E. melanophloia</i> , <i>E. dealbata</i> , <i>E. macrorhyncha</i> , <i>Callitris glaucophylla</i> or <i>E. fibrosa</i> ; Pilliga heathy woodland 2, Variously <i>Eucalyptus fibrosa</i> , <i>Callitris glaucophylla</i> , <i>E. crebra</i> , <i>Callitris endlicheri</i> or <i>Corymbia trachyphloia</i> ; occasionally <i>E. blakelyi</i> , <i>E. chloroclada</i> , <i>Angophora floribunda</i> or <i>Allocasuarina luehmannii</i> ; rarely <i>Angophora leiocarpa</i> , <i>E. dealbata</i> ; Pilliga heathy woodland 1, Variously <i>Corymbia trachyphloia</i> , <i>Callitris endlicheri</i> and <i>Eucalyptus fibrosa</i> ; occasionally <i>Callitris glaucophylla</i> <i>E. chloroclada</i> , <i>E. dwyeri</i> , <i>E.</i>	



crebra; infrequently E. blakelyi, E. macrorhyncha, Angophora floribunda, E. rossii.

Land use	not recorded		
Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	not recorded
Cultivation limitation	not recorded	Fertility	not recorded
Qualities and limitations			
Landscape			
Steep slopes	not observed	Mass movement hazard	not observed
Rock outcrop hazard	not observed	Rockfall hazard	not observed
Foundation hazard	not observed	Woody weeds	not observed
Complex terrain	not assessed	Dieback	not assessed
Productive arable land	not assessed		
Hydrology			
Poor moisture availability	not assessed	Shallow soils	not observed
High watertables	not observed	Waterlogging	not observed
Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
Flood hazard	not observed	Recharge zone	not assessed
Discharge zone	not observed		
Erosion			
Wind erosion hazard	not observed	Wave erosion hazard	not observed
Gully erosion hazard	not observed	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		
Salinity			
Salinity hazard	not observed	Seepage scalds	not observed



taw	TALLY HO	Residual
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Summary

Landscape

Gently undulating to undulating broad hillcrests, plateaux, and rises on Jurassic basalts, dolerites, tuffs, and tuffaceous lithic sandstones of the Garrawilla Volcanics in the Mullaley Hills. Local relief to 50 m, slopes 1 - 5%, rock outcrop <20%. Open-woodland and closed-grassland mostly cleared for grazing.

Soils

soil types vary with parent material and level of weathering. Very shallow, well drained Leptic Rudosols (Lithosols) and Red Ferrosols (Euchrozems) are present on isolated crests and rises. Deep, moderately well drained Red, Brown, and Black Vertosols (Red and Brown Clays and Black Earths) are present on broader occurrences.

Geology and Regolith

Jurassic basalts, dolerites, tuffs and associated dykes of the Garrawilla Volcanics, with some tuffaceous lithic sandstone and unconsolidated ash deposits along the eastern edge of the Jurassic Pilliga Sandstone beds. Pilliga quartz sandstone cobbles are often present on the soil surface, suggesting that Jurassic Pilliga beds may have overlain the Garrawilla Volcanics at some time. Depth to bedrock is generally less than 1.5 m.

Vegetation

Open-woodland and closed-grassland communities mostly cleared for agriculture and grazing. Dominant woodland species include Eucalyptus albens (white box), E. blakelyi (Blakely's red gum), E. dealbata (tumbledown gum/ hill red gum), E. populnea (bimble box), E. microcarpa (western grey box), Callitris glaucophylla (white cypress pine), Acacia pendula (weeping myall), Geijera parviflora (wilga), Alectryon oleifolius (western rosewood), Alphitonia excelsa (red ash), Schinus areira (pepper tree), Brachychiton populneus (kurrajong), Dodonea viscosa (sticky hobbush), and C. endlicheri (black cypress pine). Isolated pockets of E. melliodora (yellow box) also occur, often below rock outcrops. The dominant ground cover species in grassland areas is Austrostipa aristiglumis (plains grass). Common ground cover species which occur in the woodland communities and as minor species in grassland areas include Panicum spp. (panics), Dicanthium sericeum (Queensland bluegrass), Chloris spp. (windmill grasses), Austrostipa verticillata (slender bamboo grass), Austrostipa spp. (speargrasses), Aristida vagans (threeawn speargrass), Austrodanthonia spp. (wallaby grasses), Austrostipa setacea (corkscrew grass), and Craspedia pleiocephala (soft billy-buttons).

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

not recorded

Cultivation limitation

not recorded

Fertility

not recorded

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

widespread

Rockfall hazard

not observed

Foundation hazard

widespread

Woody weeds

not observed

Complex terrain

not assessed

Dieback

not assessed

Productive arable land

not assessed

Hydrology

Poor moisture availability

not assessed

Shallow soils

localised

High watertables

localised

Waterlogging

not observed



Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
Flood hazard	not observed	Recharge zone	not assessed
Discharge zone	not observed		
<i>Erosion</i>			
Wind erosion hazard	not observed	Wave erosion hazard	not observed
Gully erosion hazard	not observed	Sheet erosion hazard	not observed
Streambank erosion hazard	not assessed		
<i>Salinity</i>			
Salinity hazard	not observed	Seepage scalds	not observed



tawb	TALLY HO VARIANT B		Residual
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Summary

Landscape Undulating to rolling hills. Linear gilgai are common on lower slopes and small upper footslopes. No significant difference from taw.

Soils No significant difference from taw.

Geology and Regolith Jurassic Garrawilla Volcanics dominated by basalts

Vegetation Northern grassy cypress woodland, Callitris glaucophylla with Eucalyptus pilligaensis, E. populnea subsp. bimbil or E. blakelyi or, less frequently, E. crebra, E. sideroxylon or E. conica; Vine thicket, Various Casuarina cristata, Callitris glaucophylla and Eucalyptus albens; occasionally E. melanophloia, E. populnea subsp. bimbil; rarely E. viridis or Corymbia tessellaris; Kaputar shrubby box woodland, usually Eucalyptus albens, often Callitris endlicheri, Angophora floribunda, Callitris glaucophylla, E. crebra or E. dealbata. Other species which may be infrequently locally dominant are E. dwyeri, E. melanophloia, E. laevopinea, E. melliodora, E. prava, E. macrorhyncha, E. volcanica or E. andrewsii; Basalt slopes box woodland, usually dominated by Eucalyptus albens, sometimes with Callitris glaucophylla or Angophora floribunda, or less frequently, Callitris endlicheri. A range of other eucalypts, including E. melliodora, occur infrequently but may be locally common; Eastern clay grassland, Typically a grassland, but sometimes with scattered trees or rarely a woodland overstorey. The most frequent tree species are Callitris glaucophylla, Eucalyptus albens and E. populnea subsp. bimbil. Much less frequent are E. melliodora, E. melanophloia, E. camaldulensis, Corymbia tessellaris and E. crebra.

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability not recorded Grazing limitations not recorded

Cultivation limitation not recorded Fertility not recorded

Qualities and limitations

Landscape

Steep slopes not observed Mass movement hazard not observed

Rock outcrop hazard widespread Rockfall hazard not observed

Foundation hazard widespread Woody weeds not observed

Complex terrain not assessed Dieback not assessed

Productive arable land not assessed

Hydrology

Poor moisture availability not assessed Shallow soils localised

High watertables localised Waterlogging not observed

Seasonal waterlogging not observed Groundwater pollution hazard not observed

Flood hazard not observed Recharge zone not assessed

Discharge zone not observed

Erosion

Wind erosion hazard not observed Wave erosion hazard not observed

Gully erosion hazard not observed Sheet erosion hazard not observed

Streambank erosion hazard not assessed



Salinity

Salinity hazard

not observed

Seepage scalds

not observed



tfy	TRINKEY FOREST	Transferral
Summary		
Landscape	<p>gently inclined footslopes and alluvial fan systems of the Eastern Pilliga and Pilliga Outwash. Derived from quartz and lithic sandstones, silty sandstones and mudstones of the Jurassic Pilliga and Purlewaugh Beds. Local relief to 50 m; slopes <5%; rock outcrop <5%; elevation range 220 - 660 m. Woodland and open-woodland, predominantly cleared outside state forests and nature reserves for grazing and cereal cropping.</p>	
Soils	<p>soil variation is determined by sediment sources and landscape position. Giant, moderately well drained Brown, Red, Grey, and Yellow Sodosols (Solonetz, Solodized Solonetz, Soloths and Solodic Soils) dominate the lower footslopes and alluvial fans. Very deep to giant, moderately well drained Red and Brown Chromosols (Non-calcic Brown Soils, Red-Brown Earths, and Soloths) are found on footslopes, and in isolated pockets on alluvial fans. Very deep, well drained Bleached-Orthic and Bleached-Leptic Tenosols (Siliceous Sands) are present near watercourses within the Eastern Pilliga. Very deep to giant, well drained Arenic Orthic Tenosols (Earthy Sands) are found within the Eastern Pilliga and in isolated pockets on alluvial fans. Very deep, imperfectly drained Brown Kurosols (Soloths) are present along some stream lines.</p>	
Geology and Regolith	<p>Alluvial fan/ footslope complex derived from quartz and lithic sandstones, silty sandstones, shales and mudstones of the Jurassic Purlewaugh beds and Pilliga sandstones, with minor influences from Triassic Narrabeen sandstones. Some minor benching occurs on upper footslopes at the junction of the Pilliga and Purlewaugh metasediments and the underlying Jurassic Garrawilla Volcanics. Total soil depths on lower slopes usually exceed 300 cm, with strongly weathered sandstones being encountered below the solum on footslopes and upper fan systems. Depth to bedrock ranges from 1 m on upper footslopes to greater than 120 m on fan systems with deep alluvium. Minor occurrences of Jurassic basalts can be found on the eastern edge of the Pilliga Nature Reserve, with isolated basaltic and Triassic sandstones and conglomerate rises within the alluvial fan systems. This survey found that the landscape included Jps, Pilliga Sandstone, which includes, Medium to very coarse grained, well sorted, angular to subangular quartzose sandstone. Minor interbeds of mudstone, siltstone and fine grained sandstone and coal. Common carbonaceous fragments and iron staining. Rare lithic fragments. Large scale tabular, clastic sediment, sandstone; Qfpl1, unnamed geological unit, which includes, Texture contrast soils with sand Predominating at the surface (39-43ka), clastic sediment, sand; Qfpl2, unnamed geological unit, which includes, Texture contrast soils with sand Predominating at the surface (39-43ka), clastic sediment, sand; Qrxs1/JKlk, Keelindi beds, which includes, Colluvial polymictic gravel, sand, silt and clay; may include some eluvial in situ regolith deposits OVERLIES Off-White, fine to coarse grained, poorly to well sorted, quartzose sandstone, pebbly sandstone and conglomerate interbedded with minor shale, s, clastic sediment, sandstone, conglomerate; Qrxs1/Jpu, Purlewaugh Formation, which includes, Colluvial polymictic gravel, sand, silt and clay; may include some eluvial in situ regolith deposits OVERLIES Fine to medium grained lithic to labile sandstone thinly interbedded with siltstone, mudstone and thin coal seams. Abundant carbonaceous fragments, clastic sediment, sandstone, siltstone, mudstone, coal; Rns, Napperby Formation, which includes, Finely laminated quartzose sandstone & siltstone interbedded with thick, massive or crossbedded quartzose sandstone. Minor conglomerate, clastic sediment, sandstone and siltstone.</p>	
Vegetation	<p>Published and In Press soil landscape reports for this landscape (Banks, 1994; Townsend and Pengelly, In Press) include the following - Species diverse woodland and open-woodland approximately 60% cleared for grazing and cultivation. Dominant tree and shrub species include Eucalyptus creba (narrow-leaved ironbark),</p>	



Eucalyptus sideroxylon (mugga/ red ironbark), Eucalyptus blakelyi (Blakely's red gum), Eucalyptus albens (white box), Eucalyptus pilligaensis (pilliga box/ narrow-leaved grey box), Eucalyptus microcarpa (western grey box), Eucalyptus conica (fuzzy box), Eucalyptus dealbata (tumbledown gum/ hill red gum), Eucalyptus fibrosa (broad-leaved ironbark/ red ironbark), Eucalyptus macrorhyncha (red stringybark), Eucalyptus populnea (bimble box), Angophora floribunda (rough-barked apple), Corymbia trachyphloia (brown bloodwood/ red bloodwood), Allocasuarina luehmannii (bulloak), Allocasuarina distyla (scrub she-oak), Brachychiton populneus (kurrajong), Callitris glaucophylla (white cypress pine), Callitris endlicheri (black cypress pine), Acacia uncinata (wavy-leaf wattle/ gold-dust wattle), Acacia decora (western golden wattle/ graceful wattle), Acacia hakeoides (western black wattle/hakea wattle), Acacia cheelii (motherumbah), Acacia piligera (wattle), Acacia subulata (awl-leaved wattle), Acacia spp. (wattles), Geijera parviflora (wilga), Eremophila mitchellii (budda), Alphitonia excelsa (red ash), Pittosporum phyllyreoides (butterbush/ bitterbush), Olearia elliptica (sticky daisy bush), Cassinia arcuata (sifton bush/ chinese shrub), Cassinia laevis (cough bush), Cassinia spp. (cough bushes/ sifton bushes), Notelaea microcarpa (native olive), Daviesia sp. (bacon and egg plant), Grevillea floribunda (rusty spider-flower/ seven dwarfs grevillea), Grevillea spp. (grevilleas), and Alectryon oleifolius (western rosewood). Eucalyptus melliodora (yellow box) is present on plain margins. The distinctive Macrozamia spp. (zamia-palms/ cycads), usually occurring as a low fern-like plant without much basal development, Dianella sp. (flax lily), and Xanthorrhoea spp. (grass trees) occur throughout the landscape. These are good indicator species for sandy soils. Groundcover species are generally sparsely distributed. They include Aristida vagans (threeawn speargrass), Aristida spp. (wiregrasses), Chloris truncata (windmill grass), Austrostipa spp. (speargrasses), Austrodanthonia spp. (wallaby grasses), Cenchrus longispinus (spiny burrgrass), Bothriochloa macra (red leg grass), Cymbopogon refractus (barbed wire grass), Themeda australis (kangaroo grass), Austrostipa tuckeri (Tucker's speargrass), Helichrysum bracteatum (golden paper daisy), and Juncus subsecundus (rush). Opuntia aurantiaca (tiger pear), Callitris spp. (cypress pines), Allocasuarina luehmannii (bulloak), Sclerolaena birchii (galvanised burr), Acacia triptera (spurwing wattle), and Cassinia spp. (cough bush/ sifton bush) all have potential to become environmental weeds in cleared or disturbed areas. Further mapping of vegetation in the Brigalow belt (BRS, Unpub) (where this landscape becomes very extensive and diverse) include the following vegetation types: Brigalow, Mostly Acacia harpophylla with Casuarina cristata and Eucalyptus populnea subsp. bimbil; Northern floodplain woodland, dominated by Eucalyptus camaldulensis, occasionally with Callitris glaucophylla, Casuarina cunninghamiana, E. melliodora, Corymbia tessellaris; rarely Allocasuarina luehmannii, Angophora floribunda, E. chloroclada; Belah wilga woodland, Almost exclusively Casuarina cristata, occasionally with Eucalyptus populnea subsp. bimbil; rarely E. pilligaensis or Callitris glaucophylla; Northern box woodland 1, Almost exclusively Eucalyptus populnea subsp. bimbil, often with Casuarina cristata, Callitris glaucophylla or E. melanophloia; rarely E. pilligaensis, E. coolabah or E. dolichocarpa; Northern cypress/bulloak woodland, mostly Allocasuarina luehmannii with Callitris glaucophylla and Eucalyptus crebr

Land use

Uncleared portions are used for light grazing, nature conservation, and private and State forestry activities. Cleared portions are used for grazing, occasionally on improved pastures, with cropping in some areas. Cropping was previously more widespread due to the lightly textured topsoils, however soil degradation and utilisation of the heavy clay soils for cropping has forced a change in land use.

Land degradation

not recorded

Land capability



Rural land capability	not recorded	Grazing limitations	not recorded
Cultivation limitation	not recorded	Fertility	not recorded
Qualities and limitations			
<i>Landscape</i>			
Steep slopes	not observed	Mass movement hazard	not observed
Rock outcrop hazard	not observed	Rockfall hazard	not observed
Foundation hazard	not observed	Woody weeds	not observed
Complex terrain	not assessed	Dieback	not assessed
Productive arable land	not assessed		
<i>Hydrology</i>			
Poor moisture availability	not assessed	Shallow soils	not observed
High watertables	not observed	Waterlogging	not observed
Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
Flood hazard	not observed	Recharge zone	not assessed
Discharge zone	not observed		
<i>Erosion</i>			
Wind erosion hazard	widespread	Wave erosion hazard	not observed
Gully erosion hazard	not observed	Sheet erosion hazard	not observed
Streambank erosion hazard	not assessed		
<i>Salinity</i>			
Salinity hazard	widespread	Seepage scalds	not observed



upz	UPLANDS		Residual
Summary			
Landscape	Gently undulating residual rises on Jurassic Garrawilla basalts of the Mullaley Hills. Local relief <30m; slopes 1-5%; elevation 300 – 360 m. Open woodland 95% selectively cleared for grazing and cropping.		
Soils	Soils are locally extensive, with soil type changing between rises. Deep, well drained Red Vertosols (Red Clays) and moderately well drained Self-mulching Black Vertosols (Black Earths) are found on crests, sideslopes, and benches below basaltic low hills. Occasional deep, poorly drained Epipedal Black Vertosols (Black Earths) of lower fertility are associated with sandstone landscapes.		
Geology and Regolith	Jurassic Garrawilla vesicular and non-vesicular basalts and other volcanic material, with associated dykes & plugs. Soil depth is often >1.5 m, overlying bedrock or up to 40 cm of weathered basalt. Sections of the soil surface are covered with weakly weathered Jurassic Pilliga quartz sandstone, relict from when the Pilliga beds extended further east. The underlying bedrock sits considerably lower than the surrounding basalt and tuffaceous lithic sandstone plateaux and low hills, producing a residual landscape below surrounding basalt landscapes such as Tally Ho (ta) soil landscape. These lower basalt rises may indicate the presence of an older basaltic flow. Some sections may have Black Vertosols (Black Earths) overlying Triassic sandstone benches where weathered basaltic parent material has accumulated over the underlying sandstone.		
Vegetation	Open woodland and woodland, 95% selectively cleared and now dominated by <i>Brachychiton populneus</i> (kurrajong), with <i>Callitris glaucophylla</i> (white cypress pine) also present. Original tree species included <i>E. albens</i> (white box), <i>E. populnea</i> (bimble box), <i>Angophora floribunda</i> (rough-barked apple), <i>Geijera parviflora</i> (wilga), and <i>Casuarina cristata</i> (belah). Groundcover is dominated by <i>Chloris truncata</i> (windmill grass), with other species such as <i>Austrodanthonia</i> spp. (wallaby grasses), <i>Austrostipa</i> spp. (speargrasses), <i>Eragrostis</i> spp. (lovegrasses), and <i>Bothriochloa macra</i> (red grass) also present. <i>Austrostipa aristiglumis</i> (plains grass) and <i>Dichanthium sericeum</i> (Queensland bluegrass) are present on fertile black soils. (Soil Conservation Service, 1978)		
Land use	not recorded		
Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	low
Cultivation limitation	low to moderate	Fertility	variable
Qualities and limitations			
Landscape			
Steep slopes	not observed	Mass movement hazard	not observed
Rock outcrop hazard	not observed	Rockfall hazard	not observed
Foundation hazard	localised	Woody weeds	not observed
Complex terrain	not assessed	Dieback	localised
Productive arable land	localised		
Hydrology			
Poor moisture availability	not assessed	Shallow soils	not observed
High watertables	not observed	Waterlogging	not observed
Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
Flood hazard	not observed	Recharge zone	widespread



Discharge zone not observed

Erosion

Wind erosion hazard localised

Wave erosion hazard not observed

Gully erosion hazard localised

Sheet erosion hazard widespread

Streambank erosion hazard not assessed

Salinity

Salinity hazard localised

Seepage scalds localised



upza	UPLANDS, VARIANT A		Residual
Summary			
Landscape	Uplands variant which is generally found as a pocket within the Trickey Forest Soil Landscape (rare) isolated pockets of very deep, imperfectly drained Epipedal Black Vertosols (Black Earths) with lower fertility than the Self-mulching Black Vertosols are present in the Trinkey Forest (tf) landscape.		
Soils	not recorded		
Geology and Regolith	Jgv?_UNW		
Vegetation	not recorded		
Land use	not recorded		
Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	not recorded
Cultivation limitation	not recorded	Fertility	not recorded
Qualities and limitations			
Landscape			
Steep slopes	not observed	Mass movement hazard	not observed
Rock outcrop hazard	not observed	Rockfall hazard	not observed
Foundation hazard	widespread	Woody weeds	localised
Complex terrain	not assessed	Dieback	not assessed
Productive arable land	not assessed		
Hydrology			
Poor moisture availability	not assessed	Shallow soils	not observed
High watertables	not observed	Waterlogging	not observed
Seasonal waterlogging	localised	Groundwater pollution hazard	not observed
Flood hazard	not observed	Recharge zone	not assessed
Discharge zone	localised		
Erosion			
Wind erosion hazard	not observed	Wave erosion hazard	not observed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		
Salinity			
Salinity hazard	not observed	Seepage scalds	not observed



tot	TOP ROCK	Transferral
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Summary

Landscape

Broad, long (1000 – 1500m) gently inclined footslopes on colluvium derived from Permian sandstones and conglomerates of the Curlewis Hills. Local relief 30 – 70 m; slopes 2 – 8%; elevation range 240 – 540m. 95% cleared for native and improved pasture grazing.

Soils

Banks and King (In Press) report that this landscape is relatively simple and dominated by hard duplex soils with highly variable gravel content and degrees of sodicity. Upper slopes are generally dominated by moderately well drained very deep Red Sodosols and some Bleached Red Chromosols (Red-brown Earths), whilst mid to lower footslopes are dominated by imperfectly to poorly drained deep to very deep Brown Sodosols (Solodic Soils). Black Vertisols dominate on plains and drainage lines with Red and Brown Chromosols on rises. Profiles in this soil landscape: sites 700, 701, 702, 703, 704

Geology and Regolith

Qrxv1/Pmx, Maules Creek Formation, (claystone, sandstone), Pmx, Maules Creek Formation, (claystone, sandstone) minor Qrxv1/Pwb1, Werrie Basalt, (basalt, coal)

Vegetation

This landscape has been extensively cleared for cropping and grazing. Trees are now restricted to isolated trees, small clumps, and linear strips along drainage lines. A good example of grassy open woodland vegetation in this landscape was found at the head of Mountain Creek catchment. It is likely that the dominant community would have been a grassy multi-layered woodland/open forest. This community varies between northern and southern areas. The dominant canopy species in the northern Bobbiwa Creek area include White box (*E. albens*), White cypress (*Callitris glaucophylla*), Rough-barked apple (*Angophora floribunda*), with occasional Kurrajong (*Brachychiton populneus*). River Red gum (*E. camaldulensis*), Rough-barked apple (*Angophora floribunda*) and the White cloud tree (*Melaleuca bracteata*) occur along drainage lines. The dominant canopy species in the southern Wave Hill area include White cypress (*Callitris glaucophylla*), Grey box (*E. moluccana*), and Bimble box (*E. populnea*), with occasional White box (*E. albens*), Silver-leaved ironbark (*E. melanophloia*), Belah (*Casuarina cristata*), and Kurrajong (*Brachychiton populneus*). The shrub understorey for both areas varied considerably from scattered plants to two defined layers (< 2m & < 6 m tall) in less disturbed areas. Common species in the Wave Hill – Maules Creek catchment include Wilga (*Geijera parviflora*), Western rosewood (*Alectryon oleifolius*), Budda (*Eremophila mitchellii*), Quinine Bush (*Alstonia constricta*), Wild Orange (*Capparis mitchellii*), Cooba wattle (*Acacia salicina*), Whitewood (*Atalaya hemiglauca*), Warrior Bush (*Apophyllum anomalum*), Myall (*Acacia pendula*), and Eastern cottonbush (*Maireana microphylla*). Common species in the Bobbiwa Creek catchment include Hop Bush (*Dodonaea viscosa* subsp. *angustifolia*), Myall (*Acacia pendula*), Native olive (*Notelaea microcarpa*), Green wattle (*Acacia deanei*), Wilga (*Geijera parviflora*), Quinine Bush (*Alstonia constricta*), Poison pimelea (*Pimelea neo-anglica*), Western golden wattle (*Acacia decora*), and Cooba wattle (*Acacia salicina*). Common grasses of the woodlands/open forests and derived grasslands include; Plains grass (*Austrostipa aristiglumis*), Panic (*Digitaria* sp.), Native Oat grass (*Themeda avenacea*), Snow grass (*Poa sieberiana*), Wire grass (*Aristida* sp.), Tall Windmill grass (*Chloris ventricosa*), Wire grass (*Aristida* sp.), Slender Bamboo grass (*Austrostipa verticillata*), Red grass (*Bothriochloa macra*), Pitted red grass (*Bothriochloa decipiens*), Rat’s tail grass (*Sporobolus creber*), and Wallaby grass (*Austrodanthonia* sp.). This landscape has a medium to high infestation of exotic plants. Common include Cotton Bush (*Gomphocarpus* sp.), Prickly pear (*Opuntia* sp.), Wild turnip (*Brassica* sp.), Pepper tree (*Schinus areira*), Coolatai grass (*Hyparrhenia hirta*), Cobbler’s Pegs (*Bidens pilosa*), Clovers (*Trifolium* sp.), and thistles.



Land use	not recorded		
Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	low
Cultivation limitation	moderate to high	Fertility	moderate
Qualities and limitations			
<i>Landscape</i>			
Steep slopes	not observed	Mass movement hazard	not observed
Rock outcrop hazard	not observed	Rockfall hazard	not observed
Foundation hazard	localised	Woody weeds	localised
Complex terrain	not observed	Dieback	localised
Productive arable land	localised		
<i>Hydrology</i>			
Poor moisture availability	not observed	Shallow soils	localised
High watertables	localised	Waterlogging	not observed
Seasonal waterlogging	localised	Groundwater pollution hazard	not observed
Flood hazard	not observed	Recharge zone	localised
Discharge zone	localised		
<i>Erosion</i>			
Wind erosion hazard	localised	Wave erosion hazard	not observed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	not observed		
<i>Salinity</i>			
Salinity hazard	localised	Seepage scalds	localised



Summary

Landscape

Undulating to rolling rises and low hills on Jurassic Purlewaugh sandstones and shales in the Trinkey Hills and Eastern Pilliga. Local relief 9 – 90 m; slopes 7 – 20%. Springs occur throughout the landscape. Open and closed woodland, approximately 60% cleared or thinned for grazing and occasional cropping.

Soils

Soil types are locally extensive but vary over short distances and are defined by landscape position, parent material and spring occurrence. Moderate to very deep, imperfectly drained Grey, Brown, Red and Yellow Sodosols (Solonetz, Solodized Solonetz, Soloths, and Solodic Soils) are present on sideslopes and dominate the landscape. Shallow to deep, moderately well drained Red and Brown Chromosols (Red-brown Earths), Red and Yellow Chromosols (Red Podzolic Soils and Yellow Earths), and Yellow, Brown and Red Kandosols (Red and Yellow Earths and Brown Podzolic Soils) also occur on this landform. Shallow, rapidly drained Leptic Tenosols and Leptic Rudosols (Lithosols) are present on crests and upper slopes, with very deep, rapidly drained Orthic and Leptic Tenosols (Earthy Sands) and Bleached-Leptic Tenosols (Siliceous Sands) on lower slopes and where springs occur. Shallow, rapidly drained Red Ferrosols (Euchrozems) and deep Self-mulching Brown Vertosols (Brown Clays) occur on localised slopes with basaltic influence.

Geology and Regolith

Rises and low hills of Jurassic Purlewaugh sandstones, shales, and lutite. Ironstone banding up to 50 cm thick is common, with fragments present in the solum. Depth to bedrock ranges from 10 cm on rocky crests to greater than 1.5 m on lower slopes. The Purlewaugh beds overlie the Jurassic Garrawilla Volcanics throughout the region. Erosion has exposed these basalts in many areas, creating a mosaic of sedimentary and volcanic landscapes.

Vegetation

Open and closed woodland, approximately 60% cleared or thinned for grazing and occasional cropping. Vegetation communities vary with soil texture and depth of sandy topsoils. On heavier soils, including texture-contrast soils with shallow topsoils, *Eucalyptus albens* (white box), *E. dealbata* (tumbledown gum/ hill red gum), *E. laevopinea* (silver-top stringybark) (localised), *Callitris glaucophylla* (white cypress pine), *Geijera parviflora* (wilga), *Acacia cheelii* (motherumba), and *Brachychiton populneus* (kurrajong) dominate the upper storey, with shrubs such as *Cassinia laevis* (cough bush), *Dodonea viscosa* (sticky hop bush/ giant hop bush), and *Acacia* spp. (wattles) forming a mid strata. Dominant groundcover species include *Austrostipa verticillata* (slender bamboo grass), *Aristida vagans* (threeawn speargrass), *Chloris truncata* (windmill grass), *Austrodanthonia* spp. (wallaby grasses), and *Themeda australis* (kangaroo grass). On deep sandy soils, tree species include *Eucalyptus blakelyi* (blakely's red gum), *E. macrorhyncha* (red stringybark), *E. laevopinea* (silver-top stringybark) (localised), *Callitris glaucophylla* (white cypress pine), *Callitris endlicheri* (black cypress pine), *Corymbia trachyphloia* (brown bloodwood/ white bloodwood/ red bloodwood), *Angophora floribunda* (rough-barked apple), *Banksia marginata* (silver banksia/ honeysuckle), and *Acacia* spp. (wattles). The shrubby mid strata is dominated by *Cassinia laevis* (cough bush), and *Acacia* spp. (wattles). At spring sites, *Imperata cylindrica* (blady grass) forms a thick groundcover; elsewhere groundcover species are sparse and include mainly *Austrostipa* spp. (speargrasses) and *Aristida* spp. (wiregrasses/ threeawn grasses/ kerosene grasses). *Macrozamia* sp. (zamia-palm/ cycad), *Dianella* sp. (flax lily/ blue flax lily/ blueberry lily) and *Wahlenbergia gracilis* (Australian bluebell/ sprawling bluebell) are also present as low shrubs and forbs with little basal development. Plant species and communities are often similar to those found in the East Pilliga Nature Reserve. A listing of species within the Pilliga region can be found in Becker and Binns (2000).



Land use	not recorded		
Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	low to moderate
Cultivation limitation	high to very high	Fertility	variable
Qualities and limitations			
<i>Landscape</i>			
Steep slopes	localised	Mass movement hazard	not observed
Rock outcrop hazard	localised	Rockfall hazard	not observed
Foundation hazard	localised	Woody weeds	not observed
Complex terrain	not assessed	Dieback	not assessed
Productive arable land	not assessed		
<i>Hydrology</i>			
Poor moisture availability	localised	Shallow soils	localised
High watertables	localised	Waterlogging	localised
Seasonal waterlogging	localised	Groundwater pollution hazard	not observed
Flood hazard	not observed	Recharge zone	localised
Discharge zone	localised		
<i>Erosion</i>			
Wind erosion hazard	not observed	Wave erosion hazard	not observed
Gully erosion hazard	localised	Sheet erosion hazard	localised
Streambank erosion hazard	not assessed		
<i>Salinity</i>			
Salinity hazard	localised	Seepage scalds	localised



tuy	TURKEY RANGE	Residual (Residual)
Summary		
Landscape	<p>Undulating to rolling low hills and hills on Jurassic Pilliga and Purlewaugh sandstones, shales, lutite and mudstones with broad crests and gently sloping upper footslopes in the Eastern Pilliga. Local relief to 150 m, slopes 2–10%, rock outcrop <20%. Woodland, open-woodland, and open dry sclerophyll forests, largely remaining as remnant communities in State Forests, but commonly cleared or thinned on private property for grazing purposes.</p>	
Soils	<p>Soils vary with parent material and landform. Shallow to very deep, well drained Arenic Orthic Tenosols (Earthy sands) occur on flat crests of quartz sandstone, with very shallow to moderately deep, well drained Lithic Leptic Rudosols (Lithosols) on smaller crests and rises. Moderately to very deep, moderately well drained Red Chromosols (Red Podzolic Soils), Brown Chromosols (Red-brown Earths, Solodic Soils, Red Podzolic Soils and Brown Podzolic Soils), Yellow Chromosols (Solonetz), Red Kurosols (Red Podzolic Soils) and Red, Brown and Grey Sodosols (Soloths, Solodic Soils and Solodized solonetz) are present on lithic sandstone and mudstone upper slopes and footslopes. Red Dermosols (affinity Non-calcic Brown Soils) occur sporadically on fine-grained sediments. Moderately deep to deep, moderately well drained Brown and Yellow Vertosols (Brown Clays) occur in areas of high basaltic influence. Moderately deep, imperfectly drained Hypocalcic Calcarosols (Brown Clays) occur sporadically in lower sections of the landscape. Occasional moderately deep, moderately well drained Acidic Yellow Dermosols (aff. Yellow Earths) are found on weathered Purlewaugh shale outcrops. Profiles in this soil landscape: 6, 21, 47, and 56</p>	
Geology and Regolith	<p>Quartz and lithic sandstones, mudstones and shales of the Jurassic Pilliga and Purlewaugh sandstone beds. Ironstone bands are common within these sediments. Ironstone pans occur above the parent material in some soils. Depth to weakly to strongly weathered bedrock generally less than 200 cm, with depths less than 30 cm common on isolated crests. Outcrops and underlying rock are generally moderately to strongly weathered to an undetermined depth. This survey also found Qrxs1/JKlk, Keelindi beds, which includes, Colluvial polymictic gravel, sand, silt and clay; may include some eluvial in situ regolith deposits OVERLIES Off-White, fine to coarse grained, poorly to well sorted, quartzose sandstone, pebbly sandstone and conglomerate interbedded with minor shale, s, clastic sediment, sandstone and conglomerate.</p>	
Vegetation	<p>Woodland and open-woodland approximately 40% cleared or thinned for grazing. Dominant tree and shrub species include Eucalyptus crebra (narrow-leaved ironbark), E. sideroxylon (mugga/ red ironbark), E. beyeri (Beyer's ironbark), E. blakelyi (blakely's red gum), E. melanophoia (silver-leaved ironbark), E. pilligaensis (pilliga grey box/ narrow-leaved grey box), E. microcarpa (western grey box), E. conica (fuzzy box), E. albens (white box), E. populnea (bimble box), E. caleyi (Caley's ironbark), E. fibrosa (broad-leaved ironbark/ red ironbark), E. dealbata (tumbledown gum/ hill red gum), E. macrorhyncha (red stringybark), E. laevopinea (silver-top stringybark), Corymbia trachyphloia (brown bloodwood/ white bloodwood/ red bloodwood), Angophora floribunda (rough-barked apple), Alphitonia excelsa (red ash), Allocasuarina luehmannii (bulloak), Allocasuarina distyla (scrub she-oak), Callitris glaucophylla (white cypress pine) and Callitris endlicheri (black cypress pine). Understorey species include Cassinia arcuata (sifton bush/ chinese shrub), Cassinia laevis (cough bush), Acacia uncinata (wavy-leaf wattle/ gold-dust wattle), Acacia decora (western golden wattle/ graceful wattle), Acacia hakeoides (western black wattle/ hakea wattle), Acacia cheelii (motherumba), Acacia piligera (wattle), Acacia subulata (awl-leaved wattle), Acacia spp. (wattles), Daviesia sp. (bitter pea/ bacon and egg plant), Banksia marginata (silver banksia/ honeysuckle), Brachyloma daphnoides (daphne heath), Geijera</p>	



parviflora (wilga), Dodonea viscosa (sticky hop bush/ giant hop bush), Eremophila mitchellii (budda), Notelaea microcarpa (native olive), Grevillea floribunda (rusty spider flower/ seven dwarfs grevillea), Grevillea spp. (grevilleas), Xanthorrhoea spp. (grass trees). Macrozamia sp. (zamia-palm/ cycad) is also present on sandy soils, occurring as a low fern-like plant with little basal development. Ground cover species are generally sparsely distributed but include Aristida vagans (threeawn speargrass), Aristida spp. (wiregrasses/ threeawn grasses/ kerosene grasses), Poa sieberana var. hirtella and var. sieberana (fine-leaf tussock grass), Austrostipa setacea (corkscrew grass), Austrostipa verticillata (slender bamboo grass), Austrostipa spp. (speargrasses), Themeda australis (kangaroo grass), Austrodanthonia spp. (wallaby grasses), Cenchrus longispinus (spiny burrgrass), Bothriochloa macra (red grass/ red-leg grass), Cymbopogon refractus (barbed wire grass), Eragrostis spp. (love grasses), Chloris truncata (windmill grass), Digitaria spp. (digit grasses), and Juncus subsecundus (rush). Wahlenbergia gracilis (Australian bluebell/ sprawling bluebell) and Dianella sp. (flax lily/ blue flax lily/ blueberry lily) are also present. Vegetation communities vary throughout the landscape with position, soil type and depth. A more complete listing of vegetation species within the Pilliga communities (similar to those found in this survey area) can be found in Beckers and Binns (2000).

Land use	not recorded		
Land degradation	not recorded		
Land capability			
Rural land capability	not recorded	Grazing limitations	moderate to high
Cultivation limitation	moderate to very high	Fertility	low
Qualities and limitations			
<i>Landscape</i>			
Steep slopes	not observed	Mass movement hazard	not observed
Rock outcrop hazard	widespread	Rockfall hazard	not observed
Foundation hazard	not observed	Woody weeds	not observed
Complex terrain	not assessed	Dieback	not assessed
Productive arable land	not assessed		
<i>Hydrology</i>			
Poor moisture availability	not assessed	Shallow soils	widespread
High watertables	localised	Waterlogging	not observed
Seasonal waterlogging	localised	Groundwater pollution hazard	not observed
Flood hazard	not observed	Recharge zone	widespread
Discharge zone	localised		
<i>Erosion</i>			
Wind erosion hazard	widespread	Wave erosion hazard	not observed
Gully erosion hazard	widespread	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		
<i>Salinity</i>			
Salinity hazard	localised	Seepage scalds	localised



Summary

Landscape Steep variant of Turkey Range Soil Landscape with slopes >20%

Soils not recorded

Geology and Regolith not recorded

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	not recorded	Mass movement hazard	not recorded
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Rock outcrop hazard	not recorded	Rockfall hazard	not recorded
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Foundation hazard	not recorded	Woody weeds	not recorded
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Complex terrain	not recorded	Dieback	not recorded
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Productive arable land	not recorded		
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Hydrology

Poor moisture availability	not recorded	Shallow soils	not recorded
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High watertables	not recorded	Waterlogging	not recorded
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Seasonal waterlogging	not recorded	Groundwater pollution hazard	not recorded
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Flood hazard	not recorded	Recharge zone	not recorded
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Discharge zone	not recorded		
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Erosion

Wind erosion hazard	not recorded	Wave erosion hazard	not recorded
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Gully erosion hazard	not recorded	Sheet erosion hazard	not recorded
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Streambank erosion hazard	not recorded		
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Salinity

Salinity hazard	not recorded	Seepage scalds	not recorded
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Summary

Landscape

undulating hills and low hills on broad basalt lava plain plateaux of the Coolah Tops and upper Liverpool Ranges. Crests usually convex with simple sideslopes. Stream lines are generally erosional and widely spaced. Local relief to 30 - 130 m, slopes 1 - 10%. Tall to very tall semi-alpine open forest.

Soils

Soil variation is relatively low over this landscape, with variation only in depth and stoniness for the most part. Change in soil type is very predictable within topographic constraints. There is a fairly uniform cover of Moderately deep to deep haplic mesotrophic Red Ferrosols and haplic melanic Red Ferrosols (Krasnozems) which dominate the plateau surface particularly in the south of the Namoi Catchment. Moderately deep imperfectly drained ferric mesotrophic Brown Ferrosols (No Suitable Group) occur on swamp/drainage line margins and on some basalt benches and some lower slope positions where there has been or is a seasonally high watertable. Tending and east and north from the Liverpool Ranges towards Walcha on the Yarrowitch and Nundle Sheets, some Black Vertosols become apparent, but in terms of limitations, they are similar to the Ferrosols.

Geology and Regolith

Tv, Comboyne Basalt, (basalt) and Tl, Liverpool Range Basalts

Vegetation

Tall semi alpine open-forest dominated by Eucalyptus laevopinea (Silvertop stringybark), Eucalyptus viminalis (manna gum), and Eucalyptus dalrympleana (mountain gum). Other common species include Eucalyptus pauciflora (snow gum), Eucalyptus stellulata (black sallee) (creeklines and frost hollows), Exocarpos cupressiformis (native cherry), Leptospermum polygalifolium (yellow tea tree), Lomatia arborescens, Bursaria spinosa var. microphylla (blackthorn), and Smilax australis (lawyer vine).

The understorey is comprised mainly of Acacia dealbata (silver wattle) and Acacia melanoxylon (blackwood).

There are localised occurrences of Eucalyptus albens (white box), Eucalyptus moluccana (grey box), and Eucalyptus nortonii (long-leaved box) on plateau edges, Eucalyptus rossii (white gum) on exposed rocky sites, with Xanthorrhoea glauca (grass tree) occurring occasionally on exposed sites on the plateaux edge

Dominant grass species are Poa labillardiera (snow grass) and Danthonia spp. (wallaby grasses).

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	low to moderate
Cultivation limitation	moderate to high	Fertility	high

Qualities and limitations

Landscape

Steep slopes	not observed	Mass movement hazard	not observed
Rock outcrop hazard	localised	Rockfall hazard	not observed
Foundation hazard	localised	Woody weeds	not observed
Complex terrain	not observed	Dieback	localised
Productive arable land	not observed		

Hydrology



Poor moisture availability	not observed	Shallow soils	localised
High watertables	localised	Waterlogging	not observed
Seasonal waterlogging	localised	Groundwater pollution hazard	not assessed
Flood hazard	not observed	Recharge zone	widespread
Discharge zone	localised		
<i>Erosion</i>			
Wind erosion hazard	not observed	Wave erosion hazard	not observed
Gully erosion hazard	localised	Sheet erosion hazard	widespread
Streambank erosion hazard	not observed		
<i>Salinity</i>			
Salinity hazard	not observed	Seepage scalds	not observed



Summary

Landscape

Broad stagnant alluvial plain landscape dominated by older alluvium in the north eastern Pilliga Outwash. Slopes generally low with local relief less than 3 m. Woodland and open forest about 60% cleared for grazing with minor cropping.

Soils

Landscape dominated by an even mixture of imperfectly drained, giant, Eutrophic, Brown or Yellow Sodosols (Solodic Soils)(in the south and imperfectly drained, giant,often Epicalcareous-Endoacidic (Belah and Brigalow soils), Epipedal to self-mulching, Grey Vertosols (Grey Clays), with minor scalded poorly drained, giant, Episodic-Gypsic, Crusty, Brown Vertosol (Brown Clays) in the northern reaches of the landscape. Type Profiles are 68 and 92 Profiles in this soil landscape: 41, 66, 67, 68, 69, 91-96.

Geology and Regolith

Qac12, unnamed geological unit, which includes, Unconsolidated silt and clay, minor sand. Commonly carbonaceous and flat to cross laminated., clastic sediment, silt, clay; Qacs1, unnamed geological unit, which includes, Unconsolidated silt and clay, minor sand. Commonly carbonaceous and flat to cross laminated., clastic sediment, silt, clay; Qat11, unnamed geological unit, which includes, Interpreted clay, silt, sand, gravel., clastic sediment, clay, silt, sand, gravel; Qfpl2, unnamed geological unit, which includes, Texture contrast soils with sand Predominating at the surface (39-43ka)., clastic sediment, sand; Qfps2, unnamed geological unit, which includes, Texture contrast soils with sand Predominating at the surface (39-43ka)., clastic sediment, sand; Qrhs3, unnamed geological unit, which includes, Clayey alluvium often gilgaid (>88ka)., clastic sediment and alluvium.

Vegetation

Brigalow, Mostly Acacia harpophylla with Casuarina cristata and Eucalyptus populnea subsp. bimbil; Belah wilga woodland, Almost exclusively Casuarina cristata, occasionally with Eucalyptus populnea subsp. bimbil; rarely E. pilligaensis or Callitris glaucophylla; Northern cypress/bulloak woodland, mostly Allocasuarina luehmannii with Callitris glaucophylla and Eucalyptus crebra; occasionally Callitris endlicheri, infrequently Corymbia dolichocarpa or E. melanophloia; Northern belah, Usually Casuarina cristata, occasionally Eucalyptus populnea subsp. bimbil; rarely E. coolabah, Callitris glaucophylla, E. albens or E. pilligaensis; Moree grassland, Trees usually absent, but Casuarina cristata or Eucalyptus populnea subsp. bimbil may occur infrequently, as scattered individuals; Northern floodplain woodland, dominated by Eucalyptus camaldulensis, occasionally with Callitris glaucophylla, Casuarina cunninghamiana, E. melliadora, Corymbia tessellaris; rarely Allocasuarina luehmannii, Angophora floribunda, E. chloroclada.

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low to moderate

Cultivation limitation

moderate to extreme

Fertility

variable

Qualities and limitations

Landscape

Steep slopes

not observed

Mass movement hazard

not observed

Rock outcrop hazard

not observed

Rockfall hazard

not observed

Foundation hazard

widespread

Woody weeds

localised

Complex terrain

not assessed

Dieback

localised

Productive arable land

not assessed

Hydrology



Poor moisture availability	localised	Shallow soils	not observed
High watertables	not observed	Waterlogging	localised
Seasonal waterlogging	localised	Groundwater pollution hazard	not observed
Flood hazard	widespread	Recharge zone	localised
Discharge zone	localised		
<i>Erosion</i>			
Wind erosion hazard	localised	Wave erosion hazard	not observed
Gully erosion hazard	widespread	Sheet erosion hazard	widespread
Streambank erosion hazard	not assessed		
<i>Salinity</i>			
Salinity hazard	localised	Seepage scalds	localised



Summary

Landscape Eastern Variant of Walla Walla Soil Landscape described by Pengelly (unpublished). May be dominated by heavier soils than the main extent of this landscape.

Soils not recorded

Geology and Regolith not recorded

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	not recorded	Mass movement hazard	not recorded
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Rock outcrop hazard	not recorded	Rockfall hazard	not recorded
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Foundation hazard	not recorded	Woody weeds	not recorded
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Complex terrain	not recorded	Dieback	not recorded
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Productive arable land	not recorded		
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Hydrology

Poor moisture availability	not recorded	Shallow soils	not recorded
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High watertables	not recorded	Waterlogging	not recorded
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Seasonal waterlogging	not recorded	Groundwater pollution hazard	not recorded
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Flood hazard	not recorded	Recharge zone	not recorded
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Discharge zone	not recorded		
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Erosion

Wind erosion hazard	not recorded	Wave erosion hazard	not recorded
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Gully erosion hazard	not recorded	Sheet erosion hazard	not recorded
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Streambank erosion hazard	not recorded		
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Salinity

Salinity hazard	not recorded	Seepage scalds	not recorded
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yuz	YUGGEL	Erosional
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Summary

Landscape

Undulating low hills of predominantly red soil with broad crests and long sideslopes on Jurassic Garrawilla Volcanics in the Mullaley Hills and Trinkey Hills. Local relief 5 – 70 m; slopes 0 – 5%. Surface is often gravelly. Open woodland, 90% cleared for grazing and cropping.

Soils

Moderately deep, rapidly drained Red Ferrosols (Euchrozems) are dominant in upper and midslope positions, with occasional moderately deep, well drained Red Kandosols (aff. Red Podzolic Soils) and Leptic Rudosols (Lithosols) on crests. Moderately deep, well drained Red Vertosols (Red Clays) occur in midslope positions, grading to imperfectly to poorly drained Black Vertosols (Black Earths) and Grey Vertosols (Grey Clays) on lower slopes.

Geology and Regolith

The soils on these basalts are relatively young compared to other areas of the Jurassic Garrawilla Volcanics. The soil formation process started when the overlying Jurassic Pilliga and Purllewaugh sedimentary beds were eroded away, exposing the basalt flows. Caps of Jurassic sediments are still present in many areas. Those soils found higher in the landscape, such as the Ferrosols (Euchrozems) are the youngest, having been exposed for the shortest period. The quartz fraction found in topsoils of the Ferrosols is caused by sheet erosion of the overlying sedimentary caps. Soils on lower slopes have had longer to form, and occur as Red Vertosols (Red Clays) and darker Black Vertosols (Black Earths and Grey Clays). Many soils have gravelly topsoils with up to 50% coarse fragments composed of lithic and quartz sandstone, basalt, jasper, quartz, and ironstone.

Vegetation

Open woodland communities, 90% cleared for agriculture. Two separate communities are present. On the Red Ferrosols and Red Vertosols, the dominant tree species include *Angophora floribunda* (rough-barked apple), *Brachychiton populneus* (kurrajong), and *Callitris glaucophylla* (white cypress pine), with occasional *Eucalyptus albens* (white box) and *E. melliodora* (yellow box). Groundcover species include *Aristida vagans* (threeawn speargrass), *Austrostipa verticillata* (slender bamboo grass), *Bothriochloa macra* (red grass/ red-leg grass), *Chloris truncata* (windmill grass), *Themeda australis* (kangaroo grass), *Austrostipa setacea* (corkscrew grass), and *Austrodanthonia* sp. (wallaby grass). *Cassinia laevis* (cough bush) provides a shrubby mid strata in some areas. On darker soils, the upper storey is dominated by *Eucalyptus albens* (white box), with minor occurrences of other tree species found on red soils. Groundcover is dominated by *Austrostipa aristiglumis* (plains grass), *Dichanthium sericeum* (Queensland bluegrass), *Bothriochloa macra* (red grass/ red-leg grass) and *Austrodanthonia* spp. (wallaby grasses).

Land use

not recorded

Land degradation

not recorded

Land capability

Rural land capability

not recorded

Grazing limitations

low

Cultivation limitation

low to moderate

Fertility

high

Qualities and limitations

Landscape

Steep slopes

not assessed

Mass movement hazard

not assessed

Rock outcrop hazard

not assessed

Rockfall hazard

not assessed

Foundation hazard

widespread

Woody weeds

not assessed

Complex terrain

not assessed

Dieback

localised



Productive arable land not assessed

Hydrology

Poor moisture availability localised
High watertables not assessed
Seasonal waterlogging not assessed
Flood hazard not assessed
Discharge zone not assessed

Shallow soils localised
Waterlogging not assessed
Groundwater pollution hazard not assessed
Recharge zone localised

Erosion

Wind erosion hazard localised
Gully erosion hazard localised
Streambank erosion hazard not assessed

Wave erosion hazard not assessed
Sheet erosion hazard localised

Salinity

Salinity hazard localised

Seepage scalds localised



Summary

Landscape Variant of Yuggel Soil Landscape including areas of spring eruption and relatively poor fertility due to sedimentary influence.

Soils not recorded

Geology and Regolith Jg_BRI

Vegetation not recorded

Land use not recorded

Land degradation not recorded

Land capability

Rural land capability	not recorded	Grazing limitations	not recorded
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Cultivation limitation	not recorded	Fertility	not recorded
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Qualities and limitations

Landscape

Steep slopes	not observed	Mass movement hazard	not observed
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Rock outcrop hazard	not observed	Rockfall hazard	not observed
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Foundation hazard	not observed	Woody weeds	not observed
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Complex terrain	not assessed	Dieback	not assessed
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Productive arable land	not assessed		
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Hydrology

Poor moisture availability	not assessed	Shallow soils	not observed
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High watertables	not observed	Waterlogging	localised
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Seasonal waterlogging	not observed	Groundwater pollution hazard	not observed
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Flood hazard	not observed	Recharge zone	not assessed
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Discharge zone	not observed		
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Erosion

Wind erosion hazard	not observed	Wave erosion hazard	not observed
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Gully erosion hazard	not observed	Sheet erosion hazard	localised
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Streambank erosion hazard	not assessed		
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Salinity

Salinity hazard	localised	Seepage scalds	localised
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Appendix 7.2 Table of Selected Soil and Landscape Qualities and Limitations from Soil Landscape Reports

Soil Landscape Code	Soil Landscape name	Flood hazard	Foundation hazard	Gully erosion hazard	High run on
bck	Barradine Creek Alluvials	Widespread	Localised	Localised	Localised
bdt	Bando	Widespread	Widespread	Widespread	Localised
bil	Burma Hills	Not Observed	Localised	Widespread	Localised
blq	Bullum Bulla	Widespread	Widespread	Localised	Widespread
bov	Booloocooroo	Localised	Widespread	Not observed	Widespread
bvy	Blue Vale	Not observed	Not Observed	Widespread	Localised
bxw	Borah	Not observed	Not observed	Localised	Not observed
byr	Brentry	Localised	Localised	Localised	Widespread
cnw	Coronation Flat	Widespread	Localised	Localised	Widespread
cnwa	Coronation Flat variant a	Widespread	Not observed	Widespread	Widespread
coo	Collygra Creek	Widespread	Widespread	Localised	Widespread
cpt	Coogal Plain	Not observed	Not observed	Not observed	Not observed
cqy	Cubbo Creek Terraces	Localised	Not Observed	Localised	Localised
ctu	Cuttabri Alluvials	Localised	Localised	Localised	Widespread
dev	Dunnadie	Not Observed	Widespread	Not Observed	Localised
dix	Denison	Localised	Widespread	Localised	Widespread
ely	East Lynne	Not observed	Not observed	Localised	Widespread
gct	Garawilla Creek	Widespread	Widespread	Localised	Widespread
ghl	Ghoolendaadi	Widespread	Widespread	Not Observed	Widespread
gkz	Glen Oak	Not observed	Widespread	Not observed	Localised
gos	Goscombes Road	Localised	Localised	Localised	Widespread
gyu	Goally	Not Observed	Widespread	Widespread	Widespread
gyua	Goally variant a	Not Observed	Widespread	Widespread	Widespread
kmx	Kamilaroi	Not observed	Widespread	Widespread	Localised
kmtx	Kamilaroi variant a	Not observed	Not observed	Widespread	Widespread
lcs	Lower Coxs	Widespread	Widespread	Localised	Widespread
lcsb	Lower Coxs variant b	Widespread	Not observed	Localised	Not observed
lexa	Leard Varaiant a	Not observed	Not observed	Localised	Localised
lgy	Lever Gully	Localised	Widespread	Widespread	Widespread
lipz	Little Plain	Widespread	Not Observed	Localised	Widespread
lmy	Langs Neck	Not observed	Localised	Widespread	Widespread
lrx	Leslies Road	Widespread	Widespread	Localised	Widespread
lrxa	Leslies Road variant a	Widespread	Widespread	Localised	Widespread
lrxb	Lelsies Road variant b	Widespread	Widespread	Localised	Widespread
mmv	Mount Milbulla	Not observed	Widespread	Localised	Widespread
mnz	Moan	Not observed	Localised	Localised	Widespread



Soil Landscape Code	Soil Landscape name	Flood hazard	Foundation hazard	Gully erosion hazard	High run on
nbw	Nombi	Not observed	Not observed	Not observed	Localised
nbwa	Nombi variant a	Not observed	Not observed	Not observed	Widespread
nbwb	Nombi variant b	Not observed	Not observed	Not observed	Widespread
nbwc	Nombi Variant c	Not observed	Not observed	Not observed	Widespread
njz	Noojee	Not observed	Widespread	Widespread	Widespread
njza	Noojee variant a	Not observed	Widespread	Not observed	Widespread
njzb	Noojee variant b	Not observed	Widespread	Not observed	Widespread
njzc	Noojee variant c	Not observed	Widespread	Not observed	Widespread
oxz	Oxley Road	Widespread	Widespread	Widespread	Widespread
pbz	Pigeon Box	Not observed	Localised	Localised	Localised
rly	Rowan Leigh	Localised	Localised	Localised	Widespread
sat	Saltwater Creek	Widespread	Widespread	Localised	Widespread
sgz	Stafford Gap	Localised	Not observed	Localised	Widespread
sgza	Stafford Gap variant a	Not observed	Not observed	Localised	Localised
sgzb	Stafford Gap variant b	Not observed	Widespread	Not observed	Widespread
shr	Sleigholmes Road	Localised	Widespread	Localised	Widespread
ssv	Sunny Side	Not observed	Widespread	Localised	Localised
stv	Scratch Road	Not observed	Not observed	Localised	Localised
taw	Tally Ho	Not observed	Widespread	Localised	Localised
tawb	Tally Ho Variant b	Not observed	Widespread	Not observed	Localised
tfy	Trinkey Forest	Not observed	Localised	Widespread	Not Observed
tot	Top Rock	Not observed	Localised	Localised	Widespread
tsw	Tambar Springs	Not observed	Localised	Localised	Localised
tuy	Turkey Range	Not observed	Not observed	Widespread	Localised
tuya	Turkey Range variant a	Not observed	Not observed	Widespread	Localised
upz	Uplands	Not observed	Localised	Localised	Not observed
upza	Uplands variant a	Not observed	Widespread	Localised	Localised
wcy	Windy Creek	Widespread	Widespread	Not observed	Widespread
wet	Weaners Retreat			Widespread	Localised
wgv	Warung	Not observed	Localised	Localised	Localised
wwu	Walla Walla	Widespread	Widespread	Widespread	Localised
wwua	Walla Walla variant a	Widespread	Widespread	Widespread	Localised
yuz	Yuggel	Not observed	Widespread	Localised	Localised
yuza	Yuggel variant a	Not observed	Not observed	Not observed	Not observed

