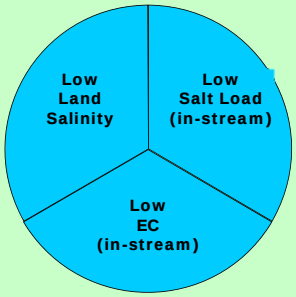
2. Boboyan Hydrogeological Landscape

LOCALITIES	**Boboyan Road, Namadgi National Park, Shannons Flat**
MAP SHEET	**Tantangara 1:100 000 Michelago 1:100 000**
CONFIDENCE LEVEL	**Moderate**



OVERVIEW

The Boboyan Hydrogeological Landscape (HGL) in Namadgi National Park extends either side of Boboyan Road from Orroral Road to near Shannons Flat on the edge on the ACT (Figure 1). The HGL covers an area of 65 km^2 and receives 650 to 1000 mm of rain per annum.

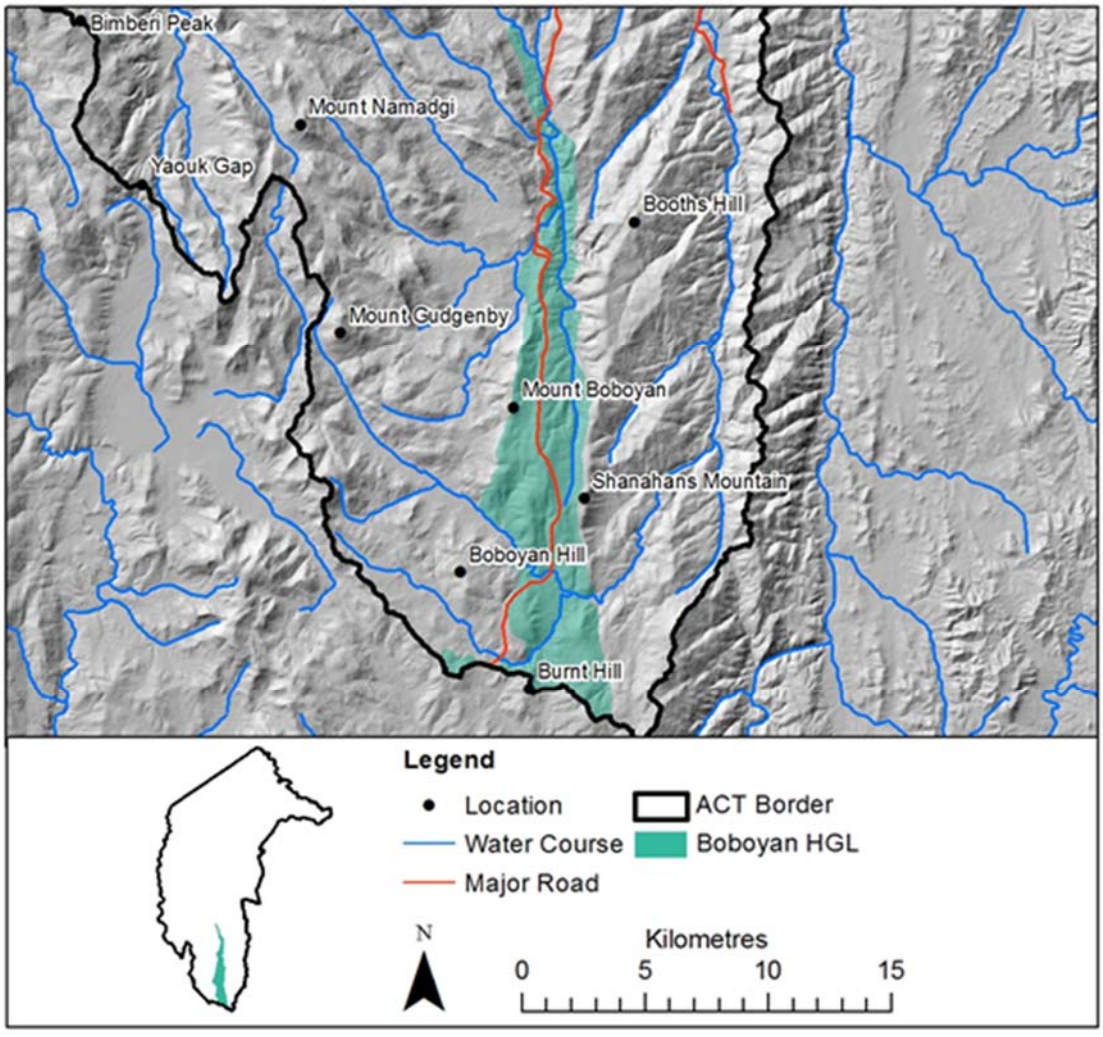


Figure 1: Boboyan HGL distribution map.

Boboyan HGL is characterised by soil landscapes and geology of the highly deformed Ordovician Adaminaby Group. The area is steep and heavily vegetated in most locations, with some cleared old grazing areas within the national park (Figure 2).

The area has some minor wetlands, with water movement recharging shallow groundwater with through flow components on side slopes. Erosion is an issue in gullies, and there is a sodic A_2 horizon. Dispersion and tunnelling in A_2 and B horizons is a common feature of the landscape when disturbed.

This landscape is different from other Ordovician Adaminaby Group landscapes in that it is heavily timbered and steep, with little salinity potential.

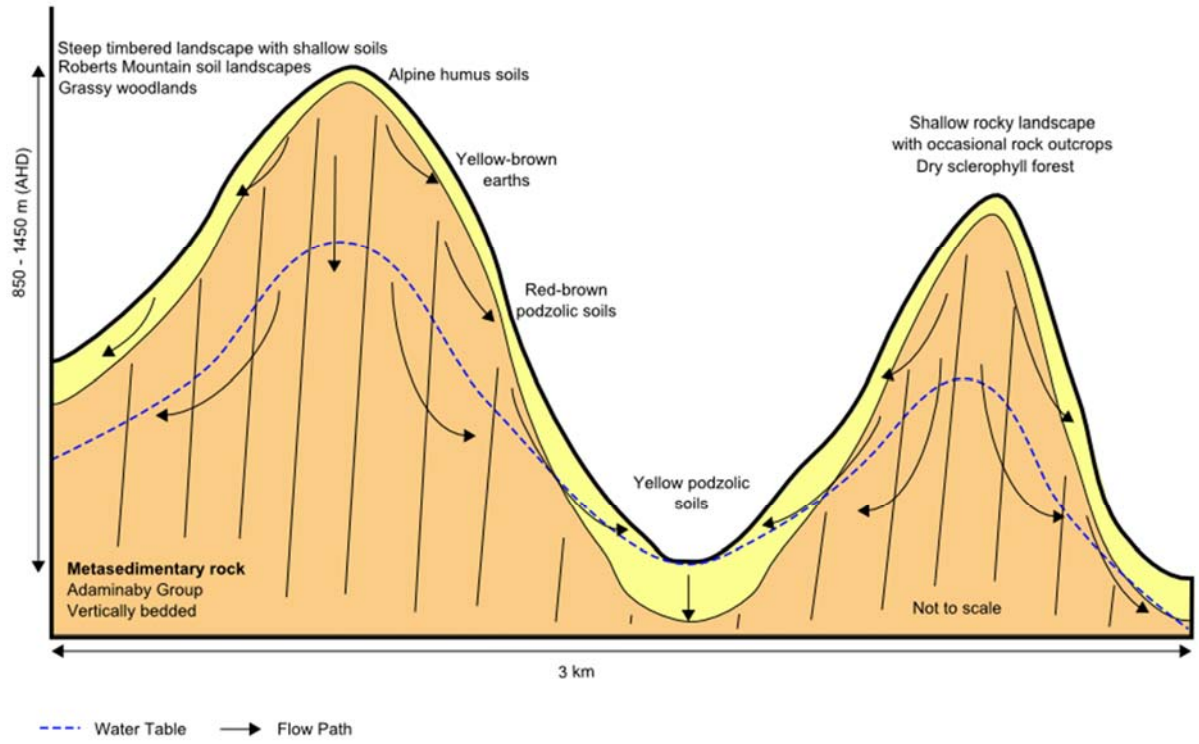


Figure 2: Conceptual cross-section for Boboyan HGL showing the distribution of regolith and landforms, salt sites if present, and flow paths of water infiltrating the system.

Evidence of salinity is not observed in this HGL (Table 1).

Table 1: Boboyan HGL salinity expression.

SALINITY EXPRESSION	
Land Salinity (Occurrence)	Low – no evidence of salinity
Salt Load (Export)	Low – net dilution landscape
EC (Water Quality)	Low – fresh water

Salt store refers to the amount of salt stored in soil and geology materials. Salt availability refers to how easily this salt can be moved by water. Salt stored within Boboyan HGL has low mobility. There is a low salt store that has moderate availability (Table 2).

Table 2: Boboyan HGL salt store and availability.

SALT MOBILITY			
	Low availability	**Moderate** availability	**High** availability
High salt store			
Moderate salt store			
Low salt store		**Boboyan**	

Overall salinity hazard is based on the likelihood of salinity occurring and its impact. The overall salinity hazard in Boboyan HGL is very low. This is due to the low likelihood that salinity issues will occur and that they would have potentially limited impacts (Table 3).

Table 3: Likelihood of salinity occurrence, potential impact and overall hazard of salinity for Boboyan HGL.

OVERALL SALINITY HAZARD			
	Limited potential impact	**Significant** potential impact	**Severe** potential impact
High likelihood of occurrence			
Moderate likelihood of occurrence			
Low likelihood of occurrence	**Boboyan**		

LANDSCAPE FEATURES

The following photographs illustrate landscapes and specific features observed in this HGL. Information used to define the HGL is summarised in Table 4.

Photo 1: Roberts Mountain Soil Landscape soils developed on the steep metasediments (Photo: DPI / A Nicholson).

Photo 2: Landscape view of Boboyan HGL (Photo: DPI / A Nicholson).

Photo 3: Steep heavily timbered Boboyan HGL (Photo: DPI / A Nicholson).

Table 4: Summary of information used to define Boboyan HGL.

Lithology *(Raymond et al. 2007; Geoscience Australia 2015)*	This HGL comprises Ordovician metasediments. Key lithologies include: • Adaminaby Group

Annual Rainfall	650 – 1000mm
Regolith and Landforms	Soil generally < 1 m with deeper pockets associated with saprolite along fractures. Shallow depth and high rainfall provide low potential for salt store. Slope class 10–32% with 0–10% in valley bottom Elevation range 850–1450 m
Soil Landscapes *(Jenkins 1993; Jenkins 2000; Cook & Jenkins in prep)*	The following soil landscapes are dominant in this HGL: • Roberts Mountain (variant A) • Roberts Mountain • Wathonga (minor) Tenosols (Alpine Humus Soils) are limited to the highest parts of the landscape. Crests at lower elevation or in more exposed positions contain Clastic Rudosols (Lithosols). Shallow Yellow and Brown Kandosols (Shallow Red and Yellow Earths) are common on upper and some mid slopes. On gentler mid slopes and most lower slopes Red and Brown Chromosols (Red and Yellow Podzolic Soils) may be found. On the lowest slopes relatively deep Red Kandosols (Red Earths) occur in association with colluvial deposits (e.g. talus). Limited floodplains with Stratic Rudosols (Alluvial Soils and unconsolidated sediments)
Land and Soil Capability	Class 6
Land Use	Native forest, national park, old grazing lands in national park
Key Land Degradation Issues	• gullying and water erosion • road and access track sediment • shallow soils • soil acidity
Native Vegetation *(Keith 2004; Gellie 2005; Dept. of Environment 2012)*	This HGL is situated within the IBRA7 Australian Alps region and South Eastern Highlands (Murrumbateman subregion) The HGL is largely uncleared with vegetation formations comprised mostly of Grassy Woodlands in alpine areas and Dry Sclerophyll Forest. Small areas of Wet Sclerophyll Forest and Grasslands are also present. Local vegetation is described by Gellie (2005)

HYDROGEOLOGY

Typical values for the hydrogeological parameters of this HGL are summarised in Table 5.

Table 5: Summary of values for typical hydrogeological parameters of Boboyan HGL.

Aquifer Type	Unconfined to semi-confined in fractured rock and saprolite Lateral flow through unconsolidated colluvial sediments on lower slopes and in flow lines

Hydraulic Conductivity	Moderate Range: 10^{-2}–10 m/day
Aquifer Transmissivity	Low Range: <2 m^2/day
Specific Yield	Low Range: <5%
Hydraulic Gradient	Moderate Range: 10–30%
Groundwater Salinity	Fresh Range: <800 µS/cm
Depth to Watertable	Intermediate to deep Range: 2–>8m
Typical Sub-Catchment Size	Small (<100 ha)
Scale (Flow Length)	Local Flow length: <5 km (short)
Recharge Estimate	Moderate
Residence Time	Medium (years)
Responsiveness to Change	Fast to medium (months to years)

MANAGEMENT OPTIONS

Overarching salinity management strategies have specific biophysical outcomes. These are achieved by implementing a series of targeted land management actions that take into account the opportunities and constraints of the particular HGL. The actions recognise the need for diffuse and specific activities within the landscape to impact on salinity. Further explanation of land management functions, strategies and actions can be found in Wooldridge *et al.* (2015).

Salinity is driven by interactions between water-use capacity of vegetation, physical soil properties and hydrogeological processes within the HGL.

Actions that influence the way water is used by vegetation or stored in the soil profile will have impacts on recharge. The influence of both continual and episodic recharge and the impacts of extreme weather events should be considered when deciding on appropriate management actions. Short and long-term climate cycles also should be considered as they have a bearing on salinity processes, particularly salt load and land salinity.

Landscape Functions – Boboyan HGL

Functions this landscape provides within a catchment scale salinity context:

- **A.** The landscape provides fresh water runoff as an **important water source.**

- **B.** The landscape provides fresh water runoff as an **important dilution flow source.**

Landscape Management Strategies – Boboyan HGL

Appropriate strategies pertinent to this landscape:

- **Maintain or maximise runoff (10)**
- **Maintain current hydrology (11)**

Key Management Focus – Boboyan HGL

Managing water within a national park for both water quality and water quantity is a major focus. Fire and access tracks form part of the management infrastructure for natural resource management. The focus of this catchment is primarily water delivery.

There are areas of high altitude in the national park that have wetland of ecological significance. The area has a highly erodible and sensitive base, with lack of disturbance a major management priority.

Specific Land Management Opportunities

Specific opportunities for this HGL:

- public land – national park
- intact vegetation communities
- hydrology is mainly intact
- high biodiversity and ecological function in high altitude areas including some wetlands.

Specific Land Management Constraints

Constraints on land management in this HGL include:

- fire regime will have a large impact on the hydrology of this HGL
- access and topography limit land management options
- it is difficult to limit the access of feral animals to sensitive areas – riparian zones
- infrastructure – access track construction, location and maintenance.

Specific Targeted Actions

Management areas for this HGL are illustrated in Figures 3 and 4. The specific management actions for these areas are described in Table 6.

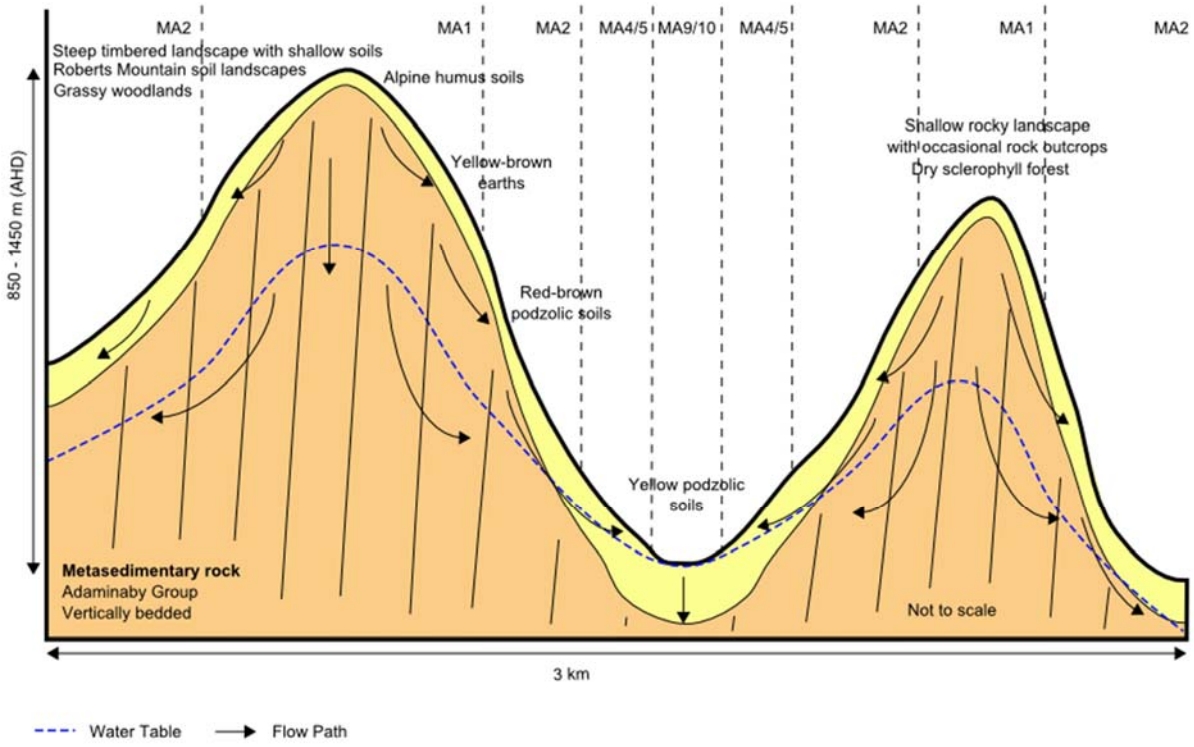


Figure 3: Management cross-section for Boboyan HGL showing defined management areas.

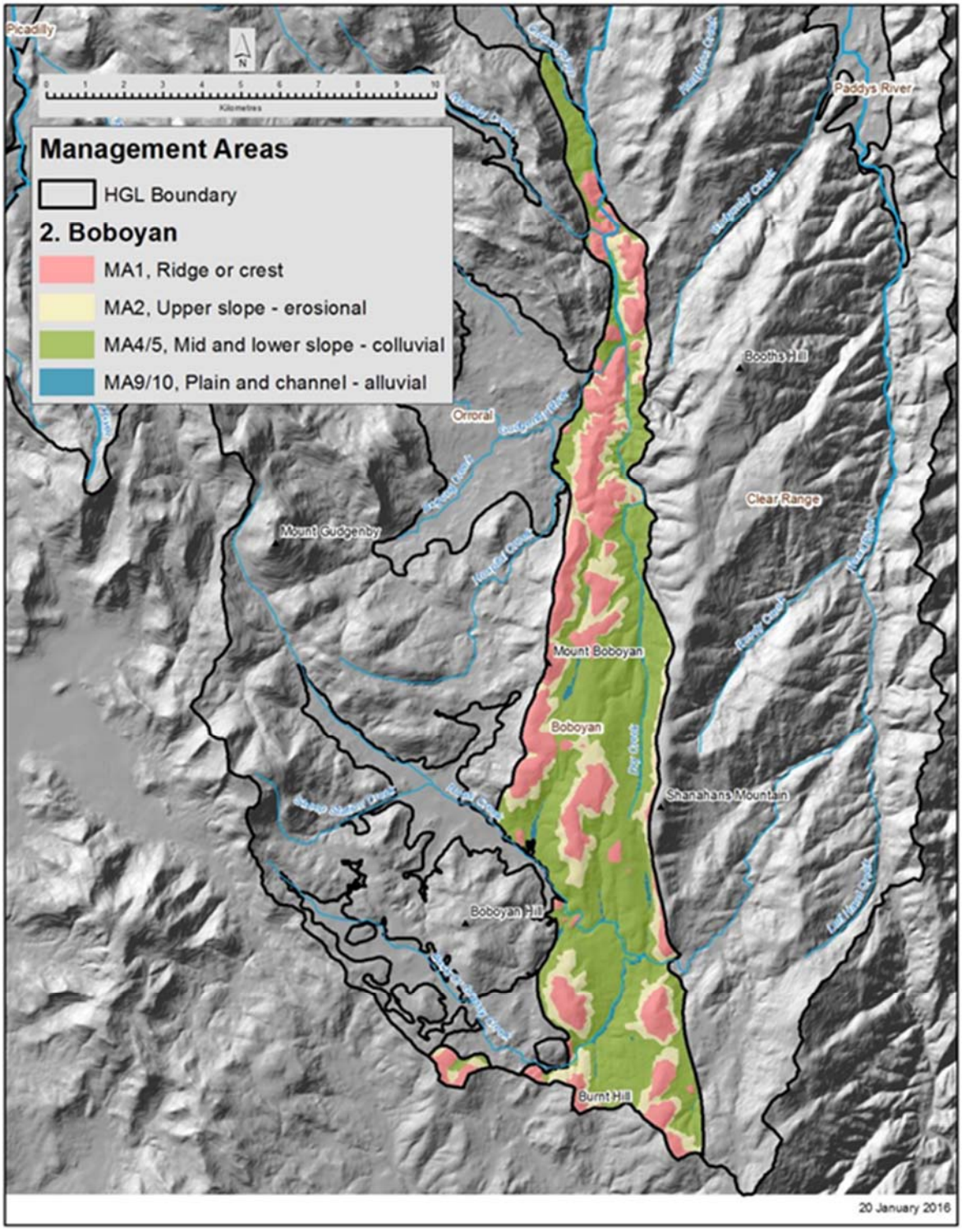


Figure 4: Spatial distribution of management areas for Boboyan HGL.

Table 6: Specific management actions for management areas within Boboyan HGL.

Management Area (MA)	Action
MA 1 (RIDGES)	**Vegetation for ecosystem function** Maintain and improve existing native vegetation to protect current landscape hydrology **(VE8)**
MA 2 (UPPER SLOPE – EROSIONAL)	**Vegetation for ecosystem function** Maintain and improve existing native vegetation to protect current landscape hydrology **(VE8)**
MA 4/5 (MID SLOPE & LOWER SLOPE – COLLUVIAL)	**Vegetation for ecosystem function** Maintain and improve existing native vegetation to protect current landscape hydrology **(VE8)**
MA 9/10	**Vegetation for ecosystem function** Maintain and improve existing native vegetation to protect current landscape hydrology **(VE8)** Manage animal impact on sensitive areas for hydrology outcomes **(VE10)**

High Hazard Land Use

There are some management actions that should be discouraged in this HGL as they will have negative impacts on salinity (Table 7).

Table 7: Management actions having negative salinity impacts in Boboyan HGL.

At Risk Management Areas	Action
MA 1, 2, 4/5 & 9/10	Clearing and poor management of native vegetation **(DLU4)** Fire regime management Feral animal control Access track construction Inappropriate location of infrastructure

REFERENCES

Department of the Environment 2012, *Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (Regions),* Australian Government, Department of the Environment, Canberra, ACT

Gellie, N.J.H. 2005, Native vegetation of the Southern Forests: South-east Highlands, Australian Alps, South-west Slopes and SE Corner bioregions, *Cunninghamia 9(2)*, pp 219–253

Geoscience Australia, 2015, *Australian stratigraphic units database*, Canberra, ACT, [Accessed: 20 June 2015] http://dbforms.ga.gov.au/www/geodx.strat_units.int

Jenkins B.R. 1993, *Soil Landscapes of the Michelago 1:100 000 Sheet map and report*, Department of Conservation and Land Management, Sydney, NSW

Jenkins B.R. 2000, *Soil Landscapes of the Canberra 1:100 000 Sheet map and report*, Department of Land and Water Conservation, Sydney, NSW

Keith, D. A. 2004, *Ocean shores to desert dunes: the native vegetation of New South Wales and the ACT*, NSW Department of Environment and Conservation, Hurstville, NSW

Raymond, O.L., Lui, S., Kilgour, P., Retter, A.J., Stewart, A.J. and Stewart, G. 2007, *Surface geology of Australia 1:1,000,000 scale, New South Wales – 2nd edition*, Geoscience Australia, Canberra, ACT

Wooldridge, A., Nicholson, A., Muller R., Jenkins, B. R., Wilford, J. and Winkler, M. 2015, *Guidelines for managing salinity in rural areas*, NSW OEH, Sydney, NSW [Accessed: 20 June 2015] http://www.environment.nsw.gov.au/resources/salinity/150241-HGL-salinity-rural.pdf