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Editing Mitchell Landscapes Final Report

Editing Mitchell Landscapes
(Project No. 092-019)

Report prepared for:
Department of Environment and Climate Change

September 2008

ABN 87 096 512 088 | address Suite 4 2-4 Merton Street Sutherland NSW 2232
postal PO Box 12 Sutherland NSW 1499 | phone 02 8536 8600 | fax 02 9542 5622
web www.ecoaus.com.au

Document Tracking

Item	Detail	Signature
Project Name	Editing Mitchell Landscapes	
Project Number	92-10	
Prepared by	VT	
Approved by	DJ	
Status	Final	

Acknowledgements
This document has been prepared by Eco Logical Australia Pty Ltd with support from DECC.

The study team would like to thank Mike Cavanagh, Ron Avery, Peter Bowen and Dani Ayers for their help with the project.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

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1. Introduction

The Mitchell Landscapes data layer is used for a variety of purposes by NSW DECC, including the determination of overcleared landscapes and the calculation of Biobanking credits. The overcleared landscapes, which were calculated by intersecting Mitchell Landscapes with a native vegetation extent mask of NSW and then refined through a series of expert workshops, are used in the Property Vegetation Plan (PVP) process to approve, or refuse, clearing applications. In Biobanking, Mitchell Landscapes can significantly influence the amount of credits required or generated at a site. As such, the spatial accuracy of Mitchell Landscapes is extremely important.

The Mitchell Landscapes were mapped in 2002 using a combination of landsystems in the west of NSW and geology and a Digital Elevation Model (DEM) in the east of NSW. Landscapes were digitised from existing digital line work in western NSW, ensuring spatial consistency with the landsystem data already mapped. In eastern NSW hardcopy maps containing geology and a DEM were used, and digitising occurred off these hardcopy maps.

Since the mapping of Mitchell Landscapes several more fine scale data layers have been made available, including (and most notably) SPOT 5 satellite imagery, NSW wetlands, contours and improved drainage layers. The availability of these finer scale data layers has highlighted spatial inconsistencies in the Mitchell Landscapes data layer, identifying areas where shifts in data have occurred, or where digitising has not captured the intricacies of the underlying data layers.

In 2007 Eco Logical Australia (ELA) were engaged by DECC to review the spatial accuracy and consistency of the Mitchell Landscapes data layer. During the project ELA reviewed the spatial accuracy of the landscapes and polygons, identifying where major inconsistencies occurred with the underlying data layers, such as geology, SPOT and drainage. ELA recommended that the spatial inaccuracies be edited using finer scale data throughout the state.

1.1 Project Description

ELA were engaged by DECC to correct the Mitchell Landscapes data layer throughout the state. The main errors to be corrected during the project included shifts in landscape polygons, correcting digitising or scale errors, digitising missed water bodies and correcting coastal alignment issues. A variety of data layers were used to correct the errors identified. These data layers include:

- SPOT 5
- Drainage lines
- Contours (10 m)
- State Boundary
- Geology
- Wetlands
- Tidal Limits

Errors were corrected by editing one 1:250,000 mapsheet at a time, with digitising being undertaken at a 1:100,000 scale. The correction of errors has involved the adjustment of existing inaccurate line work, as opposed to a complete remapping of the data layer.

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2. Methods for Editing Data

ArcGIS 9.2 was utilised to undertake on screen digitising at a 1:100,000 scale. The Mitchell Landscapes data layer was split into 61 1:250,000 mapsheets prior to editing, enabling edits to be tracked. Mapsheets were allocated different colours to highlight and differentiate between a mapsheet being edited, mapsheets that were yet to be edited and mapsheets where edits had been completed.

The editing and correction of errors for the Mitchell Landscapes data layer commenced with mapsheets in western and central-western NSW and progressively moved to eastern NSW. The mapsheet of interest was zoomed into at a logical point (coastline or corner of a mapsheet), at a scale of 1:100,000, and edited in logical paths (across or down the mapsheet) to ensure that no section was missed. Where there were permanent waterbodies (large dams, estuaries etc) without an appropriate landscape feature attribute, they were added as a landscape feature and tagged with "Estuary/Water". Additionally, any land present within a waterbody was attributed as the nearest appropriate landscape feature.

Edits were made using the most reliable and applicable data layer(s) available. The data layers used for making edits were given varying priorities based on their reliability; with priority given to SPOT, contours, and drainage lines, followed then by wetlands and geology.

Line work was firstly compared to SPOT, contours and drainage lines. If an inconsistency was identified, the line work was edited using these base layers. Occasionally the wetlands and tidal limits data layers were also used in conjunction with these data layers to increase their spatial accuracy. If no inconsistencies were identified using the high priority layers, then the line work was compared to the underlying geology data. If an inconsistency was evident (where it was obvious the line work should have been the same as geology) then the line work was edited accordingly. Where no obvious difference could be identified between the line work and base data layers, or where the line work did not seem to match any of the base data layers, no edits were made.

The state boundary layer was independent of all the other data layers and therefore was always used to identify and edit state boundary inaccuracies in the Mitchell Landscapes data layer.

Editing was undertaken within a personal geodatabase and the topology editing tools of ArcGIS utilised. The main editing tools that were used within ArcGIS were 'Auto-Complete Polygon', 'Cut Polygon Features', 'Create New Feature', 'Reshape Edge' and 'Reshape Feature'. Topology edits were identified and corrected with the 'Fix Topology Error Tool' using the topology rules of "Polygons must not overlap" and "Polygons must not have gaps".

Some data layers were more useful than others in the editing process and edits generally required the use of multiple data layers to attain a higher degree of spatial accuracy. The use of each data layer is outlined below.

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2.1 SPOT 5

The SPOT data layer was most useful for obvious landscape features such as waterbodies, channels and floodplains, gorges and tablelands. It was often difficult to use SPOT to identify and differentiate between landscapes mapped using geology, due to a lack of obvious landscape features. SPOT was the most reliable data layer used and often added value when combined with other base data layers, such as such as drainage lines and contours.

2.2 Drainage Lines

The drainage lines data layer was useful for landscapes such as alluvial plains, lakes, channels and floodplains. Before edits were undertaken it was common for drainage lines to extend outside their "channels and floodplains" landscape. Therefore the drainage lines data layer was used to adjust the line work for these landscapes to completely encompass the drainage lines and surrounding floodplains.

2.3 Contours

The contours data layer was used extensively in the eastern mapsheets due to the rugged terrain, with landscape features such as escarpments, plateaus, ranges, slopes, hillslopes and footslopes all being edited using the contour information. The layer was used rarely in western mapsheets due to the flatter terrain.

2.4 Wetlands

The wetlands data layer was not widely used as SPOT generally provided a more accurate base data layer for wetland features, however it was useful on some occasions to map landscape features such as marshes, lagoons, lakes, swamps and lunettes. In all cases the wetlands data layer was used in conjunction with other data layers, such as SPOT and drainage lines, to gain an accurate boundary of the wetland feature.

2.5 Tidal Limits

The tidal limits data layer was only used where waterbodies added as "Estuary/Water" continued a significant distance inland. The tidal limits were used to define the inland extend of these waterbodies.

2.6 State Boundary

The state boundary data layer was used for mapsheets located along the state boundary and coastline. Often the Mitchell Landscapes data layer did not reach the state boundary, or extended outside the state boundary. The landscapes line work was subsequently edited to match the state boundary layer.

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2.7 Geology

Due to the known limitations of the geology data layer it was used to inform edits only after the landscapes had been checked against the SPOT, contours and drainage line data layers. Geology was used to edit line work in eastern NSW where the landscape mapping was based on a combination of geology and DEM data layers. Most edits conducted with geology as a base layer corrected data shifts or potential errors made during the digitising of the original landscapes layer.

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3. Results

Over 750 hours of digitising was undertaken to edit the Mitchell Landscapes data layer, with some 1:250,000 mapsheets edited to a greater degree than others. Additionally, over 5,150 topology edits were made on the data layer.

In total 50 mapsheets had line work edited, with 5 of these mapsheets also undergoing significant topological editing. A further 6 mapsheets underwent only topological editing. 5 1:250,000 mapsheets were not edited as they were found to be completely based on the landsystems data layer and no inconsistencies/shifts or topological errors were identified. Most edits took place in the north-eastern and central eastern mapsheets, with fewer in the south-west.

Examples of the type of edits undertaken, and the base data layers used to inform these edits, can be seen in the following figures (Figures 1-4). Pre-edit Mitchell Landscapes are shown in red, while post edit Mitchell Landscapes are shown in orange. Figure 5 highlights the topological errors that required editing.

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Figure 1a: SPOT 5 Pre-Edit

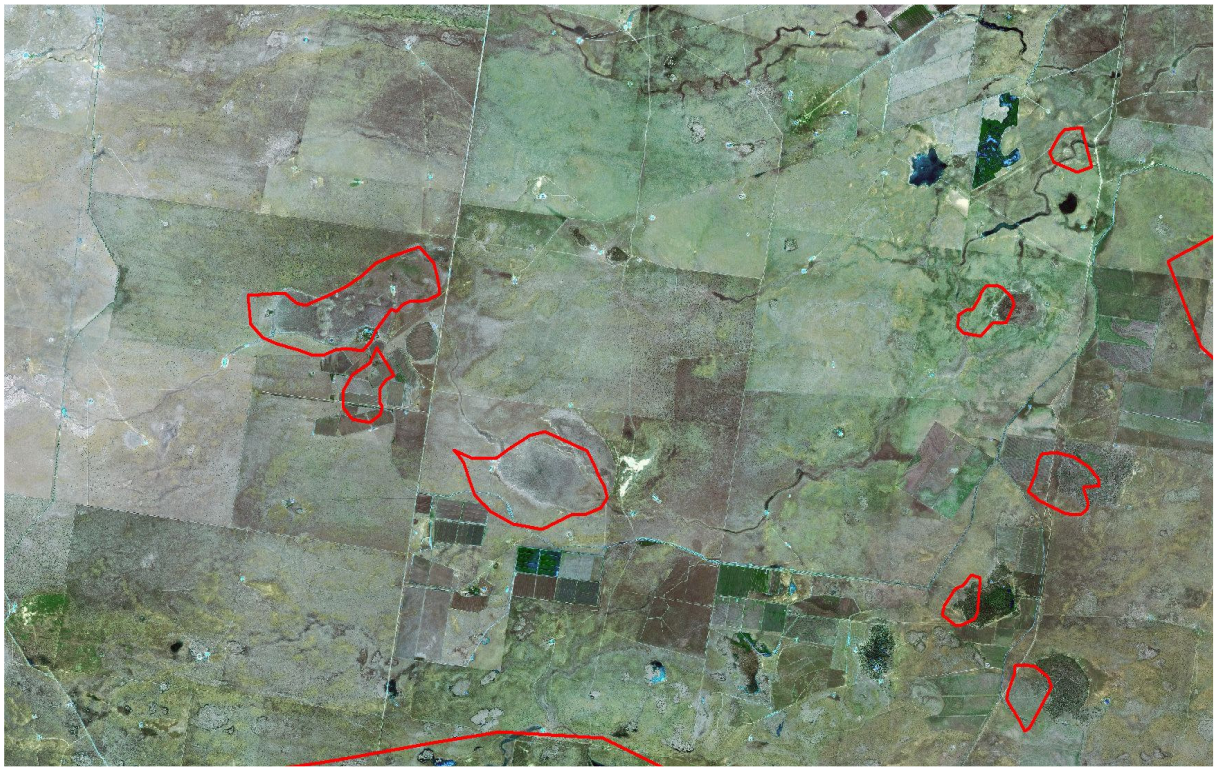

Figure 1b: SPOT 5 Post-Edit

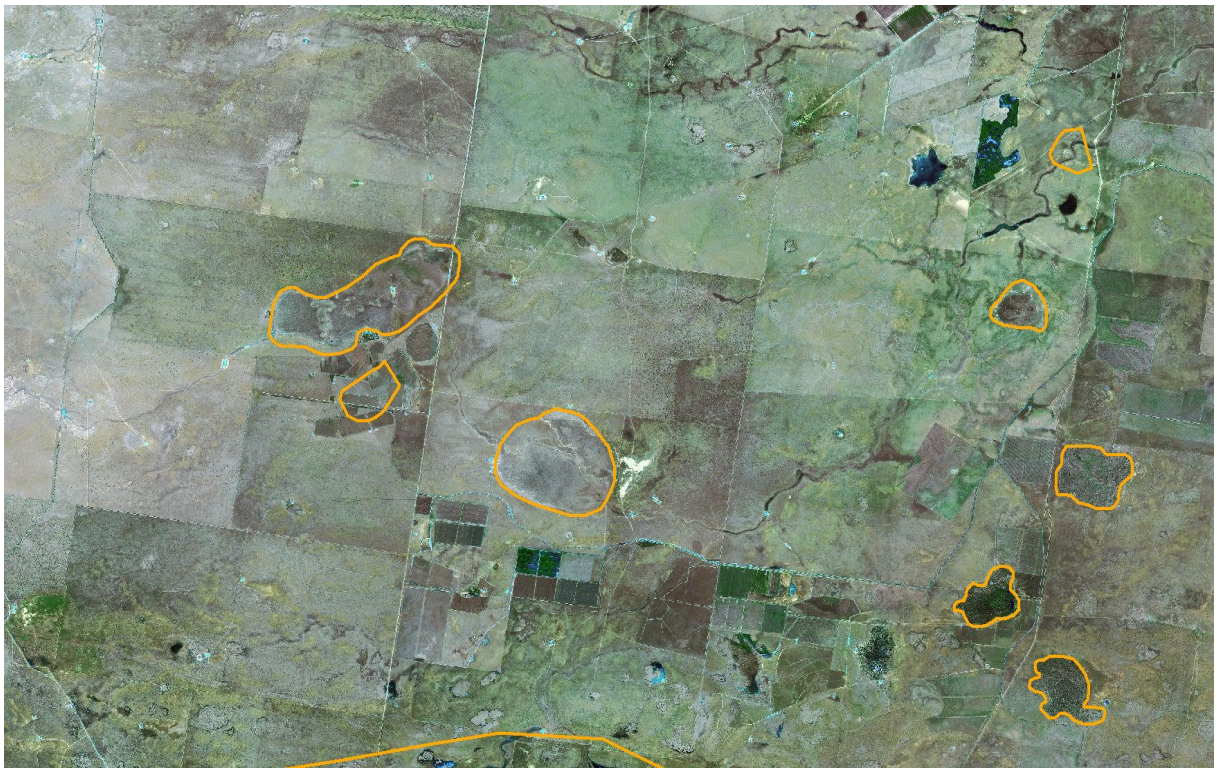

Figure 1a/1b Caption: The changes required for some landscapes could be clearly seen from the SPOT image. The example above demonstrates the highly accurate use of the SPOT image to realign the original line work.

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Figure 2a: Drainage Line Pre-Edit

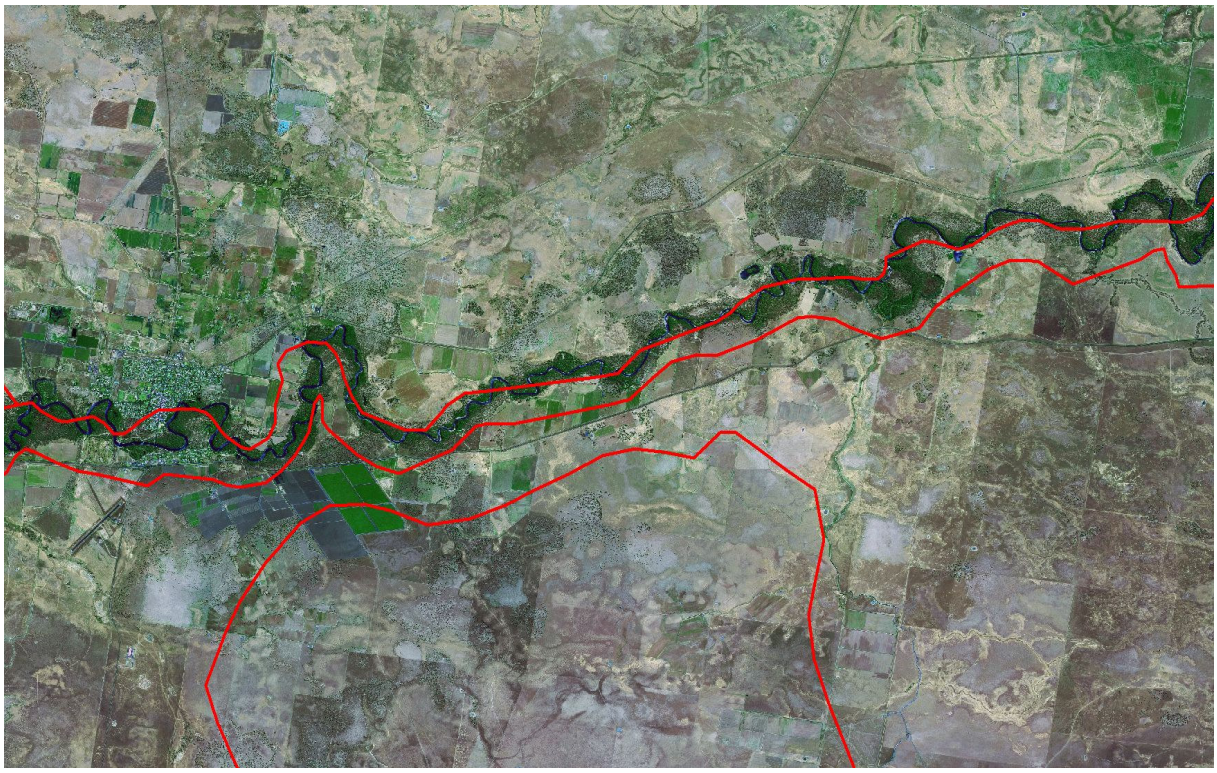

Figure 2b: Drainage Line Post-Edit

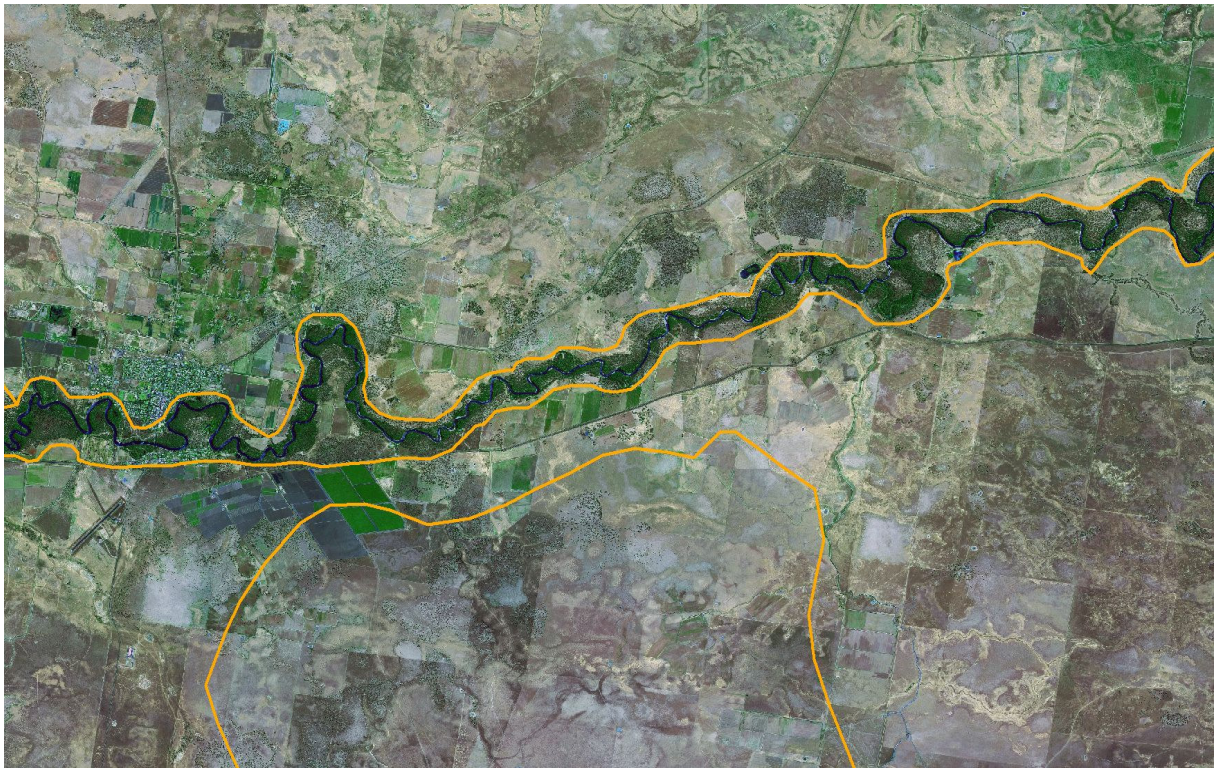

Figure 2a/2b Caption: The above example demonstrates the realignment of drainage landscapes to the more accurate drainage data layer and SPOT image. This type of edit was common throughout the data layer.

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Figure 3a: Contours Pre-Edit

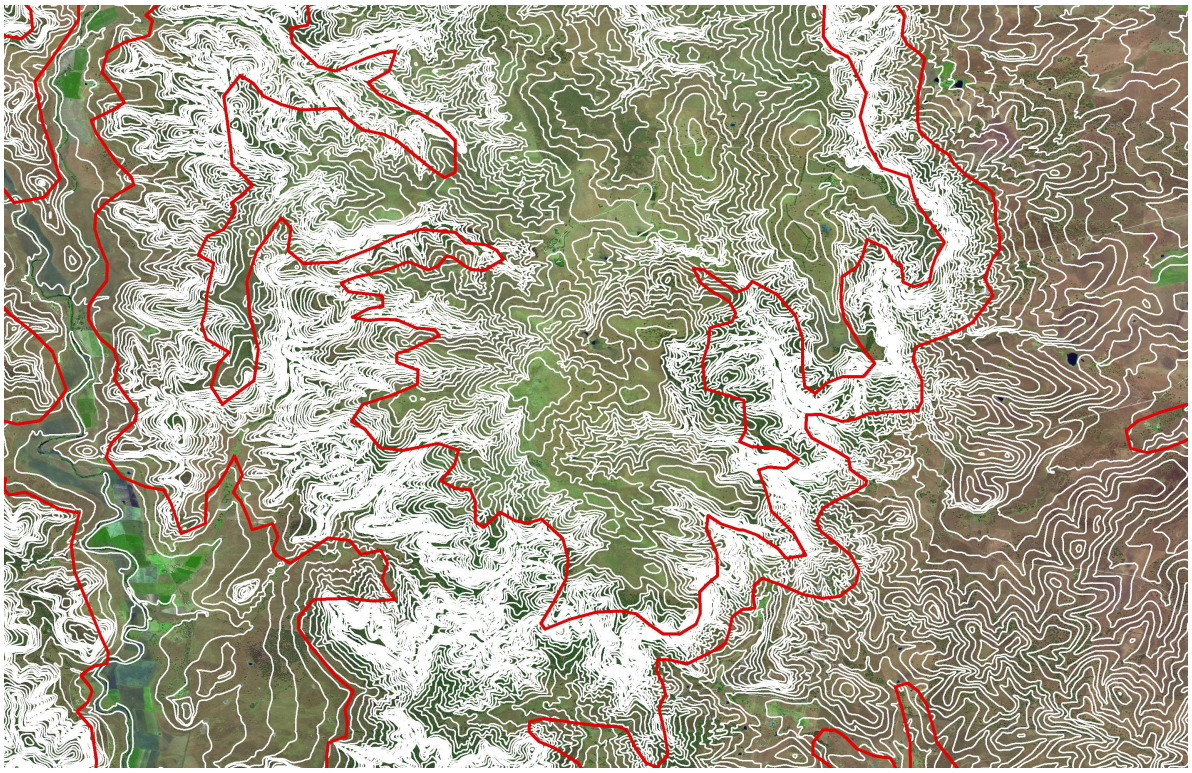

Figure 3b: Contours Post-Edit

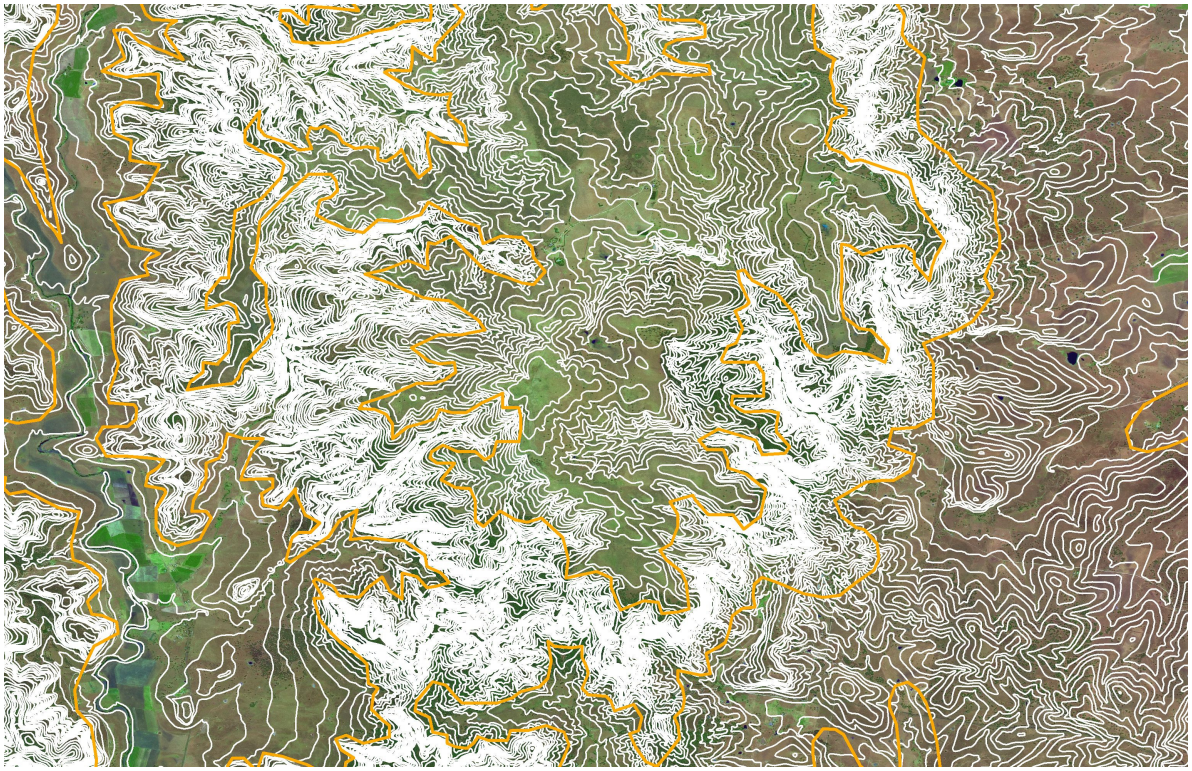

Figure 3a/3b Caption: Contours were used to realign landscapes in rugged areas. The above example demonstrates the use of contours in a 'ranges and valleys' scenario, where the original line work is realigned to the more accurate contours data.

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Figure 4a: Geology Pre-Edit

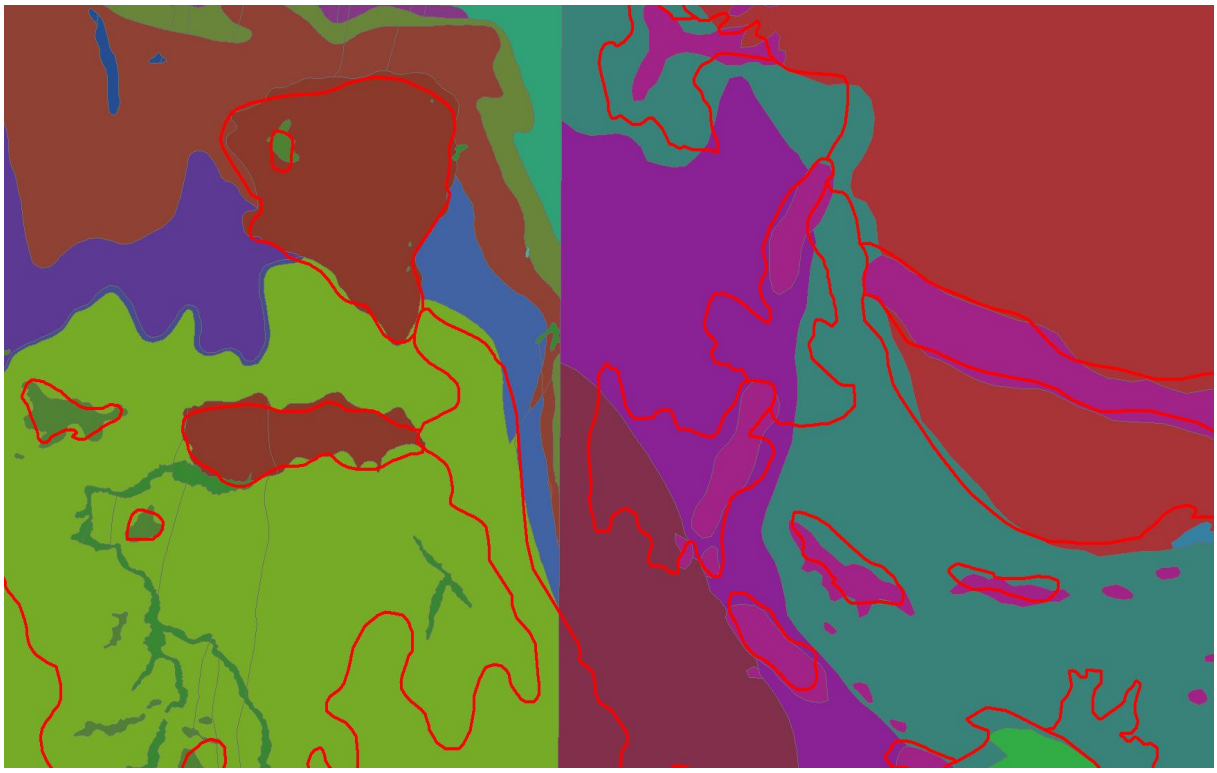

Figure 4b: Geology Post-Edit

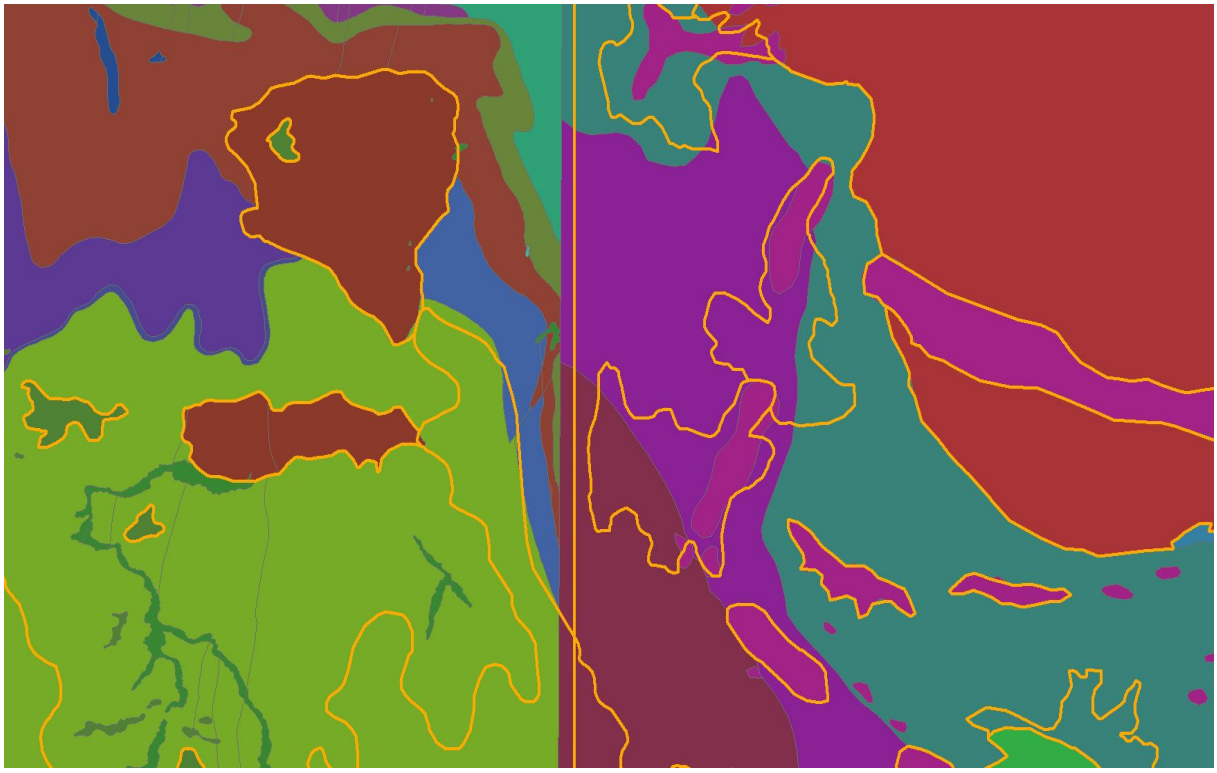

Figure 4a/4b Caption: In the examples above the line work was aligned to geology where it was obvious this was the original base layer used. Where the original line work is not related to geology the line work was not changed.

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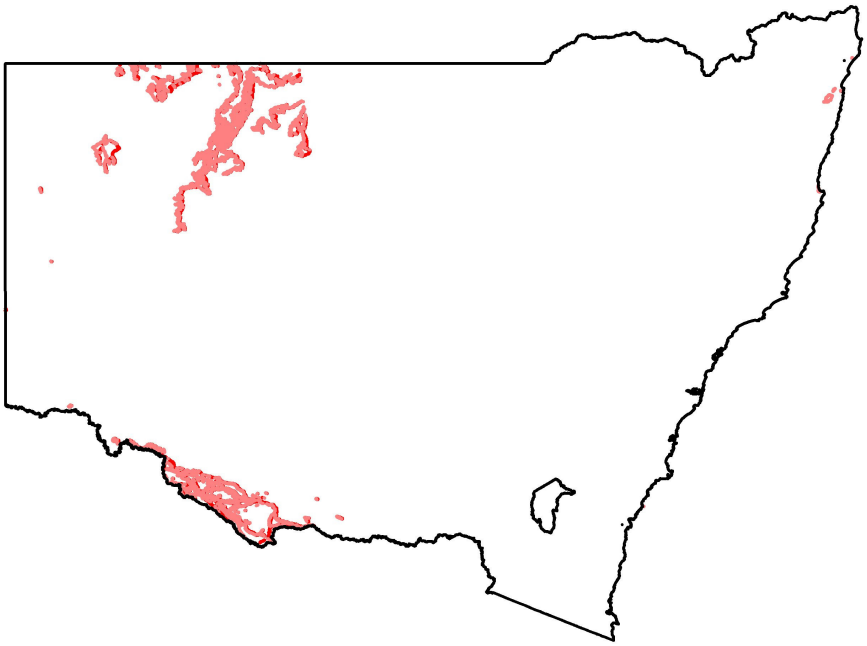
Figure 5: Extent of Topology Errors Edited



3.1 Summary of Edits

Table 1 outlines the edits undertaken for specific 1:250,000 mapsheets, as well as the main base layers used for editing. The main base layers are listed in order of their degree of usage.

Table 1: Summary of Edits by 1:250,000 Mapsheets

Mapsheet	Edits Undertaken	Main Base Layers
Ana Branch	Yes – Line Work	SPOT
Angledool	Yes – Line Work	SPOT; Drainage; Wetlands
Armidale Special	Yes – Line Work	Geology ; Contour; Drainage; SPOT; State Boundary
Balranald	Yes – Topology; Line Work	Drainage; SPOT; State Boundary
Barnato	No	N/A
Bathurst	Yes – Line Work	Geology; Contours; Drainage; SPOT
Bega	Yes – Line Work	Wetlands; Drainage; Contour; Geology; SPOT; State Boundary
Bendigo	Yes – Topology; Line Work	Geology; State Boundary; SPOT
Booligal	Yes – Line Work	Drainage; SPOT
Bourke	Yes – Line Work	Drainage; SPOT
Brisbane Special	Yes – Line Work	Geology; Contours; Drainage; SPOT; State Boundary; Tidal Limit
Broken Hill	No	N/A
Canberra	Yes – Line Work	Geology; Contours; Drainage; SPOT
Cargelligo	Yes – Line Work	Contours; Geology; Drainage; SPOT
Cobar	Yes – Line Work	Drainage; SPOT
Cobham Lake	Yes - Topology	N/A
Cootamundra	Yes – Line Work	Contours; Geology; Drainage; SPOT

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Mapsheet	Edits Undertaken	Main Base Layers
Deniliquin	Yes – Topology; Line Work	Geology; Drainage; State Boundary; SPOT
Dubbo	Yes – Line Work	Contours; Drainage; Geology; SPOT
Enngonia	Yes – Line Work	Drainage; SPOT
Forbes	Yes – Line Work	Contours; Geology; Drainage; SPOT
Gilgandra	Yes – Line Work	Contours; Drainage; Geology; SPOT
Goondiwindi	Yes - Line Work	Drainage; Geology; SPOT; State Boundary
Goulburn	Yes – Line Work	Geology; Drainage; SPOT
Grafton	Yes – Line Work	Contours; Geology; Drainage; SPOT
Hastings	Yes – Line Work	Geology; Drainage Contours; SPOT; State Boundary
Hay	Yes – Topology; Line Work	SPOT; Drainage; Geology
Inverell	Yes – Line Work	Geology; Drainage; Contours; SPOT; State Boundary
Ivanhoe	Yes – Line Work	Drainage; SPOT
Jerilderie	Yes – Line Work	Geology; Contours; Drainage; SPOT; State Boundary
Lismore Special	Yes – Line Work	Geology; Contours; SPOT; Tidal Limit; State Boundary
Louth	Yes - Topology	N/A
Mallacoota	Yes – Line Work	Geology; Drainage; State Boundary; SPOT
Manara	No	N/A
Manilla	Yes – Line Work	Contour; Geology; Drainage; SPOT
Menindee	No	N/A
Mildura	Yes – Line Work	Drainage; SPOT; State Boundary
Milparinka	No	N/A
Moree	Yes – Line Work	Drainage; SPOT; Geology
Narrabri	Yes – Line Work	Drainage; SPOT; Geology
Narrandera	Yes – Line Work	Contours; Geology Drainage; SPOT
Narromine	Yes – Line Work	Contours; Drainage; Wetlands; SPOT
Newcastle	Yes – Line Work	Contours; Geology; SPOT; State Boundary
Nymagee	Yes – Line Work	Contours; SPOT
Nyngan	Yes – Line Work	Drainage; SPOT; Geology
Pooncarie	Yes – Line Work	SPOT
Singleton	Yes – Line Work	Contours; Drainage; Geology; SPOT
St George	Yes - Line Work	Drainage; Geology; State Boundary; SPOT
Swan Hill	Yes – Topology; Line Work	Drainage; Geology; SPOT; State Boundary
Sydney Special	Yes – Line Work	Contour; Drainage; Geology; SPOT; State Boundary
Tallangatta	Yes – Line Work	Contour; Geology; Drainage; SPOT; State Boundary
Tamworth	Yes – Line Work	Contours; Geology; Drainage; SPOT
Urisino	Yes - Topology	N/A
Wagga Wagga	Yes – Line Work	Geology; Contours; Drainage; State Boundary; SPOT
Walgett	Yes – Line Work	Geology; Drainage; Wetlands; SPOT
Wangaratta	Yes – Line Work	SPOT; State Boundary
Warwick	Yes – Line Work	Geology; Contours; Drainage; State Boundary; SPOT

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Mapsheet	Edits Undertaken	Main Base Layers
White Cliffs	Yes - Topology	N/A
Wilcannia	Yes - Topology	N/A
Wollongong Special	Yes – Line Work	Contours; Geology; Drainage; SPOT
Yantabulla	Yes - Topology	N/A

SPOT was used as the base layer to inform edits for all 50 mapsheets that were edited, emphasising its importance to the editing process. The importance of SPOT was followed by drainage (43 mapsheets), geology (37 mapsheets), contours (22 mapsheets), state boundary (21 mapsheets), wetlands (4 mapsheets) and tidal limits (2 mapsheets).

3.2 Limitations

The main limitation of the digitising and refinement undertaken is the use of the geology data for identifying and editing inaccuracies when features were not obvious in more accurate data layers, such as within the SPOT, contours or drainage line data layers. The geology layer is of unknown accuracy and contains inconsistencies and potential errors in its own right. It is therefore important to note that where the geology data has been used as the base layer, the edit made is potentially not as accurate as one that was made using SPOT, contours or drainage lines.

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Fax - (02) 9542 5622

4. Conclusion and Recommendations

The Mitchell Landscapes data layer was split into 61 1:250,000 mapsheets, with 56 edited to varying degrees based on a variety of available data layers. The SPOT, contours and drainage line data layers were given priority over the geology data layer due to their higher degree of accuracy. The major limitation with many of the edits undertaken was the use of the geology data layer which contains inconsistencies and is of unknown accuracy.

Additional work is required on the Mitchell Landscapes data layer to further increase its accuracy and reliability in problematic areas. The following recommendations are made for this work:

- A new, more accurate and consistent geology layer should be sourced from the Department of Primary Industries (if available). This layer would more accurately inform the edits made and lead to a more precise Mitchell Landscapes data layer.
- Further regional and state-wide data layers should be sourced when available, including recent soils or vegetation mapping. These layers could potentially inform the edits made.
- Mapsheets heavily dependent on the geology data layer for editing should undergo more review, and potentially be redefined. These mapsheets are predominantly in the east of the state and include:
    - Armidale Special
    - Bathurst
    - Bendigo
    - Brisbane Special
    - Canberra
    - Deniliquin
    - Goulburn
    - Hastings
    - Inverell
    - Jerilderie
    - Lismore Special
    - Mallacoota
    - Wagga Wagga
    - Walgett
    - Warwick
- Should the review of a large number of mapsheets not be desirable, DECC should prioritise areas where a large number of PVP or Biobanking assessments are currently undertaken. These areas could be reviewed in the first instance. Alternatively, highly cleared Mitchell Landscapes within these mapsheets could be targeted for review to ensure these landscapes are mapped correctly and the decisions made on the basis of these Mitchell Landscapes are accurate.

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