

# Australian Hydrological Geospatial Fabric (Geofabric) Tutorial

Use Environmental Stream Attributes to  
extend stream and catchment attribution

Version 2.1 – May 2013



**Australian Government**  
**Bureau of Meteorology**



This page intentionally left blank

## Contact details

Geospatial Data Unit

Bureau of Meteorology  
GPO Box 2334 CANBERRA ACT 2601

Phone: 02 6232 3502  
Email: [ahgf@bom.gov.au](mailto:ahgf@bom.gov.au)

## Contents

|       |   |    |
|-------|---|----|
| 1     | Introduction.....   | 5  |
| 1.1   | Background.....   | 5  |
| 1.2   | Extend Geofabric attribution .....                                | 5  |
| 1.3   | Delivery format .....   | 5  |
| 1.3.1 | EnvironmentalStreamAttributes ZIP file.....                       | 6  |
| 1.3.2 | stream_attributes GDB .....                                       | 6  |
| 1.3.3 | ANU_ReleaseNotes_NationalCatchmentDatabase PDF .....              | 6  |
| 1.3.4 | NVIS_major_vegetation_Sub-groups PDF.....                         | 7  |
| 1.3.5 | ReadMe TXT.....   | 7  |
| 1.3.6 | segment-envatts XLS .....   | 7  |
| 1.4   | Additional sources of environmental attributes .....              | 7  |
| 1.5   | ArcGIS version .....  | 7  |
| 2     | Tutorial .....  | 8  |
| 2.1   | Create a subset of the Geofabric data.....                        | 8  |
| 2.2   | Join lookup table (LUT) to AHGFNetworkStream, AHGFCatchment ..... | 8  |
| 2.3   | Symbolise LUT attributes.....                                     | 12 |
| 3     | Examples of symbolised LUTs and their attributes .....            | 15 |
| 3.1   | run70_08 – annual mean runoff.....                                | 15 |
| 3.1.1 | RUNANNMEAN.....   | 16 |
| 3.2   | Landuse – forestry.....   | 17 |
| 3.2.1 | STR_FORSTRY.....  | 17 |
| 3.2.2 | SUB_FORSTRY.....  | 18 |
| 3.2.3 | CAT_FORSTRY.....  | 18 |
| 3.3   | Landuse – modified land .....                                     | 19 |
| 3.3.1 | STR_MOD .....   | 19 |
| 3.3.2 | SUB_MOD .....   | 20 |
| 3.3.3 | CAT_MOD .....   | 20 |
| 3.4   | Veg forestry.....   | 21 |
| 3.4.1 | STRFORESTS_NAT .....  | 21 |
| 3.4.2 | CATFORESTS_NAT .....  | 22 |
| 3.5   | Terrain – mean elevation.....                                     | 23 |
| 3.5.1 | STRELEMEAN .....  | 23 |
| 3.5.2 | SUBELEMEAN .....  | 24 |
| 3.5.3 | CATELEMEAN .....  | 24 |

# 1 Introduction

## 1.1 Background

The National Environmental Stream Attributes dataset was developed by the Australian National University (ANU) in 2011. It is a set of lookup tables (LUT) that supply attributes which describe the natural and anthropogenic characteristics of the stream and catchment environment at three spatial scales:

1. the stream and its valley
2. the sub-catchment
3. catchment.

The spatial units at these scales are delineated by, respectively, the 9 second grid cells comprising:

1. the stream segment (the links in the Geofabric Surface Network's AHGFNetworkStream layer) including where indicated, the adjacent valley bottom flats
2. the stream segment sub-catchment (Geofabric Surface Catchments AHGFCatchment)
3. either the catchment area upstream or the flow path downstream of the stream segment.

This tutorial provides examples of Environmental Stream Attribute lookup tables and demonstrates how they can be joined to the Geofabric product enabling further analysis of the products.

Detailed analyses may require the input of additional data.

## 1.2 Extend Geofabric attribution

The data is supplied as a supplementary Geofabric product. Geofabric Surface Network's AHGFNetworkStream and Geofabric Surface Catchments AHGFCatchment can be joined to any national environmental stream attribute table using the SEGMENTNO field.

## 1.3 Delivery format

The LUTs are available as an ESRI ArcGIS File Geodatabase v9.3 and supplied as a packaged ZIP file

A Microsoft Excel file describing the attributes and their values is available as a separate file and as part of the ZIP.

They can be downloaded from Geoscience Australia:

<http://ga.gov.au/topographic-mapping/national-surface-water-information.html>

### 1.3.1 EnvironmentalStreamAttributes ZIP file

This ZIP file contains:

- stream\_attributes GDB
- ANU\_ReleaseNotes\_NationalCatchmentDatabase PDF
- NVIS\_major\_vegetation\_Sub-groups PDF
- ReadMe TXT
- segment-envatts XLS

### 1.3.2 stream\_attributes GDB

This is an ArcGIS 9.3 geodatabase of lookup tables (LUT). See Table 1 for a list of the LUTs and a brief description of their content.

**Table 1 Stream attributes**

| <b>LUT name</b> | <b>Description of data</b>   |
|-----------------|--|
| climate         | Parameters describing annual, seasonal and extreme climate and rainfall intensity                |
| connectivity    | Presence of major in-stream barriers including dams and waterfalls                               |
| identifiers     | Stream segment, basin and pour-point identifiers   |
| Landuse         | Land-use and population density  |
| network         | Stream network parameters / habitat availability   |
| npp             | Mean net primary productivity  |
| Rdi_geodata2    | River Disturbance Indices indicators of pressure on stream ecosystems due to human activities    |
| run70_08        | Summary statistics derived from the accumulated monthly runoff for the period 1970–2008          |
| run71_00        | Summary statistics derived from the accumulated monthly runoff for the period 1971–2000          |
| substrate       | Soil hydrologic properties, surface geology  |
| terrain         | Elevation, slope, Strahler stream order, catchment area and shape, distance from source / outlet |
| veg             | Aggregated vegetation classes cover  |
| Veg_mvsg        | Major vegetation sub-groups  |

### 1.3.3 ANU\_ReleaseNotes\_NationalCatchmentDatabase PDF

This PDF contains a brief introduction to the National Catchment and Stream Environment Database and revision history.

The database includes the stream environmental attribute lookup tables together with the DEM derived streams and National Catchment Boundaries that form the foundation layers for the Geofabric Surface Network's AHGFNetworkStream and Geofabric Surface Catchments AHGFCatchment products respectively.

### 1.3.4 NVIS\_major\_vegetation\_Sub-groups PDF

A table listing the Major Vegetation Subgroups (MVS) and their respective MVS number which is used in the veg\_msg LUT.

Major Vegetation Subgroups data and the associated description were sourced from the National Vegetation Information System (NVIS) compiled by the Environmental Resources Information Network unit within the Department of Sustainability, Environment, Water, Population and Communities. It is based on NVIS data provided by State, Territory and Commonwealth organisations.

See details at

<http://www.environment.gov.au/erin/nvis/index.html>

### 1.3.5 ReadMe TXT

A text file which describes and lists the content of the ZIP file.

### 1.3.6 segment-envatts XLS

This spreadsheet can be downloaded as part of the ZIP file as well as a standalone file from the Geoscience Australia website mentioned in Section 1.4.3.

This spreadsheet describes the contents of each LUT in stream\_attributes GDB and the source of the data used to calculate the LUT attributes.

## 1.4 Additional sources of environmental attributes

Environmental attributes not included in the National Environmental Stream Attributes dataset can be calculated using existing Geofabric attributes or Bureau of Meteorology data.

Please refer to the following tutorials on the Geofabric website for some examples:

<http://www.bom.gov.au/water/geofabric/documentation.shtml>

- Calculate upstream drainage area with ArchHydro – uses Geofabric Surface Network data
- Calculate rainfall summary statistics for a derived catchment – uses Geofabric Surface Network data and publicly available Bureau of Meteorology rainfall data

## 1.5 ArcGIS version

The steps outlined in this tutorial use ArcGIS 10 (SP 3).

## 2 Tutorial

### 2.1 Create a subset of the Geofabric data

This tutorial illustrates the environmental stream attributes using a subset of Geofabric data – Geofabric Hydrology Reporting Regions’ Tuross River RiverRegion.

For instructions on how to create a subset of the national Geofabric dataset, refer to the Geofabric Tutorial Creating a subset of Geofabric data which is available from:

<http://www.bom.gov.au/water/geofabric/documentation.shtml>

### 2.2 Join lookup table (LUT) to AHGFNetworkStream, AHGFCatchment

Every LUT has a SEGMENTNO field which is used to join the LUT to AHGFNetworkStream or AHGFCatchment.

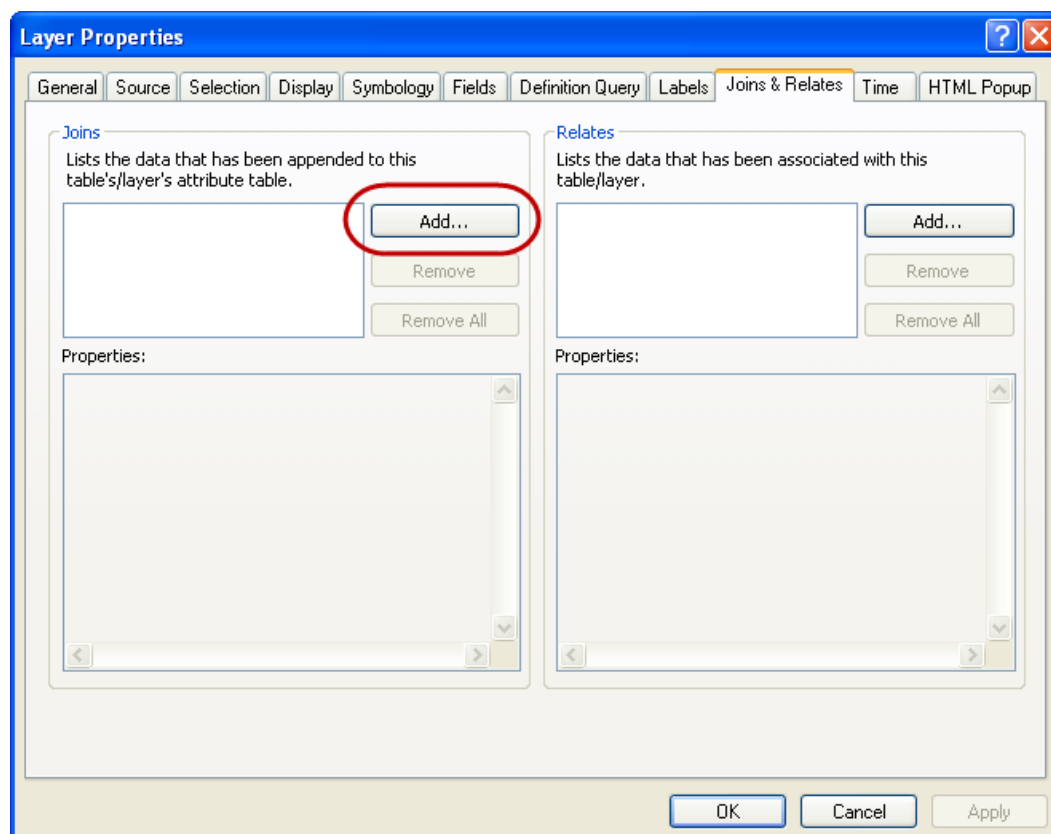
The join process is identical for all LUTs and for both AHGFNetworkStream and AHGFCatchment and is described below.

1. In ArcMap, add:
  - AHGFCatchment
  - AHGFNetworkStream
  - a LUT (in this example run70\_08\_lut.)

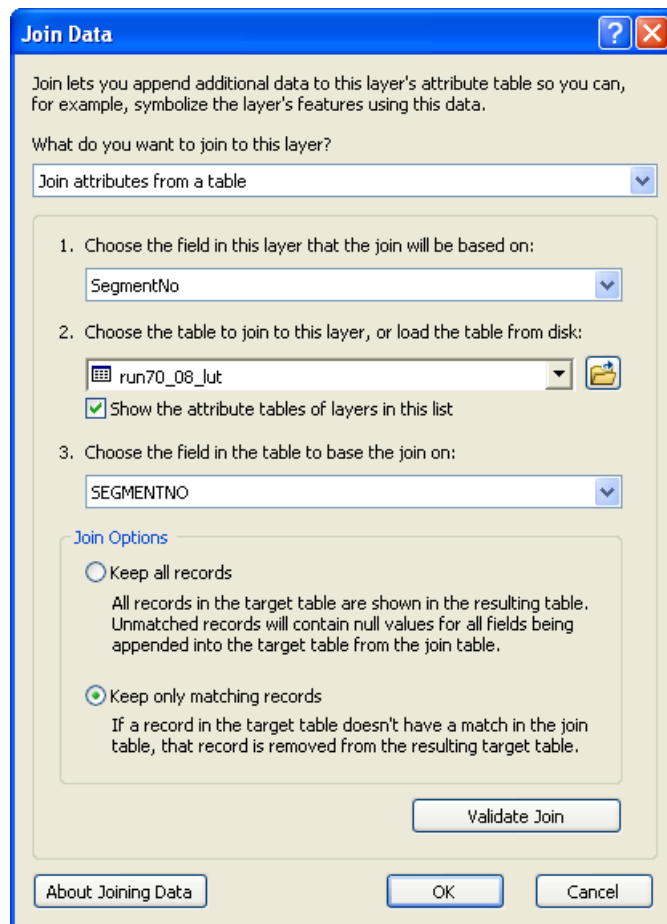


## Australian Hydrological Geospatial Fabric (Geofabric) Tutorial 5 Use Environmental Stream Attributes to extend stream and catchment attribution

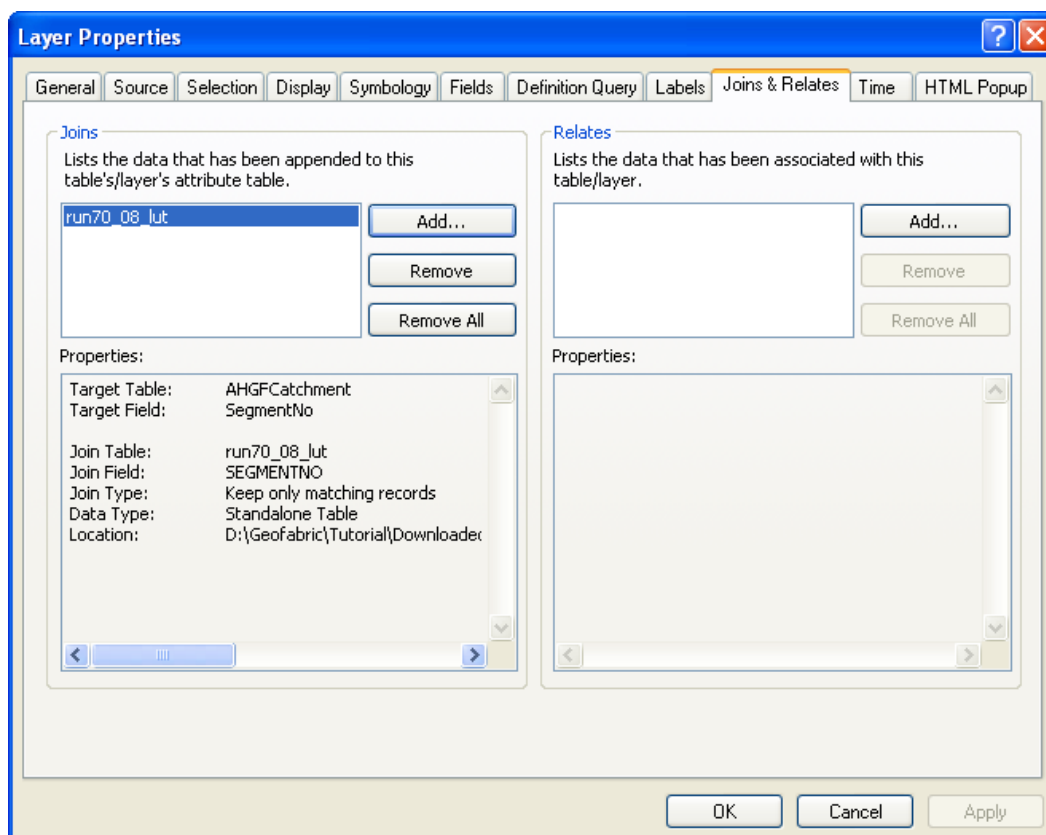
2. Right click on AHGFNetworkStream or AHGFCatchment, and select Layer Properties
3. Click on the Joins & Relates tab. In Joins click on Add...



4. In the Join Data table:
  - In 1. Choose the field in this layer that the join will be based on: select SegmentNo
  - In 2. Choose the table to join to this layer or load the table from disk:, select the LUT. The example below is joining AHGFNetworkStream to run70\_08\_lut.
  - In 3. Choose the field in the table to base the join on:, select SEGMENTNO
  - In Join Options, select Keep only matching records
  - Click OK.

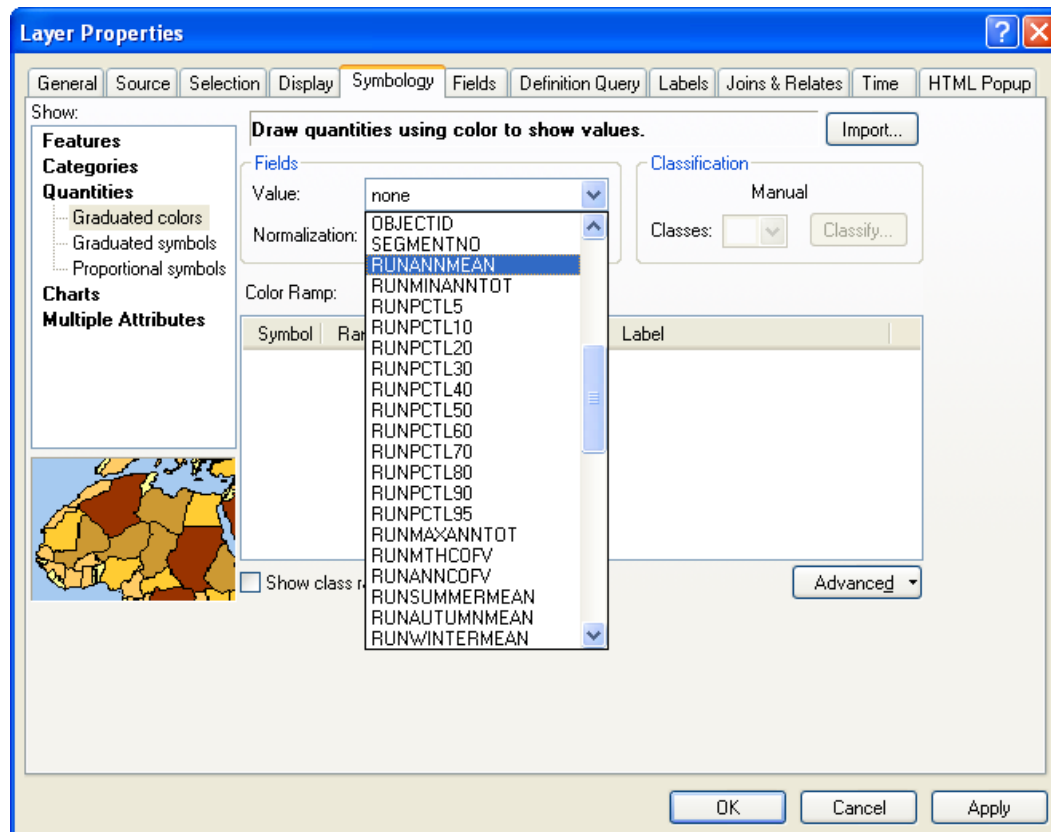


5. The joined table will appear in the Joins & Relates tab.



## 2.3 Symbolise LUT attributes

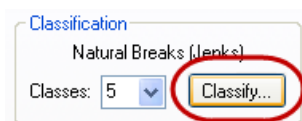
1. Whilst still in the Layer Properties window, select the Symbology tab.
2. In Show: select Quantities > Graduated colors
3. In Fields > Value: select the attribute you want to symbolise in the example below it is RUNANNMEAN (Annual mean accumulated soil water surplus)



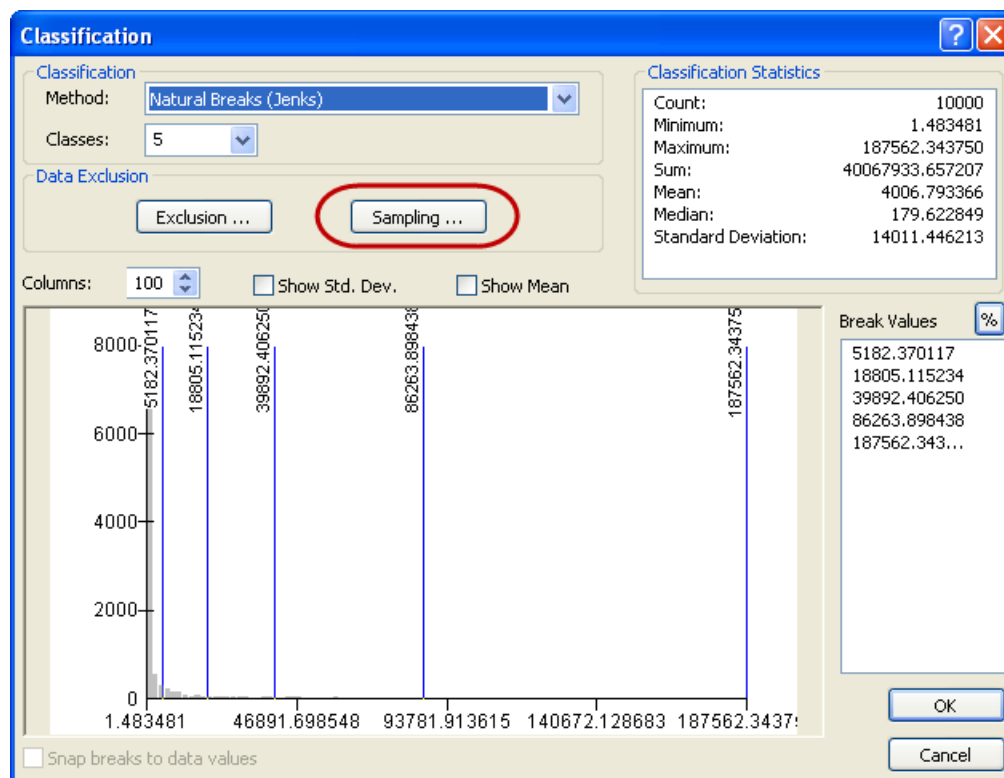
4. If the following warning appears, the maximum sample size needs to increase to include all records. Click OK.



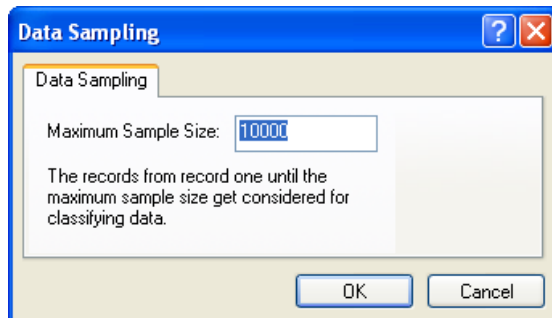
- In the Symbology tab, go to Classification and click Classify...



- In the Classification window, go to Data Exclusion and the Sampling... button.



- The Data Sampling window opens with the Maximum Sample Size: set to the ArcGIS default value of 10,000 records which is the number of records used to classify the data. The warning indicates that your feature class has more than 10,000 records to classify. Edit the maximum sample size to a value will include and classify all your records. Click OK.



- The Classification window histogram will update to reflect the new Maximum Sample Size. To modify ArcMap's default number of classes and/or Break edit them here otherwise OK.
5. In the Layer Properties, Symbology tab, select a Color Ramp or edit the colours for each class individually and click OK.

### 3 Examples of symbolised LUTs and their attributes

Illustrated here, using both AHGFNetworkStream and AHGFCatchment and ArcMap's default number of classes and break values, are the environmental stream attributes:

- run70\_08 – annual mean runoff
- Landuse – forestry
- Landuse – modified land
- Veg – forestry
- Terrain – mean elevation

The symbology has been modified to illustrate the attributes.

Major AHGFNetworkStream features are included in some of the following AHGFCatchment maps for locational reference and indicate the major stream outlet.

#### 3.1 run70\_08 – annual mean runoff

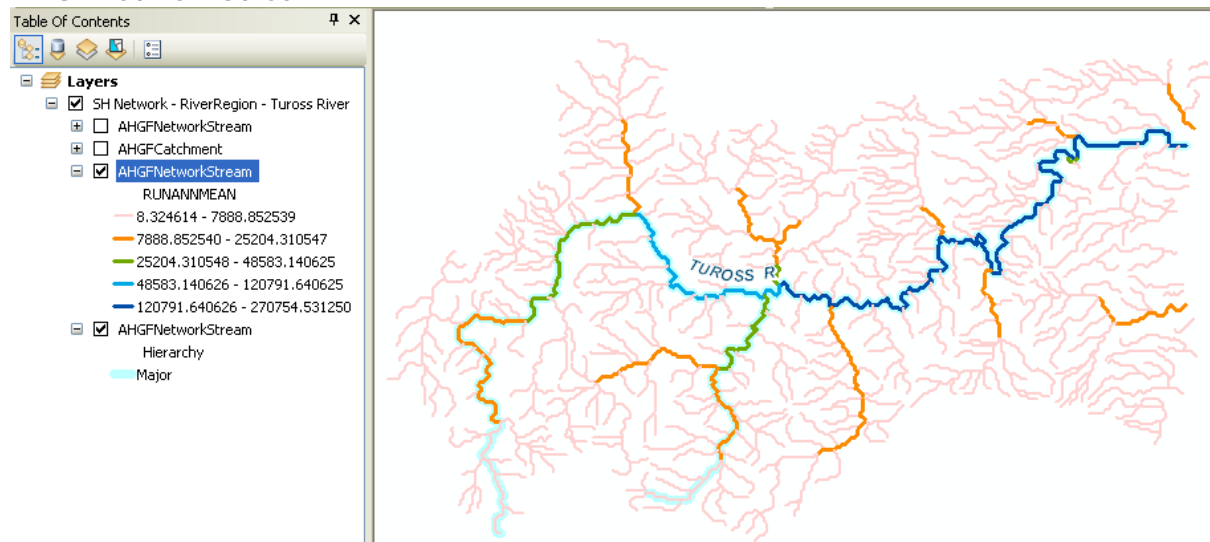
This table has summary statistics derived from the accumulated monthly runoff for the period 1970–2008.

The data source for this LUT is a modelled runoff time series computed with the water balance module of the Growest program by The Fenner School of Environment and Society, Australian National University.

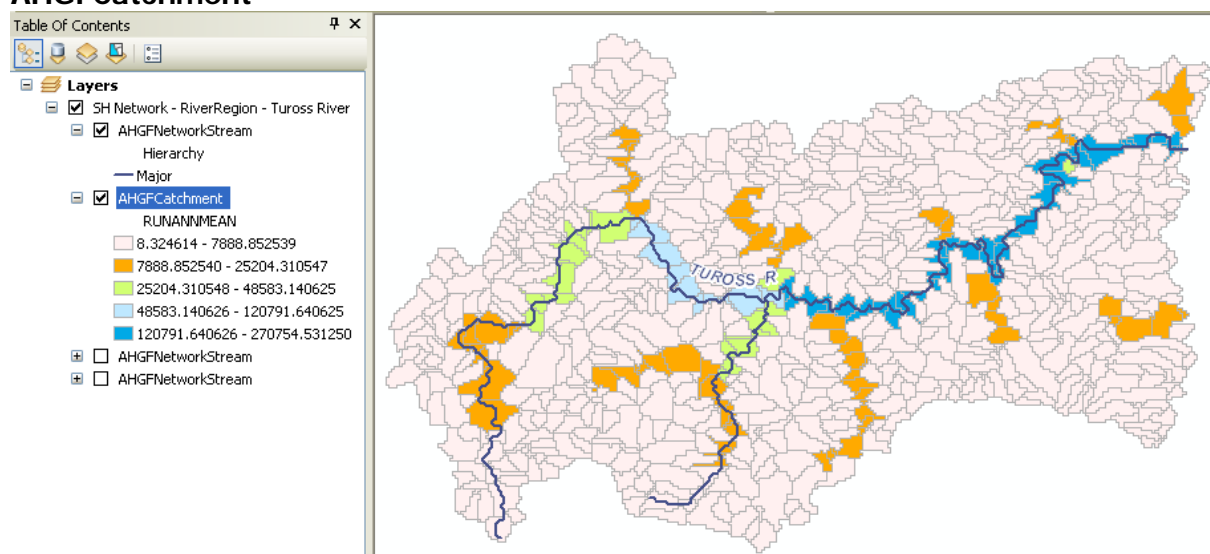
### 3.1.1 RUNANNMEAN

This attribute is the Annual mean accumulated soil water surplus.

#### AHGFNetworkStream



#### AHGFCatchment





## 3.2 Landuse – forestry

The data source for the forestry attributes in Section 3.2.1 is Catchment Scale Land Use Mapping for Australia Update April 2009 (CLUM Update 04/09).

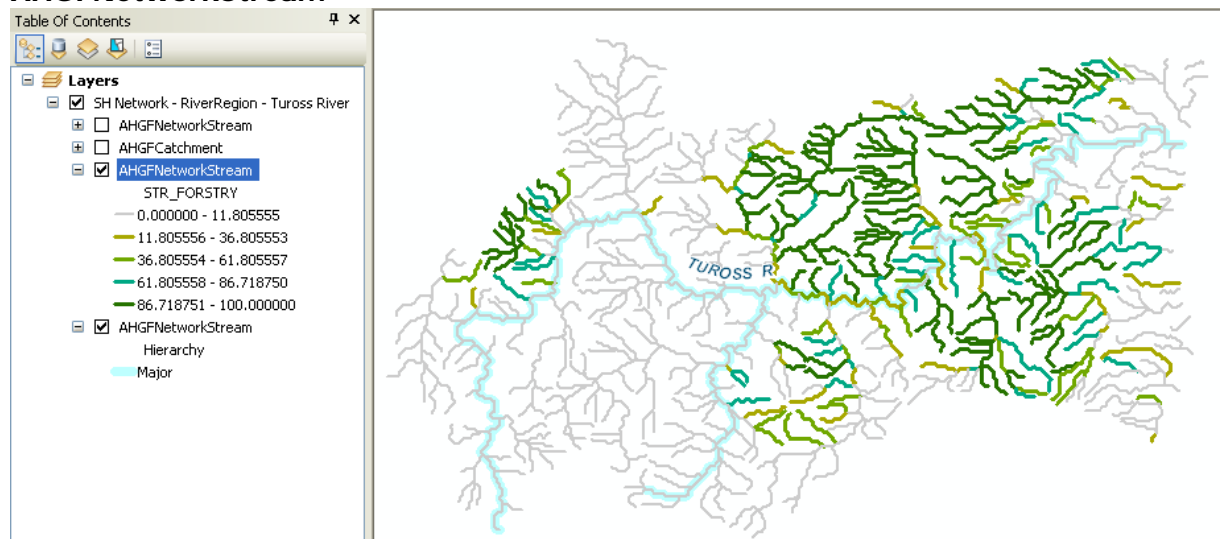
(Department of Agriculture, Fisheries and Forestry (DAFF) Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) 2009, *Catchment scale land use mapping for Australia Update April 2009*, ABARES).

<http://adl.brs.gov.au/landuse/index.cfm?fa=main.downloadData>

### 3.2.1 STR\_FORSTRY

This attribute is the proportion of the stream and its associated valley bottom that is used for forestry.

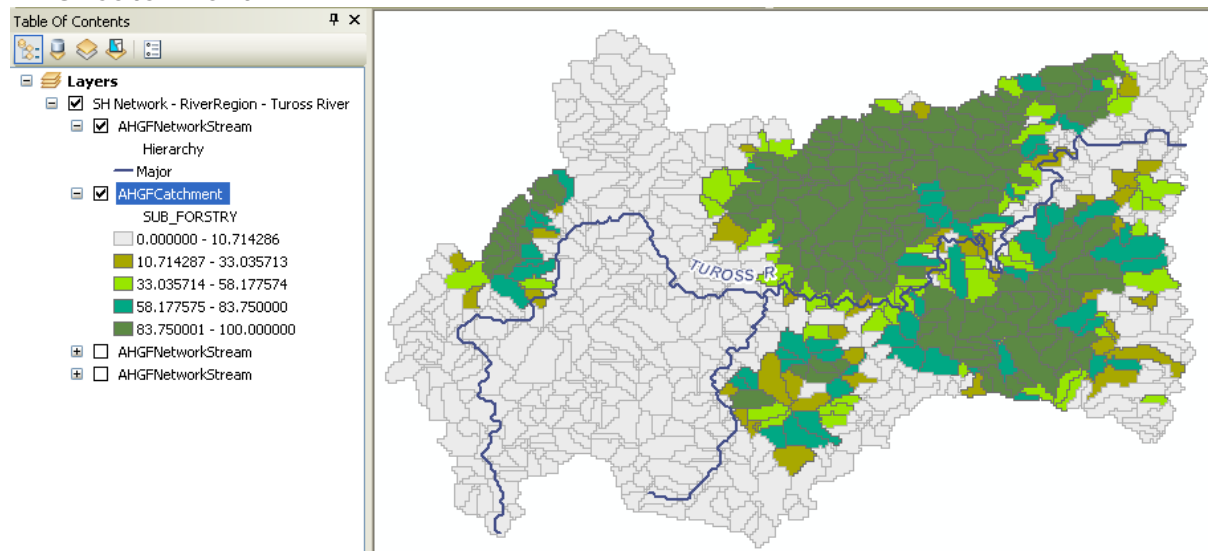
#### AHGFNetworkStream



### 3.2.2 SUB\_FORSTRY

This attribute is the proportion of the sub-catchment that is used for forestry.

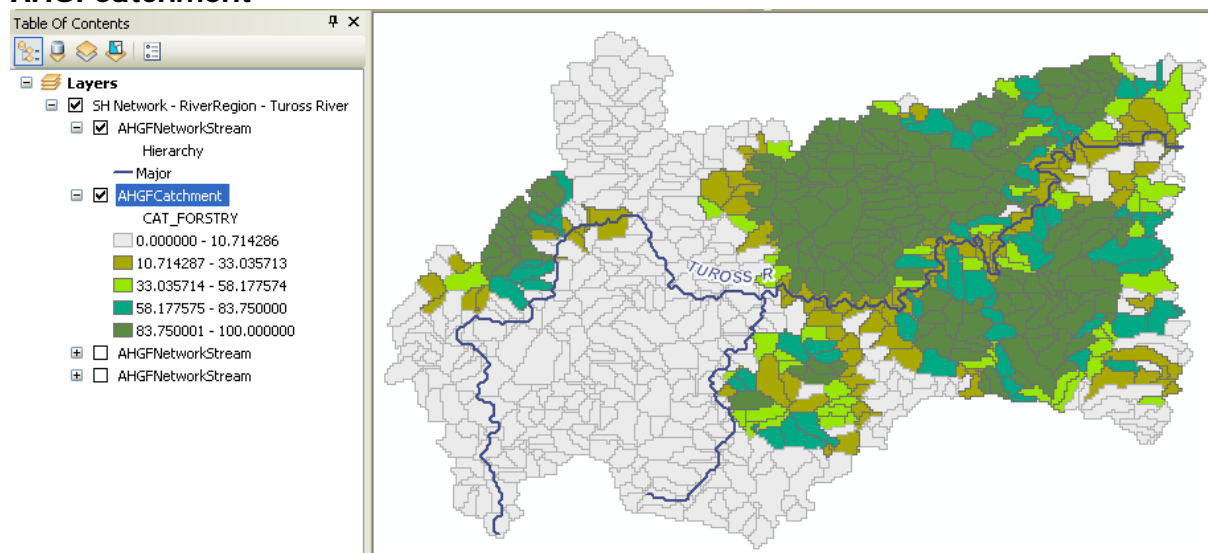
#### AHGFCatchment



### 3.2.3 CAT\_FORSTRY

This attribute is the proportion of catchment used for forestry.

#### AHGFCatchment



### 3.3 Landuse – modified land

The data source for the modified land attributes shown below is Catchment Scale Land Use Mapping for Australia Update April 2009 (CLUM Update 04/09).

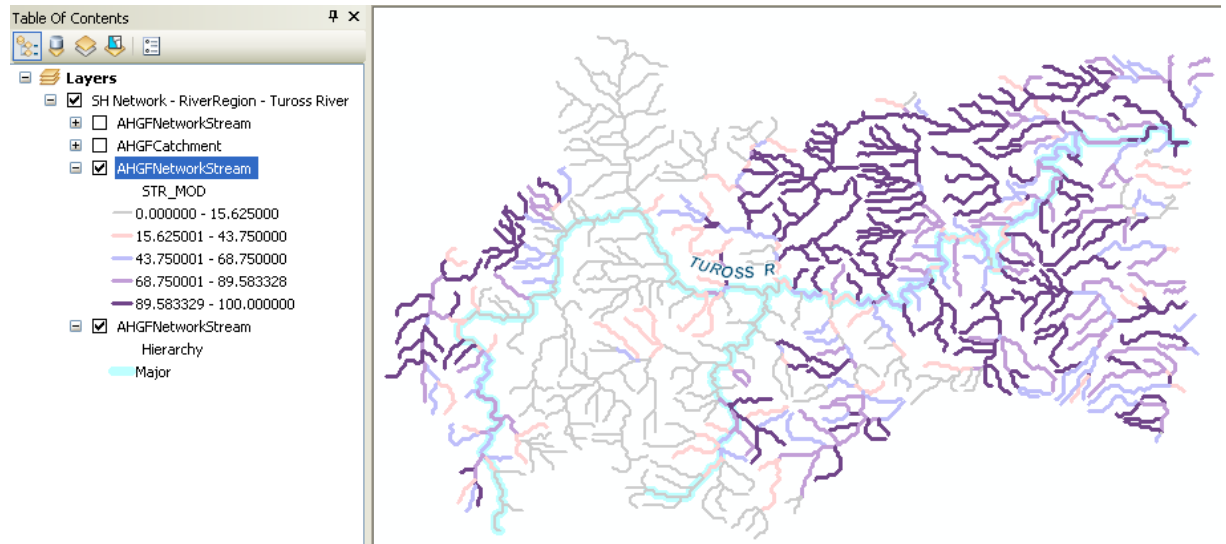
(Department of Agriculture, Fisheries and Forestry (DAFF) Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)2009, *Catchment scale land use mapping for Australia Update April 2009*, ABARES.

<http://adl.brs.gov.au/landuse/index.cfm?fa=main.downloadData>

#### 3.3.1 STR\_MOD

This attribute is the proportion of the stream and its associated valley bottom that is modified land (i.e. not conservation).

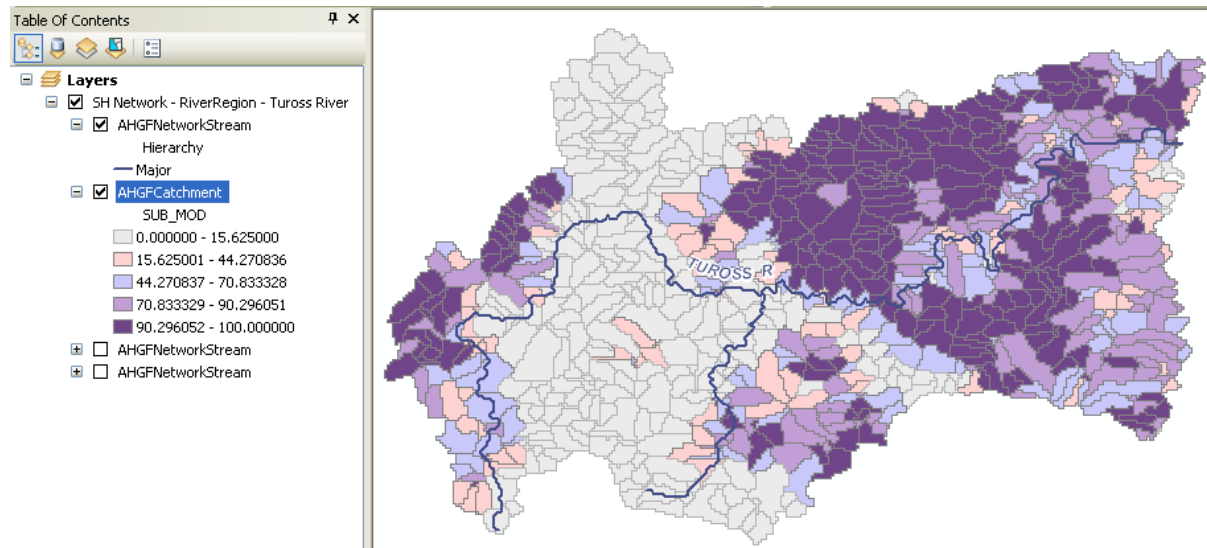
##### AHGFNetworkStream



### 3.3.2 SUB\_MOD

This attribute is the proportion of the sub-catchment that is modified land (i.e. not conservation).

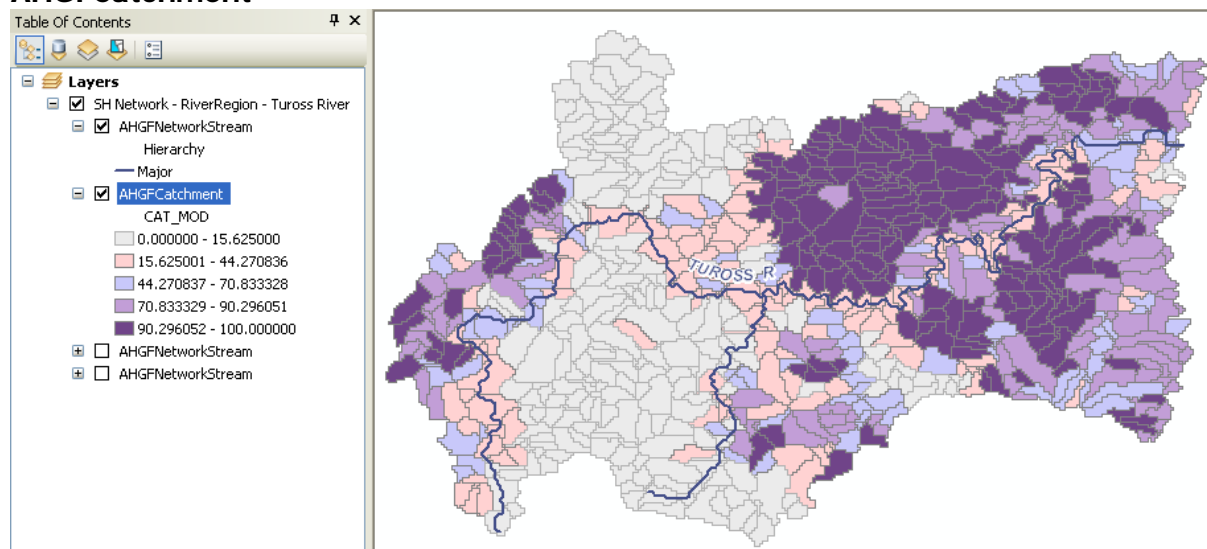
#### AHGFCatchment



### 3.3.3 CAT\_MOD

This attribute is the proportion of catchment that is modified land (i.e. not conservation).

#### AHGFCatchment



### 3.4 Veg forestry

This table records the stream and valley as well as catchment percentage of natural and extant vegetation cover.

The data source for this LUT is the NVIS Major Vegetation Subgroups Version 3.1.

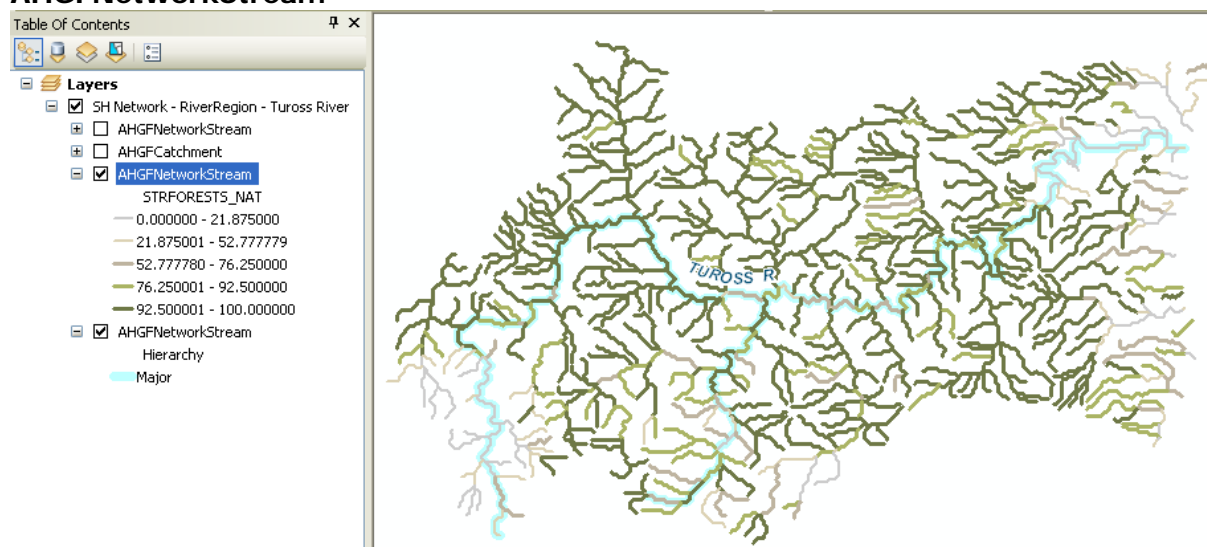
(Department of Sustainability, Environment, Water, Population and Communities,  
*National Vegetation Information System NVIS Major Vegetation Subgroups (Version 3.1*

<http://www.environment.gov.au/erin/nvis/mvg/>)

#### 3.4.1 STRFORESTS\_NAT

This attribute is the stream and valley natural forests cover.

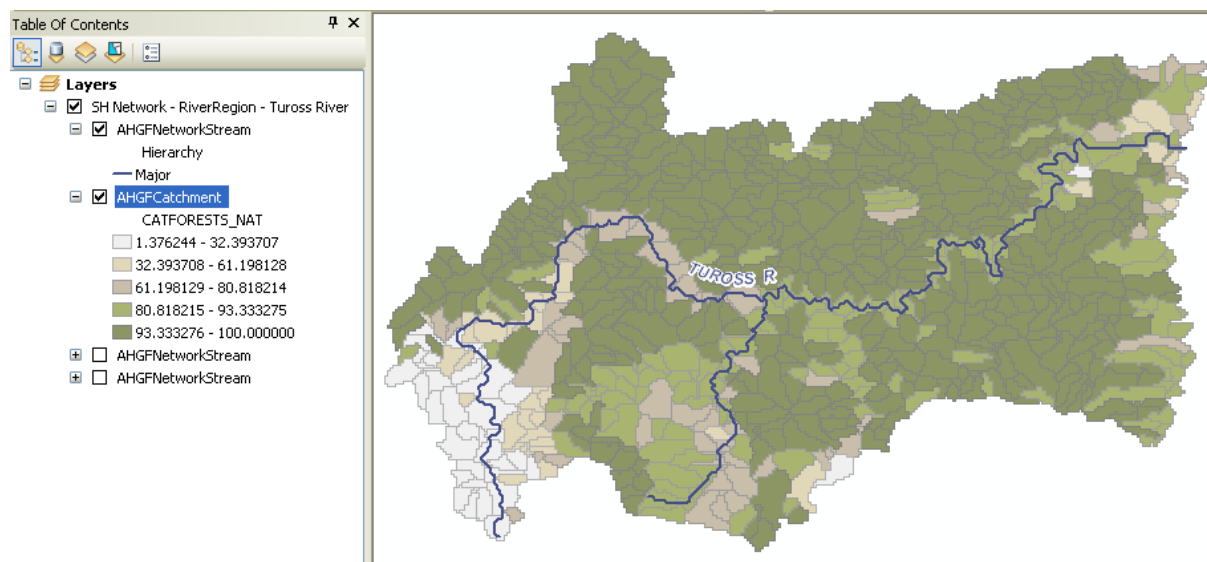
##### AHGFNetworkStream



### 3.4.2 CATFORESTS\_NAT

This attribute is the catchment natural forests cover.

#### AHGFCatchment



### 3.5 Terrain – mean elevation

The data source for the elevation attributes in this LUT is the 9" DEM of Australia version 3 (2008).

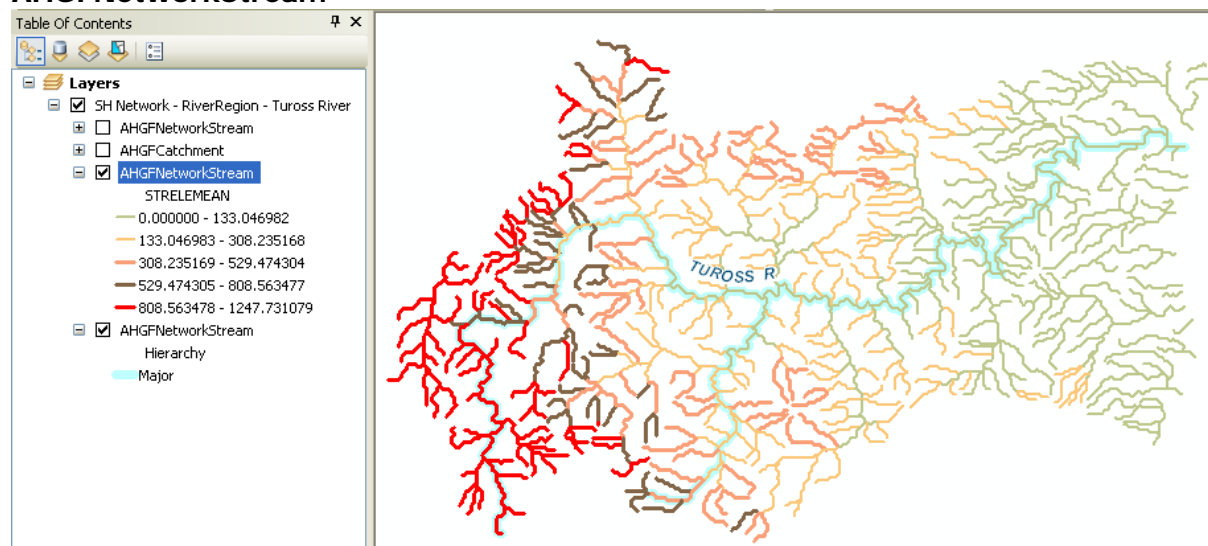
Geoscience Australia (GA), 2008, *GEODATA 9 second DEM and D8: Digital Elevation Model Version 3 and Flow Direction Grid 2008*

[https://www.ga.gov.au/products/servlet/controller?event=GEOCAT\\_DETAILS&catno=66006](https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=66006)

#### 3.5.1 STRELEMEAN

This attribute is the mean stream segment elevation.

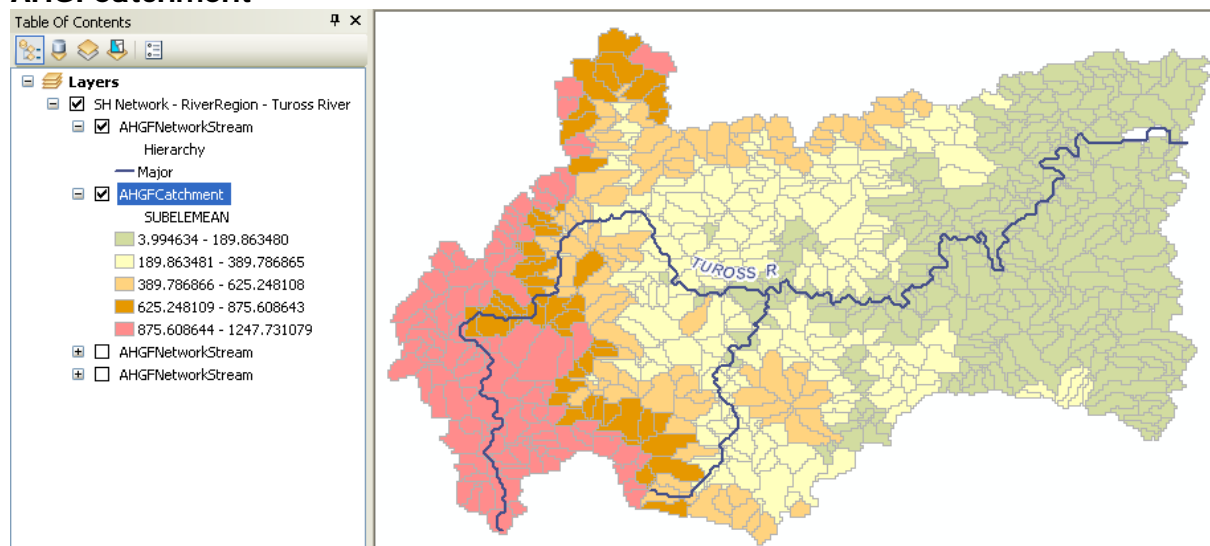
##### AHGFNetworkStream



### 3.5.2 SUBELEMEAN

This attribute is the mean sub-catchment elevation.

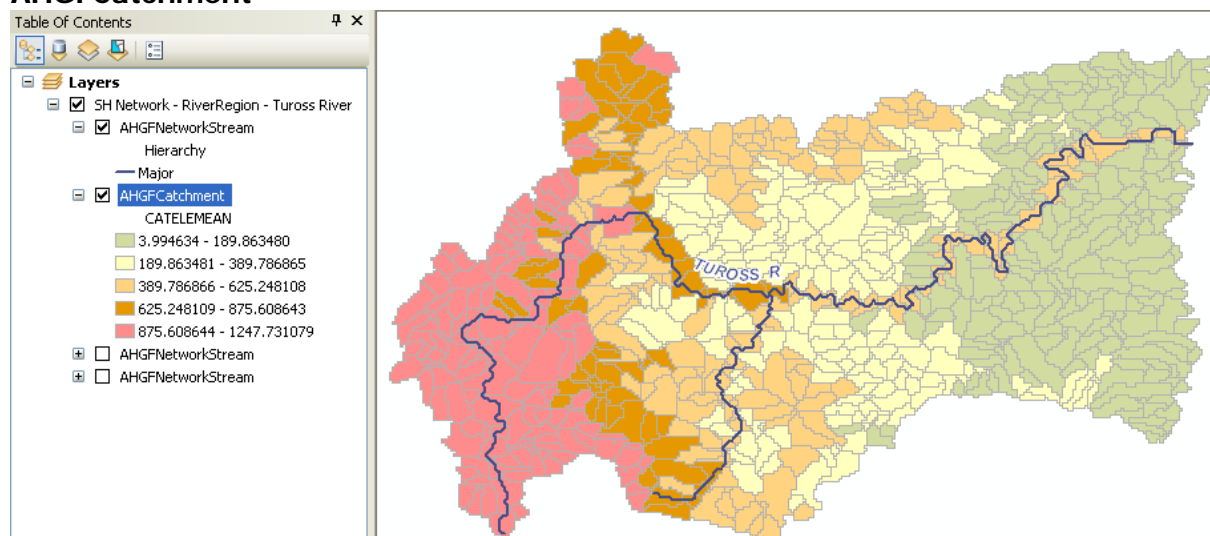
#### AHGFCatchment



### 3.5.3 CATELEMEAN

This attribute is the mean upstream elevation.

#### AHGFCatchment







Through the *Water Act 2007*, the Australian Government has given the Bureau of Meteorology responsibility for compiling and delivering comprehensive water information across Australia.

**For more information**

Visit our website at [www.bom.gov.au/water](http://www.bom.gov.au/water)

Send an email request to [waterinfo@bom.gov.au](mailto:waterinfo@bom.gov.au)



**Australian Government**  
**Bureau of Meteorology**