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GEODATA TOPO 250K Series 2

Product User Guide

National Mapping Division,
Geoscience Australia

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Technical support:
For up to date information on *GEODATA TOPO 250K* refer to the Geoscience Australia website:
www.ga.gov.au

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Geoscience Australia gratefully acknowledges contributions to map content. Information is supplied by Commonwealth, State, Territory and local government, private sector agencies and individuals. A comprehensive list is available from our web site at www.ga.gov.au/nmd/mapping/acknowledge.htm

About this product user guide
This product user guide sets out the fundamental concepts and characteristics of *GEODATA TOPO 250K*. The guide begins with general information and provides more details in later sections. The overview of data content and structure will allow you to make immediate use of the data.

The information in this product user guide was correct at the time of publication and is subject to change. Geoscience Australia assumes no liability resulting from any statements, errors or omissions in the publication or from the use of information contained in this product user guide.

Contents

1 User Information

1.1 User support/contact information

A copy of the licence conditions are supplied at the time of purchase or download, and should be retained for proof of licensing.

Geoscience Australia welcomes feedback on any aspect of its product or services. Please direct your comments or any queries regarding this document or data to:

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1.2 Geoscience Australia – National Mapping Division

Geoscience Australia is the national agency for geoscience research and spatial information. It serves government and supports the community through its output areas of geoscience for urban centres, oceans and coasts, and regional and rural areas.

The National Mapping Division within Geoscience Australia undertakes national mapping, remote sensing maritime boundary and land information coordination activities in support of Australia's economic and social development.

1.3 Other contributors

Geoscience Australia gratefully acknowledges contributions to map and data content. Information supplied by a range of Commonwealth, State, Territory, Local Government, private sector agencies and individuals is utilised to update and enhance the spatial and attribute content of map and digital data products. A comprehensive list is available from the Geoscience Australia website www.ga.gov.au/nmd/mapping/acknowledge.htm

2 About GEODATA TOPO 250K

2.1 GEODATA TOPO 250K components

Your *GEODATA TOPO 250K* data package has four components which combine to give you a complete data product. The components are:

- **Product user guide**
  This guide describes the structure and content of *GEODATA TOPO 250K*. This incorporates information relevant to all GEODATA TOPO 250K tiles.
- **Tile Quality Information (tqi)**
  This table contains quality information specific to a particular GEODATA TOPO 250K tile.
- **Data Quality Table (dqt)**
  This table contains data quality information about each feature instance in the data.
- **Data files**
  The number of files will vary with the application format of the data.

2.2 The GEODATA TOPO 250K Series 2 product

The original TOPO 250K product (Series 1) was largely sourced from the 1:250 000 scale National Topographic Map Series (NTMS) and the full national coverage was completed in 1994. TOPO 250K Series 1 contained the three themes of hydrography, infrastructure and relief.

The revised TOPO 250K product is known as TOPO 250K Series 2. This second generation product builds upon the original product while incorporating many additional features from the paper map series. Satellite imagery, in conjunction with other revision sources, is used to revise the features contained in the data.

TOPO 250K is a vector representation of the features that appear on the earth's surface. TOPO 250K uses a feature-based data model, ie. phenomena in the real world are represented by features. For example, a road is a feature and the characteristics of a feature are described by attributes (eg. road name). The spatial component of the data is composed of points, chains and polygons. A feature instance is the unique occurrence of a feature defined by its location and the values of its attributes.

Features of the same type are grouped into features classes. There are 140 feature classes in TOPO 250K Series 2, with features having up to seven attributes. Logically related features are grouped into one of TOPO 250K's five themes of hydrography, infrastructure, vegetation, reserved areas and relief. In addition, a common set of features called the framework layer is provided for each TOPO 250K tile. Framework features include the sea and land polygons, State borders and the extent of the geographic area supplied.

The content of each theme is:

- **Hydrography:** Drainage networks including watercourses, lakes and wetlands.
- **Infrastructure:** Human settlements including built-up areas, localities and homesteads; and the systems for transportation and communication between those settlements, i.e. roads, railways, powerlines and pipelines.
- **Vegetation:** Ground cover including forest, pine plantation, mangrove and rainforest.
- **Reserved Areas:** Special purpose land such as national parks, Aboriginal land and prohibited areas.
- **Relief:** Representations of the physical terrain including contours and spot elevations.

2.3 The GEODATA Standard

All GEODATA products are:

- **GIS Compatible:**
  Every GEODATA product is designed to be immediately useful within GIS. You save the expense of bringing the data up to standard. For vector products, this means the adoption of a suitable data model and exacting standards for topological integrity;
- **Nationally Consistent:**
  Each GEODATA product adheres to a consistent, national specification. As a consequence, each product offers consistency in the treatment of features and attributes, the criteria for feature selection, the positional and attribute accuracy, and the data point density;
- **Quality Assured:**
  All products undergo independent quality assurance, including tests on vital aspects such as topological integrity, completeness, and positional and attribute accuracy;
- **Comprehensively Documented:**
  Comprehensive documentation accompanies all GEODATA products, allowing you to determine whether a particular product is suitable for your application and to ensure you realise maximum value from the data.
- **Regularly Maintained:**
  Through timely revisions and upgrades, all GEODATA products remain up-to-date and relevant to changing customer requirements.

2.4 Coordinate system

GEODATA TOPO 250K data is available in geographic coordinates (latitude and longitude) in decimal degrees using the Geocentric Datum of Australia 1994 (GDA 94) coordinate system. Heights are based upon the Australian Height Datum (AHD).

3 Data loading

3.1 Application formats

The *GEODATA TOPO 250K* data is supplied in three application formats:

- ArcInfo export;
- ArcView shapefile; and
- MapInfo mid/mif.

3.1.1 ArcInfo Export Format

Format Description

The GEODATA TOPO 250K data is supplied in ArcInfo export format. Spatial data in each theme is divided into layers. Each layer corresponds to an export file and can be built into an ArcInfo coverage. Associated with each coverage is either a point, polygon or arc attribute table which contains the attribute information for each of these three feature types. In some cases, both point and arc attribute tables or arc and polygon attribute tables exist in the same coverage.

In addition, a layer quality table and a layer frequency table is linked to each coverage. Associated with each transfer are a number of additional tables, which when imported into ArcInfo, build into relational database tables. These are Data Quality Tables and a number of attribute Look-Up tables.

Data Loading

ArcInfo Command Line (version 7.x, 8.x)

Coverages may be loaded into ArcInfo using the *import* command with the cover *parameter*. This command is entered at the Arc prompt as shown in the example below;

eg. `Arc: import cover [path]/f5502dld.e00 [path]f5502dld`

The Data Quality Table (dqt) can be loaded by entering the following command at the arc prompt;

eg. `Arc: import info [path]/f5502dqt.e00 [path]f5502dqt`

The Attribute Look Up Tables (lut) can be loaded by entering the following command at the arc prompt;

eg. `Arc: import info [path]/gag_lut.e00 [path]gag_lut`

ArcGIS Desktop (versions 8.x - ArcInfo, ArcEditor and ArcView licenses)

A variety of GIS routines can be accessed through the ArcGIS component program ArcToolbox. This program is accessed via the ArcGIS menu group or alternatively via a desktop shortcut.

Tools are arranged in a hierarchical structure. To locate the import tool, click on the following location;

Conversion Tools \ Import to Coverage \ Import from Interchange File.

Follow the instructions provided in the window that appears.

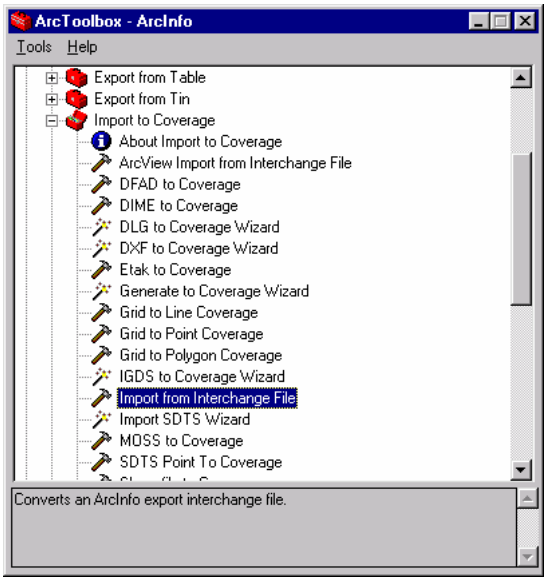

Figure 1 - ArcToolbox Import to Coverage

ArcView 3.x

ArcInfo export files may be converted into coverages in ArcView 3.x using the Import71 executable. Consult your ArcView documentation for further information.

Special Notes

GDA94 Support – pre 8.x versions

All supplied ArcInfo export files have projection parameters defined as GDA94 Datum based on the GRS1980 spheroid. ArcGIS versions 8.x directly support the GDA94 datum. ArcInfo versions prior to version 8 have the facility to add support for GDA94. Consult the ESRI web page for further information on GDA94 support in ESRI software - http://www.esri.com.

Null Integer Fields in INFO

In INFO, fields with an integer format cannot contain a null entry. In the data supplied to you, a zero is used in integer format fields to indicate a not applicable or null entry. For example, swamps and reservoirs do not have the attribute of perenniality, but in the ArcInfo primary attribute tables there is a space for this value. The field for swamp and reservoir would contain a 0 (zero) to indicate a null entry.

Data Precision

ArcInfo data is only available in double precision coverages. The precision refers to the number of bytes used to carry numerical data such as coordinates. Old software versions (ArcInfo version 5 or earlier) cannot access this type of data.

Pseudo Nodes and the UFI

TOPO 250K data is generally produced in ArcInfo format with careful minimisation of pseudo nodes where practical. However, when the data is built into ArcInfo coverages, ArcInfo breaks long features and places a pseudo node at every 500th vertex. For this reason, a number of feature instances in an ArcInfo coverage may have the same unique feature identifier.

Fuzzy tolerance

When data is supplied in ArcInfo export format and imported into a GIS, it is given a system generated 'fuzzy tolerance' which may not reflect the true resolution of the data. This is especially noticeable when using TOPO 250K. Users of ArcInfo should be very cautious when using commands which use the fuzzy tolerance as the data may be corrupted. The fuzzy tolerance used in the creation of TOPO 250K is 1m for data in MGA and 0.00001 degrees in geographical coordinates. These values should be applied if you are using a command which requires an fuzzy tolerance parameter.

3.1.2 ArcView Shapefile Format

Format Description

The shapefile format data has been converted from the source ArcInfo export format files, using the Feature Manipulation Engine (FME) software produced by Safe Software Inc.

Shapefiles store non-topological geometry and attribute information for spatial features. There are three main files that make up the shapefile;

- Main file – stores feature geometry (*.shp)
- Index File – stores file look-up index (*.shx)
- dBase table – contains feature attributes with one record per feature (*.dbf)

An additional projections definition file (*.prj) has been included with each shapefile to provide projection information.

Data Loading

ArcGIS Desktop (versions 8.x - ArcInfo, ArcEditor and ArcView licences)

Shapefiles can be accessed directly via the ArcMap, ArcCatalog and ArcToolbox component programs.

ArcView 3.x

Shapefiles can be accessed directly from the main ArcView program.

Special Notes

GDA94 Support

ArcGIS versions 8.x directly support the GDA94 datum. ArcView versions prior to version 3.2 do not incorporate support for this datum. However there is the facility to add GDA support for ArcView 3.1. Consult the ESRI web page for further information on GDA94 support in ESRI software - http://www.esri.com.

3.1.3 MapInfo MID/MIF Format

Format Description

TOPO 250K data is available in MapInfo Data Interchange Format. Each layer of each tile is transferred by a number of files in MapInfo Data Interchange Format. The format comprises two types of ASCII files – a *.mif* file which contains the spatial data and a *.mid* file which contains the corresponding attribute information.

Each TOPO 250K layer may be transferred by either one or two sets of mid/mif files, depending on the spatial objects present in the layer. Each mid/mif combination builds into a single MapInfo table. Additional information may be supplied as text files. In MapInfo format a layer frequency table and tile quality information table are supplied as delimited text files.

Data Loading

Data files (both online and CD packaged) are supplied in Zip compressed format and need to be uncompressed before data import can take place. After unzipping, files are in MapInfo Interchange format and can be loaded into MapInfo using the **Table** / **Import** command as demonstrated opposite.

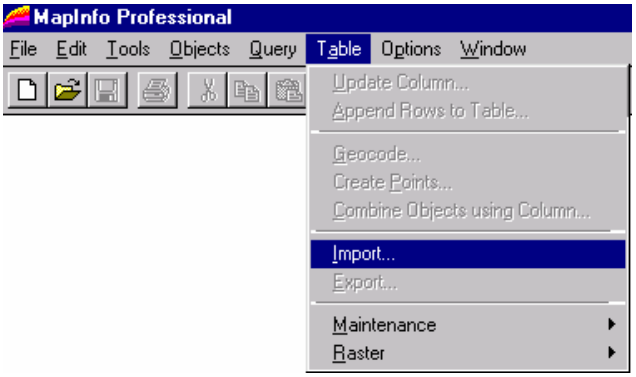

Figure 2 - Table/Import menu

After running the import command, there will be a total of four tiles created. These consist of :

- a *.tab* file which describes the structure of the table;
- a *.dat* file which contains the tabular data;
- a *.map* file which describes the spatial objects; and
- an *.id* file which provides a cross reference from the data to the spatial objects.

Once imported, the layer can be opened within MapInfo using the **File** / **Open Table** command to create either a Mapper or Browser window. The Data Quality Table can only be loaded into a Browser window, because it has no spatial component. However, you can join it to each of the data tables using the **Table** / **Update Column** command.

The Attribute Look-Up tables are loaded using the **Table** / **Import** command. As they have no spatial component, they can only be loaded into a MapInfo browser window. They can be joined to the appropriate data tables using the **Table** / **Join** command, or you can substitute the descriptions in the Look-Up table with the code in the Data Tables by using **Table** / **Update Column** on the joined table.

Special Notes

GDA94 support

GDA94 is supported by MapInfo Professional Version 6 or later. This is specified as *Projection 116 – GDA94 datum based on the GRS1980 ellipsoid*. To ensure compatibility with older MapInfo versions which may not support this datum, projection information has been specified as *Projection Number 104 – WGS84 datum based on the WGS84 ellipsoid*. Users of MapInfo versions 6 or higher may wish to change the projection specification to the correct GDA Projection – 116. However, for most practical purposes GDA94 and WGS84 coordinates can be considered the same. For further information consult the GDA section of the Intergovernmental Committee on Surveying & Mapping (ICSM) website – http://www.icsm.gov.au/gda.

Null Integer Fields

In the data supplied to you, a zero is used in integer format fields to indicate a not applicable or null entry. This can occur in TOPO 250K Series 2 in drainage, waterbody, framework, road transport and rail transport layers.

For example, the framework includes the polygon features of island, sea and mainland. Sea features do not have the attribute of 'state', but in the MapInfo table there is a space for this value. In the instances where the feature code is *sea* the field for state would contain a 0 (zero) value to indicate a null entry.

Superfluous Linear Features

The GEODATA TOPO 250K data model includes as features the polygon boundaries as well as the polygons themselves. These boundaries can contain useful attribute information (eg. the boundaries of the mainland polygons are state border, waterline, junction and tile edge).

In order to retain information about polygon boundary features, MapInfo, in contrast to other GIS, requires the boundary information to be stored twice. This can waste space. For this reason, polygon boundary features have only been included in the MapInfo version of TOPO 250K where they add significant extra value (eg. state border).

Additional Modifications to some Layers

There are limitations within MapInfo on the number of vertices that can constitute a polygon or region (complex polygon). Occasionally, polygons in the TOPO 250K framework and waterbody layers may exceed the MapInfo limits. In order to allow these features to be imported successfully into MapInfo, over sized polygons have been split into a number of smaller polygons that comply with the MapInfo limits.

3.2 Description of Files

3.2.1 Theme/Layer Naming Conventions

In order to provide useful information to the user, the names of the (uncompressed) datafiles consist of the following components (these codes are described in detail on the following pages) ;

ArcInfo export

	<map id>	<layer id>	<coord id>	<precision id>	.	<file ext>
Example	f5502	d	l	d	.	e00

Example filename will be **f5502dld.e00**

ArcView shapefile

	<map id>	<layer id>	Underscore	<object id>	.	<file ext>
Example	i5002	t	_	r	.	shp

Example filenames will be **i5002t_r.shp** (plus associated files i5002t_r.shx & i5002t_r.dbf)

MapInfo mid/mif

	<map id>	<layer id>	Underscore	<object id>	.	<file ext>
Example	i5002	t	_	r	.	shp

Example filenames will be **i5002t_r.mid** & **i5002t_r.mif**

Map ID <map id>
Applies to All formats
This refers to the map sheet identifier for the relevant source map sheet. For example, the mapsheet of Bathurst which has a map sheet identifier of **SI55-08**, would have a map id of i5508. The leading "S" has been dropped as it is constant for all Australian 1:250 000 map sheets.

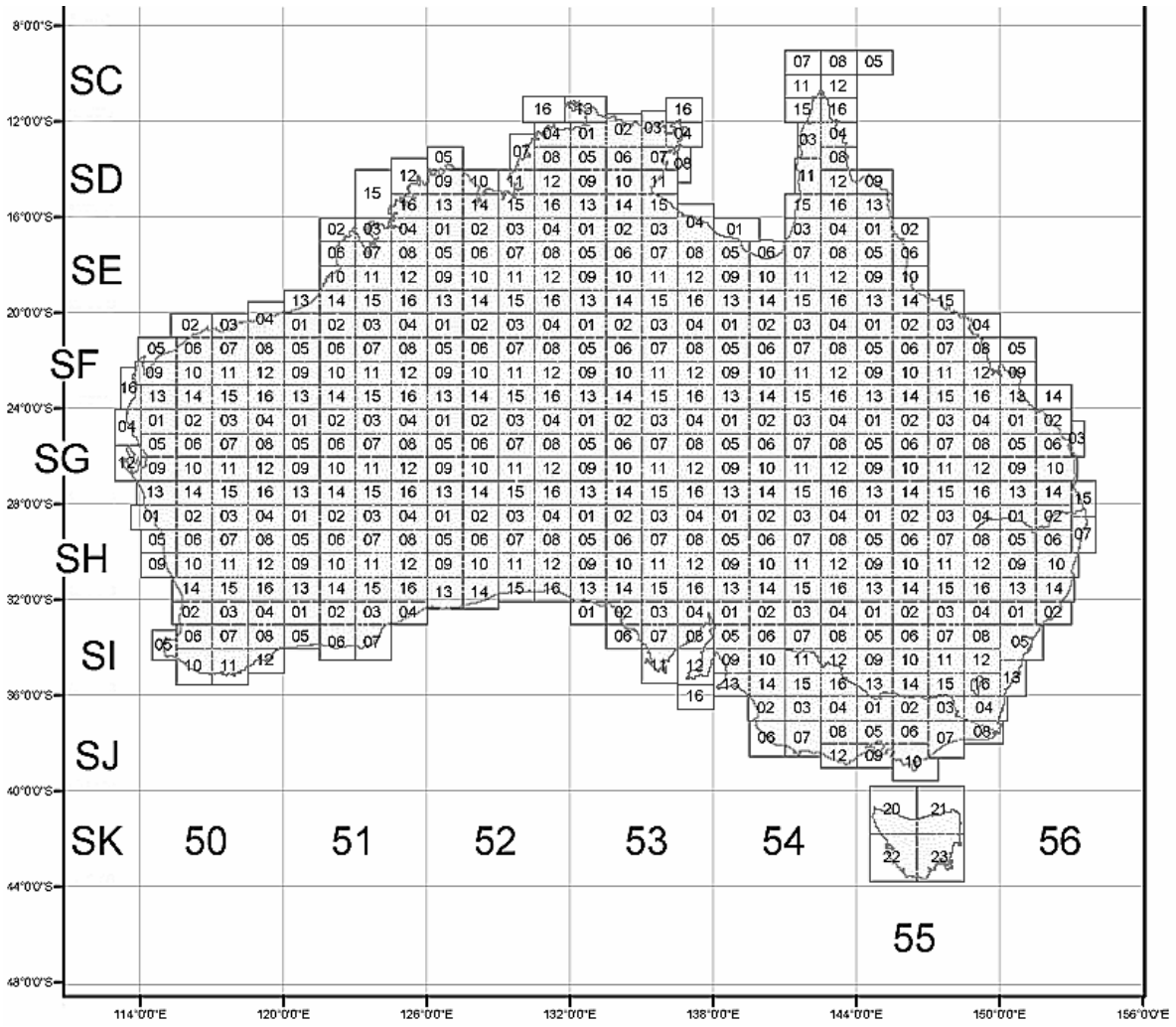

Figure 3 - GEODATA TOPO 250K Index Map

Layer ID <layer id>
Applies to All Formats
This is a single character code which identifies the TOPO 250K layer. Table 1 sets out the layer codes used for GEODATA TOPO 250K tiles.

Table 1 - Layer codes used for TOPO 250K layers.

Theme	Layer	<layer id>
Hydrography	Drainage	d
	Marine Facilities	h
	Navigation	n
	Offshore	o
	Waterpoints	x
	Waterbodies	w
Infrastructure	Aeronautical Point	a
	Built-Up Areas	b
	Localities	l
	Buildings Point	g
	Rail Transport	r
	Road Transport	v
	Utilities	u
	Seismic Lines	4
	Powerlines	k
	Pipelines	p
Vegetation	Vegetation	t
	Vegetation Miscellaneous	j
Reserved Areas	Security Areas	1
	Reserved Areas	3
Relief	Spot Heights	e
	Survey Marks	y
	Sand Ridges	s
	Relief Area	q
	Contours	c
	Morphology	m
Framework	Framework	f

Coordinate ID <coord id>
Applies to ArcInfo export format only
This is a single character code which identifies the coordinate system in which the data is supplied.

l = the data is in geographical coordinates (latitude and longitude) in decimal degrees based on the Geocentric Datum of Australia, 1994 (GDA94).

Precision ID <precision id>
Applies to ArcInfo export format only
This is a single character code which identifies that the data coordinates are supplied in double precision.

d = the coordinates are supplied in double precision.

Object ID <obj id>
Applies to MapInfo mid/mif format and ArcView shapefile format.
This is a single character code which identifies the spatial object type that is contained in the file. Only one type of spatial object is transferred in each .mif and .shp file. Table 2 sets out the codes used for the three basic spatial objects.

Table 2 - Spatial Object ID codes

Spatial Object	<object id>
Point	p
Chain (line)	l
Polygon (region)	r

File Extension <file ext>
Applies to All Formats
The file extension refers to the relevant three character identifier that defines the data format.

Table 3 - File Extension Descriptions

Spatial Object	<file_ext>
ArcInfo export format	.e00
MapInfo Interchange Format	.mid & .mif
ArcView shapefile format	.shp, .shx, .dbf

3.2.2 Online Product

To minimise download times, all GEODATA TOPO 250K tiles have been compressed using the Zip format. The Zip file format (originally based on PKWare's PKZip product) is extensively used in a range of commercial, shareware, freeware, and open source programs, which can be readily found using a web search engine.

Table 4 provides detailed information on the uncompressed structure of the online tiles. Users will need to download the User Guide (this document) as a separate file – it is not included as part of each tile download. Users should note that not all layers may exist for a particular tile. This occurs when a particular layer is not found on that tile ;

eg 1. Marine related layers will not be found on inland tiles,
eg. 2. Reserved Areas may not exist on particular tiles.

Table 4 - Online Tiles : Sample Data Structure

Compressed Data	Category	Layer Description	ArcInfo export eg. (g5401_e00.zip)	MapInfo mid/mif eg. (g5401_mif.zip)	ArcView shapefile eg. (g5401_shp.zip)
Uncompressed Data	**GIS DATA** (See section 5) Number of layers present will vary with individual tile.	Reserved Areas	g54013ld.e00	g54013_<obj id>.mid / .mif	g54013_<obj id>.shp (.dbf .shx)
		Aeronautical Point	g5401ald.e00	g5401a_<obj id>.mid / .mif	g5401a_<obj id>.shp (.dbf .shx)
		Built-Up Areas	g5401bld.e00	g5401b_<obj id>.mid / .mif	g5401b_<obj id>.shp (.dbf .shx)
		Contours	g5401cld.e00	g5401c_<obj id>.mid / .mif	g5401c_<obj id>.shp (.dbf .shx)
		Drainage	g5401dld.e00	g5401d_<obj id>.mid / .mif	g5401d_<obj id>.shp (.dbf .shx)
		Spot Heights	g5401eld.e00	g5401e_<obj id>.mid / .mif	g5401e_<obj id>.shp (.dbf .shx)
		Framework	g5401fld.e00	g5401f_<obj id>.mid / .mif	g5401f_<obj id>.shp (.dbf .shx)
		Buildings Point	g5401gld.e00	g5401g_<obj id>.mid / .mif	g5401g_<obj id>.shp (.dbf .shx)
		Localities	g5401lld.e00	g5401l_<obj id>.mid / .mif	g5401l_<obj id>.shp (.dbf .shx)
		Sand Ridges	g5401sld.e00	g5401s_<obj id>.mid / .mif	g5401s_<obj id>.shp (.dbf .shx)
		Vegetation	g5401tld.e00	g5401t_<obj id>.mid / .mif	g5401t_<obj id>.shp (.dbf .shx)
		Utilities	g5401uld.e00	g5401u_<obj id>.mid / .mif	g5401u_<obj id>.shp (.dbf .shx)
		Road Transport	g5401vld.e00	g5401v_<obj id>.mid / .mif	g5401v_<obj id>.shp (.dbf .shx)
		Waterbodies	g5401wld.e00	g5401w_<obj id>.mid / .mif	g5401w_<obj id>.shp (.dbf .shx)
		Waterpoints	g5401xld.e00	g5401x_<obj id>.mid / .mif	g5401x_<obj id>.shp (.dbf .shx)
		Survey Marks	g5401yld.e00	g5401y_<obj id>.mid / .mif	g5401y_<obj id>.shp (.dbf .shx)
	DATA QUALITY (See section 6)	Data Quality Table (dqt)	g5401dqt.e00	g5401dqt.mid / .mif	dqt (folder) g5401dqt.e00
		Layer Quality Table (tqi)	(INFO table after import)	g5401.tqi	g5401<layer id>_tqi.dbf
		Layer Frequency Table (.frq)	(INFO table after import)	g5401mi.frq	g5401<layer id>_frq.dbf
	LOOK-UP TABLES (See section 5.4)	Look Up Tables (stored in separate folder)	lut (folder) *.e00	lut (folder) *.mid/mif	lut (folder) *.e00

3.2.3 Packaged Product (CD-ROM)

Map tiles are available from the packaged CD product for each State/Territory. All GEODATA TOPO 250K tiles have been compressed using the Zip format. The Zip file format (originally based on PKWare's PKZip product) is extensively used in a range of commercial, shareware, freeware, and open source programs, which can be readily found using a web search engine.

The packaged product has been structured with three main folders (see Figure 4);

1. DATASETS – contains the relevant compressed (.zip) package GIS data and associated tables. Themes for each tile in each state/territory have been compressed into a single zip archive. For example, **hydrography.zip** located under the **NSW/Arc_Info_export** folder, will contain all the hydrography related themes (in .e00 format) for all the tiles in the NSW package. Users can opt to uncompress all the tiles from the CD, or they may extract a subset of tiles via their Zip software. If this approach is adopted, care should be taken to ensure that all necessary files are extracted – MapInfo files require both the *.mid and *.mif files, whilst Shapefiles require the *.shp, *.dbf , *.shx and *.prj files.

2. DOCUMENTATION – contains the User Guide (this document)

3. TILE_INDEX – contains GIS vector and raster layers to assist users in locating their tile of interest. This includes GIS layers in each of the three supplied data formats showing GEODATA TOPO 250K tile outlines, as well as a raster based map at 1: 9 million scale.

In addition, a Licence file is included in the top level CD directory, which outlines the licence conditions pertaining to the packaged product.

Updated tile GIS data will be available as new maps are completed in the 1:250 000 scale mapping program. These will be available for download from the Geoscience Australia website – http://www.ga.gov.au/download

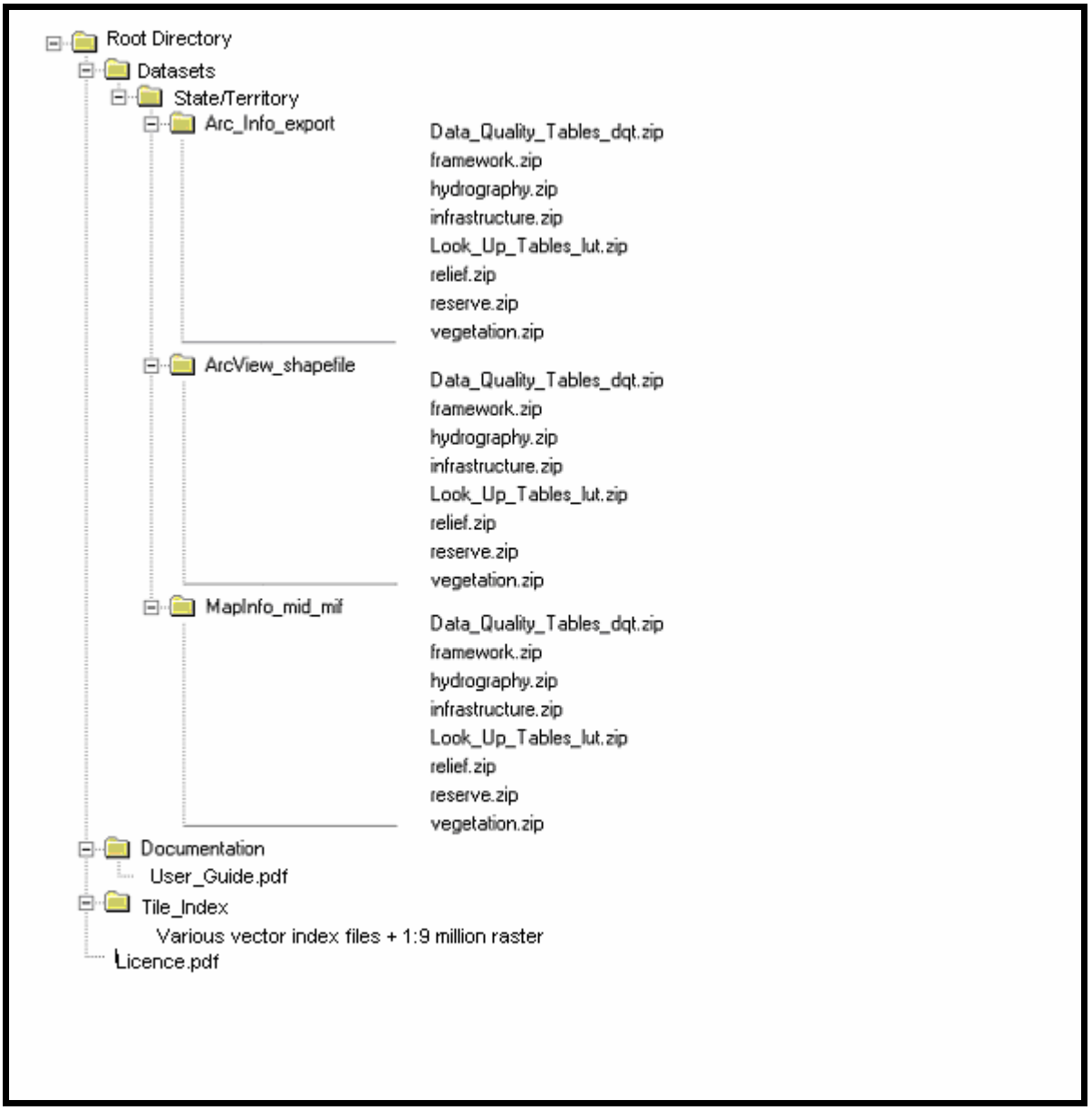

Figure 4 - Packaged Product (CD-ROM) General Structure

4 Data characteristics and concepts

4.1 GEODATA TOPO 250K essential characteristics

Truth-in-labelling
GEODATA TOPO 250K is accompanied by sufficient information to enable you to assess whether the data are fit for use in your application. The information will also assist you to use the data to their maximum potential. Data quality information is provided from three sources:

- **This Product User Guide**
  Sections in the User Guide cover positional accuracy and topological integrity.
- **The Data Quality Statement**
  This narrative information, provided in the section on the Data Quality Statement, is also included as a text file in each data transfer.
- **The Data Quality Table**
  This table contains data quality information which is linked to each feature instance in the data.

These resources and their content are described in more detail in Chapter 6 - Data quality information.

Resolution of coordinates
The horizontal coordinates of the data are given to a resolution of 0.00001 degrees in geographical coordinates (approximately 1metre on the ground). Vertical coordinates (spot elevations) are given to 5 metres.

Area of tile coverage
The geographic area covered by each file of spatial data is described as a tile. In TOPO 250K, tiles equate to the base area covered by the individual 1:250 000 scale map sheets. Standard 1:250 000 mapsheets cover a base area defined by 1 ° of latitude (approx. 110 kilometres) and 1.5 ° in longitude (approx. 160 kilometres).

On occasions, to avoid maps having only small areas of land, the sheet limits of maps are altered. Such alterations include extensions to the area of land covered and insets of offshore islands. In these cases, the geographic area covered by the tile is increased or altered to reflect the alteration in the map sheet. The addition of the word “Special” (eg. *Wollongong Special*) to the map name denotes those maps where the extents have been considerably altered. GEODATA TOPO 250K Specials may differ in spatial extents from the corresponding printed mapsheet Specials.

Appendix E contains a listing of adjusted GEODATA TOPO 250K tiles and their spatial extents.

Topological integrity
GEODATA TOPO 250K data are tested to ensure that they comply with the rules for topological integrity set out below. The data must comply with these rules, and others, to specified levels set out in the Data Quality Statement in Chapter 6. Generally the compliance rate is greater than 95% with a 99% confidence. This means that the data may be accepted, even if they contain a small number of errors.

- The data have a node/chain structure. Within a linear network layer or a polygon layer, all linear features are broken by a node at intersections or at the point where an attribute of the feature changes. This is demonstrated in the following diagram.

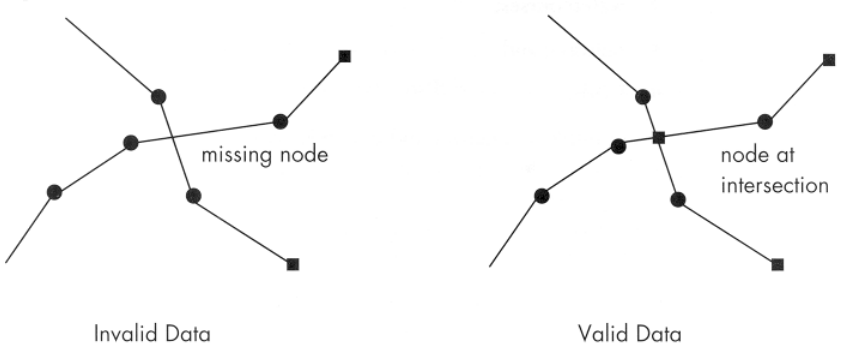

Figure 5 - Linear intersections

- Every linear feature instance has a node at each end.
- All polygons are completely closed.
- Every polygon feature contains one polygon label point only.
- Polygons in the same layer cannot overlap.
- Within a layer there are no coincident features.
- When two features in separate layers share the same physical position on the source material, they have exactly coincident spatial objects. The same feature instance may occur twice in the data supplied to you. When this occurs the repeated feature instance has exactly the same coordinates.
- There are no undershoots. This possible error is illustrated below.

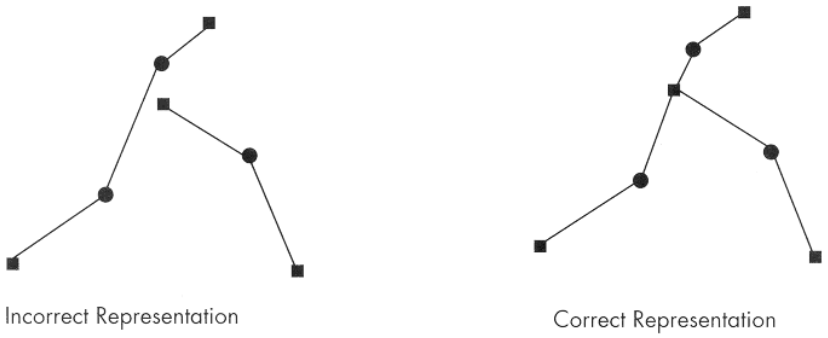

Figure 6 - Undershoots

- The spatial data have no overshoots, broken lines or other artefacts of the data capture process. These possible errors in the data are illustrated below.

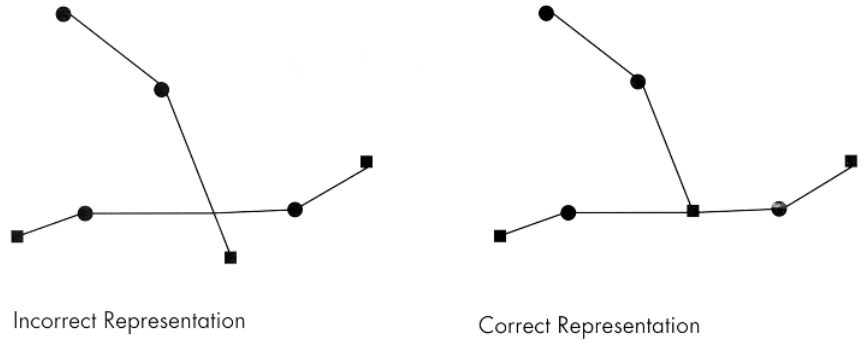

Figure 7 - Overshoots

Figure 8 - Broken lines

Figure 9 - Data spikes

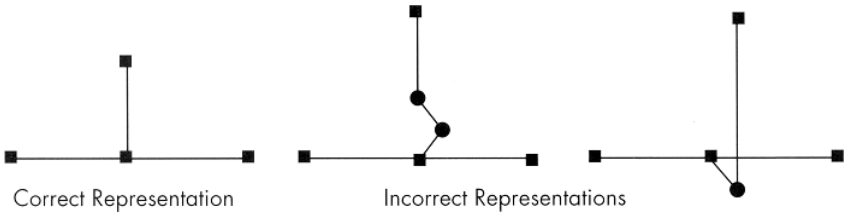

Figure 10 - Artefacts

Point density reduction
Point density is controlled so that the locational information is conveyed by the minimum number of points while still retaining the smooth shape of the source information.

The following specifications apply for data point reduction for *GEODATA TOPO 250K*:

- The minimum length of a line segment is 25 metres; and
- The maximum length of a line segment is 20,000 metres.

For features other than roads, feature instances of less than 20 points will not be filtered (ie: such features are an exception to this rule). Sections of the chains which must be coincident with such features will also be an exception to the rule.

Unique feature identifier
Each entity in *GEODATA TOPO 250K* has an attribute code which is unique to that entity. This attribute, known as the unique feature identifier (UFI), is nationally unique and allowance has been made for up to 100 million entities. The UFI has two applications. It is used to facilitate the supply of 'change only' updates of the data, and is a tag that can be used to keep an historical log of changes to *GEODATA TOPO 250K*.

Many polygon and linear entities are artificially split by tile edges. In these cases, the two or more component feature instances on either side of the edge have different UFIs and data quality pointers. This can result in an entity, represented by several feature instances, having numerous UFIs.

Edge-matching
Edge matching is the process of digitally aligning contiguous linear features which cross adjacent maps and tiles. It ensures that the coordinates of a feature's intersection with the tile edge are coincident in the digital data for the adjacent tiles. It also ensures that there are no discontinuities within a tile where a feature crosses the boundary between adjacent source maps. Edge-matching of spatial data therefore creates a 'seamless' database, allowing the application of linear network analyses such as length of coastline calculations.

The edges of every TOPO 250K tile are checked with the edges of adjacent tiles for positional and attribute matching. When features are not coincident at the tile edge, one feature may be edited to achieve continuity. The edge of one tile may not match the edge of the adjacent tile only when temporal differences in source material could not be resolved.

Source map edge-matching
The edges of every source map were checked with the edges of adjacent maps for positional and attribute matching. If a feature at the map edge was displaced less than 20 metres, the feature on the most reliable map sheet remained fixed and the feature on the least reliable map sheet was positionally adjusted to achieve a smooth join. If the displacement was greater than 20 metres, additional source material was accessed and, if necessary, the feature revised. Data quality information on the revised feature indicates any revision.

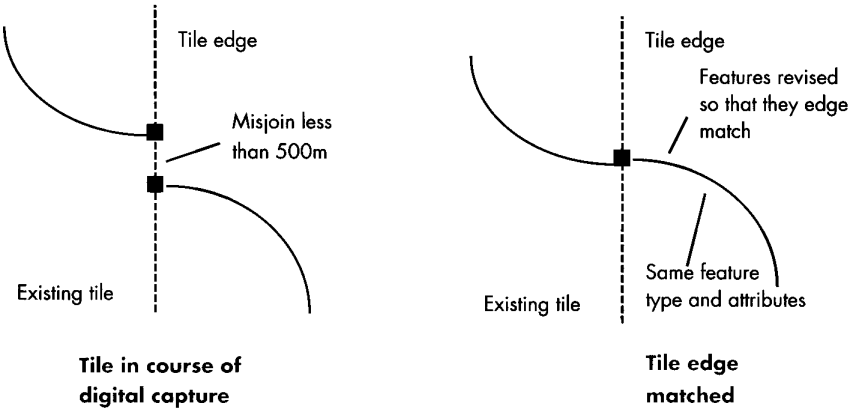

Figure 11 - Edge-matching of source maps

Edge-matching polygon features

There are some additional considerations that apply for edge matching polygons. Because of the position of the tile edge, an entity may be represented by separate polygon feature instances in adjacent tiles. Unless the attribute values of the label point of each of these separated polygons are identical, it is not easy to dissolve the line between the two polygons to create a single feature.

Except for the unique feature identifier and data quality pointer attributes, the edge-matching process ensures identical attribute values for polygon features that have been split by the tile edge.

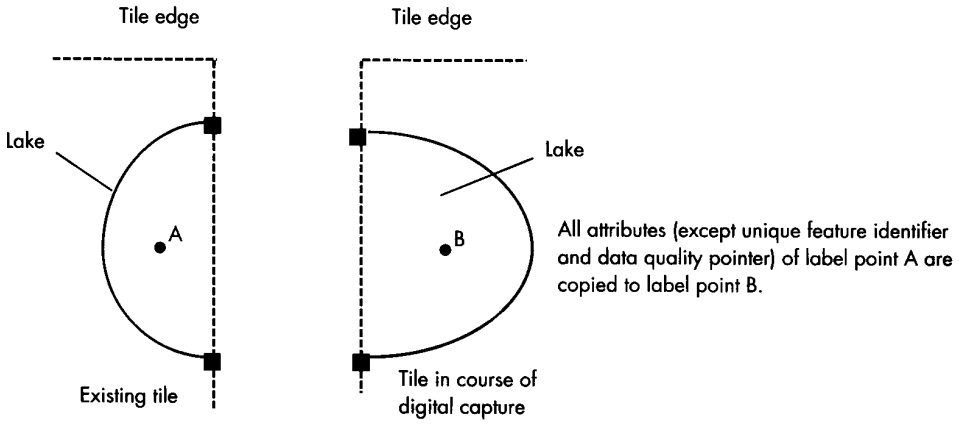

Figure 12 - Edge-matching of polygons

4.2. GEODATA TOPO 250K data concepts

Each feature in *GEODATA TOPO 250K* is defined by a spatial object and an attribute object. These features fit into the hierarchy of theme and layer. At the highest level, associated features are grouped into themes. Themes are subdivided into layers according to the spatial objects used to represent the features.

Vector data
Vector data describes spatial data in which the location of a real world phenomenon is defined by points and straight lines (vectors) between these points. The vector data model used for GEODATA also includes polygons - areas bounded by straight lines.

Feature-based data
The GEODATA vector products use a feature-based data model described by the following definitions. These are used to describe data that represent phenomena in the real world:

- **Entity:** A real world phenomenon which cannot be divided into phenomena of the same type.
- **Feature instance:** A single occurrence of a feature which has a unique set of spatial and attribute object values.
- **Attribute:** A descriptive characteristic of a feature. Attributes can be spatial (or locational) and aspatial (or non-locational).
- **Attribute value:** A value assigned to an attribute, either for a feature instance or its attributes.
- **Feature class:** A group of feature instances defined by a set of rules and having common attributes and relationships that are the properties of the corresponding real world phenomena.
- **Entity class:** A group of entities of the same kind, matching the members of a feature class.

The structure of a feature instance in the feature based data model can be summarised as:
feature instance = [*spatial object* + *attribute object*]

Spatial object
Spatial objects are the locational attributes of the feature. In GEODATA, they comprise the special cases of points, chains and polygons. Spatial objects have a spatial address which consists of one or more couplets (x, y) or triplets (x, y, z).

Point
A *point* is a geometric representation defined by a single (x, y) coordinate couplet or a (x, y, z) triplet. Three special points are used.

- **Entity point**
  An *entity point* is used to locate point entities, or area entities represented by a point because of the scale of the source material and/or scale of the final GEODATA product.

- **Polygon label point**
  A *polygon label point*, contained within every polygon feature instance, locates information about that polygon. It is linked to the bounding chains of the polygon. In proprietary GIS software packages, this point type is sometimes known as a centroid.

- **Node**
  A *node* is a junction of two or more feature instances or an end point of a feature instance. Nodes may carry attribute information.

Chain
A *chain* is a spatial object composed of a sequence of non-intersecting line segments which is bounded by nodes at each end. Chains may carry topological information such as a reference to the polygons to the left and right (with respect to the direction of digitising) and reference the start and end nodes.

A line segment is a straight line between two consecutive vertices in a chain. Each vertex is defined by a single (x, y) coordinate couplet.

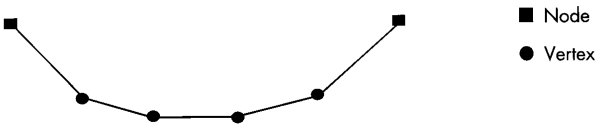

Figure 13 - Chain spatial object

Polygon
A *polygon* is a bounded, continuous region consisting of an interior area, and an outer boundary defined by a set of chains. A polygon may also contain one or more non-nested inner boundaries also defined by sets of chains.

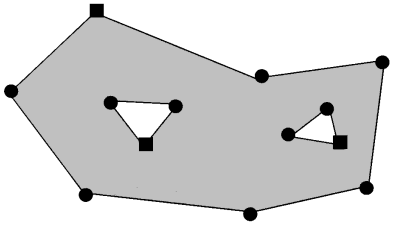

Figure 14 - Polygon spatial object

The entity and its spatial object
The spatial object used to depict a feature depends on the size of the entity with respect to the scale of the source material and/or the final GEODATA product. For example, a small lake would be represented as an entity point whereas a large lake would be represented by a polygon. For this reason, a class of feature may be depicted by more than one type of spatial object.

Attribute object
An *attribute object* identifies the class of feature and the non-locational properties of the feature. The following two examples illustrate the possible content of the attribute object:

Attribute	Attribute value
Feature	Watercourse
Name	Murray River
Perenniality	1
Unique Feature Identifier	BA20300107
Data Quality Pointer	H56105

Attribute	Attribute value
Feature	Island
Name	Fraser Island
State	5
Unique Feature Identifier	BA09400035
Data Quality Pointer	G56062

Figure 15 - Examples of attribute objects

It is possible for a feature's attribute object to consist of more than one set of attribute tables. The above attribute tables are known as *primary attribute tables*. Additional descriptive information about a feature instance can be provided by a *secondary attribute table*.

For example, the value for the State attribute in the following Fraser Island example is the link to the relevant row of information in a secondary attribute table called *'State'* which gives the value of *'Queensland'* for the State code of *5*.

Primary attribute table

Attribute	Attribute value
Feature	Island
Name	Fraser Island
State	5
UFI	BA09400035
Data Quality Pointer	G56062

Secondary attribute table

State	Description
0	Not applicable
1	ACT
2	JBT
3	NSW
4	NT
5	QLD
6	SA
7	TAS
8	VIC
9	WA

Figure 16 - Primary and secondary attribute table relationship

5 Data structure and content

5.1 Data structure

The spatial object and attribute object as previously defined are the primitive components of GEODATA. When combined, these objects define a feature instance. Features are grouped to form a hierarchy which is used for the capture and transfer of the data.

Theme
The digital spatial data contained in GEODATA are primarily derived from existing map production material. The data on the source material are captured as features and these features may be grouped into themes - each containing logically related geographic information. The theme is the highest level of data grouping in the GEODATA structure. *GEODATA TOPO 250K* is composed of five themes. All five themes include a common set of features called the *framework*. Framework features include the sea and land polygons, State Borders and the extent of the geographic area supplied. For the purposes of description, the framework features have been detailed as a separate theme in this guide.

Layer
Each theme may consist of one or more layers. A layer is a grouping of features which have compatible spatial objects. GEODATA may contain four types of layers:

- **Linear network layer**
  Linear layers contain linear features such as watercourses. These layers are composed of nodes and chains.
- **Polygon layer**
  Polygon layers contain area features represented by polygons, such as lakes and reefs. Polygons in the same layer do not overlap.
- **Point layer**
  Point layers contain features that are represented by entity points, such as buildings or aircraft facilities.
- **Point/linear layer**
  Point/linear layers contain a combination of entity point and chain features such as road networks with bridges and river networks with waterfalls and locks.

5.2 Data Layers

5.2.1 Hydrography Theme

Structure and content of the hydrography theme

The hydrography theme is composed of the following layers:

- **Drainage <d>**
  This point/linear layer depicts the drainage system as a network of interconnected chains with point features such as locks, represented as coincident nodes on the network. The majority of the chains represent watercourses or canals, depicted as single lines on the source material. To ensure the continuity of this network, connector features are used to bridge area features such as lakes, swamps and watercourses which are sufficiently wide to be shown as polygons on the source material.

- **Waterbody <w>**
  This is a polygon layer of waterbody area features such as lakes, swamps, land subject to inundation and watercourses sufficiently wide to be shown as polygons on the source material or at 1:250 000 scale.
- **Offshore <o>**
  The offshore layer is used to represent offshore polygon features such as reefs.
- **Navigation <n>**
  This point layer contains features which can be used as a guide for coastal navigation such as lighthouses and wrecks. This data however should not be used as a source for marine navigation.
- **Waterpoint <x>**
  This is a point layer showing point water features such as bores and springs which exist independently of the drainage network.
- **Marine facilities <h>**
  This linear layer depicts constructed features used for the docking or safe anchorage of marine craft.

Hydrography Theme Notes

Waterbody polygon Boundaries

Polygon features in the waterbody layer often have common boundaries. For instance, a swamp and an area of land subject to inundation can be adjacent. To avoid repeating the shared boundary chain in the data, a common feature of waterline has been used. All polygon features in the waterbody layer have waterline bounding chains.

Connector feature

Drainage patterns are made up of both linear features (narrow streams) and polygon features (lakes, swamps etc.) and as such do not constitute a rigorous linear network. To allow linear analysis on this theme an artificial feature called a *connector* has been added to the data.

This feature is used to bridge the gap in linear hydrographic features where they are separated by waterbodies such as lakes, swamps and watercourses that are depicted as polygons. The connector feature is composed of one or more chains in the general location that would be expected if the polygon feature was collapsed to a line (see diagram below). Because the connector has been arbitrarily positioned and does not depict an entity in the real world, it cannot be given any value for planimetric accuracy. This is indicated in the Data Quality Table by a value of 9999 for the planimetric accuracy of the feature instance.

The connector is only used if there is flow across a waterbody polygon feature. Thus if there is only inflow to a lake and no outflow the connector feature is not used.

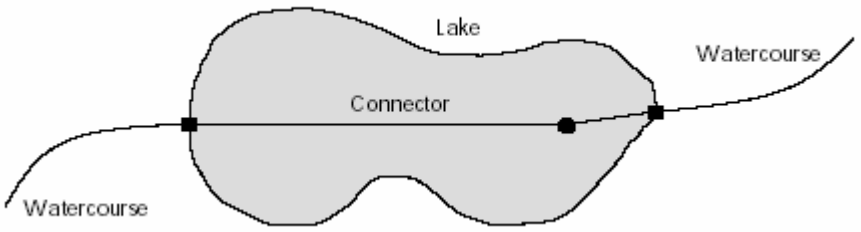

Figure 17 - Waterbody Connector Feature

The use of connectors ceases once the watercourse runs into a tidal area such as an estuary, bay or inlet of the sea. Connector features have the attributes of the watercourse they represent, not the waterbody through which they pass.

Junction feature

A *junction* is a linear feature in the waterbody layer. It is an artificial line used to separate adjacent polygon areas which have differing attributes and across which flow can occur. For example, a junction feature will separate the confluence of two watercourses depicted as polygons on the source material. A junction may also separate watercourse polygons from the sea.

The junction feature is arbitrarily placed and cannot be given any value for planimetric accuracy. This is indicated in the Data Quality Table by a value of 9999 for the planimetric accuracy of the feature instance.

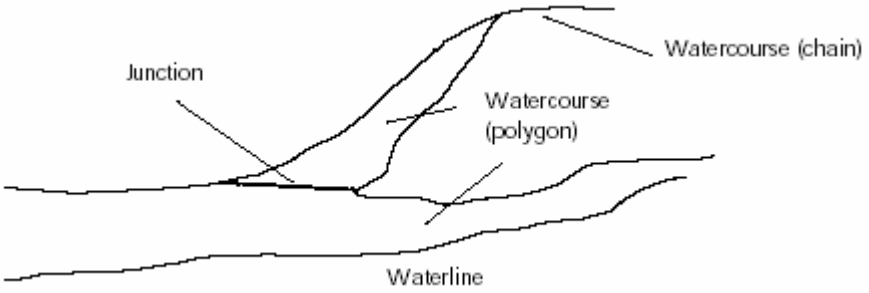

Figure 18 - Waterbody Junction Feature

Void polygons

A polygon may contain an inner set of boundary chains as well as a set of external boundary chains (see Section 5.1). The internal boundary chains may delimit an area which is not defined in that polygon layer. For example, a lake may contain an island. No island polygon feature is defined for the waterbody layer. Generally, such polygons are known as void polygons (see diagram below). In the waterbody layer they are known as *waterbody void* features.

Similarly, foreshore flats may contain areas where the floor of the sea is at such a depth that it is not exposed by tidal movements. These areas are known as *offshore voids*.

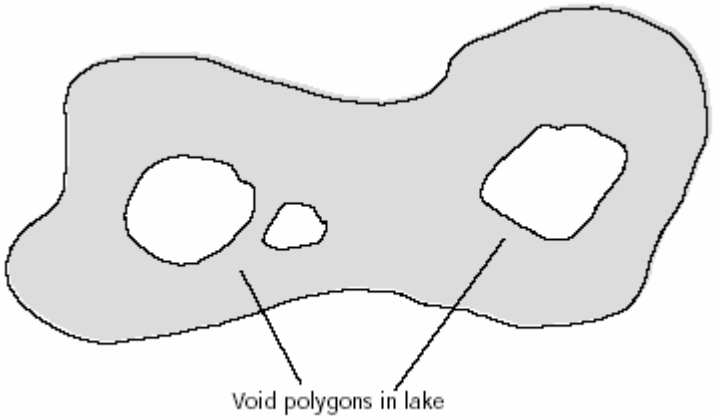

Figure 19 - Waterbody void polygons

Depiction of the coastal environment

In tiles which cover coastal areas, the coastal and estuarine environments are depicted by a combination of features in both the waterbody layer and the framework layer of the hydrography theme.

The waterbody layer contains named watercourse (polygon) features and when these occur in estuaries they are separated from the sea with a junction feature (see diagram below). This use of the junction feature does not preclude the watercourse polygon from being tidal, but allows the name of the watercourse to be carried for its entire length.

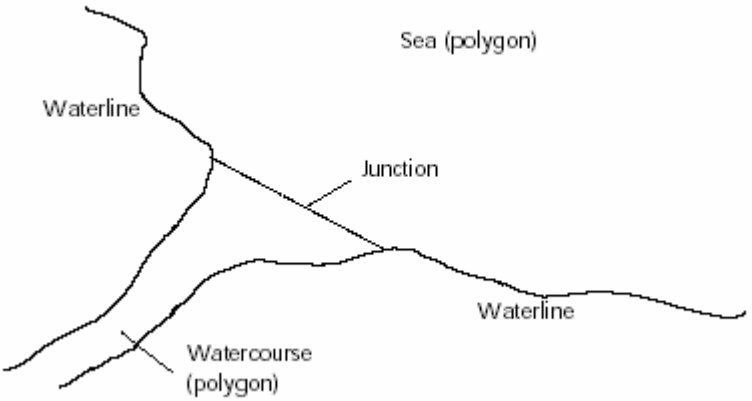

Figure 20 - Coastal Junction features

Other hydrography waterbody layer features which are often found in the coastal environment are saline coastal flat and mangrove flat. Where the bounding chains of these polygon features are coincident with the boundaries of the sea, they are duplicated in the framework layer as waterline features. This is shown in the following diagrams.

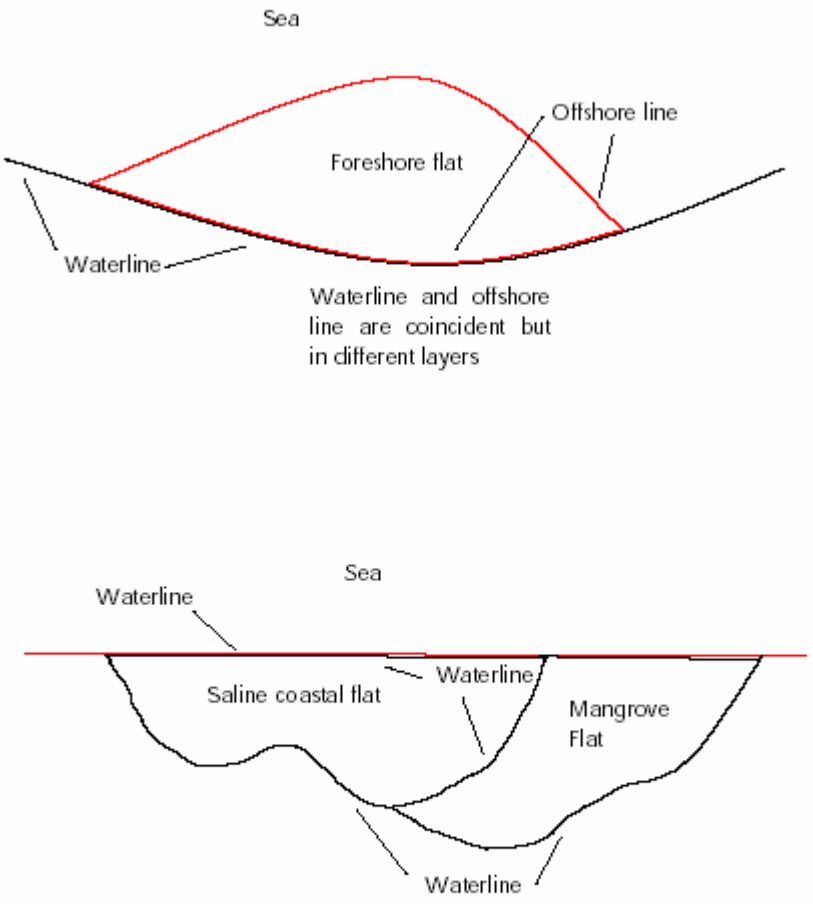

Figure 21 - Waterline depiction

Table 5 - Structure and Content of Hydrography theme

Layer (Layer Code)	Layer Type	Feature	Feature Code	Attributes	ArcInfo Coverage Name	ArcView Shapefile Name	MapInfo Table Name
Drainage (d)	point	Lock	lock	Name	<map id>xld	<map id>d_p	<map id>d_p
	point	Waterfall	fall_p	Name			
	point	Waterhole	waterhole	Name, Perenniality			
	line	Canal	canal	Name	<map id>dld	<map id>d_l	<map id>d_l
	line	Connector	connector	Name, Perenniality, Hierarchy			
	line	Rapid	rapid_l	Name, Perenniality, Hierarchy			
	line	Spillway	spillway	Name, Perenniality, Hierarchy			
	line	Watercourse	watercours_l	Name, Perenniality, Hierarchy			
Waterbody (w)	line	Junction	junction		<map id>wld	<map id>w_l	<map id>w_l
	line	Rapid Area Line	rapid_a_l				
	line	Tile Edge	tile_edge				
	line	Waterline	waterline				
	polygon	Canal	canal_a	Name		<map id>w_r	<map id>w_r
	polygon	Lake	lake	Name, Perenniality			
	polygon	Land Subject to Inundation	sub_to_inund	Name			
	polygon	Mangrove Flat	mangrove_flt				
	polygon	Marine Swamp	swamp_marine				
	polygon	Rapid	rapid_a	Name, Perenniality, Hierarchy			
	polygon	Reservoir	reservoir	Name			
	polygon	Saline Coastal Flat	saln_cst_flt				
	polygon	Salt Evaporator	salt_evap				
	polygon	Settling Pond	sew_pond				
	polygon	Swamp	swamp	Name			
	polygon	Waterbody Void	w_body_void				
	polygon	Watercourse	watercours_a	Name, Perenniality, Hierarchy			

Table continues next page

Layer (Layer Code)	**Layer Type**	**Feature**	**Feature Code**	**Attributes**	**ArcInfo Coverage Name**	**ArcView Shapefile Name**	**MapInfo Table Name**
Offshore (o)	line	Offshore Line	offshor_l		<map id>old	<map id>o_l	<map id>o_l
	line	Tile Edge	tile_edge				
	polygon	Foreshore Flat	foreshor_flat			<map id>o_r	<map id>o_r
	polygon	Offshore Void	offshor_void				
	polygon	Reef	reef	Name, Relationship, Reef			
Navigation (n)	point	Lighthouse	lighthouse		<map id>nld	<map id>n_p	<map id>n_p
	point	Offshore Rock	rock_offshor	Name			
	point	Wreck	wreck	Name, Relationship			
Waterpoints (x)	point	Bore	bore	Name, Relationship	<map id>xld	<map id>x_p	<map id>x_p
	point	Spring	spring				
	point	Water Tank	tank_dam_p				
	point	Waterpoint	waterpoint	Waterpoint Code			
	point	Windpump	windpump				
Marine Facilities (h)	line	Breakwater	breakwater		<map id>hld	<map id>h_l	<map id>h_l
	line	Jetty	jetty				
	line	Wharf	wharf				

5.2.2 Infrastructure Theme

Structure and content of the infrastructure theme
The infrastructure theme is composed of the following layers:

- **Aeronautical point <a>**
  This point layer uses points to depict aircraft facilities including airports, landing grounds and heliports.

- **Buildings point <g>**
  This point layer is used to depict permanent walled and roofed constructions or the remaining ruins of such constructions. Buildings are not shown in built-up areas.

- **Built-up areas <b>**
  This is a polygon layer representing the urban environment.

- **Localities <l>**
  This point layer shows named places or areas as a point locality. A locality may be a populated centre such as a town or a homestead, or may be linked to a geographic feature such as a mountain peak, a bay or a road junction. Other localities may not be based on any ground feature.

- **Pipelines <p>**
  The pipeline layer is a linear network representing pipelines which carry water, gas, oil and/or other materials. Pipelines are not shown in built-up area polygons.

- **Rail transport <r>**
  This combined point/linear layer, depicts transport systems which use one or more rails to carry freight or passengers. All rail features are attributed with the number of tracks, the status of the railway and the rail gauge.

- **Road Transport <v>**
  The road transport layer comprises both point and linear features which relate to vehicle transport. Roads, and the related infrastructure such as tunnels and bridges, are classified under a hierarchy of road types as provided in the Data Dictionary in Section 5.2.

  Road formation and route numbers are also included as attributes to the data.

  Minor bridges are not shown in the data. Gates and stockgrids in more densely settled areas are not included in the data except for those in vermin and dog proof fences. Only foot tracks of national significance are included in the data.

- **Utilities <u>**
  This combined point/linear layer is used to depict a range of purpose built features. These features include aerial cableways, mines, fences and yards, storage tanks, dams and landmarks.

  Fences are not depicted in more densely settled areas of Australia with the exception of major vermin and dog proof fences.

- **Powerlines <k>**
  This linear feature depicts only powerlines carrying 110 kilovolts or greater.

- **Seismic Lines<k>**
  This layer depicts seismic lines and cleared lines. These are graded paths in a straight line which may be used for the purpose of sub-surface geological exploration.

Infrastructure Theme Notes

Road and rail linear networks

The road transport layer and the rail transport layer contain point and chain features which describe complete linear networks. The fundamental characteristic of a GEODATA linear network is connectivity. This property allows the data to be used in many ways. For example, the shortest path between two points on the network can be calculated, or all places within a set road distance of a point of origin can be derived.

- **Road transport**

The road transport layer contains roads as chains. The chains have nodes at intersections with other roads, and where the road is broken by a ford, gate, stock grid, road bridge or road tunnel. Depending on the length of the ford, road bridge or road tunnel features, they are depicted as either a node in the network or a chain. The ferry route feature allows for networking of roads joined by a vehicular ferry.

Named places, such as towns, cities and homesteads etc., which may be reached by road transport are held in the localities and built-up areas layers. These named places have been positioned so they are coincident with the road transport features, and, if possible, they are coincident with nodes in the network.

- **Rail transport**

The rail transport layer contains railways as chains. These chains have nodes at intersections with other railway features and where the railway is broken by a rail bridge or a rail tunnel. Depending on the length of the rail bridge or rail tunnel features, they are depicted as either a node in the network or a chain.

Railway stations are also coincident with nodes in the rail network. The railway stations have 'name' as an attribute and this may result, on some occasions, in the same place name being repeated in the rail transport, localities and built-up areas layers.

Road and rail intersections

Special attention has been paid to the configuration of intersections in the road and rail transport layers of this theme. An intersection in the digital data contains the same number of intersection nodes as on the source material (see diagram below).

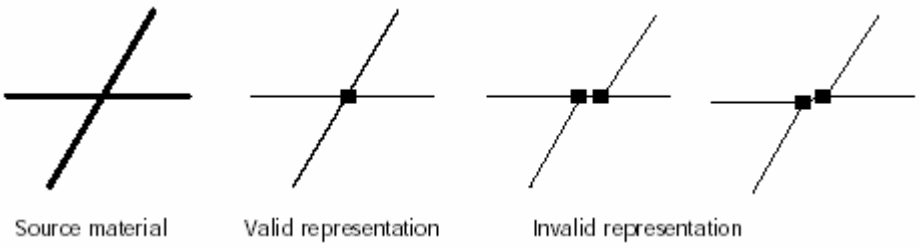

Figure 22 - Depiction of road and rail intersections

Void polygons

A polygon may contain an inner set of boundary chains as well as a set of external boundary chains. The internal boundary chains may delimit an area which is not defined in that polygon layer. For example a built-up area may contain a large open space such as a forest. No forest polygon feature is defined for the built-up areas layer, so this internal polygon is undefined with respect to the layer. Generally, such polygons are known as void polygons. In the built-up areas layer they are known as built-up area void features.

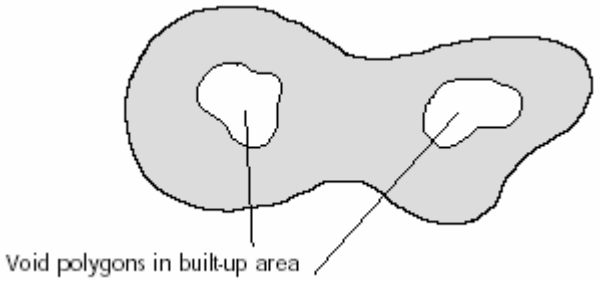

Figure 23 - Void Polygons (Infrastructure)

Names of places and features
When a feature has a geographic name, that name is included in the name attribute for the feature. There are, however, many instances where place names, which constitute important locational information, are not related to specific features held in the data. The use of the locality feature allows this important information to be included in the theme.

The locality feature is used to represent the following named entities:

- populated place;
- homestead;
- mountain, peak or pinnacle;
- mountain pass;
- road junction;
- headland, cape, head or point;
- bay, inlet or cove;
- place name;
- gorge;
- cemetery;
- beach; and
- waterbody island.

Not every occurrence of these entities on the source material is captured and the relevant selection criteria are set out in the entry for the locality feature in the Data Dictionary. The names of feature instances in the localities layer are those shown on the source material, and have not necessarily been approved by the relevant names authority.

The coordinates of the locality feature are those of the entity on the source material, not the location of its text or annotation. Where the entity has some area or extent, such as a bay, the locality feature is positioned at the approximate centre of the entity.

Built-up areas
In urban areas, where the density of buildings is such that each structure cannot be depicted individually, a built-up area polygon feature is used to indicate the extent of the developed area. Built-up areas are used for cities, suburban areas, towns and large villages.

A number of built-up area polygons in the data may have the same name. This can happen when the metropolitan area of a large city or town is split by areas of open space or a watercourse polygon. The location of the polygon label point for a built-up area does not have any positional significance. This is indicated by a value of 9999 for its planimetric accuracy in the Data Quality Table. The centre of the city or town and the location of its suburbs are given by the locality feature.

Cemeteries and parks are also included in this polygon layer. Parks include land developed for recreation purposes such as ovals, gardens and golf courses. Cemeteries which are too small to be shown as polygons are included in the localities layer.

Coincident areas
Some built-up areas have a link to other features. For example, a built-up area may be defined by a bounding road or be adjacent to the coast or to a reserved area. Because of these relationships, when depicted in the data, these features may be made coincident such that the nodes and/or vertices of the two features align. If the features are within 50 metres of each other as provided by the source material, they are considered to be adjoining and therefore made coincident in the data.

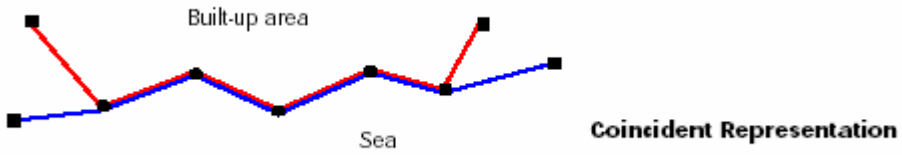

Figure 24 - Coincident areas (Infrastructure)

Table 6 - Structure and Content of Infrastructure theme

Layer (Layer Code)	Layer Type	Feature	Feature Code	Attributes	ArcInfo Coverage Name	ArcView Shapefile Name	MapInfo Table Name
Aeronautical Point (a)	point	Aircraft Facility	aircrft_flty	Name, Aircraft Facility Type	<map id>ald	<map id>a_p	<map id>a_p
Built-up Areas (b)	line	Built-up Area Line	builtup_l	Name	<map id>bld	<map id>b_l	<map id>b_l
	line	Tile edge	tile_edge	Name			
	polygon	Built-up Area	builtup_a			<map id>b_r	<map id>b_r
	polygon	Built-up Area Void	bua_void				
	polygon	Cemetery	cemetery				
	polygon	Park	park				
Localities (l)	point	Locality	locality	Name, Locality Code	<map id>lld	<map id>l_p	<map id>l_p
Buildings Point (g)	point	Building	building	Building Code	<map id>gld	<map id>g_p	<map id>g_p
Rail Transport (r)	point	Railway Bridge (point)	bridge_rl_p	Name, Tracks, Status, Gauge	<map id>rld	<map id>r_p	<map id>r_p
	point	Railway Station	railway_station				
	point	Railway Tunnel (point)	tunnel_rl_p	Name			
	line	Railway	railway	Name, Tracks, Status, Gauge		<map id>r_l	<map id>r_l
	line	Railway Bridge (chain)	bridge_rl_l	Name, Tracks, Status, Gauge			
	line	Railway Causeway	causeway_r	Name, Tracks, Status, Gauge			
	line	Railway Tunnel (chain)	tunnel_rl_l	Name			
Road Transport (v)	point	Ford (point)	ford_p	Name, Classification,Formation, National Route Number, State Route Number	<map id>vld	<map id>v_p	<map id>v_p
	point	Gate	gate	As above			
	point	Road Bridge (point)	bridge_rd_p	As above			
	point	Road Tunnel (point)	tunnel_rd_p	As above			
	point	Stock Grid	grid	As above			
	line	Ferry Route	ferry_route	Name		<map id>v_l	<map id>v_l
	line	Foot Track	foot_track	Name			
	line	Ford (chain)	ford_l	Name, Classification,Formation, National Route Number, State Route Number			
	line	Road	road	As above			

Table continues next page

Layer (Layer Code)	Layer Type	Feature	Feature Code	Attributes	ArcInfo Coverage Name	ArcView Shapefile Name	MapInfo Table Name
Road Transport (cont.) (v)	line	Road Bridge (chain)	bridge_rd_l	Name, Classification,Formation, National Route Number, State Route Number	<map id>vld	<map id>v_l	<map id>v_l
	line	Road Causeway	causeway_rd	Name, Classification,Formation, National Route Number, State Route Number			
	line	Road on Dam	road_on_dam	Name, Classification,Formation, National Route Number, State Route Number			
	line	Road Tunnel (chain)	tunnel_rd_l	Name, Classification,Formation, National Route Number, State Route Number			
Utilities (u)	point	Gas Well	gas_well		<map id>uld	<map id>u_p	<map id>u_p
	point	Landmark	landmark_p	Description			
	point	Mine	mine	Name			
	point	Storage Tank	stor_tank_p				
	point	Yard	yard				
	line	Aerial Cableway	chairlift	Name		<map id>u_l	<map id>u_l
	line	Conveyor	conveyor				
	line	Dam	dam	Name			
	line	Fence	fence				
Seismic Lines (4)	line	Seismic line / Cleared line	seismic_l		<map id>4ld	<map id>4_l	<map id>4_l
Powerlines (k)	line	Powerline	powerline		<map id>kld	<map id>k_l	<map id>k_l
Pipelines (p)	line	Pipeline	pipeline	Product Code, Relationship	<map id>pld	<map id>p_l	<map id>p_l

5.2.3 Vegetation Theme

Structure and content of the vegetation theme
The vegetation theme is composed of the following layers:

- **Vegetation <t>**
  This polygon layer contains forest features which are defined as areas of land with greater than 20% cover of trees or scrub. This layer also contains specific vegetation classes including mangrove, orchard, pine plantation and rainforest.
- **Vegetation Miscellaneous <j>**
  This layer contains linear features which represent narrow strips of natural or planted trees, positioned to break the force of the prevailing wind.

Vegetation Theme Notes

Vegetation polygon boundaries

Polygon features in the vegetation layer often have common boundaries. For instance, a pine plantation and a forest can be adjacent. To avoid repeating the shared boundary chain in the data, a common feature called *vegetation line* has been used. All polygon features in the vegetation layer have vegetation line bounding chains.

Void polygons

A polygon may contain an inner set of boundary chains as well as a set of external boundary chains. The internal boundary chains may delimit an area which is not defined in that polygon layer. For example, a forest area may contain a built-up area. No built-up area polygon feature is defined for the vegetation layer, so this internal polygon is undefined with respect to the layer. Generally such polygons are known as void polygons. In the vegetation layer they are known as vegetation void features.

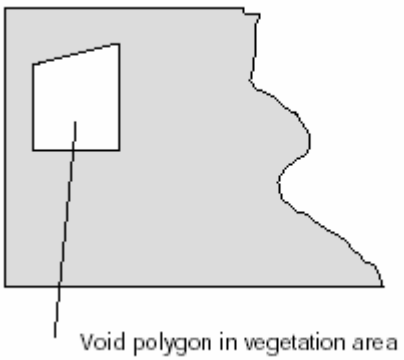

Figure 25 - Void polygons (Vegetation)

Size criteria

For forested areas, only areas greater than 250 000 square metres have been captured. Non-forested areas contained within a forest polygon are shown as vegetation voids. For cleared areas of forest, only areas which are 250 000 square metres or more have been captured. Where the non-forested area coincides with another features such as a lake or an aircraft facility the vegetation void may be as small as 62 500 square metres.

Coincident features

Some vegetation areas have a natural link to other features. For example, a forested area may be broken by a reservoir or be contained within a built-up area. Because of these relationships, when depicted in the data, these features may be made coincident such that the nodes and/or vertices of the two features align. If the features are within 50 metres of each other as provided by the source material, they are considered to be adjoining and therefore made coincident in the data. Vegetation polygons may be made coincident with built-up areas, waterbodies, aircraft facilities or the sea.

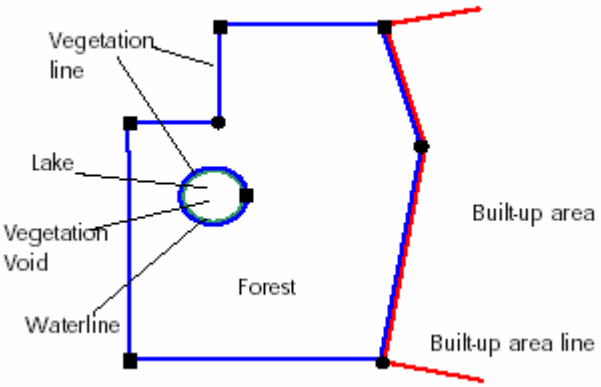

Figure 26 - Coincident features (Vegetation)

Table 7 - Structure and Content of Vegetation theme

Layer (Layer Code)	**Layer Type**	**Feature**	**Feature Code**	**Attributes**	**ArcInfo Coverage Name**	**ArcView Shapefile Name**	**MapInfo Table Name**
Vegetation (t)	line	Tile Edge	tile_edge		<map id>tld	<map id>t_l	<map id>t_l
	line	Vegetation Line	veg_l				
	polygon	Forest	forest			<map id>t_r	<map id>t_r
	polygon	Mangrove	mangrove				
	polygon	Orchard	orchard				
	polygon	Pine Plantation	pine				
	polygon	Rainforest	rainforest				
	polygon	Vegetation Void	veg_void				
Vegetation Miscellaneous (j)	line	Windbreak	windbreak		<map id>jld	<map id>j_l	<map id>j_l

5.2.4 Reserved Areas Theme

Structure and content of the reserved areas theme
The reserved areas theme is composed of the following layers:

- **Security areas <1>**
  Prohibited Area features are areas of land set aside for defence, scientific or other activities in the public interest. Examples of this are CSIRO research areas and communications sites which are sufficiently sized to be shown as polygons on the source material.

  All land reserved for the Australian military forces is classed as Prohibited Area. This includes features such as army barracks, firing ranges, naval bases and military training areas.

- **Reserved areas <3>**
  This polygon layer contains four reserved area features; namely, Aboriginal areas, forestry reserves, nature conservation areas and water supply reserves.

  Aboriginal area features describe freehold, leasehold or Crown land that is assigned to an Aboriginal community. It does not include land held privately by individual Aboriginal landowners.

  Forestry reserves are public land managed by State forestry authorities. These include State forests and timber reserves.

  Nature conservation areas are land that is set aside for the protection of the natural environment. This feature includes national parks, flora reserves, State recreation areas and conservation parks.

  Water supply reserves are Crown land set aside for the protection of water supply catchments and associated works.

Reserved Areas Theme Notes

Reserved area polygon boundaries
Polygon features in the reserved areas layer often have common boundaries. For instance, a nature conservation area and a forestry reserve may be adjacent. To avoid repeating the shared boundary chain in the data, a common feature of reserve line is used. All polygon features in the reserved areas layer have reserve line bounding chains.

Void polygons
A polygon may contain an inner set of boundary chains as well as a set of external boundary chains. The internal boundary chains may delimit an area which is not defined in that polygon layer. For example a forestry reserve may contain a large open space such as a farm. No farm or open space polygon feature is defined for the reserved areas layer, so this internal polygon is undefined with respect to the layer. Generally such polygons are known as void polygons. In the reserved areas layer they are known as reserve void features. In the security areas layer they are known as prohibited area void features.

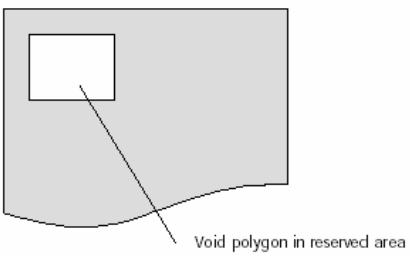

Figure 27 - Void Polygons (Reserved Areas)

Table 8 - Structure and Content of Reserved Areas theme

Layer (Layer Code)	**Layer Type**	**Feature**	**Feature Code**	**Attributes**	**ArcInfo Coverage Name**	**ArcView Shapefile Name**	**MapInfo Table Name**
Security Areas (1)	line	Prohibited Area Line	proh_a_l		<map id>1ld	<map id>t_l	<map id>t_l
	line	Tile Edge	tile_edge				
	polygon	Prohibited Area	proh_a	Name, Authority Code		<map id>t_r	<map id>t_r
	polygon	Prohibited Area void	proh_a_void				
Reserved Areas (3)	line	Reserve Line	res_a_l		<map id>3ld	<map id>3_l	<map id>3_l
	line	Tile Edge	tile_edge				
	polygon	Reserve – Aboriginal Area	abor_res	Name, Authority Code		<map id>3_r	<map id>3_r
	polygon	Reserve - Forestry	forest_res	Name, Authority Code			
	polygon	Reserve – Nature Conservation	nat_res	Name, Authority Code			
	polygon	Reserve – Water Supply	water_res	Name, Authority Code			
	polygon	Reserve – Void	res_a_void				

5.2.5 Relief Theme

Structure and content of the relief theme
The relief theme is composed of the following layers:

- **Spot heights <e>**

This point layer contains discrete point information with height values contained as attributes. Spot elevations have been selected to show terrain shape, change of slope and high and low points. In any group of mountains and hills, spot elevations are used to show the highest point. Due to the introduction of contours in GEODATA TOPO 250K Series 2, there are not as many spot elevations as provided in Series 1.

- **Survey marks <y>**

This point layer contains spot elevations for which at least the height (for Bench Marks) or the position (for Horizontal Control Points) has been determined by geodetic survey.

- **Sand ridges <s>**

This is a linear layer which represents sand drifts, formed by prevailing winds. Where known, an average height for each sand ridge is provided as an attribute in the data.

- **Relief area <q>**

This polygon layer depicts areas of land which have a particular surface condition. Features such as sand, sand dunes, craters, open cut mines and rocky outcrops are included in this layer.

- **Contours <c>**

Contours at 50 metre intervals form the basis of this polygon layer. The area between adjacent contours are held as hypsometric area polygons.

- **Morphology <m>**

This combined point/linear layer represents the location of specific landforms on the earth's surface. Morphology features may be natural such as a cave or a cliff; or constructed such as a levee or a cutting.

Relief Theme Notes

Relief area polygon boundaries
Polygon features in the relief area layer sometimes have common boundaries. For instance, a sand dunes polygon and a sand polygon can be adjacent. To avoid repeating the shared boundary chain in the data, a common feature of relief area line has been used. All polygon features in the relief area layer have relief area line bounding chains.

Contours
All contours are attributed with a contour code. The contour code is a value representing the type of contour as described below.

Contour Code	Type of Contour	Usage
1	Standard	Depict Standard Contours.
2	Depression	Depict Depression Contours.
3	Connector on Cliff	Depict contours added to the data where the contours on the repromat were broken for a cliff symbol.
4	Connector Standard	Depict contours where the contour's position is not known, for example in a watercourse polygon.
5	Interpolated Contour	

Table 9 - Contour Codes

Hypsometric areas are polygons in between consecutive contours and carry the elevation of the lower contour. Hypsometric areas do not cover the sea and no voids apply to it; for instance, lakes do not form voids in hypsometric areas.

The coastline, including junctions, has been cloned as the 0 metre contour.

Table 10 - Structure and Content of Relief theme

Layer (Layer Code)	Layer Type	Feature	Feature Code	Attributes	ArcInfo Coverage Name	ArcView Shapefile Name	MapInfo Table Name
Spot Heights (e)	point	Spot Elevation	spot_elevatn	Elevation, Source, Point Determination	<map id>eld	<map id>e_p	<map id>e_p
Survey Marks (y)	point	Bench Mark	bench_mark	Elevation, Code	<map id>yld	<map id>y_p	<map id>y_p
	point	Horizontal Control Point	trig_station	Elevation, Code			
Sand Ridges (s)	line	Sand Ridge	sand_ridge	Average Height	<map id>sld	<map id>s_l	<map id>s_l
Relief Areas (q)	line	Relief Area Line	rel_area_l		<map id>qld	<map id>q_l	<map id>q_l
	line	Tile Edge	tile_edge				
	polygon	Crater	crater			<map id>q_r	<map id>q_r
	polygon	Distorted Surface	dist_surf				
	polygon	Open Cut / Mining Area	open_cut				
	polygon	Relief Area Void	rel_a_void				
	polygon	Rocky Outcrops	rocky_a				
	polygon	Sand	sand				
	polygon	Sand Dunes	dunes				
Contours (line) (c)	line	Contour	contour	Elevation, Contour	<map id>cld	<map id>c_l	<map id>c_l
	line	Tile Edge	tile_edge	Elevation			
Contours (polygon) (c)	polygon	Hypsometric Area	hypso_a	Code		<map id>c_r	<map id>c_r
Morphology (point) (m)	point	Cave	cave		<map id>mld	<map id>m_p	<map id>m_p
	point	Pinnacle	pinnacle				
Morphology (line) (m)	line	Cliff	cliff			<map id>m_l	<map id>m_l
	line	Cutting	cutting				
	line	Embankment	embankment				
	line	Levee	levee				

5.2.6 Framework Layer

Structure and content of the framework layer <f>

All of the five themes described in previous sections include a common layer called **Framework**. Framework features include the sea and land polygons, State Borders and the extent of the geographic area supplied.

Framework Layer Notes

- **Framework polygon boundaries**

When a polygon feature of island, mainland or sea intersects the tile edge, the bounding chain which is coincident with the neatline comprises the tile edge feature. This means each framework layer tile is bounded by one continuous series of tile edge feature instances.

It should be noted by users of GEODATA TOPO 250K Series 1 data, that this is a variation on the handling of polygon boundaries from Series 1. For more information, users should refer to the User Guide provided with the Series 1 data.

- **Depiction of the coastal environment**

In tiles which cover coastal areas, the coastal and estuarine environments are depicted by a combination of features in both the hydrography theme's waterbody layer and the framework layer.

The waterline feature in the framework layer generally represents the position of mean high water, and forms one of the bounding chains of the sea polygon. Bays and inlets are part of the sea feature which is separated from watercourse polygons of the hydrography theme by the junction feature. Junction features of this type are duplicated in the waterbody layer of the hydrography theme.

The following diagram shows the components of the framework layer. (The dashed lines are waterline features which are part of the hydrography theme.)

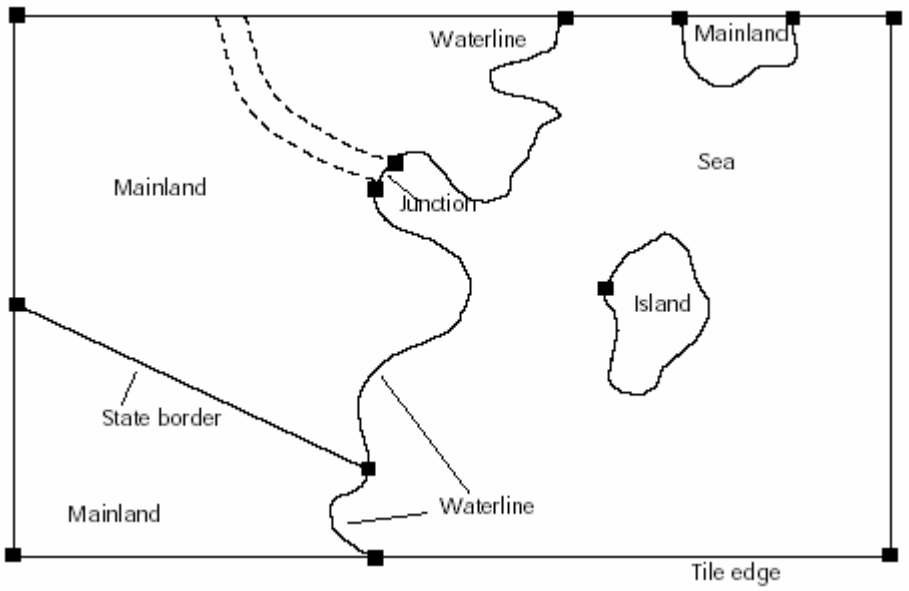

Figure 28 - Framework layer components

- **Coastal relationships**

The following diagram identifies features associated with coastlines and shows the relationships between the respective features.

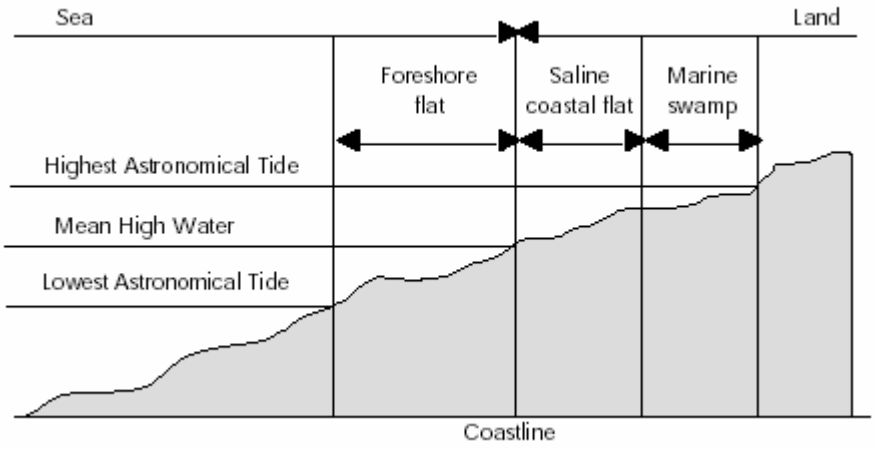

Figure 29 - Coastal Relationships

The coastline follows the mean high water mark except in areas covered by mangroves. Mangrove flats may cover the area between high and low water marks. In mangrove areas, the limit between the sea and the land is considered to be the seaward side of the mangroves.

- **Sea walls**

Sea walls are shown when they are coincident with the coastline, that is when the wall is wet under normal daily tidal action. Retaining walls adjacent to beaches or in river banks do not fall in this feature class.

- **Sea names**

The sea feature's name attribute gives the names of the seas and oceans which bound the Australian continent. A defined set of values has been specified for this attribute. They are:

- Coral Sea
- Tasman Sea
- Southern Ocean
- Indian Ocean
- Timor Sea
- Arafura Sea

- **Edge matching adjacent tiles**

The edges of all GEODATA TOPO 250K Series 2 data tiles will match with the edges of the adjacent tiles for position and attributes. Features that cross the tile boundary are split at the tile edge. In geographical coordinates (latitude and longitude), the nodes that split these features will be exactly on the tile edge.

When matching GEODATA TOPO 250K Series 1 and Series 2 tiles, users must take into account the change of datum between the Series. One of the tiles must be datum shifted in order for data to align correctly. More information about the Geocentric Datum of Australia and the process of transferring data between datums can be located on the GDA website at http://www.icsm.gov.au/gda

Table 11 - Structure and Content of Framework Layer

Layer (Layer Code)	**Layer Type**	**Feature**	**Feature Code**	**Attributes**	**ArcInfo Coverage Name**	**ArcView Shapefile Name**	**MapInfo Table Name**
Framework (f)	line	Junction	junction		<map id>fll	<map id>fll	<map id>fll
		Sea Wall	sea_wall				
		State Border	state_border				
		Tile Edge	tile_edge				
		Waterline	waterline				
	polygon	Island	island	Name, State/Territory	<map id>frl	<map id>frl	<map id>frl
		Mainland	mainland	State/Territory			
		Sea	sea	Name			

5.3 Data dictionary

Characteristics which are common to all features:

- **Unique Feature Identifier (UFI)**
  An attribute code that is unique to that instance.
- **Data Quality Pointer**
  This attribute points to a record in the Data Quality Table which holds information on the quality aspects of the feature. The contents of this secondary attribute table are set out in the data quality information within Chapter 6.

The Data Dictionary has been included as Appendix C.

5.4 Attribute Look-Up Tables

In order to reduce the size of files, most attributes of features in GEODATA TOPO 250K data have codified attribute values. These codes are numeric and sequential from zero or one. Table 12 sets out the <alut id> codes used for GEODATA TOPO 250K. Further information can be found in the Data Dictionary, attached as Appendix C. The naming convention for the attribute Look-up Table has the form:

<alut id>_lut . <file_ext>

Table 13 - Attribute Look-Up Table Codes

Theme	Attribute	<alut id>
Hydrography	Hierarchy	her
	Perenniality	per
	Reef Code	ref
	Waterpoint Code	wat
Infrastructure	Aircraft Facility Type	fac
	Building Code	bld
	Classification	cla
	Formation	for
	Gauge	gag
	Locality Code	loc
	Park Code	prk
	Product Code	pro
	Relationship	rel
	Status	stu
	Tracks	tra
Reserved Areas	Authority	aut
Relief	Contour Code	con
	Point Determination	pnt
	Source	src
Framework Layer	State	sta

6 Data quality information

Quality information allows the users of the data to make informed decisions about the fitness of the data for their application. Quality information is provided in three ways :

- Product Quality information
- Tile Quality information
- Feature Quality information

Product	**Tile**	**Feature**
All GEODATA TOPO 250K Tiles	*Single GEODATA TOPO 250K Tile*	*Individual Feature (eg. watercourse)*
This User Guide	Tile Quality Information (.tqi) Tile Frequency Information (.frq)	Data Quality Table (.dqt)

6.1 Product Quality Information

The following information is applicable to the whole of *GEODATA TOPO 250K* (ie. all data tiles). This includes a history of the source material, a description of the digitising methods and quality aspects that are common to all tiles such as positional accuracy, attribute accuracy, logical consistency and completeness.

6.1.1 Lineage

This section contains information on the lineage of the spatial data in this product. Lineage is the history of the spatial data: including the source of the data, how it was captured and how and when it was revised. Although reference is made to Geoscience Australia (GA), most tasks were carried out by GA's predecessor organisations (AUSLIG – Australian Surveying and Land Information Group from 1987 to 2001, and the Division of National Mapping prior to 1987).

History of the 1:250 000 Scale Mapping Program

The majority of the 1:250 000 topographic mapping program was shared by GA and the Royal Australian Survey Corps (RASvy). A small number of map sheets were also produced by State mapping agencies. The *National Topographic Map Series* (NTMS) at 1:250 000 scale published by GA and the *Joint Operation Graphics* (JOG) published by RASvy replaced the R502 Series which consisted largely of uncontoured maps at the same scale.

The 544 sheets in the NTMS/JOG series provided the first nationwide coverage of published, fully contoured, topographic maps. National coverage was completed in 1988. Because many of the NTMS sheets were converted by RASvy to their specifications and republished as JOG maps, there are many sheets available today with identical reliability dates but published by both agencies.

The map reproduction material used for the printing of the maps with the latest reliability date was used as the primary source material for GEODATA TOPO 250K. However, where both agencies published maps with identical reliability dates, the NTMS material was used. Most of the 1:250 000 scale NTMS and JOG maps were derived manually from 1:100 000 scale topographic maps and compilations. Some were derived from 1:100 000 and 1:50 000 digital data.

Production Methods for the 1:100 000 NTMS

Overall positional control for the 1:100 000 series was based on the Australian geodetic network using the 1966 adjustment and the Australian National Spheroid. (Readers are referred to 'The Australian Geodetic Datum: Technical Manual', National Mapping Council of Australia, Special Publication 10, for more information on this geodetic datum) The base data for the map compilation material were obtained through the stereographic observation of aerial photography. The aerial photography was generally flown at a nominal scale of 1:80 000 in blocks which equate to 1:250 000 map sheets. Some photography was at a larger scale.

A variety of specialised aerial photography cameras were used. Propagation of positional control through the blocks of photography was carried out by slotted template adjustment until the mid 1970s when a method using analytical block adjustments was introduced. In some areas radar altimetry was used to extend vertical control. As with the cameras, a number of models of stereo plotter were used for the plotting of detail and production of contours on the compilation material. Finally, all map production material was checked against other sources of information. Extensive field checking on the ground and from the air was carried out, local authorities were consulted, and larger scale reference material and supplementary photography were used.

Methods Used to Produce Source Material

To produce the 1:250 000 scale map products 1:100 000 scale material was used. Where 1:100 000 maps were published the relevant map repromat was used. In the remote areas where 1:100 000 maps were not published the relevant 1:100 000 compilation material was used.

To ensure accurate registration of all the required drafting materials (clear film, scribe sheets, masks, photographic film etc.), the materials were pre-punched on the same, large format register punch. Reference grids and graticules were computer generated and plotted on a separate layer of stable base drafting film. Map corner marks were placed on all separate layers, eg. infrastructure, roads, contours etc. which were then reduced photographically to 1:250 000 scale on a large format Klimsch *'Super Autohorika 101'* camera using the same camera setting for all material of the one map area. A pre-punched clear film was registered to the graticule and all six reduced film positives of each layer registered to the relevant section of the 1:250 000 scale graticule, trimmed, butt joined and fixed to the clear film. A contact negative was produced from each of these assemblies.

Each negative was printed down on scribing material as a guide for the cartographer to manually scribe the detail according to map specifications. Map detail was displaced if necessary to avoid overprinting and to ensure a cartographically acceptable product. Masks were cut on 'peelcote' type material to provide infill for area features, such as lakes, built-up areas etc. A colour proof of the linework was used as a guide to type positioning on a clear film overlay. Type was added to the proof on completion of the overlay. The proof was thoroughly checked for accuracy, completeness and correct registration of detail. After proof corrections were carried out the final reproduction material used for platemaking by the printer was produced. Checking forms were used for quality control throughout the production process.

The GEODATA TOPO 250K Program

In response to significant user demand for high quality digital map data for GIS, GA commenced development and production of a GIS ready topographic data product. This product, GEODATA TOPO 250K, was designed to meet the needs of users in a broad range of professional activities by providing a nationally consistent dataset. GA commenced this program in 1990 and completed full national coverage by mid 1994. This original version of GEODATA TOPO 250K is now referred to as GEODATA TOPO 250K Series 1.

To ensure national coverage in a relatively short period of time, GEODATA TOPO 250K Series 1 included the base topographic features in three themes but did not include all topographic features contained on the paper map product. In total, 43 different feature types were captured. The three themes captured in GEODATA TOPO 250K Series 1 were:

1. **Infrastructure** (eg. road, rail, localities);
2. **Hydrography** (eg. streams & lakes); and
3. **Relief** (spot elevations only).

Production of GEODATA TOPO 250K Series 1

The key source for the production of GEODATA TOPO 250K Series 1 was the repromat from the paper map product. Photographic film positives of the various layers (drainage, roads, railways, etc.) of the original map production material were produced for scanning. These positives were then scanned on a Scitex R280 blue argon laser scanner/ plotter at a resolution of 20 pixels per millimetre. The resultant raster image was then checked for content and batch cleaned to remove background noise, such as, dust spots and film blemishes. The raster files were then converted to vector form by using either vectorising software on the Scitex system or by ProVec software. Additional editing of the road vector files was required in MicroStation to correct road intersections. This procedure required the vector file to be overlayed on the raster file.

All data files were transformed from system coordinates into AMG coordinates through an affine adjustment routine. A residual report was generated which contained the transformation parameters. The average of the residuals had to be less than 50 m with a maximum individual residual less than 50 m. If the residuals failed these criteria the control from the scanned file was adjusted and re-transformed. Verification plots were generated to check content and accuracy. All corrections were attended to before applying a blanket feature code to the vector file (eg. road, river, railway etc). The vector file, original scanned material, residual reports and verification plots were then dispatched to production teams for further editing and tagging with feature codes and attributes. The production teams then converted the data into GINA format. The GINA file was then built into a database on the GeoVision GIS system.

GeoVision GIS was the production system for the tagging, attributing and structuring of the data. As the database was built the data were separated into a number of layers which equated to the final product, ie. hydrography, infrastructure and framework. Initially, the data were checked for positional accuracy (bulk shifts or rotations) by comparing the position of the features close to the edge with a mathematically generated tile edge. Adjustments were made as necessary. The point density of the data was then filtered according to the parameters stated in the specification. Overshoots and undershoots were corrected and gaps in the data were checked by software. Once all the gaps/undershoots were resolved, the hydrography layer was processed to separate the linear streams network from the waterbody polygons.

When the separation was finished, the connector features were positioned. Linear topology for the streams network and polygon topology in the waterbody network were generated using the GeoVision software. The roads network was given a systematic, visual check on the screen to detect wrongly shaped intersections. Small polygons at intersections were located by custom written software. Bridges and tunnels were placed and a plot generated to check for completeness, accuracy of tagging and mutual correlation. The appropriate topology in the remaining layers was

generated and a final plot of the entire database was checked for completeness, accuracy of tagging and mutual correlation. The attributes of the features were generated by two methods:

- automatically, using in-house software which associates the attributes with the production feature codes. The automatic output was checked to guarantee no abnormalities; and

- manually, especially for attribute information such as names and road route numbers. The spelling of names was checked by software against an existing gazetteer.

Once the attributing was finalised, the production feature codes were replaced by the GEODATA TOPO 250K feature classes and the unique feature identifier was generated. The spot elevations in the relief theme were derived from 1:100 000 scale compilation material, printed maps or digital topographic data which had been captured prior to beginning production of GEODATA TOPO 250K data.

Map and Data Revision Program

Following the completion of the GEODATA TOPO 250K Series 1 program, it was apparent that the paper map products needed to be updated however there was also a demand for incorporating all map features into the data product. At this time GA commenced production of a joint map and data specification for topographic data at both 1:100 000 and 1:250 000 scales. At the same time it was recognised that efficiencies could be gained from producing the paper map and digital data product using parallel production methods. GA specified the production of a central database comprising the information to be included in both products as well as features which are specific to either the data (eg hypsometric areas) or the map (eg. grid and graticule). From this database, the map features and layout can be extracted to produce a postscript file for repromat production, and, the data features can be extracted to form the GEODATA TOPO 250K tile. This central database is referred to as the 'Working Database' and is held in ARC/INFO format. This database will be the key data source for future revisions of both map and data products at 1:250 000 scale.

Another key feature of this program was the introduction of non-standard sheet lines for some map and data areas. Strong customer feedback was received about the availability of maps where the majority of the map was covered with sea and only a very small area of land was shown. Customers were also clearly frustrated by the break up of major cities or features across two map areas. Because of this, GA reviewed all traditional sheet lines and where practical, these were altered to provide optimum representation of the landmass and key map features. As a result, many map sheets were extended beyond the bounds of the traditional map areas and some map areas were rotated to cover an area of 1.5° latitude and 1° longitude.

Production of GEODATA TOPO 250K Series 2

As an outcome of the Federal Government Budget in 1996, GA was instructed to market test the production of its topographic map and data products. As a result of the market testing, GA outsourced product delivery to the private sector, creating a facilities management contract and a panel of external suppliers. Under this outsourced arrangement, GA provides the Specification and revision material to the contractors and undertakes independent quality testing of the completed products. Additionally, GA sets the priorities for the program and manages the contractors on behalf of the Commonwealth.

Information sources which have been supplied to the Contractors for revision are:

- GEODATA TOPO 250K Series 1 data;
- GEODATA TOPO 250K data error reports;
- Horizontal control points data;
- Reproduction material from the previous edition map (contours, cultural features, hydrographic features);
- Satellite imagery (Landsat TM Bands 1,2,3,4,5,7 & SPOT PAN)
- Geographic source information; and

- Map surrounds information.

Satellite imagery has been used to generate the forest areas within the vegetation theme. New features have been identified and placed using satellite imagery, however this information is verified and attributed using other revision intelligence.

A further element of the production of maps and data has been the datum shift from the Australian Geodetic Datum 1966 (AGD66) to the Australian Geodetic Datum 1994 (GDA94). To date, all contractors for the production of maps and data under the current revision cycle have used ARC/INFO as their base production tool. ARC/INFO format is the specified delivery format for the working database and GEODATA TOPO 250K Series 2 tile.

6.1.2 TOPO 250K Maintenance

All tiles within the GEODATA TOPO 250K product are subject to a maintenance program. However the maintenance program focuses on certain major classes of feature. These are road and rail features, built-up areas and locality features. Initially, the maintenance program is focusing on those areas where change is rapid and the source material is most out-of-date.

6.1.3 Total Quality Management

Procedures throughout the entire production process are designed to ensure that data are produced right - first time, every time. The Total Quality Management system guarantees quality from the product planning stage, right through to product delivery to the client. To ensure that the product meets customers' needs, GA uses market research in the product development stage and incorporates customer feedback.

GA's commitment to truth-in-labelling for GEODATA products (complete information on data quality) helps customers to use the data appropriately. A detailed technical specification is developed for each GEODATA product. The technical specification is a controlled document. This means that GA and its contractors have correct and current copies of the specification. The technical specification is the basis for the validation and testing of data tiles and other documentation such as the Data User Guide. The latest version of the GEODATA TOPO 250K GEODATA technical specifications can be found at the GA web site:
http://www.ga.gov.au/nmd/mapping/specs.htm

6.1.4 Post-production Verification and Testing

After the production teams complete work on a map area the data are dispatched for post-production verification and testing. A separate cell has been set up totally independent of the production areas to carry out the verification and testing. The data are statistically sampled and tested to ensure compliance with the technical specification. A range of programs have been developed to test topological integrity, completeness, positional accuracy, filtering, and edge matching. Some tests are carried out on the full population, while others test a randomly selected subset and still others select and test a block of data equivalent to 1/6th of the sheet.

When carrying out tests which require sampling, statistically acceptable procedures are adopted. The sampling procedures adopted are based on the *Australian Standard AS1199-1988: Sampling procedures and tables for inspection by attribute*. For some tests such as polygon closure, a zero failure tolerance is set and the entire population is tested. For other tests sufficient samples are tested to ensure that an error rate of less than 1% to 5% is possible in the data. Where a significant historical record indicates a particular test passes every time for every sheet checked, that test is classified into a particular class "spot" and testing is carried out at random. This will continue until the

data begin to fail. Where the test is largely automated or seen to be critical it is carried out every time regardless of its past record. The testing methodology ensures a 99% confidence that the error rate is less than the Acceptable Quality Level (AQL).

If any data do not satisfy the conformance criteria they are sent back to the production area for reprocessing. Further information on the validation and testing methodology used by GA can be found in Appendix J of the GA Topographic Data and Map Specifications. This specification is available on the web at http://www.ga.gov.au/nmd/mapping/specs.htm

6.1.5 Positional Accuracy

The positional accuracy of spatial objects is an estimate of the degree to which the planimetric coordinates and elevations of a feature instance agree with their real world values. The measure of accuracy given for GEODATA TOPO 250K is the standard deviation. The planimetric accuracy attainable in the GEODATA Topographic Vector data will be composed of errors from three sources:

1. The positional accuracy of the source material
2. Errors due to the conversion process
3. Errors due to the manipulation process

Well-defined points
A well-defined point is one which can be accurately identified on the source material and in the digital data. Most commonly the well-defined points used in tests are nodes at intersections. GA has carried out both error budget analysis and field tests to verify the positional accuracy of the data. There is an expectation that the source data complies with the following statement:

`Not more than 10% of well-defined points are in error by more than 0.5 mm measured on the source material'.

Statistically, this relates to a standard deviation on the map (S_{map}) of 0.31 mm. The errors caused by the digitising process depend on the accuracy of the set-up, systematic errors in the equipment, errors caused by software, and errors specific to the operator. An accepted standard for digitising is that the accuracy should be within half a line width. The majority of features in the 1:250 000 NTMS have a line width of 0.2 mm or greater. The half line width is taken as 0.1 mm and this is interpreted as one standard deviation (S_{data}) for the distribution of errors. The processes used during data manipulation will introduce an error S_{man} not greater than 10% of S_{data}.

The total statistical error from the source material, digitising process and manipulation process (S_{total}) discussed above is given by taking the square root of the sum of the squares of the component standard deviations (S_{map}, S_{data} and S_{man}). This gives a total standard deviation of 0.34mm. This represents an error of 85 m on the ground for GEODATA TOPO 250K data. A more conservative estimate of 100 m for the standard deviation is used in any data quality information on this product.

Planimetric accuracy

GEODATA TOPO 250K data complies with the following statement of Planimetric accuracy:

`The summation of errors from all sources results in data with a standard deviation of 85 metres for well defined points'.

Alternative and equal ways of expressing this error are:

- Not more than 10% of well-defined points are in error by more than 140 m.
- In the worst case, a well-defined point is out of position by 300 m.

An estimate of the standard deviation of planimetric error of each feature instance is given in the Data Quality Table. The value for point and linear features is generally 100 metres. A value of 9999 is used when a feature's positional accuracy is not definable or not applicable. For example, the coordinates of a connector feature do not carry any meaning with respect to positional accuracy and so the value given is 9999.

Cartographic displacement

GEODATA TOPO 250K data were digitised from existing map production material and some features may be subject to cartographic displacement. Entities may be located on the earth's surface such that they cannot be separated at the scale of the map. To ensure cartographic clarity, one feature is held in the correct position and the rest are displaced.

The source material used for digitising does not indicate which feature has been displaced. At the time of map compilation a hierarchy was used to determine which features were held in the correct position. The following GEODATA TOPO 250K linear features may have been displaced where one or more are adjacent. The higher up the list that a feature is, the more likely it has been held in the correct position compared to features lower down the list.

- Hydrographic lines such as coastline, watercourses and lakes
- Railway
- Principal roads
- Secondary roads
- Minor roads
- Tracks
- Buildings
- Vegetation boundaries

For example, when a railway and road are coincident at the scale of the source material, the road is displaced. The relative positioning of the features is always retained, i.e. a road will not be moved to the other side of a railway.

The following table indicates features that may have been displaced and the range of displacement that may have occurred due to generalisation.

Table 14 - Displacement ranges due to feature generalisation

Feature	Situation where displacement may occur	Typical displacement
Aircraft Facility	When positioned adjacent to sharp angular line intersections or adjacent to roads or railways.	Up to 125 m
Built-up area line	When road or railway forms part of a built-up area boundary.	100 to 175 m
Island	If narrower than 75 m	Widened by 25
	If waterline of island less than 25m from waterline of another island or mainland.	Moved by 25 m to increase separation
Land subject to inundation	If adjacent to railway, road	Up to 125 m
	If width less than 50 m	Widen by 25 m
Mangrove	If width less than 50 m	Widen by 25 m
Railway	Moved if adjacent to reservoirs, watercourses, coastline and lakes.	Up to 125 m
Road	Moved if adjacent to reservoirs, watercourses, coastline and lakes.	Up to 125 m
Saline coastal flat	If adjacent to road, railway	Up to 125 m
State Border	If defined by a natural feature such as watercourse chain or waterline it is displaced so it is alongside that feature.	100 m
Waterline	Boundary of watercourse: usually held in correct position but may be moved when adjacent to coastline	Up to 125 m
	Boundary of sea : held in correct position.	

Where two or three features are close, and adjacent, one may have been displaced by up to 225 metres. In the worst case, where 5 of these features are close, and adjacent, one may have been displaced by up to 675 metres.

6.1.6 Vertical Accuracy

The accuracy of the points captured for the relief layer varies with the type of source material from which they were captured and the point determination for each particular point. The table below summarises these accuracies.

Table 15 - Vertical Accuracy for relief features

Feature	Printed Map	Compilation Material	Digital Topographic Data
Spot Elevation	+/- 5 metres	+/- 5 metres	+/- 5 metres
Spot Elevation inside depression contour	+/- 5 metres	+/- 5 metres	+/- 5 metres
Spot Elevation on sand ridge	+/- 5 metres	+/- 5 metres	+/- 5 metres
Bench Mark			+/- 1 metre
Horizontal Control Point			+/- 15 metres

The accuracy of contours is defined as half the contour interval, for example +/- 25 metres for a 50 metre contour interval.

6.1.7 Attribute Accuracy

Attribute accuracy is a measure of the degree to which the features and their attribute values are correct. For this product, attribute accuracy is a measure of the degree to which the attribute values of features agree with the information on the source material. The allowable error in attribute accuracy ranges between 0% and 5%.

Description of Testing Procedure Used

Where less than 1% of attribute errors are permissible the entire population is tested. Where a less stringent limit is set for allowable errors a random subset of the relevant features in the tile may be tested. The sample size is determined from statistical tables using the known population size of the relevant feature.

6.1.8 Logical Consistency

Logical consistency is a measure of the degree to which data complies with the technical specification. Validating logical consistency may involve tests to check that table and file names are set out as in the Data Dictionary. Also included are graphical tests which check such things as intersections, polygon closure, minimum sizes of polygons and topological relationships. The allowable error in logical consistency ranges from 0% to 5%.

Description of Testing Procedure Used

The logical consistency of the data is tested using a mixture of ARC/INFO commands and UNIX scripts. Where less than 1% logical consistency errors are allowed the entire population is tested. Where a less stringent limit is set for allowable errors, then a random subset of the relevant features in the tile may be tested. The sample size is determined from statistical tables using the known population size of the relevant feature.

6.1.9 Completeness

Completeness is a measure of the degree to which all features listed in the technical specification have been captured, in accordance with the selection criteria, definitions and other rules specified. All instances of a feature and its attribute values that appear on the source material are captured unless otherwise indicated in the selection criteria for that feature.

Description of Testing Procedure Used

The completeness of the data is tested by overlaying symbolised plots of the digital data on the source material and carrying out a visual comparison. The allowable error in completeness ranges from 1% to 5%. Where feature populations are small, the entire population is tested, while a statistical subset may be tested where the numbers are larger. The sample size is determined from statistical tables using the known population size of the relevant feature.

Further information on the validation and testing methodology used by GA can be found in section 3 of the GEODATA TOPO 250K GEODATA Specifications at the GA web site: http://www.ga.gov.au/nmd/mapping/specs.htm

6.2 Tile Quality Information (.tqi & .frq)

The Tile Quality Information provides information which is specific to the tile covered by the data file. For data in ArcInfo format, each layer of a tile will have associated with it one layer quality table and one layer frequency table :

- layer quality tables **`<layer name>.tqi`**
- layer frequency tables **`<layer name>.frq`**

For other TOPO 250K formats, one layer quality table and one layer frequency table is provided for each tile. These tables are an aggregation of the separate tables provided in ArcInfo format. The naming convention for these files is :

- layer quality tables **`<map id>.tqi`**
- layer frequency tables **`<map id>.frq`**

Layer Quality Table (.tqi)

Fields in the layer quality table are outlined in the table below :

Table 16 - Description of Layer Quality Table

Name	Example g5615vld.tqi	Description
TILE_NAME	Brisbane Special	The Tile Name.
TILE_CODE	SG 56-15	The Tile Code.
THEME	INFRASTRUCTURE	The Theme of which the layer is part.
TECH_SPEC	GTVPTS 3.5	The technical specification to which the data conforms.
QC_PASSED	13/06/2002	The date the data passed Geoscience Australia's quality control.
FMT_CONV_SW	ProVec 2.1	The software used to convert the data into vector format.
FMT_CONV_DT	01/01/1996	The date the data was converted into vector format.
DATUM	GDA94	The datum on which the data is based.

Tile frequency table (.frq)

The tile frequency table contains the frequency of occurrence of each feature in the layer. It has two fields :

FEAT_CODE – the feature class

FREQUENCY – the number of feature instances (frequency)

A sample tile frequency table is shown below :

Table 17 - Sample tile frequency table

FEAT_CODE	FREQUENCY
bridge_rd_l	58
bridge_rd_p	10
causeway_rd	1
ferry_route	24
foot_track	13
road	1754
road_on_dam	1

6.3 Feature Quality Information (.dqt)

The Data Quality Table is a look-up table which contains data quality information about each feature instance in the dataset. There will only be one Data Quality Table per tile, and the following naming convention has been adopted:

<map id>dqt.<file_ext>

Table 18 - Description of attributes within the Data Quality Table

Attribute	Item Name	Item Value Type	Description
Data Quality Pointer	q_info	character	An index value held in the data quality pointer attribute. This is the link field to the primary attribute table.
Feature Reliability	feat_rel	date	Date of photography, field verification or other event which verified the existence of the feature. Only month and year information are significant. The default will be the first day of the respective month. If the month is not known then the default is 1 January of that year. If unknown, a date of 01/01/1901 is recorded.
Attribute Reliability	att_rel	date	Date on which attribute information of the feature was last verified. If one attribute of the feature is amended it is assumed that all attributes have been verified. The default will be the first day of the respective month. If the month is not known then the default is 1 January of that year. If unknown, a date of 01/01/1901 is recorded.
Planimetric Accuracy	plan_acc	integer	The accuracy of the horizontal position in metres of a feature on the map sheet used as source material. If a planimetric accuracy for the feature is not applicable, relevant or cannot be reliably quoted then this field shall contain 9999.
Elevation Accuracy	elev_acc	integer	The accuracy of the elevation in metres of a feature on the map sheet used as source material. Not all features have an elevation value.
Source	source	character	The official name of the agency that performed the original capture of the spatial object.

There is one Data Quality Table per data file. The link between the table and each feature instance is the Data Quality Pointer and is shown in the figure below.

Attribute	Attribute value
Feature	watercourse
Name	Tallebudgera Creek
Perenniality	1
Hierarchy	1
Unique Feature Identifier	BA09902145
Data Quality Pointer	G56154

Data quality pointer	Feature reliability	Attribute reliability	Planimetric accuracy	Elevation accuracy
G56151	03/05/2002	03/05/2002	100	9999
G56152	03/05/2002	03/05/2002	9999	9999
G56153	03/05/2002	03/05/2002	100	25
G56154	01/01/1994	01/01/1994	100	9999
G56155	01/01/1994	01/01/1994	9999	9999

Figure 13: Attribute and data quality pointer relationship

Appendix A: Metadata

Note: This dataset description is metadata (data about data) which describes the actual dataset in accordance with the ANZLIC (Australia New Zealand Land Information Council) Core Metadata Guidelines Version 2.

Dataset citation

ANZLIC unique identifier: ANZCW0702000025

Title: GEODATA TOPO 250K Series 2 Topographic Data

Custodian

Custodian: Geoscience Australia

Jurisdiction: Australia

Description

Abstract:

Contains a medium scale vector representation of the topography of Australia. The data include the following themes: Hydrography - drainage networks including watercourses, lakes, wetlands, bores and offshore features; Infrastructure - constructed features to support road, rail and air transportation as well as built-up areas, localities and homesteads. Utilities, pipelines, fences and powerlines are also included; Relief - features depicting the terrain of the earth including 50 metre contours, spot heights, sand dunes, craters and cliffs; Vegetation - depicting forested areas, orchards, mangroves, pine plantations and rainforests; and Reserved Areas - areas reserved for special purposes including nature conservation reserves, aboriginal reserves, prohibited areas and water supply reserves.

For completed and forthcoming tiles see the Geoscience Australia Forward Program - http://www.ga.gov.au/nmd/products/fwdprogram/index.jsp

ANZLIC search words:

- BOUNDARIES Mapping
- LAND Geography Mapping
- VEGETATION Mapping
- ENERGY Mapping
- LAND Topography Mapping
- WATER Mapping
- FORESTS Mapping
- MARINE Coasts Mapping
- WATER Hydrology Mapping
- FORESTS Natural Mapping
- MARINE Reefs Mapping
- WATER Lakes Mapping
- FORESTS Plantation Mapping
- TRANSPORTATION Mapping

- WATER Rivers Mapping
- HERITAGE Natural Mapping
- TRANSPORTATION Air Mapping
- WATER Wetlands Mapping
- HUMAN ENVIRONMENT Mapping
- TRANSPORTATION Land Mapping
- LAND Mapping
- UTILITIES Mapping

Geographic extent name:

AUSTRALIA EXCLUDING EXTERNAL TERRITORIES - AUS - Australia - Australia

Note: The format for each Geographic extent name is: Name - Identifier - Category - Jurisdiction (as appropriate) See GEN Register

Geographic bounding box:

North bounding latitude: -9°
South bounding latitude: -44°
East bounding longitude: 154°
West bounding longitude: 112°

Data currency

Beginning date: Not Known

Ending date: Current

Dataset status

Progress: In progress

Maintenance and update frequency: Irregular

Access

Stored data format:

Digital: ArcInfo export
Digital: ArcView shapefile
Digital: MapInfo mid/mif
Non-digital : MAPS

Available format type:

Digital: ArcInfo export
Digital: ArcView shapefile
Digital: MapInfo mid/mif
Non-digital : MAPS

Access constraints:

The data are subject to Copyright. Data files may be downloaded from Geoscience Australia's website at www.ga.gov.au/download/. A licence agreement is required.

Data quality

Lineage:

GEODATA TOPO 250K Series 2 is primarily sourced from GEODATA TOPO 250K Series 1 and 1:250 000 scale map reproduction material (from the National Topographic Map Series and Defence Joint Operation Graphics). A key revision source for the data is satellite imagery taken from the SPOT Panchromatic and LANDSAT Thematic Mapper Sensors. Revision material has also been gathered from a variety of authoritative sources. More information about the sources for this data can be found in Geoscience Australia's Topographic Data and Map Specifications.

Positional accuracy:

Geoscience Australia has carried out both error budget analysis and field tests to verify the positional accuracy of the data. GEODATA TOPO 250K Series 2 data complies with the following statement of horizontal accuracy: "The summation of errors from all sources results in data with a standard deviation of 85 metres for well defined features". Alternative and equal ways of expressing this error are: Not more than 10% of well-defined points are in error by more than 140 metres; and In the worst case, a well defined point is out of position by 300 metres. As the GEODATA TOPO 250K Series 2 data were digitised from existing map production material, some features may be subject to cartographic displacement.

A full description of the features that may have been displaced and the range of displacement that may have occurred due to generalisation is provided in the GEODATA TOPO 250K Series 2 User Guide. An estimate of the standard deviation of planimetric error of each feature instance is given in the Data Quality Table. Vertical Accuracy: The accuracy of the spot elevations in the relief layer varies with the type of source material from which they were captured and the point determination for each particular point. Most spot heights have an accuracy of + or - 5 metres, however bench marks and horizontal control points have an accuracy of + or - 1 metre. The accuracy of contours is defined as 1/2 of the contour interval, for example + or - 25 metres for a 50 metre contour interval.

Attribute accuracy:

For the GEODATA TOPO 250K product, attribute accuracy is a measure of the degree to which the attribute values of features agree with the information on the source material. The allowable error in attribute accuracy ranges from 0.5% to 5%, at a 99% confidence level. Where less than 1% of attribute errors are permissible the entire population is tested. Where a less stringent limit is set for allowable errors a random subset of the relevant features in the tile is generally tested. The sample size is determined from statistical tables using the known population size of the relevant feature. Further information on the validation and testing methodology used by Geoscience Australia can be found in section 3 of the Topographic Data and Map Specifications.

Logical Consistency:

Validating logical consistency may involve tests to check that table and file names are set out as in the Data Dictionary. Also included are graphical tests which check such things as intersections, polygon closure, minimum sizes of polygons and topological relationships. The allowable error in logical consistency ranges from 0% to 5%. Further information on the validation and testing methodology used by Geoscience Australia can be found in section 3 of the Topographic Data and Map Specifications.

Completeness:

All instances of a feature and its attribute values that appear on the source material are captured unless otherwise indicated in the selection criteria for that feature.

Contact information

Contact organisation: Geoscience Australia

Contact position: Geoscience Australia Sales Centre

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Electronic mail address: sales@ga.gov.au

Metadata information

Metadata date: 2003-09-22

Additional metadata

Metadata reference XHTML: http://www.ga.gov.au/meta/ANZCW0703005458.html

Metadata reference XML: http://www.ga.gov.au/meta/ANZCW0703005458.xml

Attributes:

- aircraft facility type
- average height of sand ridge
- benchmark code
- building code
- contour code
- data quality pointer
- description of landmark feature
- elevation
- facility type
- locality type
- name
- national route number
- park code
- perenniality

- point determination for spot elevation
- product code
- railway gauge
- railway status
- reef code
- relationship to ground/sea level
- reserve authority code
- road - classification
- road - formation
- source of spot elevation
- state route number
- stream hierarchy
- tracks
- unique feature identifier
- waterpoint code

Size of dataset:

513 tiles, 5 themes per tile. An average of 10Mb per file (all themes) depending on format.

Scale/resolution:

1:250 000

Projection/datum:

Datum: GDA94
Projections: Geographical – latitude and longitude

Appendix B: Product maintenance form

You can help us keep our products up-to-date and error free by letting us know about those features which are missing or incorrectly shown in digital form (or on a map), or any other errors that you have identified. When we receive your information, it will be reviewed before being incorporated into the next version of the product. Amendments to maps and data could take some time to appear in new editions because revision cycles can span several years.

To add a suggestion or identify a problem, please complete the form over the page and return it via one of the methods shown below;

By Post

Print out sheet shown over the page, fill out the details and post to :

Maintenance Cell
Geoscience Australia
GPO Box 378
CANBERRA ACT 2601

By Fax

Print out sheet shown over the page, fill out the details and fax to :

Geoscience Australia - +61 2 6249 9960

By Email

Please send email to the following address (including details shown over the page) :

sales@ga.gov.au

Table 19 – GEODATA TOPO 250K Series 2 Product Maintenance Form

Name …… Contact Phone No. (…….)…… Date …… /……/……

Organisation …… Email …… @……..

Data Format	Tile Number	Theme Name	Layer Name	Feature Code	Location (UFI &/or Co-ordinates)	Description of Issue
Eg. ArcView Shapefile	H5509	Infrastructure	Rail Transport	railway_station	UFI : BB09900009 Location : 148.567 E -32.678 S	Railway Station no Longer Exists.

Thankyou for your interest and assistance !

Appendix C: Data Dictionary

Feature	Description	Object	Attribute	Attribute values	Selection criteria
AERIAL CABLEWAY	A conveyor system in which carrier units run on wire cables strung between supports.	Chain	Name		Only cableways with a length of 750 metres or more, have been captured.
AIRCRAFT FACILITY	A paved or cleared strip on which aircraft take off and land.	Entity Point	Name		Only operational facilities are shown. Facilities are classified according to the *Enroute Supplement Australia* published by Airservices Australia http://www.airservices.gov.au Heliports are only included when they are not within the boundaries of another aircraft facility.
			Facility Type	1 = *Airport*: facility licensed by Airservices Australia for the movement of aircraft and the receipt and discharge of cargo 2 = *Landing ground*: unlicensed facility with clearly marked runway but no airport facilities 3 = *Heliport*: a constructed and maintained landing area for helicopters	
BENCH MARK	A permanently marked point, the elevation of which above sea level has been determined by levelling.	Entity Point	Elevation		Only bench marks on the previous edition map are shown.
			Code		
BORE	A small diameter hole in the ground for the purpose of obtaining subterranean water by natural flow or mechanical pumping.	Entity Point			Bores are only shown in areas which are unshaded on the Fence and Water Facilities Guide at the end of this chapter.
BREAKWATER	A solid structure to break the force of the waves, sometimes detached from the coast, protecting a harbour or anchorage.	Chain			Only breakwaters which have a length of 250 metres or more, have been captured.
BUILDING	A permanent walled and roofed construction or the ruin of such a construction.	Entity Point	Building Code	1 = *Operational* 2 = *Ruin* 3 = *Abandoned Homestead*	Buildings in built-up areas are not shown. This feature may represent a single building or a group of buildings. Individual buildings are shown where the scale permits.

Feature	Description	Object	Attribute	Attribute values	Selection criteria
BUILT-UP AREA	An area where buildings are close together and have associated road and other infrastructure networks. Included terms are village, town and city.	Polygon	Name		In some instances, parts or suburbs of a town or city may be split from the main body of the built-up area by open land or a double-sided stream. In these cases, the separate built-up area polygons will carry some of the same attributes including the name, eg. 'Melbourne'. Area features such as parks and lakes, and areas of open space which are not parks, are excluded from built-up area features. Areas of open space which are not parks and have an area greater than 390 625 square metres are excluded from built-up areas.
BUILT-UP AREA LINE	The bounding line of a built-up area, built-up area void, park, or cemetery polygon.	Chain			
BUILT-UP AREA VOID	An empty or void area in a built-up area, park or cemetery polygon which is not occupied by a park or a cemetery feature.	Polygon			Only void areas of 62 500 square metres or more are shown as built-up area voids.
CANAL	An artificial watercourse conveying water for inland navigation or irrigation purposes.	Chain or Polygon	Name		Only canals with a length of 1.25 kilometres or more have been captured. Canals wider than 250 metres and with areas of 312 500 square metres or more, are shown as polygons.
CAVE	The mouth of a naturally formed, subterranean open area or chamber.	Entity Point			Only feature occurrences on the previous edition map have been captured. This feature may represent an individual cave or a group of caves.
CEMETRY	An area of land for burying the dead.	Polygon	Name		Only cemeteries with an area of 140 625 square metres or more are shown. Cemeteries with a smaller area may be represented as Locality features with the cemetery code.

Feature	Description	Object	Attribute	Attribute values	Selection criteria
CLIFF	A high, steep, significant or overhanging face of rock	Chain			Only cliffs with a length of 1.25 kilometres or more and a height of 25 metres or more, have been captured
CONNECTOR	An artificial line used to connect linear hydrographic features across an area feature to allow a network analysis of riverine systems.	Chain	Name		
			Perenniality	0 = *Not Applicable* 1 = *Perennial*: normally contains water, except in unusually dry periods. 2 = *Non-perennial*: occasionally contains water, particularly during the wet season.	
			Hierarchy	0 = *Not Applicable* 1 = *Major* 2 = *Minor*	
CONTOUR	A line which represents an imaginary line on the ground joining points of equal elevation in relation to the Australian Height Datum (AHD)	Chain	Elevation		Standard connectors are used when the contour's position is not known, for example in a watercourse polygon or through an open cut mine. Connectors on cliffs, cuttings and embankments are used where contours on the source material where broken for the relevant feature symbol. Contours have been interpolated to join discontinued contours or to replace a contour absent in the source material.
			Contour code	1 = *Standard* 2 = *Depression* 3 = *Connector on Cliff/Cutting/Embankment* 4 = *Connector Standard* 5 = *Interpolated Contour*	
CONVEYOR	A continuous belt or series of belts mounted on rollers, and used to move large quantities of goods, especially grain or ore.	Chain			Only conveyors with a length of 750 metres or more have been captured.
CRATER	A bowl-shaped natural depression with steep slopes at the rim, formed by volcanic activity or meteor impact.	Polygon			Only craters with an area of 62 500 square metres or more have been captured.

Feature	Description	Object	Attribute	Attribute values	Selection criteria
CUTTING	An open excavation of the Earth's surface to provide passage for a road, railway, canal or similar entity.	Chain			Only cuttings with a length of 500 metres or more and a depth of 25 metres or more have been captured. A pair of cuttings will indicate a feature sunk below the level of the surrounding terrain.
DAM	A barrier of earth and rock, concrete or masonry constructed to form a reservoir of water storage purposes or to raise the water level.	Chain	Name		Only dams with a length of 250 metres or more have been captured.
DISTORTED SURFACE	An area over which vehicular movement is difficult or impossible due to the fractured nature of the ground, or rock debris lying on the surface.	Polygon			This feature can include distinctive broken country characterised by fractures, joints, faults, gilgai or broken stone. Only areas which are 390 625 square metres or greater have been captured.
EMBANKMENT	An artificial bank of earth and/or stone built above the natural surface.	Chain			Only embankments with a length of 500 metres or more and a height of 25 metres or more have been captured. A pair of embankment features will indicate a feature built up from the surrounding terrain.
FENCE	A structure which encloses, bounds or divides a property or part thereof.	Chain			With the exception of vermin-proof and dog-proof fences, fences are only shown in the unshaded areas on the Fences and Water Facilities Guide, which is shown in Appendix D. Fences along roads will be shown only if they complete a fence pattern. In the prescribed areas, only fences with a length of 2.5 kilometres or more have been captured.
FERRY ROUTE	A route across a river, lake, reservoir or sea used by a vessel for the regular transport of vehicles and/or passengers from one terminal point to another.	Chain	Name		Only operational ferry routes are included.

Feature	Description	Object	Attribute	Attribute values	Selection criteria
FOOT TRACK	A track designed to carry pedestrian traffic only.	Chain	Name		Foot tracks will only be shown where they do not follow roads or vehicle tracks shown on the map. Generally, only tracks of national significance are included. Foot tracks with a length of less that 1.25 kilometres have not been captured.
FORD	A shallow or flat portion of the bed of a watercourse where a crossing may be effected.	Entity point/ Chain	Name		Note: the attributes relate to the road the ford is located on.
			Classification	1 = *Dual Carriageway* 2 = *Principle Road* 3 = *Secondary Road* 4 = *Minor Road* 5 = *Track*	
			Formation	1 = *Sealed* 2 = *Unsealed* 3 = *Unknown* 4 = *Under Construction*	
			National Route Number		
			State Route Number		
FORESHORE FLAT	The part of the seabed, or estuarine area, between mean high water and the line of low water.	Polygon			Only foreshore flats with an area of 390 625 square metres or greater, have been captured.

Feature	Description	Object	Attribute	Attribute values	Selection criteria
FOREST	An area of land with greater than 20% canopy cover of trees or scrub.	Polygon			Areas of forest less than 250 000 square metres have not been captured. Non-forested areas contained within a forest polygon are shown as Vegetation voids. For cleared areas of forest, only areas which are 250 000 square metres or more have been captured. Where the non-forested area coincides with another feature such as a lake or an aircraft facility, the vegetation void may be as small as 62 500 square metres. This classification excludes mangroves, orchards, pine plantations and rainforests.
GAS WELL	A pipe sunk in the ground for the purpose of obtaining subterranean oil of gas.	Entity point			Gas wells may be located onshore of offshore. Abandoned wells are only shown if of landmark significance
GATE	An opening in a fence or wall for the passage of vehicles , people or animals and which may contain a device to limit passage.	Chain			With the exception of gates in vermin-proof and dog-proof fences, gates are note shown over vehicle tracks and are only shown in the unshaded areas on the Fence and Water Facilities Guide, which is provided at the end of this chapter.
HORIZONTAL CONTROL POINT	A point on the ground, the geographical position of which has been determined by geodetic survey.	Entity point	Elevation Code		Only permanently marked and monumented horizontal control points (ie. those with a beacon, cairn or pole) and their elevation are shown.
HYPSOMETRIC AREA	The area enclosed between adjacent contours.	Polygon	Elevation		

ISLAND	An area of land fully surrounded by the sea.	Polygon	Name State 0 = *Not Applicable* 1 = *ACT*: Australian Capital Territory 2 = *JBT*: Jervis Bay Territory 3 = *NSW*: New South Wales 4 = *NT*: Northern Territory 5 = *QLD*: Queensland 6 = *SA*: South Australia 7 = *TAS*: Tasmania 8 = *VIC*: Victoria	Only offshore islands completely surrounded by the sea are included. Islands in inland water features are shown as voids within waterbody polygons.
JETTY	A structure projecting into a body of water for use as a promenade or as a platform alongside which vessels may be secured for loading and unloading passengers and cargo.	Chain		Only jetties with a length of 250 metres or more have been captured.
JUNCTION	An artificial line used to separate adjacent hydrographic areas which have differing attributes and across which flow can occur. For example, a junction feature will separate the confluence of two watercourses depicted as areas on the source material. A junction also separates a watercourse polygon from the sea.	Chain		Junction features are placed to: • Separate double line watercourses from other water bodies such as lakes and reservoirs; • Separate waterbody polygons of the same class but with difference attributes; • Close the mouth of rivers; and • Complete the coast in the Framework layer.

LAKE	A naturally occurring body of mainly static water surrounded by land.	Polygon	Name Perenniality 1 = *Perennial* 2 = *Non-perennial*	Only lakes with an area of 62 500 square metres or greater have been captured. Lakes which are smaller than this and located on a watercourse are shown in as Waterholes. Those not on a watercourse and smaller than the minimum size for lakes, are shown as Waterpoint features.
LAND SUBJECT TO INUNDATION	Low-lying land usually adjacent to lakes or watercourses, which is regularly covered with flood water for short periods.	Polygon	Name	Only land subject to inundation with an area of 390 625 square metres or greater has been captured.
LANDMARK	A constructed permanent feature having landmark significance or use for navigation. Such features have a height above the local terrain.	Entity point	Description	
LEVEE	A low earth wall erected to restrain flood waters or contain irrigation water.	Chain		Only levees with a length of 500 metres or more and a height of 2 metres or more have been captured.
LIGHTHOUSE	A building or structure housing a light used as a navigational aid to shipping.	Entity point	Name	

LOCALITY	A named place or area.	Entity point	Name		All beaches named on the source material are included except where an adjacent populated place has the same root-name, ie. Bondi Beach does not appear because of the adjacent populated place, Bondi. Homesteads are shown in the unshaded areas on the Fences and Water Facilities Guide, which is shown in Appendix D. A selection of homesteads may be shown in other areas. Abandoned homesteads are not shown. Outstations are considered as homesteads. All populated places with a population of 200 or more are shown. Whenever possible, the locality is positioned coincident with a node in the road network; otherwise it is positioned coincident with a point on a road network feature. For populated places with a population of over 20 000, the position of the locality is as near as possible to the location of the central post office. The name of some populated places may appear two or three times in the infrastructure theme, eg. if there is also a railway station or a built-up area of the same name. Only named islands and those which form part of the coastline (ie. those which are not completely surrounded by sea) are included as waterbody island features. Offshore islands are named as an attribute of the Island feature. Cemeteries are shown as localities where they do not meet the area criteria for Cemetery features. The place name code is used to show localities that do not fall into any other category. Suburb names on the latest edition of the map are included.
			Locality code	1 = *Bay, Inlet, Cove* 2 = *Beach* 3 = *Cape, Headland, Point* 4 = *Homestead* 5 = *Road Junction* 6 = *Mountain, Peak, Hill* 7 = *Pass* 8 = *Populated Place* 9 = *Waterbody Island* 10 = *Place Name* 11 = *Gorge* 12 = *Cemetery*	

LOCK	An enclosure in a waterbody with gates at both ends to raise or lower the water level to enable vessels to pass from one level to another	Entity point	Name		
MAINLAND	The area of continental Australia, including Tasmania.	Polygon	State/Territory	0 = *Not Applicable* 1 = *ACT*: Australian Capital Territory 2 = *JBT*: Jervis Bay Territory 3 = *NSW*: New South Wales 4 = *NT*: Northern Territory 5 = *QLD*: Queensland 6 = *SA*: South Australia 7 = *TAS*: Tasmania 8 = *VIC*: Victoria	
MANGROVE	A dense growth of mangrove trees, which grow to a uniform height on mud flats in estuarine or salt waters.	Polygon			Only mangroves with an area of 390 625 square metres or greater have been captured.
MANGROVE FLAT	A nearly level tract of land between the low and high water lines vegetated with mangroves.	Polygon			Only mangroves flats with an area of 390 625 square metres or greater have been captured. Mangrove flat polygons will exactly match mangrove polygons.
MARINE SWAMP	The low-lying part of the backshore areas of tidal waters, usually immediately behind saline coastal flats, which maintains a high salt water content, and is covered with characteristic thick grasses and reed growths.	Polygon			Only marine swamps with an area of 250 000 square metres or greater have been captured.
MINE	An excavation for the extraction of minerals.	Entity point	Name		This feature may represent a single mine or a small group of mines.
OFFSHORE LINE	The line bounding polygons in the Offshore layer.	Chain			This feature replaces the Foreshore Flat Line feature in GEODATA TOPO 250K Series 1.

OPEN-CUT/ MINING AREA	An excavation made by the removal of stone, gravel, clay or mineral from the ground for commercial or industrial purposes, and tailing dumps from mining operations.	Polygon		Only mining areas of 140 625 square metres or greater have been captured. Mining areas smaller than this are shown using the Mines feature.
ORCHARD	An area covered by an orderly planting of trees, vines or bushes which yield fruits, nuts or other edible products.	Polygon		Only orchards with an area of 390 625 square metres or greater have been captured.
PARK	An area of land maintained for recreational purposes.	Polygon	Name Park Code 1 = *Gardens* 2 = *Recreation Area* 3 = *Golf Course* 4 = *Racecourse* 5 = *Oval* 6 = *Multiple Use* 7 = *Civic Square* 8 = *Showground* 9 = *Rifle Range* 10 = *Other*	These features replace Built-up Area Voids in GEODATA TOPO 250K Series 1, where the areas formerly shown as voids meet the definition of a Park. Parks will usually be surrounded by built-up areas, however they may also be isolated polygons outside the built-up area. Parks should not be confused with the Reserve-Name Conservation feature. Only parks with an area of 140 625 square metres or greater have been captured.
PINE PLANTATION	An area covered with coniferous trees planted in an orderly pattern.	Polygon		Only plantations with an area of 390 625 square metres or greater, have been captured.
PINNACLE	A tall, slender, spire-shaped rock; projecting from a level or gently sloping surface, or the tape of a mountain.	Entity point		

PIPELINE	A pipe used for carrying gases and/or liquids.	Chain	Product Code	1 = *Water* 2 = *Gas* 3 = *Oil* 4 = *Gas and Oil* 5 = *Other* 6 = *Unknown*	Only pipelines with a length of 1.35 kilometres or more have been captured.
			Relationship	1 = *Elevated* 2 = *Above Ground* 3 = *Underground*	
POWERLINE	A wire or wires supported on poles, towers or pylons, used for the transmission of high voltage electricity.	Chain			Only powerlines with a rated capacity of 110kV or greater are shown. Powerlines with a length of less than 2.5 kilometres have not been captured.

PROHIBITED AREA	An area into which entry is prohibited without permission from the controlling authority.	Polygon	Name		Only prohibited areas of 3 125 000 square metres or greater have been captured. Defence reserves are classified as Prohibited Areas.
			Authority Code	0 = *Not Applicable* 1 = *State/Territory National Park Service* 2 = *Aboriginal and Torres Strait Islander Commission* 3 = *Aboriginal Lands Trust* 4 = *State Wildlife Authority* 5 = *Local Government Authority* 6 = *Australian Nature Conservation Agency* 7 = *Department of Defence* 9 = *State Forestry Commission* 10 = *State Lands Department* 11 = *Aboriginal Land Council* 12 = *ACT Parks and Conservation Service* 13 = *Other State and Federal Government Organisations* 14 = *Great Barrier Reef Marine Park Authority* 15 = *State Department of Primary Industries* 16 = *State Department of Water Resources/Public Works* 17 = *Qld. Dept. of Family and Community Services and Aboriginal & Islander Affairs*	

PROHIBITED AREA LINE	The boundary of a Prohibited Area or a Prohibited Area Void polygon.	Chain			
PROHIBITED AREA VOID	An unrestricted area contained within a Prohibited Area polygon.	Polygon			Only Prohibited Area Voids with an area of 390 625 square metres or more have been captured.
RAILWAY	A transportation system using one or more rails to carry freight or passengers.	Chain	Name		Only railways with a length of 1.25 kilometres or more have been captured. Permanent sections of light railways are included. Short lengths of light railways, in position only during the seasonal harvesting of crops, have not been captured.
			Tracks	1 = *One* 2 = *Multiple* 3 = *Unknown*	
			Status	1 = *Operational* 2 = *Abandoned* 3 = *Under Construction*	
			Gauge	0 = *Not Applicable* 1 = *Standard*: 1435 mm 2 = *Broad*: 1600 mm 3 = *Narrow*: 1067 mm 4 = *Other* 5 = *Unknown* 6 = *Standard*: broad 7 = *Standard*: narrow	

RAILWAY BRIDGE	A structure erected over a depression or obstacle to carry rail traffic.	Entity Point/ Chain	Name		Only significant railway bridges are shown. Railway bridges shorter than 100 metres are shown as points. Railway bridges greater than this are held as chains in the Rail network. Bridges which carry both road and rail traffic are held as coincident Road Bridge and Rail Bridge features in their respective networks. Attributes relate to the railway carried by the bridge.
			Tracks	1 = *One* 2 = *Multiple* 3 = *Unknown*	
			Status	1 = *Operational* 2 = *Abandoned* 3 = *Under Construction*	
			Gauge	0 = *Not Applicable* 1 = *Standard*: 1435 mm 2 = *Broad*: 1600 mm 3 = *Narrow*: 1067 mm 4 = *Other* 5 = *Unknown* 6 = *Standard*: broad 7 = *Standard*: narrow	

RAILWAY CAUSEWAY	An embankment of earth or masonry erected across open water or areas subject to inundation and carrying a railway.	Chain	Name			Only railway causeways with a length of 500 metres or more have been captured. Causeways which carry both road and rail traffic are held as coincident Road Causeway and Rail Causeway features in their respective networks. Attributes relate to the railway carried by the causeway.
			Tracks	1 = *One* 2 = *Multiple* 3 = *Unknown*		
			Status	1 = *Operational* 2 = *Abandoned* 3 = *Under Construction*		
			Gauge	0 = *Not Applicable* 1 = *Standard*: 1435 mm 2 = *Broad*: 1600 mm 3 = *Narrow*: 1067 mm 4 = *Other* 5 = *Unknown* 6 = *Standard*: broad 7 = *Standard*: narrow		
RAILWAY STATION	A recognised stopping place for trains where passengers may board or alight, or where freight is loaded and unloaded. There may or may not be a platform.	Entity Point	Name			All railway stations on operational lined have been captured. Former railway stations on abandoned lines are not shown. Names of former railway stations are depicted as localities if the same name is not in use for another locality feature.

RAILWAY TUNNEL	An artificial underground or underwater passage carrying a railway.	Entity Point/ Chain	Name		Railway tunnels are shown as points when they are shorter than 250 metres. Tunnels which carry both road and railway traffic are held as coincident Road Tunnel and Rail Tunnel features in their respective networks. Attributes relate to the railway which passes through the tunnel.
			Tracks	1 = *One* 2 = *Multiple* 3 = *Unknown*	
			Status	1 = *Operational* 2 = *Abandoned* 3 = *Under Construction*	
			Gauge	0 = *Not Applicable* 1 = *Standard*: 1435 mm 2 = *Broad*: 1600 mm 3 = *Narrow*: 1067 mm 4 = *Other* 5 = *Unknown* 6 = *Standard*: broad 7 = *Standard*: narrow	
RAINFOREST	A dense mixed forest characterised by a thick canopy of branches and leaves, with a height of 25 metres or more above ground level and in a virgin state providing more than 85% ground cover. One or more understoreys of trees and dense undergrowth is usually present.	Polygon			Only rainforests with an area of 390 625 square metres or greater have been captured.
RAPID	An area of broken, fast-moving water in a watercourse, where the slope of the bed increases (but without a prominent break of slope which might result in a waterfall), or where the water passes an outcrop of harder rock.	Chain or Polygon	Name		Only rapids with a length of 250 metres or more have been captured. Rapids are only shown in perennial streams.
			Perenniality	0 = *Not Applicable* 1 = *Perennial* 2 = *Non-perennial*	
			Hierarchy	0 = *Not Applicable* 1 = *Major* 2 = *Minor*	
RAPID AREA LINE	The boundary of a rapid area polygon.	Chain			

REEF	An area of rock or coral that is exposed between mean high water and lowest tides, or just below approximate lowest tide, which is visually prominent or a hazard to shipping.	Polygon	Name		Only reefs with an area of 390 625 square metres or greater have been captured.
			Relationship	4 = *Bare* 5 = *Tidal* 6 = *Submerged*	
			Reef	1 = *Reef, Cay* 2 = *Shoal, Bank, Patch*	
RELIEF AREA LINE	The line bounding a Crater, Distorted Surface, Open-cut/Mining Area, Relief Area Void, Rocky Outcrop, Sand or Sand Dune polygon.	Chain			
RELIEF AREA VOID	An empty or void area in a Crater, Distorted Surface, Open-cut/Mining Area, Relief Area Void, Rocky Outcrop, Sand or Sand Dune polygon.	Polygon			Only voids of 62 500 square metres or greater have been captured.

RESERVE - ABORIGINAL AREA	Crown land reserved for use by Aboriginal and Torres Strait Islander people.	Polygon	Name		Only Aboriginal land with an area of 3 125 000 square metres or greater has been captured.
			Authority Code	0 = *Not Applicable* 1 = *State/Territory National Park Service* 2 = *Aboriginal and Torres Strait Islander Commission* 3 = *Aboriginal Lands Trust* 4 = *State Wildlife Authority* 5 = *Local Government Authority* 6 = *Australian Nature Conservation Agency* 7 = *Department of Defence* 9 = *State Forestry Commission* 10 = *State Lands Department* 11 = *Aboriginal Land Council* 12 = *ACT Parks and Conservation Service* 13 = *Other State and Federal Government Organisations* 14 = *Great Barrier Reef Marine Park Authority* 15 = *State Department of Primary Industries* 16 = *State Department of Water Resources/Public Works* 17 = *Qld. Dept. of Family and Community Services and Aboriginal & Islander Affairs*	

RESERVE - FORESTRY	Public land reserved for forestry purposes.	Polygon	Name		Only forestry reserves with an area of 3 125 000 square metres or greater have been captured.
			Authority Code	0 = *Not Applicable* 1 = *State/Territory National Park Service* 2 = *Aboriginal and Torres Strait Islander Commission* 3 = *Aboriginal Lands Trust* 4 = *State Wildlife Authority* 5 = *Local Government Authority* 6 = *Australian Nature Conservation Agency* 7 = *Department of Defence* 9 = *State Forestry Commission* 10 = *State Lands Department* 11 = *Aboriginal Land Council* 12 = *ACT Parks and Conservation Service* 13 = *Other State and Federal Government Organisations* 14 = *Great Barrier Reef Marine Park Authority* 15 = *State Department of Primary Industries* 16 = *State Department of Water Resources/Public Works* 17 = *Qld. Dept. of Family and Community Services and Aboriginal & Islander Affairs*	

RESERVE - NATURE CONSERVATION	Public land reserved for the conservation of native flora and fauna and the natural environment.	Polygon	Name		Only nature conservation areas with an area of 3 125 000 square metres or greater have been captured.
			Authority Code	0 = *Not Applicable* 1 = *State/Territory National Park Service* 2 = *Aboriginal and Torres Strait Islander Commission* 3 = *Aboriginal Lands Trust* 4 = *State Wildlife Authority* 5 = *Local Government Authority* 6 = *Australian Nature Conservation Agency* 7 = *Department of Defence* 9 = *State Forestry Commission* 10 = *State Lands Department* 11 = *Aboriginal Land Council* 12 = *ACT Parks and Conservation Service* 13 = *Other State and Federal Government Organisations* 14 = *Great Barrier Reef Marine Park Authority* 15 = *State Department of Primary Industries* 16 = *State Department of Water Resources/Public Works* 17 = *Qld. Dept. of Family and Community Services and Aboriginal & Islander Affairs*	

RESERVE - WATER SUPPLY	Public land reserved to protect water supply catchments.	Polygon	Name		Only water supply reserves with an area of 3 125 000 square metres or greater have been captured.
			Authority Code	0 = *Not Applicable* 1 = *State/Territory National Park Service* 2 = *Aboriginal and Torres Strait Islander Commission* 3 = *Aboriginal Lands Trust* 4 = *State Wildlife Authority* 5 = *Local Government Authority* 6 = *Australian Nature Conservation Agency* 7 = *Department of Defence* 9 = *State Forestry Commission* 10 = *State Lands Department* 11 = *Aboriginal Land Council* 12 = *ACT Parks and Conservation Service* 13 = *Other State and Federal Government Organisations* 14 = *Great Barrier Reef Marine Park Authority* 15 = *State Department of Primary Industries* 16 = *State Department of Water Resources/Public Works* 17 = *Qld. Dept. of Family and Community Services and Aboriginal & Islander Affairs*	

RESERVE LINE	The boundary of a Reserved Area polygon.	Chain			
RESERVE VOID	An unprotected area of land contained within a reserved area.	Polygon			Only void areas of 250 000 square metres or greater have been captured.
RESERVIOR	A body of water collected and stored behind a constructed barrier for a specific use.	Polygon	Name		Only reservoirs with an area of 140 625 square metres or greater have been captured. Reservoirs smaller than 140 625 square metres in area are shown as Water Tank features.
ROAD	A route for the movement of vehicles, people or animals.	Chain	Name		Only roads with a length of 1.25 kilometres or more have been captured. Minor roads may not be shown in built-up areas.
			Classification	1 = *Dual Carriageway*: freeway, tollway or other major road with lanes in opposite directions separated by a physical barrier. 2 = *Principle Road*: highway, regional or through road. 3 = *Secondary Road*: connector or distributor road. 4 = *Minor Road*: access, residential or local road. 5 = *Track*: public or private roadway of minimum or no construction, not necessarily maintained.	
			Formation	1 = *Sealed* 2 = *Unsealed* 3 = *Unknown* 4 = *Under Construction*	
			National Route Number		
			State Route Number		

ROAD BRIDGE	A structure erected over a depression or obstacle to carry road traffic.	Entity Point/ Chain	Name		Road bridges with a length of 100 metres or more are held as chains in the road network. Road bridges shorter than this are shown as points. Bridges which carry both road and rail traffic are held as coincident features in their respective networks.
			Classification	1 = *Dual Carriageway*: freeway, tollway or other major road with lanes in opposite directions separated by a physical barrier. 2 = *Principle Road*: highway, regional or through road. 3 = *Secondary Road*: connector or distributor road. 4 = *Minor Road*: access, residential or local road. 5 = *Track*: public or private roadway of minimum or no construction, not necessarily maintained.	
			Formation	1 = *Sealed* 2 = *Unsealed* 3 = *Unknown* 4 = *Under Construction*	
			National Route Number		
			State Route Number		

ROAD CAUSEWAY	An embankment of earth or masonry erected across open water or areas subject to inundation, and carrying a road.	Chain	Name		Only road causeways with a length of 500 metres or more have been captured. Causeways which carry both road and rail traffic are held as coincident Road Causeway and Rail Causeway features in their respective layers. Attributes relate to the road which is carried by the causeway.
			Classification	1 = *Dual Carriageway*: freeway, tollway or other major road with lanes in opposite directions separated by a physical barrier. 2 = *Principle Road*: highway, regional or through road. 3 = *Secondary Road*: connector or distributor road. 4 = *Minor Road*: access, residential or local road. 5 = *Track*: public or private roadway of minimum or no construction, not necessarily maintained.	
			Formation	1 = *Sealed* 2 = *Unsealed* 3 = *Unknown* 4 = *Under Construction*	
			National Route Number		
			State Route Number		

ROAD ON DAM	The section of road carried by a dam.	Chain	Name		Only roads on dams with a length of 250 metres or more have been captured. Attributes relate to the road which is carried by the dam.
			Classification	1 = *Dual Carriageway*: freeway, tollway or other major road with lanes in opposite directions separated by a physical barrier. 2 = *Principle Road*: highway, regional or through road. 3 = *Secondary Road*: connector or distributor road. 4 = *Minor Road*: access, residential or local road. 5 = *Track*: public or private roadway of minimum or no construction, not necessarily maintained.	
			Formation	1 = *Sealed* 2 = *Unsealed* 3 = *Unknown* 4 = *Under Construction*	
			National Route Number		
			State Route Number		

ROAD TUNNEL	An artificial underground or underwater passage carrying a load.	Entity Point/ Chain	Name		Road tunnels are shown as points when they are shorter than 250 metres. Tunnels which carry both road and trail traffic are held as coincident Road Tunnel and Rail Tunnel features in their respective networks. Attributes relate to the road which passes through the tunnel.
			Classification	1 = *Dual Carriageway*: freeway, tollway or other major road with lanes in opposite directions separated by a physical barrier. 2 = *Principle Road*: highway, regional or through road. 3 = *Secondary Road*: connector or distributor road. 4 = *Minor Road*: access, residential or local road. 5 = *Track*: public or private roadway of minimum or no construction, not necessarily maintained.	
			Formation	1 = *Sealed* 2 = *Unsealed* 3 = *Unknown* 4 = *Under Construction*	
			National Route Number		
			State Route Number		
ROCKY OUTCROP	An area of land where large rocks or boulders protrude from, or rest on the Earth's surface.	Polygon			Only rocky outcrops with an area of 390 625 square metres or greater have been captured.
SALINE COASTAL FLAT	The nearly level tract of land between mean high water and the line of the highest astronomical tide.	Polygon			Only saline coastal flats with an area of 390 625 square metres or greater have been captured.
SALT EVAPORATOR	A flat area, usually segmented, used for the commercial production of salt by evaporation.	Polygon			Only salt evaporators with an area of 390 625 square metres or greater have been captured.
SAND	An area predominantly covered with sand and devoid of vegetation.	Polygon			Only areas of sand of 390 625 square metres or greater have been captured.
SAND DUNES	Mounds of loose sand, usually crescent-shaped and transverse to the prevailing winds.	Polygon			Only sand dunes with an area of 390 625 square metres or greater have been captured.

SAND RIDGE	Sand drifts in lone ridges tending parallel to and elongating in the direction of the prevailing winds.	Chain	Average height		Only sand ridges with a length of 1mm or greater at scale have been captured.
SEA	The waters surrounding the Australian continent and its offshore islands.	Polygon	Name		Where two seas/oceans appear on the one tile, the boundary between them will be shown by a junction feature.
SEA WALL	A solid structure usually constructed of concrete, masonry or soil, built to prevent erosion or encroachment by the sea.	Chain			Only sea walls with a length of 250 metres or more have been captured.
SEISMIC LINE/ CLEARED LINE	A graded path in a straight line for the purpose of sub-surface geological exploration.	Chain			
SETTLING PONDS	Shallow beds, usually segmented by constructed walls, for the treatment of sewerage or other wastes, or for aquaculture.	Polygon			Only settling ponds with an area of 390,625 square metres or greater have been captured.
SPILLWAY	A channel or duct formed around the side of a reservoir past the end of the dam, to convey flood discharge from the watercourse above the reservoir into the watercourse below the dam.	Chain	Name		The spillway feature represents the spillway chute and any associated stilling basins. Where the water overtops the dam wall, a spillway is not shown. Only spillways with a length of 250 metres or more have been captured.
			Perenniality	0 = *Not Applicable* 1 = *Perennial* 2 = *Non-perennial*	
			Hierarchy	0 = *Not Applicable* 1 = *Major* 2 = *Minor*	
SPOT ELEVATION	A point on the earth's surface of known elevation, above or below the Australian Height Datum (AHD99).	Entity Point	Elevation		Elevations have been selected to best show terrain chape, change of slope and all high and low points.
			Source	1 = *Printed map* 2 = *Compilation material* 3 = *Digital topographic data*	
			Point Determination	1 = *Spot height* 2 = *Spot height inside depression contour* 3 = *Spot height on sand ridge*	
SPRING	A place where water issues naturally from the ground.	Entity Point			Springs are only shown in the unshaded areas on the Fences and Water Facilities Guide which is shown in Appendix D.

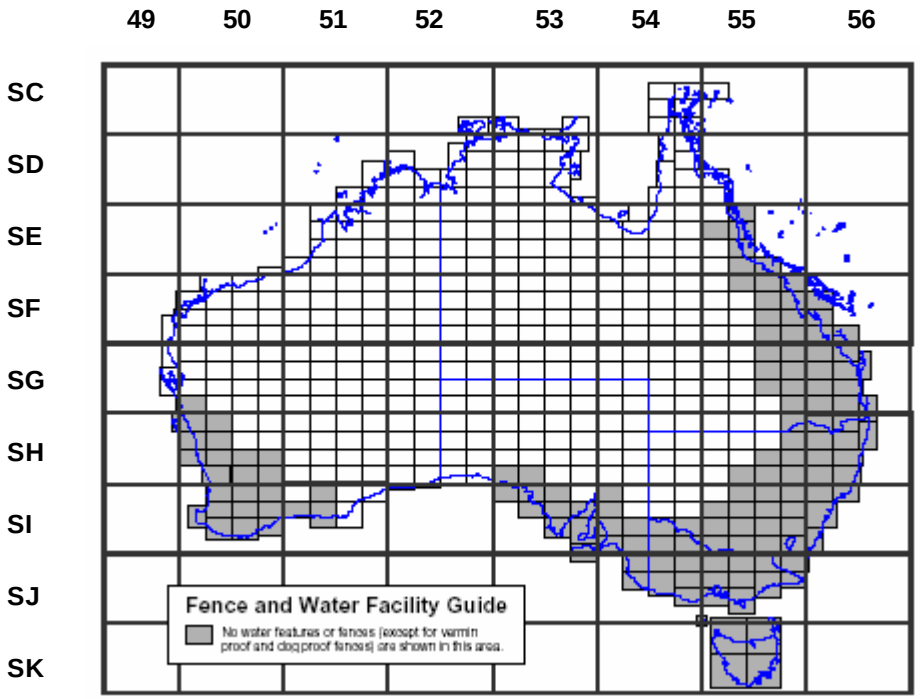
STATE BORDER	The boundary defining the division of the Commonwealth of Australia into State/Territory administrations.	Chain		The State borders are as depicted on the source material. They are not suitable for any legal interpretation of State/Territory borders.
STOCK GRID	A grid at the opening in a fence to prevent livestock crossing, but which allow for the free passage of vehicles.	Entity Point		Stock grids are only shown in the unshaded areas on the Fences and Water Facilities Guide, which is shown in Appendix D.
STORAGE TANK	A large vessel for the storage of liquids (not water) or gases, usually associated with refineries or chemical plants.	Entity Point		Storage tanks are only shown when they are sufficiently prominent to have landmark significance. This feature may represent a single tank or a group of tanks.
SWAMP	Land which is so saturated with water that it is not suitable for agricultural or pastoral use, and presents a barrier to free passage.	Polygon	Name	Only swamps with an area of 1 562 500 square metres or greater have been captured.
TILE EDGE	The line defining the limits of the data in the data transfer.	Chain		
VEGETATION LINE	A line depicting the boundary of a vegetation polygon.	Chain		
VEGETATION VOID	An area of land within a vegetated area which has less than 20% canopy cover o trees or scrub.	Polygon		Vegetation voids are used to depict cleared areas within Forest, Mangrove, Orchard, Pine Plantation and Rainforest polygons. When used for this purpose, only void areas of 250 000 square metres or greater have been captured. Vegetation voids are also used for voids in vegetation created by features such as lakes, built-up areas and aircraft facilities. When used for this purpose, only void areas of 62 500 square metres or greater have been captured.
WATER BODY VOID	A void area in a water body feature created by an inland island.	Polygon		Only islands with an area of 62 500 square metres or greater are shown as water body voids.

WATER TANK	A feature constructed on or below the ground for the storage of water.	Entity point			Water tanks are only shown in the unshaded areas on the Fences and Water Facilities Guide, which is shown in Appendix D. Water tanks with an area of 140 625 square metres or greater are shown as Reservoirs. This feature may represent a single tank or a group of tanks.
WATERCOURSE	A natural channel along which water may flow from time to time.	Chain or Polygon	Name		Only watercourses with a length of 2.5 kilometres or greater have been captured. Only watercourses wider than 250 metres and with an area of 625 000 square metres or greater are shown as polygon features.
			Perenniality	1 = *Perennial* 2 = *Non-perennial*	
			Hierarchy	0 = *Not Applicable* 1 = *Major* 2 = *Minor*	
WATERFALL	A sudden steep decent or vertical drop of water, created by a step or ledge in the bed of a watercourse.	Entity Point			
WATERHOLE	A natural depression which holds water within a non-perennial watercourse.	Entity Point	Name		Waterholes with an area of 62 500 square metres or greater are shown as lakes.
			Perenniality	1 = *Perennial*	
WATERLINE	A line depicting the boundary of a hydrographic feature.	Chain			When bounding sea and estuarine areas, the waterline is indicative of the position of mean high water. The exception is mangroves, where the line is indicative of the position of the seaward side of the mangroves. The shoreline of reservoirs and lakes as depicted by this feature is the high water line.
WATERPOINT	A natural depression which holds water and is isolated from, and not within a watercourse.	Entity Point	Waterpoint Code	1 = *Native Wall* 2 = *Gnamma Hole* 3 = *Soak* 4 = *Rock Hole* 5 = *Pool*	Waterpoints are only shown in the unshaded areas on the Fences and Water Facilities Guide, which is shown in Appendix D. Waterpoints with an area of 62 500 square metres or more are shown as lakes.

WHARF	A structure built from the land parallel to shore to provide for the berthing of vessels.	Chain		Only wharves with a length of 250 metres or more have been captured.
WINDBREAK	A narrow strip of natural or planted trees, or scrub, positioned so as to break the force of the prevailing wind.	Chain		Only windbreaks with a length of 1.25 kilometres or more have been captured. No distinction is made between different types of trees.
WINDPUMP	A tower fitted with a wind-driven pump.	Entity Point		Windpump are only shown in the unshaded areas of the Fences and Water Facilities Guide, which is shown in Appendix D. Windpumps are shown when they are sufficiently prominent to serve as landmarks. This feature may represent a single windpump or a group of windpumps.
WRECK	A disabled vessel, either submerged or visible, which is attached to, or foul of, the sea bed, or is cast up on the shore.	Entity Point	Name Relationship 4 = *Bare* 5 = *Tidal* 6 = *Submerged*	All wrecks visible above water, and all submerged wrecks which constitute a danger to shipping, are shown.
YARD	A small area of land enclosed by a fence and generally used for confining stock.	Entity Point		Yards are only shown in the unshaded areas of the Fences and Water Facilities Guide, which is shown in Appendix D. Yards with an area of 390 625 square metres or more are shown as Fences.

Appendix D: Fence and Water Facilities Guide

In predominantly wet and/or heavily developed regions, fences and water facilities such as mills, tanks and bores proliferate. Therefore, they lose their significance as landmark features and have not been shown. However all vermin-proof and dog-proof fences are shown, even in the areas marked as 'no fences'.

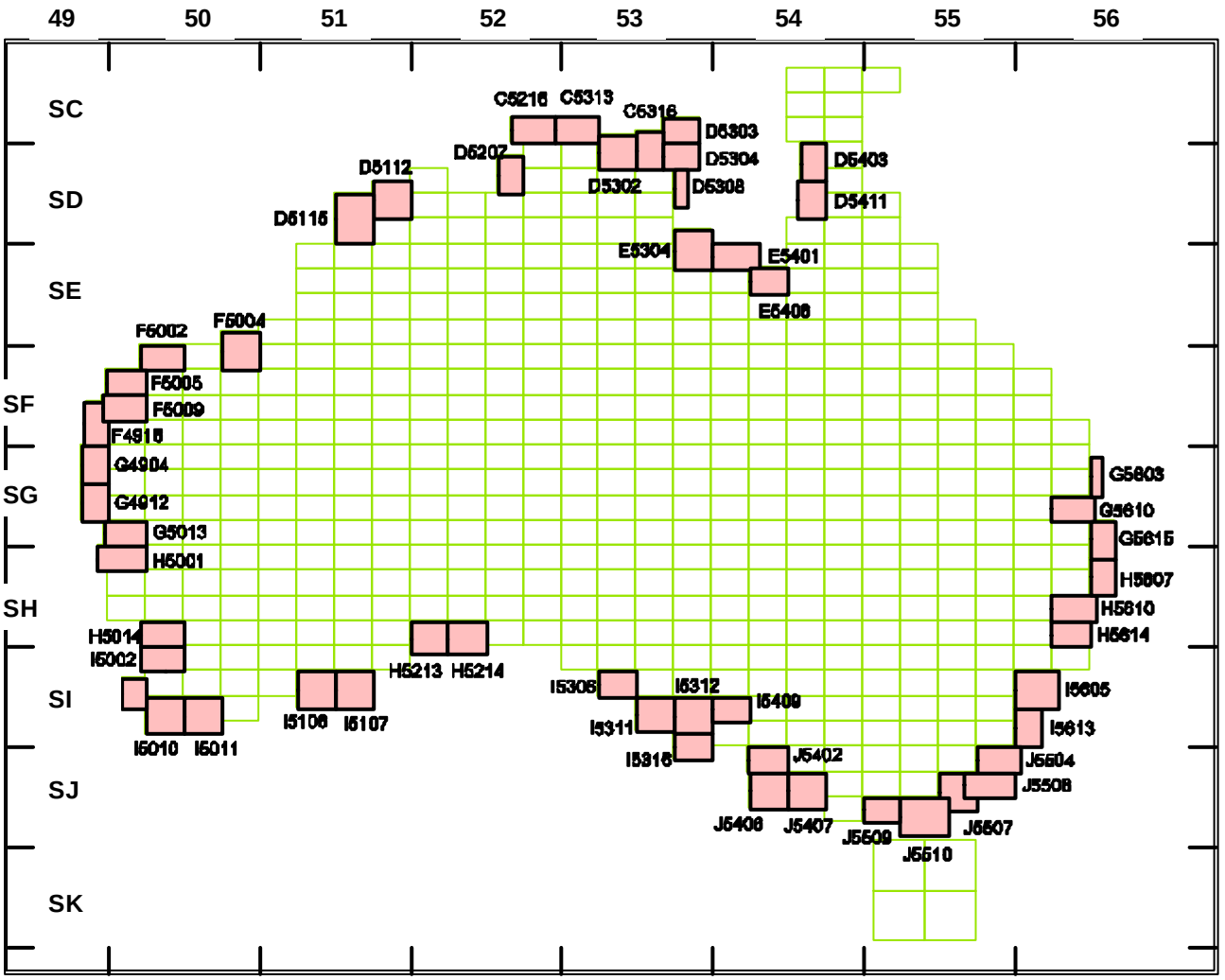


Appendix E: TOPO 250K Specials – GEODATA Extents

Each 1:1 million map is divided up into 16 rectangles 1 ° of latitude by 1.5 ° of longitude. These rectangles define the standard 1:250 000 map areas. These areas are numbered left to right and top to bottom. Combining the 1:1million number and the number of the rectangle produces the 1:250 000 map number. For example, the map number for 1:250 000 Melbourne map is SJ5505.

In Australia, a number of 1:250 000 maps vary from strict adherence to this system to reduce the production of maps which only cover small areas of land or to contain certain features on a single map. Maps which significantly vary from the system are identified as "Special" in the name, for example Fraser Island Special. Where only minor adjustments to extents are made, the term “Special” may not be added to the map name. The map number is the map number of the standard area contributing the greatest land mass to the "special" map. In the case of Tasmania a four sheet system replaces the standard grid and the sheets are identified, North-west, North-east, South-west and South-east.

These adjusted tiles (including Specials) are highlighted in the figure below (along with their map code), and their bounding coordinates can be found in the following table.



		SW Corner				NE Corner			
ID	Name	°	‘	°	‘	°	‘	°	‘
SJ5509	Port Phillip Bay Special	144		39		145	30	38	
SJ5407	Hamilton Special	141		38	30	142	30	37	
SJ5406	Penola Special	139	30	38	30	141		37	
SJ5402	Naracoorte	139	25	37		141		36	
SI5409	Adelaide Special	138		35		139	30	34	
SI5312	Yorke Peninsula Special	136	30	35	30	138		34	
SI5316	Kangaroo Island Special	136	30	36	30	138		35	30
SI5311	Lincoln Special	135		35	25	136	30	34	
SI5306	Elliston	133	30	34	01	135		33	
SH5214	Eucla Special	127	30	32	20	129		31	
SH5213	Madura Special	126		32	20	127	30	31	
SI5107	Malcolm Special	123		34	30	124	30	33	
SI5106	Esperance Special	121	30	34	30	123		33	
SI5011	Mount Barker Special	117		35	30	118	30	34	
SI5010	Pemberton Special	115	30	35	30	117		34	
SI5005	Busselton Special	114	30	34	30	115	30	33	15
SI5002	Pinjarra	115	18	33		117		32	
SH5014	Perth Special	115	18	32		117		31	
SH5001	Geraldton Special	113	24	29		115	30	28	
SG5013	Ajana	113	48	28		115	30	27	
SG4912	Monkey Mia Special	112	55	27		114		25	30
SG4904	Carnarvon Special	112	55	25	30	114		24	
SF4916	Minilya Special	113	10	24		114		22	17
SF5009	Yanrey Special	113	45	23		115	30	22	
SF5005	Onslow	113	54	22		115	30	21	
SF5002	Dampier Special	115	15	21		117		20	
SF5004	Port Hedland Special	118	30	21		120		19	30
SD5115	Camden Sound Special	123		16		124	30	14	
SD5112	Montague Sound Special	124	30	15		126		13	30
SD5207	Cape Scott Special	129	30	14		130	30	12	30
SC5216	Melville Island Special	130		12		131	45	10	57
SC5313	Cobourg Peninsula Special	131	45	12		133	30	10	57
SD5302	Milingimbi Special	133	30	13		135		11	40
SD5303	Galiwinku Special	135		13		136		11	30
SC5316	Wessel Islands Special	136		12		137	30	11	
SD5304	Gove Peninsula Special	136		13		137	30	12	
SD5308	Groote Eylandt Special	136	30	14	30	137		13	
SE5304	Robinson River Special	136	30	17		138		15	27
SE5401	Mornington Island Special	138		17		139	55	16	
SE5406	Burketown	139	30	18		141		16	57
SD5411	Holroyd Special	141	25	15		142	30	13	30
SD5403	Weipa Special	141	30	13	30	142	30	12	
SG5603	Fraser Island Special	153		26		153	30	24	30
SG5610	Gympie	151	30	27		153	12	26	
SG5615	Brisbane Special	153		28	30	154		27	
SH5607	Lismore Special	153		30		154		28	30
SH5610	Armidale Special	151	30	31		153	17	30	
SH5614	Hastings	151	30	32		153	05	31	
SI5605	Sydney Special	150		34	30	151	45	33	
SI5613	Wollongong Special	150		36		151	03	34	30
SJ5504	Bega	148	30	37		150	15	36	
SJ5508	Mallacoota	148	30	38		150	05	37	
SJ5507	Bairnsdale Special	147		38	33	148	30	37	
SJ5510	Warragul Special	145	30	39	32	147	25	38	

Glossary

ACRES
Australian Centre for Remote Sensing - the brand of satellite imagery produced by Geoscience Australia.

Attribute
The descriptive characteristic of a feature. An attribute has a defined set of attribute values.

Attribute object
The attribute object holds the non-locational or semantic information about the feature instance.

Australian Geodetic Datum 1966 (AGD66)
This datum was adopted in 1966 and is defined by the parameters of the Australian National Spheroid and the coordinates of the Johnston Geodetic Station. This datum is used for the determination of coordinates for some Geoscience Australia products. Superseded by the Geocentric Datum of Australia (GDA94).

Australian Height Datum (AHD)
The datum used for the determination of elevations in Australia. The determination used a national network of benchmarks and tide gauges and set mean sea level as zero elevation.

Australian Map Grid (AMG)
A Cartesian coordinate system based on the Universal Transverse Mercator Projection and the Australian Geodetic Datum. The unit of measure is the metre.

Chain
A line composed of a sequence of non-intersecting line segments bounded by nodes. Chains reference the polygon to the left and right of the chain.

Connector feature
An artificial linear feature used to connect a linear network across an area feature.

Data Quality Statement (DQS)
A text file which carries information about the quality of the spatial data contained in each tile of a GEODATA data transfer.

Datum
A mathematical surface from which heights or positions are referenced.

Entity
A real world phenomenon which cannot be divided into phenomena of the same type.

Entity class
A group of entities of the same kind, matching the members of a feature class.

Entity point
An entity point is used to locate point entities represented by a point because of the scale of the source material.

Feature
A feature is the cartographic or digital representation of a class of entity.

Feature class
A feature class is a group of feature instances defined by a set of rules and having common attributes and relationships that are the properties of the corresponding real world phenomena.

Feature instance

A single occurrence of a feature which has a unique set of spatial and attribute object values.

Generalisation
A process which may involve the selection, displacement, simplification, exaggeration or aggregation of features from their true position for the sake of cartographic clarity.

Geocentric Datum of Australia 1994 (GDA94)
The set of geographic coordinates based on the Geocentric Datum of Australia. It is compatible with Global Positioning Systems (GPS). Adopted in 1994 and implemented in the year 2000. Used in the production of new GEODATA, and editions of 1:100 000 and 1:250 000 NATMAPs.

GEODATA
Geoscience Australia's brand of high quality digital data products for use in Geographic Information Systems (GIS).

Geodetic datum
A datum defines the basis of a coordinate system. A local or regional geodetic datum is normally referenced to an origin whose coordinates are defined. The datum is associated with a specific reference ellipsoid which best fits the surface (geoid) of the area of interest. A global geodetic datum is now related to the centre of the earth's mass, and its associated spheroid is a best fit to the known size and shape of the whole earth. The position of a point common to two different surveys executed on different geodetic datums will be assigned two different sets of geographical coordinates.

Geographical coordinates
A position given in spherical coordinates commonly known as latitude and longitude.

Geodesic
The line of shortest distance between two points on the surface of the reference ellipsoid.

Geographic Information System (GIS)
A spatial database which is manipulated via a set of spatial operators or commands.

Georeference
Georeferencing is the process of aligning a map image or a map feature with a particular geographic coordinate system.

Latitude
The latitude of a feature is its angular distance on a Meridian, measured northwards or southwards from the terrestrial Equator.

Layer
The features in a theme are subdivided into one or more layers on the basis of the spatial objects used to represent the features. Linear networks, polygons and point features are placed in separate layers.

Linear Network
A layer consisting of linear features which are connected and which form a pathway along which movement is possible.

Longitude
An angular distance measured east or west from a reference meridian (usually Greenwich) on the earth's surface.

Map Grid of Australia 1994 (MGA94)
A coordinate system based on the Universal Transverse Mercator Projection and the Geocentric Datum of Australia 1994. The unit of measure is the metre.

MHW
Mean High Water

Mercator Projection

The conformal cylindrical projection tangential to the Equator, possessing the additional valuable property that all rhumb lines are represented by straight lines. Used extensively for hydrographic and aeronautical charts.

National Topographic Map Series (NTMS)
A civilian map series comprising a set of consistent topographic maps nationwide, at scales of 1:100 000 and 1:250 000.

NATMAP
Geoscience Australia's brand for its popular topographic map range.

Node
A point that is a junction of two or more chains or which is the end point of a chain. Connectivity of chains is indicated by the sharing of nodes at their intersections.

Node/chain structure
The structuring of linear features in a layer so that they consist of chains broken by nodes at intersections or at the point where an attribute of the feature changes.

Point
A geometric representation defined by a single (x,y) coordinate pair or an (x,y,z) triplet.

Polygon
A continuous area defined by a set of bounding chains. There is only one external polygon and there may be one or more internal, non-nested inner boundaries.

Polygon label point
A point within a polygon feature instance used to locate labels or information about that polygon. This point is sometimes known as a centroid.

Positional accuracy
Statistical estimate of the degree to which planimetric coordinates and elevations of features agree with their real world values.

Primary Attribute Table
A data table which contains information directly related to the feature instance.

Projection
Any systematic way of representing the meridians and parallels of the earth upon a plane surface or map.

Raster Data
Raster data is made up of picture elements, or pixels, each having a discrete value and ordered together in a regular grid. In terms of spatial data, each pixel represents an area of the earth's surface at a specific location.

Repromat
Colour-separated reproduction material on a stable base used for the printing of maps.

Secondary Attribute Table
Additional descriptive information about a feature instance which is related to the feature instance by way of information in the primary attribute table.

Segment
A direct line between a pair of points or a point and a node.

Spatial object
The spatial object holds the locational information of a feature instance. It is composed of either a point, chain or polygon.

Theme
The information contained in map production material can be divided into themes which contain logically related geographic information. Each theme is capable of being used as a dataset in its own right.

Tile
The area of a spatial database included in a data transfer.

Tile edge
An artificial linear feature which indicates the boundaries of the tile. The tile edge closes off polygon features which are situated in more than one tile.

Topological integrity
The measure of how well spatial data conform to the sophisticated data structure required for GIS, especially with respect to connectivity and adjacency.

Transverse Mercator Projection (TM)
A conformal cylindrical map projection, originally devised by Gauss, also known as the Gauss-Kruger Projection. As its name implies, it is constructed on the same principle as the Mercator Projection, the only difference being that the Great Circle of tangency is now any nominated meridian. Meridians and parallels are curved lines, except for the central meridian or a specified zone (meridian of tangency), which remains a straight line. Projection zones are established about the central meridian and vary in width from two degrees to six degrees of longitude, with some overlap between zones. The amount of scale distortion may become unacceptable at distances greater than about 1.5 degrees in longitude from the central meridian. In a modified form, the projection is in general use for topographic mapping at scales of 1:250 000 and larger. See Universal Transverse Mercator.

Unique Feature Identifier (UFI)
An attribute code which is unique to each feature entity and is attached to every feature instance. It is primarily used to facilitate 'change only' updates.

Universal Transverse Mercator Projection (UTM)
A worldwide systematic application of the Transverse Mercator Projection applying to the region between 80°S and 84°N latitude. The UTM is a modified TM projection whereby the natural scale of the central meridian is scaled by a factor of 0.9996 to enable a wider area to be mapped with acceptable distortion. Each Zone is six degrees of longitude in width with a half-degree of overlap within the adjoining zone and having a true origin at the intersection of the central meridian of that zone and the Equator.

Vector Data
Vector data uses points and straight lines (vectors) to describe features on, or characteristics of, the earth's surface. Vector data can also include polygons, which are areas enclosed by a number of vectors. To record additional information, data attributes can be attached to individual vector features.

Vertex
The connecting point of two line segments.

World Geodetic System 1984 (WGS84)
A geocentric datum developed by the United States Department of Defence for use with GPS. For most practical purposes it is equivalent to GDA94.