DEPARTMENT OF NATIONAL RESOURCES

Secretary: J. Scully

DIVISION OF NATIONAL MAPPING

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TECHNICAL REPORT 22

AN AUTOMATIC NAME SELECTION AND TYPESETTING SYSTEM

by

R. W. Kennard and R. J. Stott

CANBERRA, AUSTRALIA
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ABSTRACT

This report describes the automatic name selection and typesetting system in operation in the Division of National Mapping.

Automatic selection of names for maps of any scale represents a very substantial saving of time in map production. Any selection process must be based on some hierarchy of importance of features and the report describes in some detail the principles used in establishing hierarchies in the National Mapping system. The hierarchies adopted so far are flexible and may be changed if good reasons exist for changing them.

In order that the names used for derived mapping are the latest available, the existing Master Names File of names from the 1:250 000 series is being updated and corrected with names from the 1:100 000 map series.

AN AUTOMATIC NAME SELECTION AND TYPESETTING SYSTEM

CONTENTS

AN AUTOMATIC NAME SELECTION AND TYPESETTING SYSTEM

1. INTRODUCTION

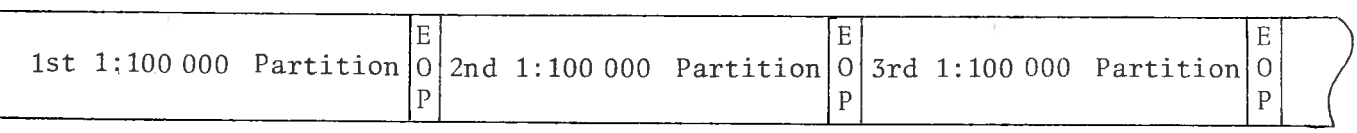
The Division of National Mapping, Department of National Resources, is becoming involved in computer assisted cartography. As part of this involvement, a system to automate the extraction and typesetting of feature names for mapping purposes has been developed. Feature names are selected by computer from a magnetic tape file according to certain variables for various map scales and set on a computer-driven typesetting machine.

2. DATA FOR THE SYSTEM

The basis of the system is the Master Names File which evolved from the gazetteer compiled from the 1:250 000 R502 map series. It contained records consisting of feature name, feature code, latitude, longitude, 1:250 000 map number and state abbreviation. To this, a hierarchy, or order of importance, and the population for populated places greater than 200 at the 1971 Census, was added.

The final step in the preparation of the Master Names File was to sort it into alphabetical order within 1:100 000 map areas. Each map area was made a separate partition, headed by the 1:250 000 and 1:100 000 map numbers, facilitating easy extraction of a single partition or amalgamations of many partitions, depending on the map scale.

The file format is:



EOP = End of partition tape mark.

The partition header consists of:

The 1:250 000 map number in character positions 1 to 8,
The 1:100 000 map number in character positions 11 to 14.

The record format is:

ITEM	CHARACTER POSITIONS
Feature name	1-34
Feature code (see Annex A for list of codes)	35-38
Latitude in degrees and minutes	39-42
Longitude in degrees and minutes	43-47
1:250 000 map number	48-53
State abbreviation	54-56
Population (for feature code POPL only)	57-64
Hierarchy	79-80

A sample list of records is shown in Annex B.

3. HIERARCHIES

To enable an automatic selection based on order of importance to be made, a hierarchical system had to be established for groups of features like populated places, drainage network, relief features etc. Table 1 shows the feature groups and the number of hierarchies established for each. A full description of the hierarchies and how they were established is given in Annex C.

Table 1. Feature groups and number of hierarchies established for each

DIVISION	GROUP	HIERARCHIES
Cultural	Populated places	11
	Homesteads etc.	3
	Roads	3
Topographic	Relief features	6
	Inland area features	12
	Islands	14
	Headlands	5
Hydrographic	Offshore areal water features	18
	Inland areal water features	14
	Drainage network	8

4. PROCESSING OF THE MASTER NAMES FILE

Programs have been written to:

1. Extract feature names, for specified maps, and allocate type font, point size and case to each.

2. Convert the selected feature names and associated type variables to code readable by the automatic type setting machine.

3. Provide listings for manual type setting.

4. Maintain the Master Names File through corrections, deletions and additions.

5. Provide listings or magnetic tape copies of feature names for specified maps or states on request.

5. FEATURE NAME EXTRACTION AND TYPE ALLOCATION

Most maps produced by the Division of National Mapping have sheet lines corresponding to amalgamations of 1:100 000 map sheets or the single 1:100 000 map itself. The program therefore extracts feature names from one or more 1:100 000 partitions on the Master Names File, depending on the requested map scale.

From a series of specified map references, feature codes and hierarchies, records are extracted and combined into a magnetic tape file to be used as input to the conversion program. Map requests for any number of map scales from 1:100 000 to 1:10 000 000 can be processed concurrently.

Input data for the extraction and allocation program consists of the following:

1. The requesting section's identification.

2. A series of map references grouped according to map scale.

3. For each map scale, the required feature codes grouped according to type font.

4. For each feature code, several hierarchy intervals together with their required point size and case.

The Master Names File is cycled through until a 1:100 000 partition forming part or all of a requested map is encountered. Records are read from the partition and extracted according to the input data. The feature code is examined first. If it is specified as being required, the hierarchy is then examined. If this feature code is not required the next record is read. For example, if the current request was for the 1:10 000 000 map of Australia, features like bores (BORE), waterholes (WTRH) and yards (YD) would not be listed.

If the feature code is required, the hierarchy is checked against the specified hierarchy intervals. If it falls within one of the intervals the feature name and the corresponding type specifications are written as one record to the output file. If the hierarchy does not fall within one of the intervals the feature name is not required and the next record is read. For example, if the current request was for a 1:1 000 000 map, rivers and creeks with a hierarchy greater than six would not be required.

A requirement of the input data is that if the feature does not have a hierarchy (e.g. bores, buildings, mines, etc) one interval is specified. Thus a type specification is provided for all features.

The output file is structured by section, requested map and type font. For requests other than 1:100 000 maps it is further subdivided into sub-map references. For example:

1. For a 1:250 000 map request the type is sorted into six 1:100 000 areas within each type font.

2. For a 1:1 000 000 map request the type is sorted into sixteen 1:250 000 areas within each type font.

That is, the output to the draftsman will be in the form most useful to him. Annex D shows sample output for Bowen 1:250 000 map.

6. CODE CONVERSION

The conversion program simply takes the file of feature names and type specifications produced by the extraction and allocation program, and converts it into a file readable by the Australian Government Publishing Service's automatic type setting machine, the Photon 7000. The type format, that is, word spacing, line spacing, page length and width is incorporated in the conversion process. This converted file is then processed by the Photon system and the type set on negative film ready for contacting to positive, reverse reading, stripping film.

7. MANUAL LISTINGS

This program provides a computer printout of feature names for manual type setting. The names are listed in type font order in decreasing point size with a new page for a change in type font. The point size and case are indicated in brackets before the feature name. See Annex E for sample listing.

8. USING THE SYSTEM

At the map compilation stage, the draftsman requests a listing of the feature names within that map. This listing is checked for accuracy and completeness and any corrections and additions listed. An update of the Master Names File is then undertaken and the extraction and allocation program run on the updated version. The conversion program is then used to produce a tape to be processed by the Photon system. Once stripping film has been contacted from the negative film output of the automatic typesetting machine, the map name overlay is prepared in the normal manner.

FEATURE CODE LIST

DESIGNATION	CODE	DESIGNATION	CODE
Abattoirs	ABAT	Cairn	MONU
Abbey	CHCH	Canal	CNAL
Agricultural Establishment	BLDG	Camp	CP
Airfield	AF	Campsite	CPST
Airport	AF	Cape	CAPE
Anchorage	ANCH	Car (or cycle) race track	RTRK
Archipelago	ARCH	Cascade	WRFL
Arsenal	RSNL	Castle	CAS
Asylum	BLDG	Cataract	WRFL
Avenue	ROAD	Cave	CAVE
		Cay (Island)	IS
Bank	BANK	Cemetery	CEM
Barn	BLDG	Chalet	BLDG
Barracks	BAR	Channel	CHAN
Basin (Wetdock)	DOCK	Chapel	CHCH
Baths	BAPL	Chasm	CHSM
Battery	BTRY	Church	CHCH
Bay	BAY	City	POPL
Beach	BCH	Clayhole	CLAY
Beacon	BCON	Claypan	CLAY
Bell Tower (Church)	CHCH	Cliff	CLIF
Billabong	LAKE	Coal Depot	BLDG
Bight	BGHT	Coastal telegraph	SIGS
Bluff	CLIF	Coke Ovens	KILN
Bore	BORE	College	SCHL
Breaker	BRK	Column	MONU
Breakwater	BRKW	Convent	CHCH
Brewery	FTRY	Copse	WOOD
Bridge	BRDG	Cove	COVE
Bickworks	BRYD	Creek	STRM
Brickyards	BRYD	Cross (Shrine)	SHR
Broadcasting Station	BCST	Crossroads	CRRD
Brook	STRM	Culvert	BRDG
Brushwood	WOOD	Customs Barracks	BAR
Butte	HILL		
By-pass	ROAD	Dairy Farm	FARM

DESIGNATION	CODE	DESIGNATION	CODE
Dam	DAM	Harbour	HBR
Depression	DEPR	Haven	HBR
Desert	DSRT	Head	PT
Deserted Village	DESV	Headland	PT
Dike	DIKE	Hedge	HDG
District	DI	Highway	HWY
Ditch (Canal)	CNAL	Hill	HILL
Downs	PLN	Hillside (Slope)	SLP
Drain	DRN	Homestead	HMSD
Dunes	DUNE	Hospital	HOSP
		Hotel	BLDG
Enclosure	FLD	House	BLDG
Entrance	ENTR	Hut	BLDG
Estuary	ESTY		
Expressway	ROAD	Inlet	COVE
		Inn	BLDG
Factory	FTRY	Institute	BLDG
Farm	FARM	Intermittent Lake	INTL
Ferry	FY	Island	IS
Field	FLD	Island Group	ISGP
Fishpond	POND	Isthmus	ISTH
Forest	FRST		
Ford	FORD	Junction	JUNC
Fort	FORT		
Fruit Fly Inspection Gate	GATE	Lagoon	LAGN
		Lake	LAKE
Gap	PASS	Lake Bed	LBED
Garden	GRDN	Lane	ROAD
Gas Field (well)	GAS	Landing Ground	LGRD
Gate	GATE	Landing Place	LNDG
Gnamma Hole	RH	Life-guard Station	LSTA
Gorge	RAV	Light	LT
Grasslands	GL	Lighthouse	LH
Guard House	BLDG	Lock	LOCK
Gully	GLLY		
Gulf	GULF	Marker	MONU

DESIGNATION	CODE	DESIGNATION	CODE
Market	MRKT	Point	PT
Marsh	SWP	Police Station	STA
Meadow	FLD	Pond	POND
Meteorological Station	MET	Pool	POOL
Mill	MILL	Pool Spring	SPRG
Mine	MINE	Port	PORT
Mining Shaft	SHFT	Post Office	PO
Mission	MSSN	Prison	PRSN
Mission Station	MSSN	Promontary	PROM
Monastery	MON		
Monument	MONU	Quarry	QUAR
Mountain	MT		
Mountain Peak	PEAK	Racetrack	RTRK
Mountain Range	MTS	Railway Station	RSTA
Mountains	MTS	Ravine	RAV
Museum	BLDG	Reach	RCH
		Reef	REEF
Native Well	SOAK	Reserve	RESV
Neck	ISTH	Reservoir	RES
Ness	PT	Rest House	BLDG
		Ridge	RDGE
Observatory	BLDG	Rifle-range	RNGE
Oil Well	OIL	River	STRM
Out Station	OS	River Mouth	SM
Ocean	OCEN	Road	ROAD
		Road Circle	JUNC
Park	PARK	Roadway	ROAD
Pass	PASS	Roadstead	HBR
Passage	CHAN	Rock (Inland)	MTRK
Pasture	FLD	Rock (Off-shore)	ROCK
Peninsula	PEN	Rockhole	RH
Pier	PIER	Ruin	RUIN
Pit	PIT		
Pipeline (Drain)	DRN	Salt marsh	SLTM
Place Name	PLNA	Salt Pan	SPAN
Plain	PLN	Sanatorium	BLDG
Plant	FRTY	Sandbank	BANK
Plantation	PLAN	Sandspit	SPIT
Plateau	PL	Sawmill	MILL

DESIGNATION	CODE
School	SCHL
Sea	SEA
Shelter	BLDG
Shoal	SHOL
Shrine	SHR
Siding	RSTA
Slate Quarry	SLQ
Slope	SLP
Soak	SOAK
Sound	SND
Sparse Forest	SFST
Spring	SPRG
Spur	SPUR
Stagnant Pool	POND
Stadium	STDM
Steelworks	FTRY
Stock Route	STOK
Stop (Railway)	RSTA
Strait	STR
Stream	STRM
Street	ST
Swamp	SWP
Tableland	PL
Tank	TANK
Tannery	FTRY
Tarn	LAKE
Tavern	BLDG
Telegraph Office	TO
Telephone Office	TO
Television Station	TVST
Temple	TMPL
Tower	BLDG
Town	POPL
Town Hall	BLDG
Trough (Marine)	DEEP
Tunnel	TUNN
Uncultivated Land	FLD
Valley	VAL
Viaduct	VDUC
Village	POPL
Vineyard	GRDN
Warehouse	BLDG
Watercourse	STRM
Waterfall	WRFL
Waterhole	WTRH
Water Tower	WTR
Water Way	CNAL
Weather Station	MET
Weir	WEIR
Well	WELL
Wet Dock	DOCK
Woods	FRST
Works	FTRY
Yard	YD

Note: The singular includes the plural unless otherwise indicated.

SAMPLE LIST OF FEATURE RECORDS

MAP IDENTIFICATION SF 55 03 8456

FEATURE NAME	FEATURE CODE	LAT D	LAT M	LONG D	LONG M	1.250000 MAP NO	STATE	HIER-ARCHY	POPULATION
BALD HILL	HILL	20	52	147	50	SF 55 3	QLD	5	0
BASIN CREEK	STRM	20	43	147	55	SF 55 3	QLD	7	0
BELLA VISTA, MOUNT	MT	20	34	147	41	SF 55 3	QLD	5	0
BELMORE	HMSD	20	39	147	53	SF 55 3	QLD	3	0
BIRRALEE	HMSD	20	40	147	40	SF 55 3	QLD	3	0
BIRRALEE CREEK	STRM	20	41	147	36	SF 55 3	QLD	8	0
BOWEN DEVELOPMENTAL ROAD	ROAD	20	41	147	51	SF 55 03	QLD	2	0
BOWEN RIVER	STRM	20	35	147	36	SF 55 03	QLD	4	0
BOWEN RIVER	STRM	20	44	147	53	SF 55 03	QLD	4	0
BRAWL CREEK	STRM	20	38	147	31	SF 55 03	QLD	7	0
CATTLE YARD SIDING	RSTA	20	34	147	50	SF 55 3	QLD	0	0
COCKATOO CREEK	STRM	20	53	147	47	SF 55 03	QLD	7	0
COCKATOO CREEK	STRM	20	58	147	47	SF 55 03	QLD	7	0
COCKATOO CREEK	STRM	20	48	147	47	SF 55 3	QLD	7	0
COLLINSVILLE	POPL	20	34	147	51	SF 55 3	QLD	7	2146
CORAL CREEK	STRM	20	37	147	54	SF 55 03	QLD	7	0
CORAL CREEK	STRM	20	36	147	50	SF 55 3	QLD	7	0
DEAF ADDER CREEK	STRM	20	33	147	52	SF 55 3	QLD	8	0
DEVLIN CREEK	STRM	20	42	147	59	SF 55 3	QLD	8	0
DEVLIN, MOUNT	MT	20	31	147	50	SF 55 3	QLD	6	0
DONALDS DREAM WATERHOLE	WTRH	20	37	147	44	SF 55 3	QLD	0	0
FIVE MILE CREEK	STRM	20	58	147	47	SF 55 3	QLD	8	0
FREDERICK CREEK	STRM	20	43	147	39	SF 55 3	QLD	8	0
GEBBIE CREEK	STRM	20	44	147	57	SF 55 3	QLD	8	0
GLENELLA CREEK	STRM	20	41	147	31	SF 55 3	QLD	7	0
GLENMORE CREEK	STRM	20	35	147	34	SF 55 3	QLD	7	0
GOLDBEETLE CREEK	STRM	20	36	147	32	SF 55 3	QLD	8	0
HAVILAH	HMSD	20	48	147	50	SF 55 3	QLD	3	0
HEIDELBERG	HMSD	20	40	147	32	SF 55 3	QLD	3	0
JACK CREEK	STRM	20	44	147	53	SF 55 3	QLD	7	0
JIMMY, MOUNT	MT	20	34	147	40	SF 55 3	QLD	6	0
KANGAROO CREEK	STRM	20	58	147	57	SF 55 3	QLD	8	0
LEICHHARDT RANGE	MTS	20	57	147	33	SF 55 03	QLD	4	0
LESLIE, MOUNT	MT	20	54	148	0	SF 55 3	QLD	4	0
LILY CREEK	STRM	20	38	147	44	SF 55 3	QLD	8	0
MOONLIGHT CREEK	STRM	20	37	147	32	SF 55 3	QLD	7	0
MOUNT LESLIE CREEK	STRM	20	53	147	58	SF 55 3	QLD	7	0
NOSTONE CREEK	STRM	20	53	147	37	SF 55 3	QLD	8	0
OAKY CREEK	STRM	20	34	147	53	SF 55 03	QLD	7	0
OAKY CREEK	STRM	20	41	147	35	SF 55 3	QLD	7	0
OAKY CREEK	STRM	20	34	147	56	SF 55 3	QLD	7	0
PARRAKEET CREEK	STRM	20	56	147	35	SF 55 3	QLD	8	0
PARROT CREEK	STRM	20	48	147	44	SF 55 03	QLD	6	0
PARROT CREEK	STRM	20	53	147	42	SF 55 03	QLD	6	0
PARROT CREEK	STRM	20	59	147	37	SF 55 03	QLD	8	0
PELICAN CREEK	STRM	20	33	147	37	SF 55 03	QLD	6	0
PELICAN CREEK	STRM	20	36	147	48	SF 55 03	QLD	6	0
PLUM CREEK	STRM	20	58	147	56	SF 55 3	QLD	7	0
RED HILL	HILL	20	32	147	32	SF 55 3	QLD	5	0
RED HILL CREEK	STRM	20	34	147	31	SF 55 3	QLD	7	0
ROSELLA CREEK	STRM	20	49	147	50	SF 55 3	QLD	6	0
SAMBO CREEK	STRM	20	56	147	45	SF 55 3	QLD	8	0
SAMBO, MOUNT	MT	20	58	147	45	SF 55 3	QLD	5	0
SANDY CREEK	STRM	20	43	147	57	SF 55 3	QLD	8	0
SCOTTVILLE	POPL	20	34	147	49	SF 55 3	QLD	11	0
SMOKO CREEK	STRM	20	44	147	31	SF 55 3	QLD	8	0
SOMERSFORD OLD CROSSING	FORD	20	30	147	35	SF 55 3	QLD	0	0
SONOMA	HMSD	20	37	147	50	SF 55 3	QLD	3	0
SONOMA PEAK	PEAK	20	34	147	54	SF 55 3	QLD	6	0
ST MARTIN, MOUNT	MT	20	50	147	55	SF 55 3	QLD	5	0
STONY CREEK	STRM	20	54	147	54	SF 55 3	QLD	7	0
STRATHBOWEN	HMSD	20	32	147	34	SF 55 3	QLD	3	0
STRATHMORE	HMSD	20	30	147	38	SF 55 3	QLD	3	0
STRATHMORE CREEK	STRM	20	31	147	45	SF 55 03	QLD	7	0
STRATHMORE CREEK	STRM	20	32	147	42	SF 55 03	QLD	7	0
TEATREE CREEK	STRM	20	33	147	53	SF 55 3	QLD	7	0
TEN MILE CREEK	STRM	20	46	147	40	SF 55 03	QLD	6	0
THREE MILE CREEK	STRM	20	55	147	48	SF 55 3	QLD	8	0
TWELVE MILE GULLY	STRM	20	44	147	47	SF 55 3	QLD	8	0
TWO MILE CREEK	STRM	20	38	147	49	SF 55 3	QLD	7	0
VISTA, MOUNT	MT	20	36	147	55	SF 55 3	QLD	5	0

HIERARCHIES AND HOW THEY WERE ESTABLISHED

Because of National Mapping's need to establish a series of related base maps at various scales and to automate type selection and setting, the system was devised so that it would satisfy the foreseeable needs of each of these projects. The system is based on a division into groups of related features, then subsequent ranking by various criteria to establish an order of importance for each feature.

The various groups and their component parts have been based on the conventional divisions of cultural detail, topography and hydrography but further refinement may be necessary to satisfy requirements.

The subdivision adopted is as follows:

DIVISION	GROUP
1. Cultural	1.1 Populated places
	1.2 Homesteads etc
	1.3 Roads
2. Topographic	2.1 Relief features
	2.2 Inland area features
	2.3 Islands
	2.4 Headlands
3. Hydrographic	3.1 Offshore areal water features
	3.2 Inland areal water features
	3.3 Drainage network

Various methods have been used to establish the hierarchy criteria for the features included in the above groups.

Generally the criteria have been adopted from the type specifications for the 1:100 000, 1:250 000 and 1:1 million WAC series maps which generally use area as a guide to selection of type size (i.e. importance). By converting these areas into geometric shapes such as ellipses or semicircles (depending on the feature), a series of guides were developed to classify features according to their cartographic importance.

The ellipse and semicircle were chosen as it was felt that these shapes closely represented the shapes found in reality particularly for lakes, islands and bays.

The selection of the more important features was based on the type specifications for the 1:2½ million scale map of Australia. In many instances specific examples were given and these have been accepted for the hierarchies adopted for the various groups. Generally these groups are the hierarchies from 1 to 4. The other hierarchies being based on the map specifications mentioned previously.

Certain groups could not be readily ranked by these methods and thus required the development of special selection processes. These groups are:

1. Relief features
2. Drainage network
3. Headlands

The criteria for establishing the range of hierarchies within each group together with a guide to the assessment technique and source material are as follows:

DIVISION 1 - CULTURAL DETAIL

Group 1.1 Populated Places

HIERARCHY	POPULATION LIMITS
1	Capital city
2	100 000 or more
3	Between 50 000 and 100 000
4	" 25 000 " 50 000
5	" 15 000 " 25 000
6	" 5 000 " 15 000
7	" 2 000 " 5 000
8	" 1 000 " 2 000
9	" 500 " 1 000
10	" 200 " 500
11	Less than 200

Source: Based on the type size specifications for the 1:100 000, 1:250 000,1:1 000 000, 1:2 500 000 map series.

Group 1.2 Homesteads etc

HIERARCHY	FEATURE LIMITS
1	Features in sparsely settled areas
2	Features in moderately settled areas
3	Features in closely settled areas

Source: Area Guide to Use of Symbols. Annex E 1:100 000 topographic map specifications.

Group 1.3 Roads

HIERARCHY	FEATURE LIMITS
1	Principal roads as shown in Annex E of 1:100 000 specifications.
2	Secondary roads as shown in Annex E of 1:100 000 specifications.
3	Minor roads

Based on the classes of roads adopted by the National Association of Australian State Road Autorities (N.A.A.S.R.A.)

DIVISION 2 - TOPOGRAPHIC

Group 2.1 Relief Features

This group is further subdivided into two parts namely:

1. Mountain ranges
2. Mountains

To enable a set of rules to be established for classifying mountain ranges and mountains, various maps and publications were consulted to obtain an overall impression of Australia's relief characteristics. Detailed mapping was used to establish, as accurately as possible, the location, extent and relative height of the features.

The following reference material was used:

1. WAC 1:1 000 000 map series
2. CSIRO 'Relief and Landform Map of Australia' at 1:5 000 000
3. Atlas of Australian Resources, Second Series, 'Landforms' and 'Surface Water Resources'
4. 1:250 000 topographic map series

The following general criteria were selected for the classification of the relief features.

1. Mountain Ranges

   a. Length
   b. Height
   c. Prominence

The prominence of a range was determined from the classification shown on the CSIRO map,'Relief and Landform Map of Australia'.

2. Mountains

   a. Height
   b. Prominence

The prominence was determined from the WAC or 1:250 000 series map on the basis of local relative relief. Nine mountainous regions were identified in Australia (see Figure 1) and these regions were used to identify one major mountain range as the most significant for each region. Since the Great Dividing Range has the highest mountain and the greatest length and complexity, it was classified separately from the other ranges.

The hierarchies and selection criteria are as follows:

Group 2.1.1 Mountain Ranges

Hierarchy 1. Great Dividing Range

Hierarchy 2. The major range in each of the eight remaining mountainous regions, selected on the basis of height, length and prominence.

2.1 Two ranges were selected in the Kimberley region as they were considered to be equally prominent namely Durack Range and King Leopold Ranges.

2.2 Clarke Range was chosen in the Mackay region as it is the most prominent.

Hierarchy 3. Ranges of marked or very marked relief in a region - height and prominence are more important than length, generally ranges with relative relief exceeding 200 metres (600 feet approx).

MOUNTAIN REGIONS

FIGURE 1

Hierarchy 4. Ranges with moderate relative relief exceeding 100 metres (300 feet approx) or being ranges of considerable length and importance locally.

Hierarchy 5. Ranges of moderate relative relief exceeding 30 metres (100 feet approx) and no shorter than 20 km (12 miles) in length.

Hierarchy 6. All other mountain ranges not included in categories 1 to 5.

Note: 1. Ranges coincident with the Great Dividing Range e.g. Snowy Mountains, Monaro Range, Barry Mountains, Montgomery Range, McIllwraith Range etc should be classified in the same manner as ranges not directly associated with the Great Dividing Range.

Group 2.1.2 Mountains

Hierarchy 1. Mount Kosciusko - the highest mountain in Australia was the only one selected for this category because of its uniqueness.

Hierarchy 2. Major mountains - classified according to prominence and height. Note: height generally exceeds 1300 m but relative relief must also be considered.

Hierarchy 3. Mountains of considerable height locally but less dominant than category 2. Note: height generally exceeds 500 m but relative relief must also be considered.

Hierarchy 4. Additional peaks in ranges, or isolated mountains and peaks of local significance but not necessarily the highest peaks in an area. These features are generally those selected to show the nature of an area's landform.

For the initial assessment by the Division of National Mapping the fourth hierarchy was allocated to those relief features (mountains, peaks, hills etc) that were shown on the 1:1 000 000 WAC series that were not included in hierarchies 1, 2 and 3. However, with more detailed mapping and additional height information some features were reclassified into different hierarchies.

Hierarchy 5 & 6 Criteria have not yet been definitely established for these two categories but generally those features of low relative relief or only local significance would fall into these two categories. The division between hierarchy 5 and 6 is based on the assumption that hierarchy 5 features would be shown on the 1:250 000 scale and hierarchy 6 features on the 1:100 000 scale topographic maps.

It is important to note that the size or height of mountain ranges and mountains selected for certain hierarchies varies considerably between the mountainous regions of Australia, but the aim was to achieve a relative order within each region so that the general nature of the relief and its local significance is reflected in the final use.

Group 2.2 Inland Area Features

HIERARCHY	FEATURE SIZE
1	Features greater than 22 000 square kilometres.
2	Features from 10 500 to 22 000 square kilometres.
3	" " 1 500 to 10 499 " "
4	" " 690 to 1 499 " "
5	" " 315 to 689 " "
6	" " 240 to 314 " "
7	" " 110 to 239 " "
8	" " 65 to 109 " "
9	" " 50 to 64 " "
10	" " 10 to 49 " "
11	Features less than 10 square kilometres
12	Very small features or features located in congested areas

Source: Based on the type size specifications for the 1:100 000, 1:250 000, 1:1 000 000, 1:2 500 000 map series.

Group 2.3 Islands

HIERARCHY	FEATURE SIZE
1	Great Barrier Reef
2	Large groups, e.g. Sir Edward Pellew Group, Wellesley Islands, Furneaux Group
3	Features less in area than those above but greater than 1 750 square kilometres
4	Features from 1 500 to 1 750 square kilometres
5	" " 800 to 1 499 " "
6	" " 690 to 799 " "
7	" " 315 to 689 " "
8	" " 240 to 314 " "
9	" " 110 to 239 " "
10	" " 65 to 109 " "
11	" " 50 to 64 " "
12	" " 10 to 49 " "
13	Features less than 10 square kilometres.
14	Very small features or features located in congested areas.

Source: Based on the type size specifications for the 1:100 000, 1:250 000, 1:1 000 000, 1:2 500 000 map series.

Group 2.4 Headlands

There are five hierarchies allocated to the features in this group. A detailed study was carried out to determine the features to be included in categories 1 to 4. All other features not in these hierarchies were then allocated to hierarchy 5.

The method of assessment involved determining the major turning points of the Australian coastline using a series of tangential lines. In certain situations, mainly around Tasmania, the Gulf of Carpentaria and the New South Wales coast from Cape Byron to Newcastle, this technique was over-ridden by selecting the most significant features either visually or on the basis of their uniqueness e.g. the most easterly point of the mainland, the continent etc.

Thus hierarchy 1 was established using this technique supplemented or modified by the other factors. Figure 2 shows the major turning points defined as hierarchy 1.

The same technique of tangential lines using the established points as pivot points was then applied to determine the next lower hierarchy. This is defined as the next headland that obscures a body of water when viewed from the headland that is one order higher. Allowance was also made for coastal shape, islands, etc and importance of selected features when selecting the headland to be placed in the relevant hierarchy. Figure 3 shows the method used to determine hierarchy 2, 3 and 4.

DIVISION 3 - HYDROGRAPHIC

Group 3.1 Offshore areal water features

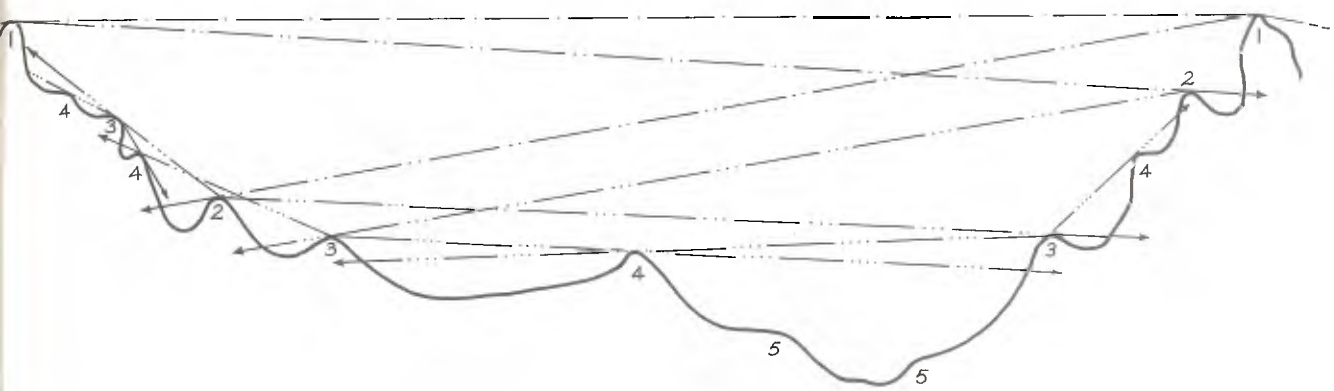
HIERARCHY	FEATURE SIZE
1	Oceans
2	Seas
3	Large straits, gulfs and bights, e.g. Gulf of Carpentaria, Bass Strait, Great Australian Bight.
4	Gulfs, straits, bights, etc of an area comparable to Van Dieman Gulf, Joseph Bonaparte Gulf, Spencer Gulf, Capricorn Channel, Curtis Channel, Torres Strait.
5	Features less in area than those above but greater than 2000 square kilometres.
6	Features from 1540 to 2000 square kilometres.
7	" " 1000 to 1539 " "
8	" " 800 to 999 " "
9	" " 350 to 799 " "
10	" " 250 to 349 " "
11	" " 130 to 249 " "
12	" " 90 to 129 " "
13	" " 60 to 89 " "
14	" " 40 to 59 " "

HIERARCHY I HEADLANDS
with modifications for islands and bights

FIGURE 2

HEADLANDS

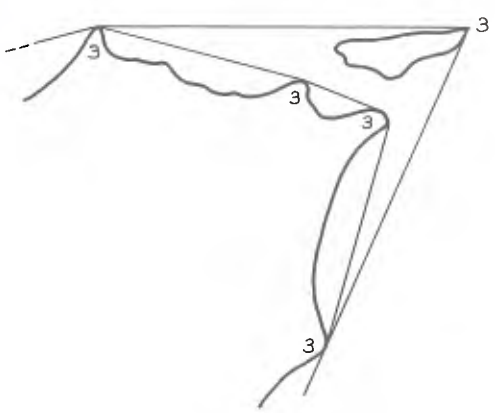
METHOD USED TO DETERMINE LOWER ORDER HIERARCHIES



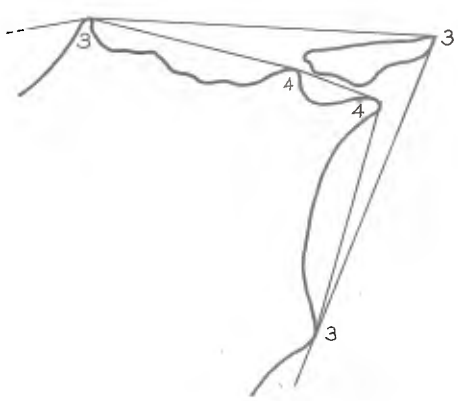
LEGEND

Tangential Line for Hierarchy 1 ——·——
Tangential Line for Hierarchy 2 ——··——
Tangential Line for Hierarchy 3 ——···——
Tangential Line for Hierarchy 4 ——····——

SELECTION OF HIERARCHIES NEAR ADJACENT ISLANDS



Example 1. Visibly separated



Example 2. Not visibly separated

FIGURE 3

15	Features from 15 to 39 square kilometres
16	" " 6 to 14 " "
17	Features less than 6 square kilometres
18	Very small features or features located in congested areas.

Source: 1. Based on the type size specifications for the 1:100 000, 1:250 000, 1:1 000 000, 1:2 500 000 map series.

2. International Hydrographic Bureau 'Limits of Oceans and Seas!

Group 3.2 Inland areal water features

HIERARCHY	FEATURE SIZE
1	Features greater than 6 000 square kilometres
2	Features from 2 750 to 6 000 square kilometres
3	" " 1 450 to 2 749 " "
4	" " 1 000 to 1 449 " "
5	" " 625 to 999 " "
6	" " 440 to 624 " "
7	" " " 230 to 439 " "
8	" " 160 to 229 " "
9	" " 100 to 159 " "
10	" " 75 to 99 " "
11	" " 25 to 74 " "
12	" " 12 to 24 " "
13	Features less than 12 square kilometres
14	Very small features or features located in congested areas.

Source: Based on the type size specifications for the 1:100 000, 1:250 000, 1:1 000 000, 1:2 500 000 map series.

Group 3.3 Drainage Network

The main objective of stream selection is to preserve the relative densities and major patterns of stream channels in proportion to scale of the map, without any loss of the characteristic drainage pattern. When automated type selection is applied to systems of stream hierarchies then the criteria may vary slightly in that there is a limit to the length of stream that can be named and the density of the type overlay is limited by the amount of other detail to be shown. The aim is to select type for certain streams and leave the streams that have less significance unnamed. With variations in map scale the extent of the streams to be named varies considerably.

For the purpose of automated type selection the order of Australian streams has been divided into eight separate classes with the hierarchy 1 being allocated to the most important streams and the hierarchy increasing numerically as stream importance decreases. This is contrary to the stream

classification systems proposed by Horton and Strahler. To assign stream orders with these systems, one goes upstream to the source, and at this point, the order of the stream is by definition equal to 1. The order is then increased by 1 whenever the stream is joined by another stream of the same order.

The Strahler method leaves the stream orders as designated whereas the Horton method reorders the stream by headward extension of the higher orders (i.e. higher numbers) to give a main channel.

Both of these methods have advantages. To vary stream networks with scale the Horton technique is superior as it maintains stream length whereas the Strahler method gives foreshortening as the headward orders are deleted. However the Strahler method is more suitable to automated type selection as it allows grading of the type size from the mouth to the source as the order changes. The method adopted by National Mapping is similar in principle to the Strahler method except that the hierarchy has been reversed and given a fixed range (at this stage) of eight. Figure 4 shows the stream classification systems.

Stream order is known to be related to the average stream length, the catchment area, the number of tributary streams, and to a limited extent, to the discharge. These relationships, except for discharge, have been used as the criteria for the selection of hierarchy as they are readily evident. Other factors to be considered are that about half the streams of a given order enter directly into a stream of two or more orders higher, and also that the ratio between the number of streams of one order to that of the next higher order is relatively constant for similar areas. Horton calls this the "bifurcation ratio" and gives a range of values from 2 to 4 with a mean figure for the United States of 3.5. Estimation of the ratio for Australia based on the compilation material for the Atlas of Australian Resources, Surface Water Resources map gives a mean value of 3.72.

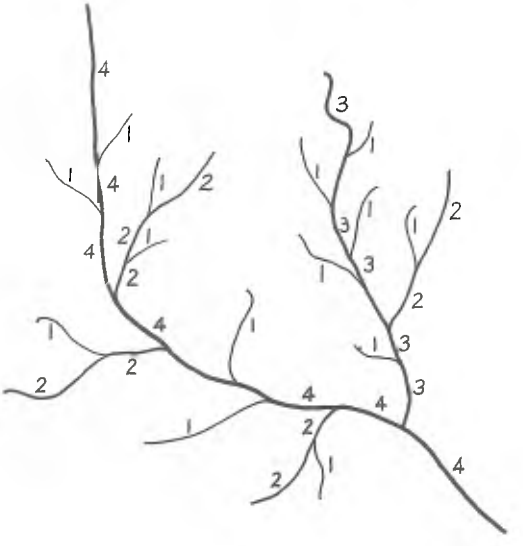
To establish more quantitative criteria, catchment areas were measured for nine extensive basins and the mean value for each hierarchy was calculated. These values were then plotted on semilog graph paper (see Figure 5) against the hierarchies to give an almost linear relationship conforming with previous published research work. Extrapolation using supplementary data for hierarchies 7 and 8 based on current hierarchy allocation techniques produced the following criteria for selection of stream hierarchy based on catchment areas.

HIERARCHY	CATCHMENT AREA IN SQUARE KILOMETRES
1	Greater than 200 000
2	50 000 to 200 000
3	20 000 to 50 000
4	7 000 to 20 000
5	2 000 to 7 000
6	700 to 2 000
7	200 to 700
8	Less than 200

STREAM CLASSIFICATION SYSTEMS

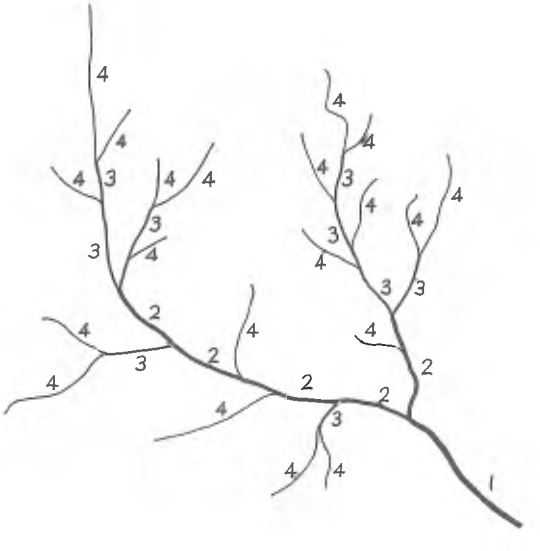
A. STRAHLER METHOD

Order left as designated.



B. HORTON METHOD

Headward extension of main tributary.



C. NATIONAL MAPPING METHOD

Drainage network hierarchies for automated type setting.

FIGURE 4

STREAM HIERARCHY AND CATCHMENT AREA RELATIONSHIP

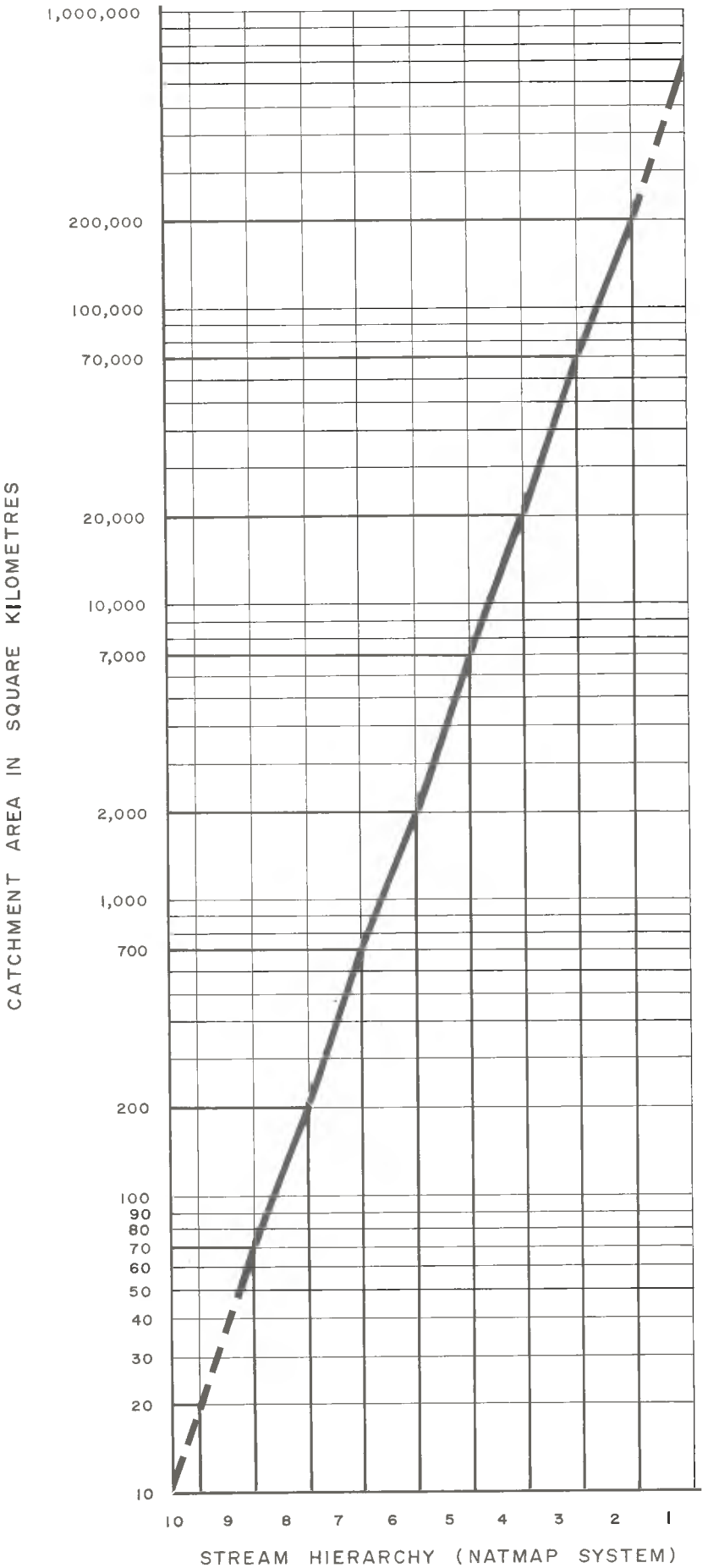


FIGURE 5

The criteria for hierarchy 1 and 2 were modified slightly to fit existing data but it can be seen that all other values start with 2 or 7. This may be a quirk of the graph being plotted on semilog paper but it does allow ready extrapolation for all lower hierarchies i.e. 9, 10 etc without the use of the graph. Apart from the bifurcation ratios, these criteria are the only quantitative criteria established so far.

SAMPLE TYPE OUTPUT FOR BOWEN 1:250 000 MAP

PAGE 1 TOPOGRAPHIC MAPPING 1:250,000
SF 55 03 BOWEN

689I

SF 55 03 8357

BOGIE RANGE BONNIE DOON HILLS MT CASTOR Expedition Pass MT GLENROY MT JOHNNYCAKE MT KING McGREGORS BONNET MT POLLUX MT WICKHAM

SF 55 03 8457

MT ABBOT Aberdeen Water Facility MT ABERDEEN CLARKE RANGE MT DILLON EDINBURGH CASTLE MT GREENTOP HERBERT RANGE MT HERBERT HIGHLANDERS BONNET HURRICANE CLIFF KNOBBIES MT MACKENZIE McGREGOR PEAK Mount Abbot Pass PETER GORDON RANGE PICCANINNY MOUNTAIN PINE HILL PINE MOUNTAIN MT PLEASANT SCRUB TOP MOUNTAIN TABLE MOUNTAIN MT TOUSSAINT Twelve Mile Tank TWINS THE WHITE PINCH THE

SF 55 03 8557

Adelaide Point BEN LOMOND BERT MT BERTHA BLACK AND WHITE HILL Bluff Point BODES RANGE MT BRAMSTON MT BUCKLEY MT CAVANA MT CHALLENGER MT DANGAR DOUBLE PEAK RANGE FLAGSTAFF HILL MT GIBRALTAR GLOUCESTER PASSAGE Gloucester Cape MT GORDON MT GREENTOP Kings Beach KNOBBIES KNOBBLERS THE MT LEE LITTLE MARIA MT MARENGO MT MARIA MT MARY MT McGUIRE MIDDLE HILL MONTE CHRISTO North Head ONE MILE MOUNTAIN MT PLUTO MT PRING MT QUANDONG ROMA PEAK Round Hill Point Sinclair Head South Head SPROLE CASTLE SUMMER HILL THREE BROTHERS THE TOMMY ROUNDBACK WHITE CLIFFS MT WILLIAMS

SF 55 03 8356

MT BATTERY CAREY GUILLE MT CONSTANCE MT DALRYMPLE EARLSCLIFF MT ELY GARTH THE MT GRAHAM HAVILAH HILL HOUSE AND KITCHEN HILLS MT JOE -DE-LITTLE Joes Gap JOHN PEAK MT LANDSBOROUGH LEICHHARDT RANGE LES JUMELLES LITTLE TOR MT MAGNUS MT MARIAN MT McCONNEL Mount Wyatt Well Peak John Well PERCY DOUGLAS RANGE MT PUFFANDWHEEZE PYRAMID RANGE PYRAMID THE REGINALD PEAK MT RICHARDSON MT ROSCOW RUTHERFORDS TABLE MT TINDALE TOR GABRIEL WHITESTONE PEAK MT WILLIAM PHILPOTT MT WYATT

SF 55 03 8456

BALD HILL MT BELLA VISTA MT DEVLIN GARTH THE MT JIMMY LEICHHARDT RANGE MT LESLIE RED HILL MT SAMBO SONOMA PEAK MT ST MARTIN TOR GABRIEL MT TOUSSAINT MT VISTA

SF 55 03 8556

BLACKWALL RANGE BROKEN RIVER RANGE MT CAMPBELL MT CAULEY MT CROMPTON MT FLAT TOP MT HECTOR MT HIGH MT LESLIE MT MAMELON MT MARION NORMANBY RANGE PINE MOUNTAIN MT QUANDONG MT ROUNDBACK MT ROUNDHILL STONE WALL THE MT SUGARLOAF TENT HILL

689R

SF 55 03 8557

Black Currant Island Gloucester Island Passage Island Poole Island Stone Island Thomas Island

690I

SF 55 03 8357

Ashman Creek Bluewater Creek Bogie River Bonnie Doon Creek Breakfast Creek Brown Creek BURDEKIN RIVER Camp Creek Dingo Creek Dozer Creek Eight Mile Creek Eight Mile Creek Expedition Pass Creek Fence Creek Glenroy Creek Jet Creek Johnnycake Creek King Creek Kirknie Creek Lagoon Creek Landers Creek Little Spring Creek Millaroo Creek Mount Harris Well Oaky Creek Oaky Creek Oaky Creek Pine Creek Pink Lily Lagoon Sandy Creek Scott Creek Spring Creek Swans Lagoon Teatree Creek Turkey Gully

SF 55 03 8457

Abbot Creek Armstrong Creek Bora Creek Boundary Creek Brigalow Creek Butchers Creek Cape Creek Capsize Creek Cattle Creek Charley Creek Chasewater Creek Crush Creek Dillon Creek Elliot River Emu Creek Finley Creek Fish Creek Gibraltar Creek Glen Blazes Creek Herbert Creek Herrod Creek Horse Lagoon Jet Creek Kangaroo Creek Manning Camp Creek Mares Nest Creek Molongle Creek Oaky Creek One Mile Creek Paddys Creek Pickhandle Creek Pine Creek Plain Creek Pullen Pullen Creek Reedy Creek Rocky Creek Rocky Creek Saltwater Creek Sandy Creek Sandy Creek Sandy Creek Sheep Station Creek Sheep Station Creek Splitters Creek Spring Creek Spring Creek Spring Creek Stockyard Creek Stockyard Creek Sundown Creek Table Mountain Creek Terry Creek Two Mile Creek

SF 55 03 8557

Albert Creek Alick Creek Bee Creek Bell Creek Ben Lomond Creek Billy Creek Bona Bay Boundary Creek Brisk Bay Brown Creek Cattle Creek Cedar Creek Charleys Creek Crab Creek Crinoline Creek Deadman Creek Deadman Creek (Left Branch) Deadman Creek (Right Branch) Denison Port Dingo Creek Dingo Creek Dingo Creek Dinner Creek Don River Duck Creek Eden Lassie Creek EDGECUMBE BAY Emu Creek Emu Creek Euri Creek Five Mile Creek Five Mile Creek Four Mile Creek Gap Creek Gold Creek Grasstree Creek Greentop Creek Gregory River Greta Creek Gypsy Creek Happy Valley Creek Hay Gully Horse Creek Horse Lagoon Humbug Creek Ida Creek Ironbark Creek Jochheim Creek Kelsey Creek La-Di-Da Creek Lethe Brook Macartys Creek Major Creek Marengo Creek Mares Nest Creek Mary Creek Menilden Creek Mica Creek Miralda Creek Monte Christo Creek Mountain Creek North Entrance Oaky Creek Oaky Creek Pandanus Creek Pipe Case Creek Police Camp Creek Proserpine River Prospect Creek Quandong Creek Range Creek Reedy Creek Ridge Camp Creek Sandy Creek Sandy Creek Scrubby Creek Selina Creek Seventy Creek Sheep Station Creek Shoal Bay Shoal Water Bay Simon Creek Sinclair Bay Six Mile Creek Slater Creek South Entrance Split Creek Spring Creek Spring Creek Spring Creek Station Creek Stockyard Creek Sugarbag Creek Tailing Gully Tea-Tree Creek Ten Mile Creek Thistle Creek Three Mile Creek Thunderbolt Creek Two Mile Creek Victoria Creek Wall Creek Ward Creek Yeates Creek

SF 55 03 8356

Ant Hill Creek Bell Creek Billy-Can Creek Bluestone Creek Bobby Dazzler Creek Boundary Creek Brawl Creek Bull Creek Burdekin Falls Charlie Creek Cockatoo Creek Collins Creek Coopers Creek Deep Creek Desmond Creek Five Mile Creek Gap Creek Glendon Creek Isabella Creek Mary Creek Mount Graham Creek Mount Harris Well Packhorse Creek Pebble Creek Percy Douglas Creek Pyramid Creek ROSETTA CREEK Rutherford Creek Sandalwood Creek Scrub Creek Sellheim River Sellheim River Somer Creek Stones Creek Stones Creek Teatree Creek Whitestone Creek Willie Moore Creek Wynne Creek 13 Mile Dam 2 Mile Creek 7 Mile Dam

SF 55 03 8456

Basin Creek Birralee Creek Bowen River BOWEN RIVER Cockatoo Creek Coral Creek Deaf Adder Creek Devlin Creek Donalds Dream Waterhole Five Mile Creek Frederick Creek Gebbie Creek Glenella Creek Glenmore Creek Goldbeetle Creek Jack Creek Kangaroo Creek Lily Creek Moonlight Creek Mount Leslie Creek Nostone Creek Oaky Creek Oaky Creek Parrakeet Creek Parrot Creek Pelican Creek Plum Creek Red Hill Creek Rosella Creek Sambo Creek Sandy Creek Smoko Creek Stony Creek Strathmore Creek Teatree Creek Ten Mile Creek Three Mile Creek Twelve Mile Gully Twelve Mile Gully Two Mile Creek

SF 55 03 8556

Alice Creek Amelia Creek Andromache River Birds Nest Creek Black Gin Creek Bluff Creek Branch Creek Broken River Camp Creek Cattle Creek Coppermine Creek Crompton Creek Dart Creek Dicks Creek East Creek Emu Creek Emu Creek Ernest Creek Exmoor Creek Fish Creek Flagstone Creek Gap Creek Gap Creek German Creek Goorganga Creek Grant Creek Grass Humpy Creek Horse Creek Humbug Creek Hungry Gully Ironbark Creek Jack Creek Key Creek Kitty Creek Lilypool Creek Long Creek Mares Nest Creek Marquis Creek Oaky Creek Oaky Creek Oaky Creek Palm-Tree Creek Pig Creek Raspberry Creek Robard Creek Sandy Creek Scrub Creek Silver Creek Spring Creek Spring Creek Spring Creek Star Creek Starvation Creek Stony Creek Thompson Creek Thunderbolt Creek Trapper Creek Turn Back Creek Urannah Creek Viola Creek Wild Creek Yellow Gully

690R

SF 55 03 8357

Dalbeg Millaroo

SF 55 03 8457

Almoola Binbee Briaba Jaraga Mount Aberdeen Mount Aberdeen Telegraph Office Somersford Old Crossing Toms Crossing

SF 55 03 8557

Armuna Bootooloo Bowen Bubialo Chinamans Rock Chyebassa Shoal Crystal Brook Debella Delta Dittmer Don Eden Lassie School Euri Euri Creek Intaburra Kelsey Creek Longford Creek Merinda Miowera Mookarra Mount Buckley Mount Dangar Ohanlons Siding Pennsfield Telegraph Office Walschs Crossing Winter Shoal

SF 55 03 8456

Almoola Cattle Yard Siding Collinsville Scottville Somersford Old Crossing

SAMPLE LISTING FOR MANUAL SETTING

AUSTRALIA 1:5M - TYPE STYLE 689I DBLUE

(9 UC) SI 55 (9 UC) FREDERICKS VALLEY(SUMMERHILL)CREEK (9 UC) KINGS PLAINS CREEK(BELUBULA RIVER)

(9 UC) LONG PLAIN DEEPWATER(COWABBIE) CR (9 UC) MURRAY RIVER (8 LC) BILLABONG CREEK (8 LC) COLEAMBALLY OUTFALL DRAIN

(8 LC) CUDGEGONG CREEK (8 LC) EDWARD RIVER (8 LC) GOGELDRIE MAIN DRAIN (8 LC) GOLGELDRIE MAIN SOUTHERN DRAIN

(8 UC) LACHLAN RIVER (8 UC) LACHLAN RIVER (8 UC) LACHLAN RIVER (8 LC) LACHLAN RIVER (8 UC) LACHLAN RIVER

(8 LC) LITTLE MIRROOL CREEK DRAIN (8 LC) MACQUARIE RIVER (8 LC) MACQUARIE RIVER (8 LC) MACQUARIE RIVER

(8 LC) MARROWIE RIVER (8 LC) MOULAMEIN OR BILLABONG CREEK (8 UC) MURRAY RIVER (8 LC) MURRAY RIVER

(8 UC) MURRUMBIDGEE RIVER (8 UC) MURRUMBIDGEE RIVER (8 LC) MURRUMBIDGEE RIVER (8 UC) MURRUMBIDGEE RIVER

(8 UC) MURRUMBIDGEE RIVER (8 UC) MURRUMBIDGEE RIVER (8 UC) MURRUMBIDGEE RIVER (8 UC) MURRUMBIDGEE RIVER

(8 LC) NAAS RIVER (8 LC) TIKI AQUEDUCT (8 LC) TUMUT RIVER (8 LC) UMBANGO CREEK (6 LC) ABERCROMBIE RIVER

(6 LC) ABERCROMBIE RIVER (6 LC) BACK OR GENARIN CREEK (6 LC) BACKWATER COWAL (6 LC) BELARBIGAL BILLABONG

(6 LC) BELL RIVER OR NANDILLION PONDS (6 LC) BELL RIVER OR NANDILLION PONDS (6 LC) BILLABONG CREEK

(6 LC) BILLABONG CREEK (6 LC) BILLABONG CREEK (6 LC) BILLABONG CREEK (6 LC) BLAND CREEK

(6 LC) BLAND OR YEO YEO CREEK (6 LC) BOGAN RIVER (6 LC) BOGAN RIVER (6 LC) BOLONG RIVER (6 LC) BOREE CREEK

(6 LC) BOX CREEK (6 LC) BOX CREEK (6 LC) BRUNGIE CREEK (6 LC) BUDGEBEGOMBIL CREEK (6 LC) BULBODNEY CREEK

(6 LC) BULLENBUNG CREEK (6 LC) BULLOCK CREEK (6 LC) BULLOCK CREEK (6 LC) BUMBOLEE CREEK (6 LC) BURGOON CREEK

(6 LC) BURRA BURRA CREEK (6 LC) BURRILL CREEK (6 LC) COCKRAN CREEK (6 LC) COOBAGGIE CREEK

(6 LC) COOKBUNDOON RIVER (6 LC) COOKOPIE CREEK (6 LC) COREEN OR WANGAMONG CREEK (6 LC) COWRA CREEK (PADDYS RIVER)

(6 LC) CROOKWELL RIVER (6 LC) CROWL CREEK (6 LC) CROWL CREEK (6 LC) CUDGEGONG RIVER (6 LC) CUNNINGHAM CREEK

(6 LC) CURRAWONG CREEK (6 LC) DILGA CREEK (6 LC) ENA OOMA OR SPRING STATION CREEK (6 LC) EREMARAN CREEK

(6 LC) FISH RIVER (6 LC) FOREST CREEK (6 LC) GOOBANG CREEK (6 LC) GOOBARRAGANDRA RIVER

(6 LC) GOOBARRAGANDRA RIVER (6 LC) GOOBARRAGANDRA RIVER (6 LC) GRAHWAY PANGEE (CROWIE) CREEK (6 LC) GUDGENBY RIVER

(6 LC) GUNNINGBLAND CREEK (6 LC) HERVEY RANGE OR GREENBAR CREEK (6 LC) IRONBONG CREEK (6 LC) JUGIONG CREEK

(6 LC) JUGIONG CREEK (6 LC) KINDRA CREEK (6 LC) KOORAWATHA OR BACK CREEK (6 LC) KOOROWATHA CREEK

(6 LC) KYEAMBA CREEK (6 LC) KYEAMBA CREEK (6 LC) LACHLAN RIVER (6 LC) LAWSON CREEK (6 LC) LERIDA CREEK

(6 LC) LEWIS PONDS CREEK (6 LC) LITTLE MURRAY RIVER (6 LC) MACQUARIE RIVER (6 LC) MANDAGERY CREEK

(6 LC) MANNA OR YEO YEO CREEK (6 LC) MANNUS CREEK (6 LC) MEROO CREEK (6 LC) METHUL CREEK (6 LC) MIRROOL CREEK

(6 LC) MITCHELL CREEK (6 LC) MOD WALL CREEK (6 LC) MOLONGLO RIVER (6 LC) MOORE CREEK (6 LC) MOORLARBAN CREEK

(6 LC) MULWAREE PONDS (6 LC) MURDA CREEK (6 LC) MUTTAMA CREEK (6 LC) NAAS CREEK (6 LC) NARRABURRA CREEK

(6 LC) NATIVE DOG CREEK (6 LC) NERRIMUNGA CREEK (6 LC) NERRIMUNGA CREEK (6 LC) NIEMUR RIVER

(6 LC) NIMMING CREEK (6 LC) NIMMING CREEK (6 LC) OAK CREEK (6 LC) OLD MANS CREEK (6 LC) PHILS RIVER