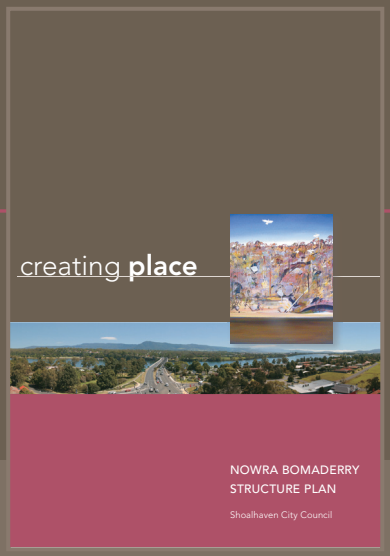
creating **place**
NOWRA BOMADERRY
STRUCTURE PLAN
Shoalhaven City Council

Background

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creating **place**

Report Structure

The structure of the Background Report of the Nowra Bomaderry Structure Plan is illustrated in Figure 1.1.

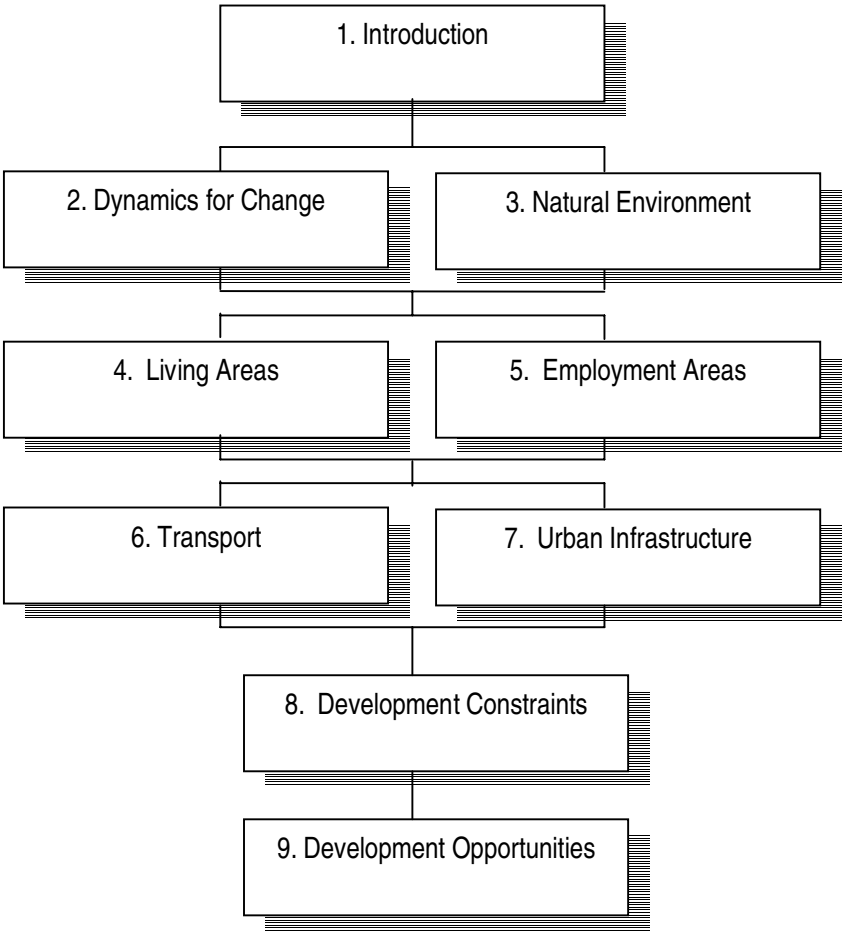
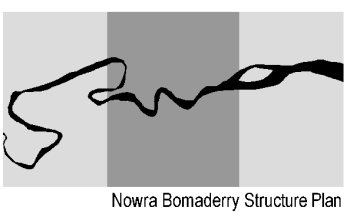


Figure 1.1: **Background Report Structure**

Study Area



Nowra Bomaderry Structure Plan

Legend

Structure Plan Boundary

September 2005

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Map 1.1

1. INTRODUCTION

Chapter 1 establishes the purpose of the Nowra Bomaderry structure plan; reviews the state and regional context in terms of strategies and policies; outlines the sub-regional centre's planning history and recent relevant studies; and highlights the key issues addressed and key stakeholders in the structure plan.

1.1 PURPOSE

The purpose of this structure plan is to provide a framework for the integrated development of the Nowra Bomaderry area which also includes the settlement of Cambewarra. It looks at the implications of the ongoing growth of the urban area and Nowra Bomaderry's long term role as the regional service provider and major urban area in the City of Shoalhaven. It assesses the need to balance this role with the need to conserve the significant environmental attributes of the area.

The structure plan takes into account state and regional policies as well as local needs and expresses the result of this process as a spatial plan and a set of policies. The structure plan will inform the revision of regional policies and provide a framework for a Local Environmental Plan. The structure plan also forms the basis of infrastructure plans such as Section 64 (Local Government Act 1993) and Section 94 Contribution Plans (Environmental Planning and Assessment Act 1979).

Map 1.1 shows the structure plan boundary.

1.2 STATE AND REGIONAL CONTEXT

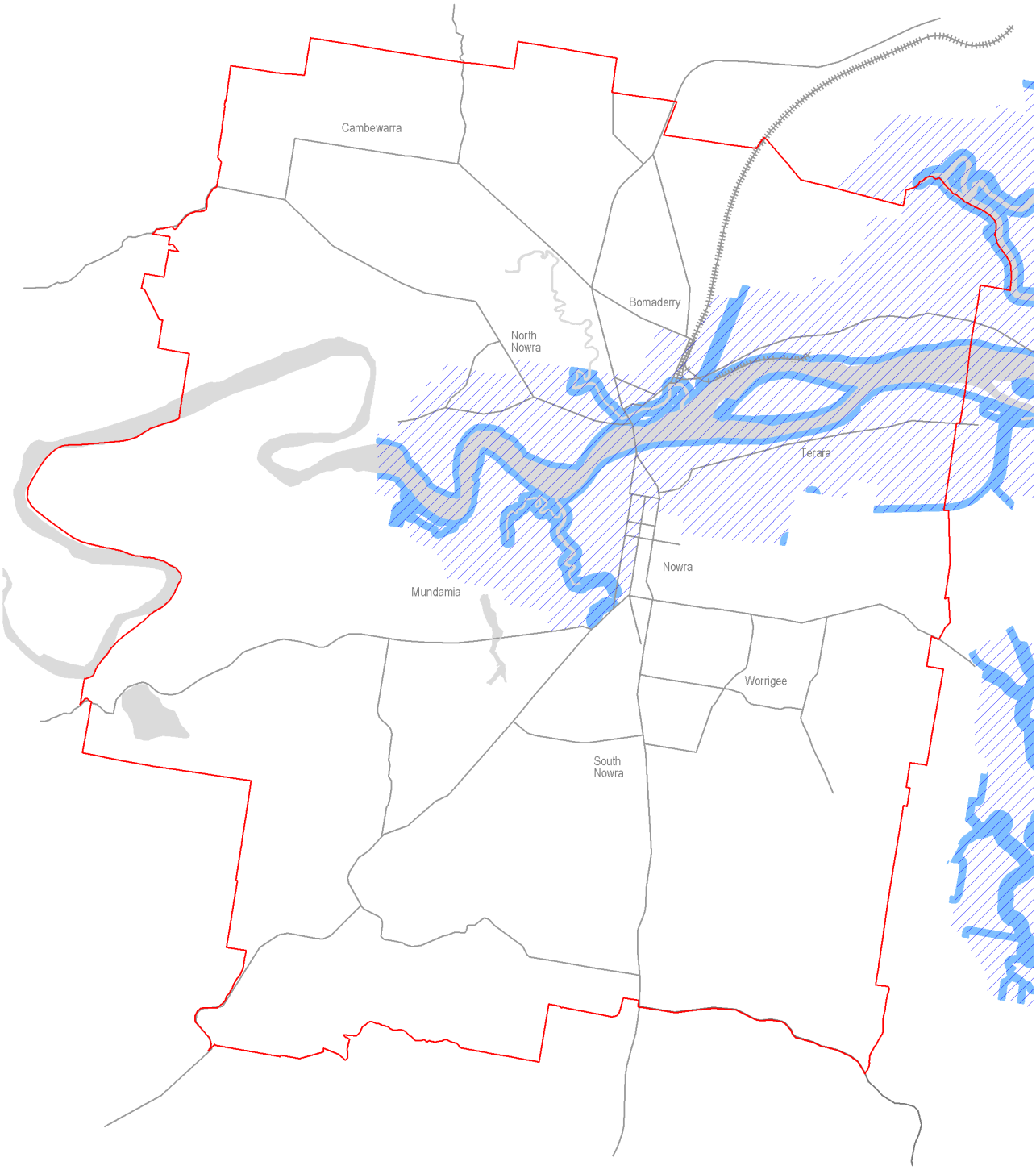
Nowra Bomaderry is important at both the state and regional levels in that it is:

- The largest service centre south of Wollongong providing higher level services outside the Sydney metropolitan region.
- At the southern extremity of the State Rail coastal network.
- The only coastal crossing of the Shoalhaven River.
- The service centre for the most visited tourist area in the state outside Sydney.
- Linked to the Sydney, Canberra, Melbourne corridor through the Moss Vale Road link and is the focal point for another important link to the south west (Main Road 92).
- The centre of one of the fastest growing local government areas in the state having the largest growth in the Illawarra Region and one of the highest growth rates outside the Newcastle-Sydney area.
- Close to both Sydney and Canberra making it accessible to two major population centres.

Coastal Policy

A significant part of the Nowra Bomaderry area comes within the ambit of the Coastal Policy (Coastal Zone). The coastal zone is defined in State Environmental Planning Policy No 71 - Coastal Protection (SEPP 71). The area definition relates to the Shoalhaven River, Nowra Creek and Broughton Creek. This reflects the importance of the Shoalhaven River. The policy's objectives seek to: protect the ecological, scenic and leisure value of the coast; maintain and where appropriate improve water quality in coastal and estuarine waters as well as coastal rivers; give high priority to the impacts of natural processes and hazards; design and locate development to complement the surrounding environment and to recognize good aesthetic qualities; effectively manage and conserve cultural heritage places, items and landscapes; promote compact and contained planned urban development; facilitate consistent and complementary decision making; and engender energy efficient design principles.

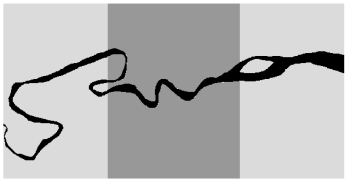
In strategy terms the ongoing development of Nowra Bomaderry has received preliminary support in that it steers development away from the immediate coastline but at the same time provides services and support to the existing coastal settlements relieving the need for them to some degree to individually expand to be able to support economical servicing. Map1.2 shows the 'Coastal Zone' and 'Sensitive Coastal Location' as defined in SEPP 71.



Coastal Policy SEPP 71

Legend

- Structure Plan Boundary
- Coastal Zone
- Sensitive Coastal Location



Nowra Bomaderry Structure Plan

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Map 1.2

Sydney Metropolitan Strategy

The role of Nowra Bomaderry in relation to the Illawarra section of the Sydney Metropolitan Strategy is now coming under review to see if it is feasible for the northern Shoalhaven to contribute to the supply of fringe metropolitan urban land. Over time upgraded transport links and higher level services in Nowra Bomaderry will accelerate the growth of interaction between Nowra Bomaderry and the urban areas to the north of the Shoalhaven.

Illawarra Regional Environmental Plan No 1

The Illawarra Regional Environmental Plan REP) (1986) contains a number of provisions relevant to the ongoing development of Nowra Bomaderry. These provisions are:

- The recognition and maintenance of Nowra CBD's role as a sub-regional centre.
- The protection of HMAS Albatross by creating a buffer.
- The creation of a services corridor to the west of the major existing urban areas.
- The creation of a north south wildlife corridor on the western side of the study area.

The Illawarra Regional Plan also required:

- Protection of prime crop and pasture land located in the northern area of the structure plan area and on the flood plain.
- Protection of rainforest vegetation, located mainly on the slopes and foothills of the Cambewarra range.
- Consideration be given to recommendations contained in the Illawarra Region Landscape and Environment Study.

Map1.3 shows the major components of the Illawarra REP that relate to the structure plan area.

The Department of Planning is currently reviewing regional planning in the area. As part of this process a number of studies are being undertaken. A significant product of this process is the development of the Illawarra and South Coast Employment Lands Strategy and the South Coast Regional Directions Statement. This structure plan takes into account these draft strategies and policies being produced as part of this process.

Subregional Context

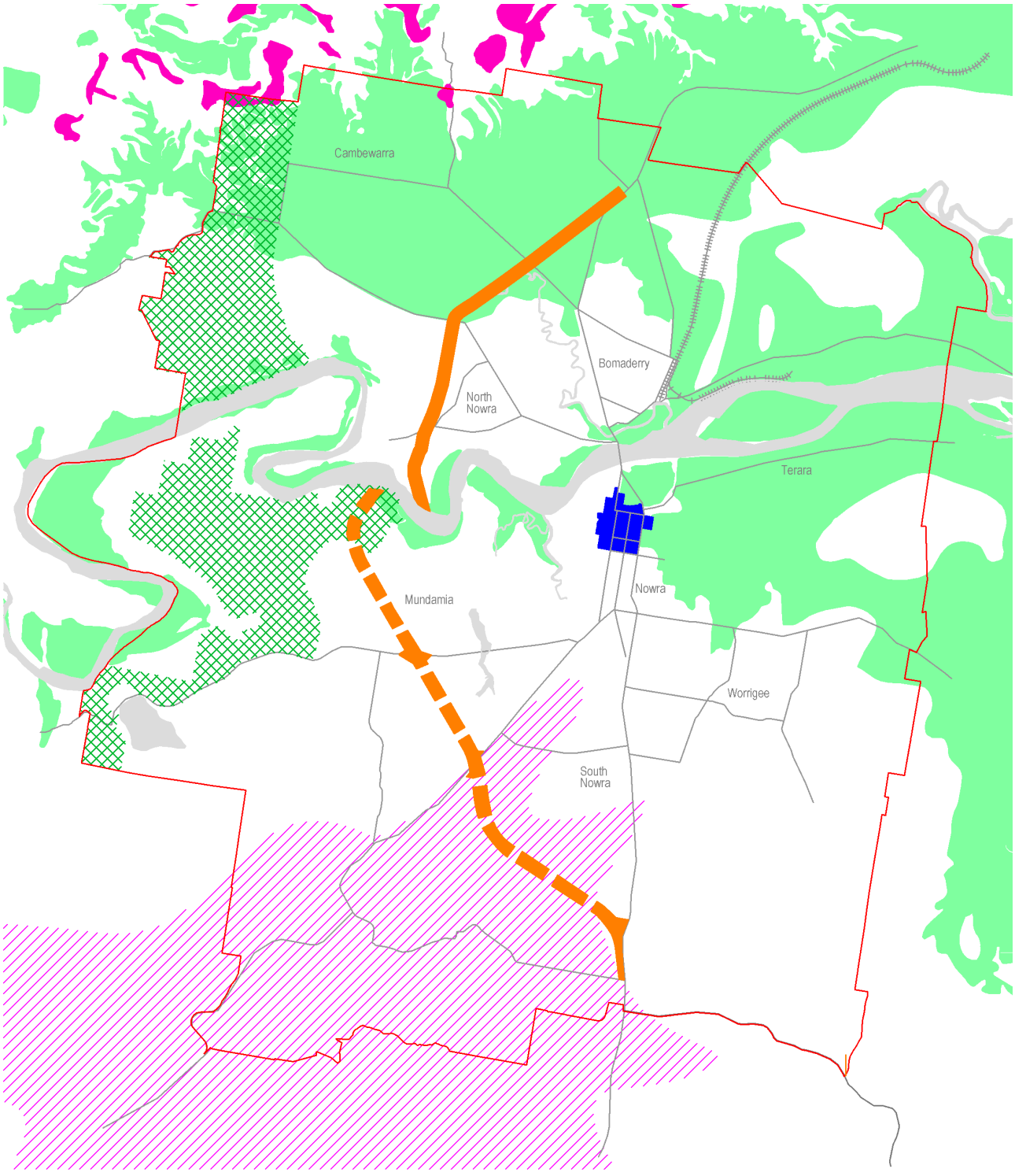
Nowra Bomaderry is the dominant centre in the Shoalhaven with 40% of estimated retail expenditure of the Shoalhaven occurring in the Nowra Central Business District (CBD). Nowra Bomaderry provides approximately 60% of the employment (equivalent full time jobs) within the Local Government Area.

The City of Shoalhaven is divided into five planning areas. Areas 1, 3 and 5 are based on the service and major urban areas of Nowra Bomaderry, Bay and Basin and Milton Ulladulla respectively. Areas 2 and 4 are second-order districts based on Culburra Beach and Sussex Inlet. Areas 1, 2 and 3 provide a ring of residential areas focused on the hub of Nowra Bomaderry. The extent of the five Planning Areas is shown on Map 1.4.

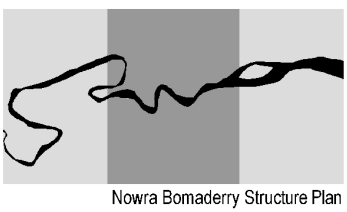
Shoalhaven Growth Management Strategy

Council is at present preparing the Shoalhaven Growth Management Strategy. Stage 1 of this project comprises the preparation and release for consultation of an issues paper relating to the conservation and settlement challenges facing the city.

The strategy will help guide future development and policy direction for the Council as well as linking into the regional planning review that Department of Planning is proposing through the planning reform process.



Illawarra Regional Plan



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Regional Services Corridor
- Regional Services Corridor LEP 1985 Amendment No14
- Sub Regional Commercial Centre
- Prime Crop & Pasture Land (Dept of Agriculture)
- Rainforest Vegetation
- Wildlife Corridors
- Airport Buffer Area

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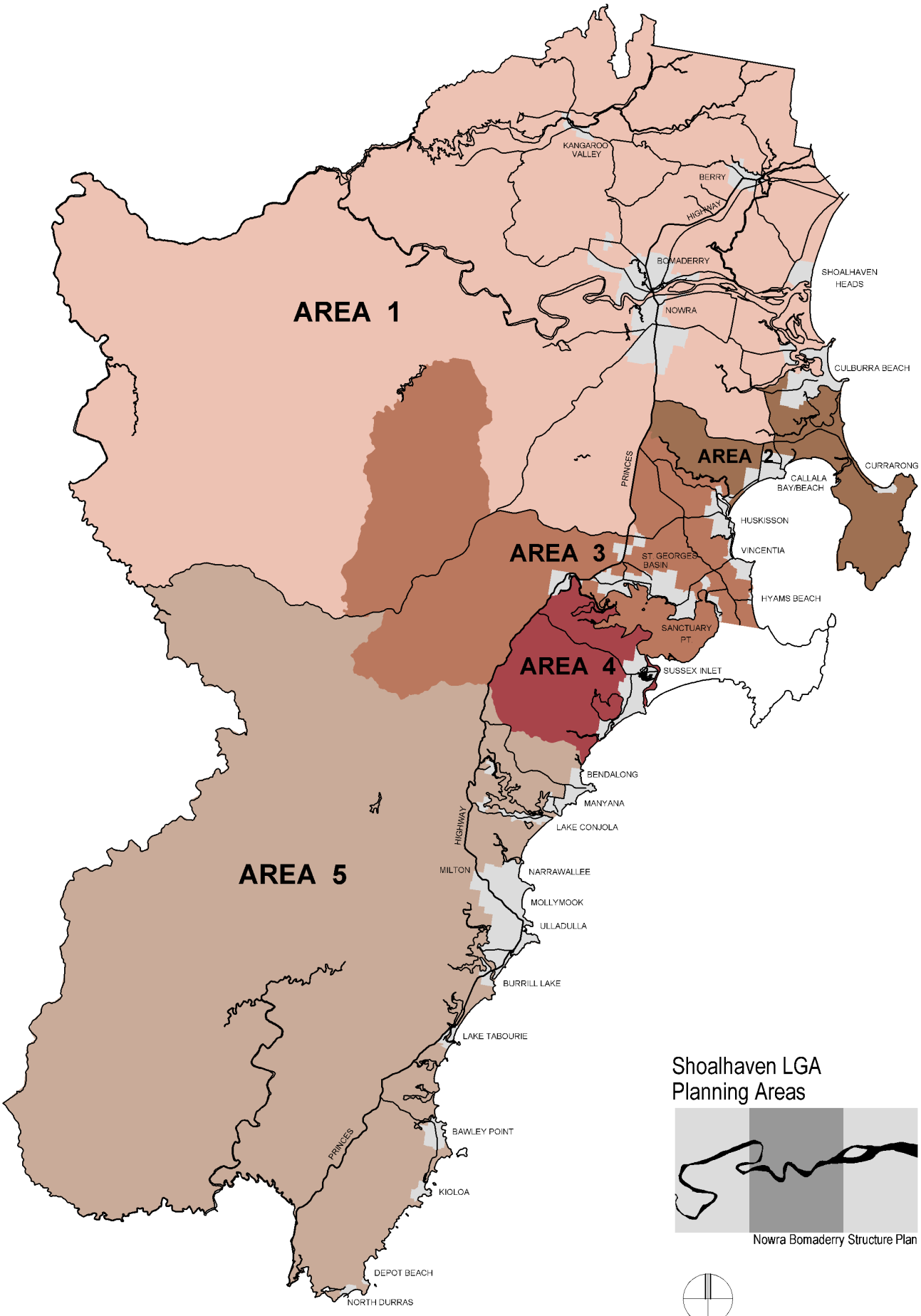
Map 1.3



Shoalhaven LGA
Planning Areas

Nowra Bomaderry Structure Plan

September 2005 Not To Scale

Map 1.4

1.3 PLANNING HISTORY

Prior to the adoption of the current Shoalhaven LEP 1985, the planning of Nowra Bomaderry has the following chronology:

- Interim Development Order No. 1 (1964)
- 'Nowra to the Year 2000' study (1968)
- 'Nowra Urban Area' study (1973)
- 'Nowra Urban Area Extension of Town Boundaries' report (1974)
- Nowra Bomaderry Structure Plan (1979)

Shoalhaven LEP 1985

The 1979 structure plan process formed the basis of the draft Shoalhaven LEP as it applied to the Nowra Bomaderry Area. This draft was publicly exhibited in 1983. The Shoalhaven LEP 1985 was gazetted in May 1985 and has been the major control for development in the area since that time. There has been approximately 80 amendments to the original LEP that relate specifically to the Nowra Bomaderry area, most of these have effected only minor changes. Some of the more significant changes relate to:

- Amendment No 14 - Creation of rural residential area at Nowra Hill.
- Amendment No 97 - Northern extension of Bomaderry.
- Amendment No 127 - Rural residential areas at Worrigee.
- Amendment No 132 - Extension to Cambewarra Village.
- Amendment No 152 - Further northern extension of Bomaderry.
- Amendment No 202 - Extension of Nowra CBD to the eastern side of the Highway.

Map 1.5 shows the current Shoalhaven LEP 1985 zones.

Nowra Bomaderry Concept Plan 2000

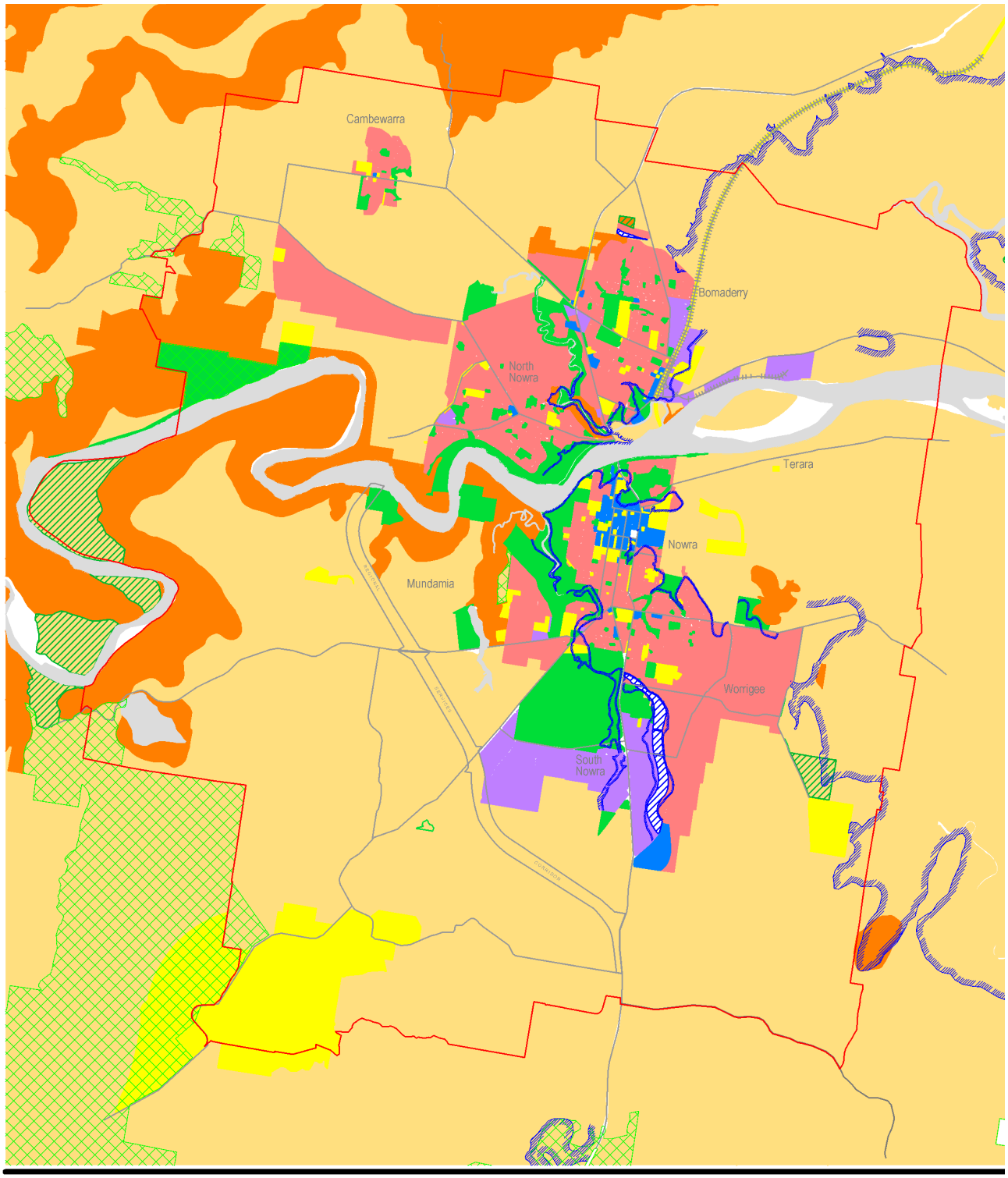
It had become apparent for some time that the strategic planning for the Nowra Bomaderry area required to be revisited and a new development-conservation framework articulated. In response to this need Council commenced the strategic planning process for the area. At the same time Council also started a process to look at the longer term direction of the Nowra Commercial Business District (CBD).

The Nowra Bomaderry Concept Plan was placed on public exhibition and a public meeting was held in October 2000. The concept plan considered a planning horizon to 2036 and revisited the previous planning constraints and a number of new issues including:

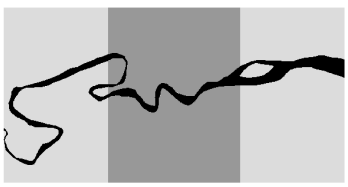
- Retention of native vegetation and protection of threatened species.
- Acid sulphate soils.
- Cultural heritage.
- Residential development pressures.

The concept plan (Map 1.6) identified the long term land requirements and potential new urban development locations for further investigation. Utilising a process of constraint sieve mapping, the concept plan identified nine investigation areas. From north to south, these included:

- Meroo (185 hectares).
- Moss Vale Road North (108 hectares).
- Moss Vale Road South (94 hectares).
- Bangalee Road West (20 hectares).
- North Nowra - Crams Road (93 hectares).
- Mundamia North (University)(59 hectares).
- Mundamia – Cabbage Tree Lane (202 hectares).
- Yalwal Road south west (186 hectares).
- Currambene (144 hectares).



LEP 1985 Current Zones



Nowra Bomaderry Structure Plan

September 2005

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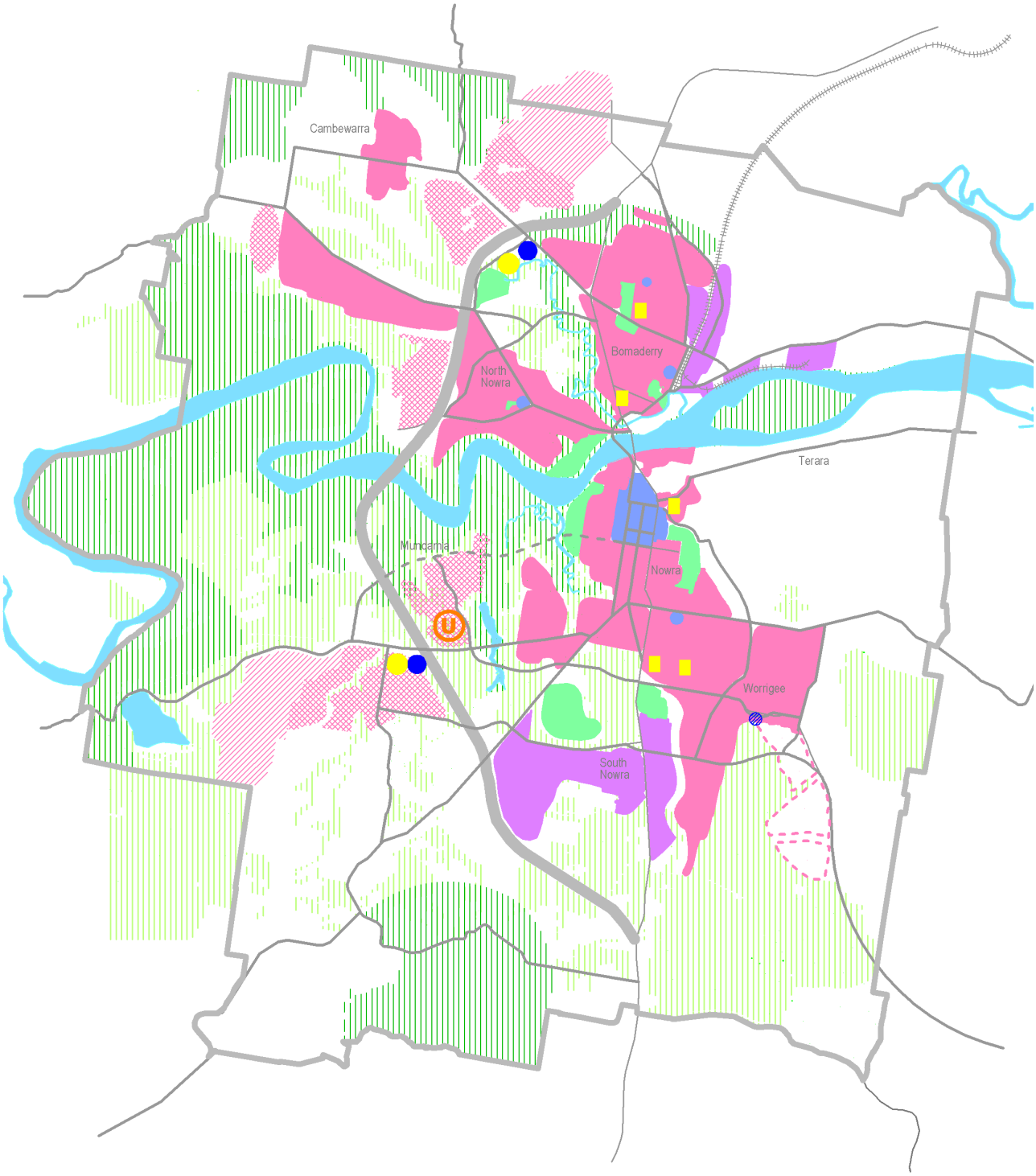
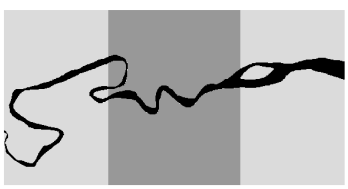
Legend

- Structure Plan Boundary
- Rural Zones
- Residential Zones
- Commercial Zones
- Industrial Zones
- Special Use Zones
- Open Space Zones
- Environment Protection Zones
- Urban Floodway Zone
- Scenic Preservation Areas
- Floodline
- Ecological Sensitivity Hatching

Map 1.5



Concept Plan 2000



Nowra Bomaderry Structure Plan

September 2000

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Legend

- Structure Plan Boundary
- Existing Residential
- Existing & Future Industrial
- Existing & Future Active Recreation
- Nowra CBD
- Neighbourhood Centre
- Proposed Neighbourhood Centre
- Local Centre
- High Schools & TAFE
- This road link is not a road proposal but is for analysis purposes only.
- University Site
- Investigation Areas
- Longterm Investigation Areas
- Future Neighbourhood Centre
- Future High Schools
- Western Bypass
- Highway
- Main Roads
- Scenic Protection Areas
- Conservation Areas
- Area potentially deleted by RFA.

Map 1.6

During the structure plan development process, which also addresses the potential for urban consolidation, potential areas have been further evaluated and more sustainable urban footprints defined. The concept plan also outlined the requirements for a long term environmental conservation strategy, which has also been incorporated and developed in the structure plan. In addition to modifications and changes resulting from more detailed investigations, other considerations have been taken into account, such as the Regional Forestry Agreement determinations together with legislative and policy changes.

Relevant Studies

The following significant studies have been undertaken or reviewed as part of the current structure plan preparation process:

- Shoalhaven River Flood Study (1991)
- Shoalhaven City Water Supply Augmentation EIS (1996)
- Shoalhaven River Healthy Rivers Enquiry (1999)
- Commercial Business District Strategy (1999)
- Shoalhaven Housing Strategy (2000)
- Pedestrian Access and Mobility Plan (2005) and Bicycle Strategy Review (2005)
- Proposed Expansion of Retailing in Nowra CBD EIS (2002)
- Nowra Bomaderry Riparian Objective Study (2004)
- Nowra and Browns Creeks Flood Study (2005)
- Nowra Bomaderry Structure Plan Retail Review (2005)
- Illawarra Local Government Areas Study - Industrial Structure Profiles (2005)
- North Nowra Link Road - various investigations and studies
- Shoalhaven River Additional River Crossing (Stage 1 - 2004)/(Stage 2 - 2005)
- Nowra CBD Traffic and Parking Strategy (2003)
- North Street Traffic Study (2004)
- Nowra CBD (East) Expansion Traffic Modelling (2005)
- South Nowra Traffic Study (2005)
- Riparian Corridor Objective Setting for Selected Streams in Nowra Bomaderry (2005)
- Bushfire Mapping (2004)
- Various flora and fauna studies relating to investigation areas
- Various bushfire studies relating to investigation areas

1.4 KEY ISSUES

The key issues addressed in this structure plan are:

- Sustainable population
- Natural environmental values and biodiversity
- Residential development
- Employment centre role
- Sustainable transport system
- Urban infrastructure provision

1.5 KEY STAKEHOLDERS

The Nowra Bomaderry structure planning process has been conducted under the stewardship of Shoalhaven City Council. In addition to Council, other main 'players' or 'stakeholders' include the Nowra Bomaderry residential and business communities, together with state and federal government (Figure 1.2). It is important that all stakeholders are involved throughout the structure planning process. In particular, the on-going planning of the district will be undertaken in collaboration with the residential and business communities of Nowra Bomaderry.

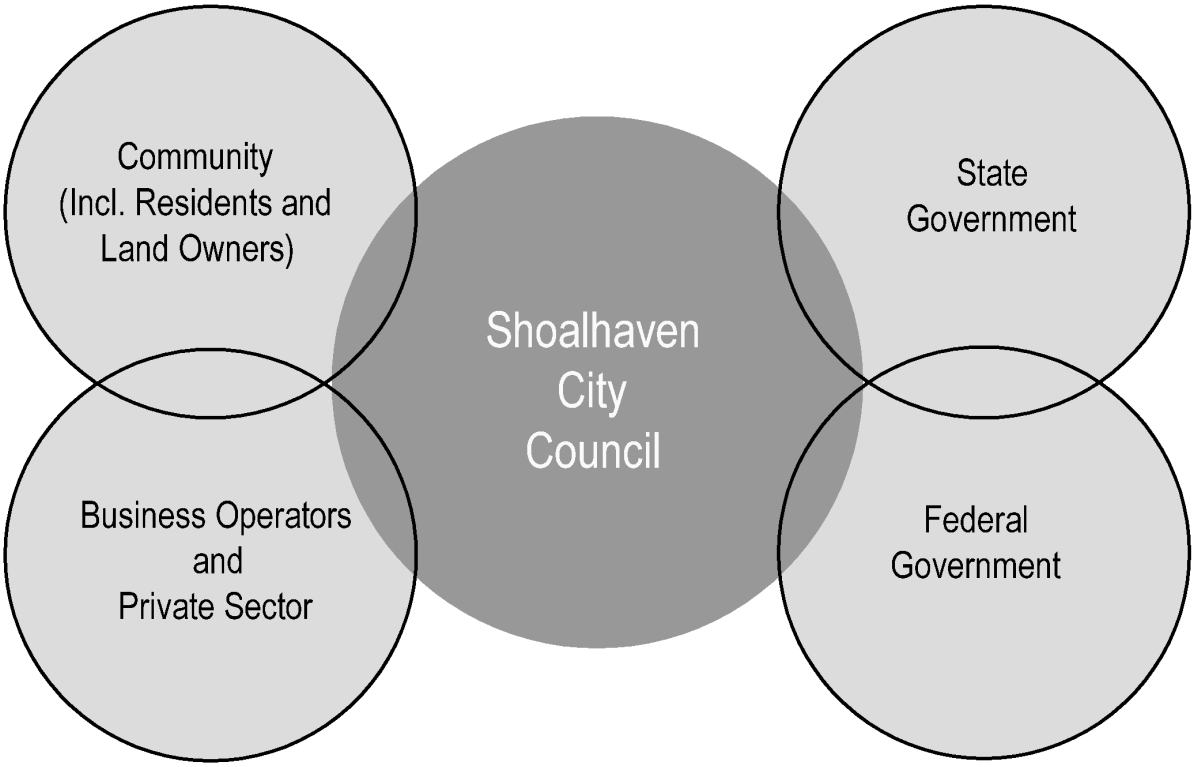


Figure 1.2: **Key Stakeholders**

2. DYNAMICS FOR CHANGE

There are a number of trends that have the potential to influence the future development of Nowra Bomaderry. These include: demographic, socio-economic, economic, environmental and technological trends. These will influence the scale, form and distribution of development. Demographic change in the Shoalhaven is greatly influenced by the development of the Sydney metropolitan area as well as that of Wollongong and other parts of the northern Illawarra.

2.1 POPULATION GROWTH TRENDS

Population in the structure plan area has increased from 14,787 persons in 1971 to 28,325 in 2001. The current population is estimated at 31,400 (January 2005). Between 1986 and 2001 the population of Nowra Bomaderry increased by 41% (Table 2.1). By comparison, the respective increase for the Shoalhaven was higher at 52% and Planning Area 1 lower at 36%.

Table 2.1: **Comparative Population Growth Trends** (Estimated Resident Persons)

Area	1981	1986	1991	1996	2001
Shoalhaven City	48600	57660	70461	79068	87650
Area 1: Northern Shoalhaven [1]	27953[1]	30362[1]	35474[1]	38718[1]	41202[1]
Nowra Bomaderry Structure Plan		21326[1]	26281[1]	28707	30168

Note 1: These figures are proportionally adjusted from the city figure, all other estimated residential figures are from the ABS. The 1996 and 2001 structure plan figures are for Shoalhaven Part A which is very similar to the structure plan area.

The declining population growth rates in Nowra Bomaderry reflect both a general widespread decline in growth and also a preference for people to live in closer proximity to the coast. In the case of Shoalhaven this has been underpinned by a large supply of affordable residential land and a significant increase (particularly 1996-2001) in the number of private motor vehicles.

The whole of the northern Shoalhaven including the very fast growing Bay and Basin district is largely dependent on Nowra Bomaderry for employment and services/facilities.

Net Migration

Shoalhaven's population relies to a large extent on people moving into the area. The Bay and Basin area (Planning Area 3) has registered the highest volume of net migration (number of people moving in less the number of people who leave) meaning that Planning Area 1 competes with Planning Area 3 regarding net migration. Area 1 (Northern Shoalhaven) attracts the second largest number with Nowra Bomaderry accounting for 50% of it (Table 2.2). Much of the in-migration comes from the Sydney metropolitan region and to a lesser extent from the Illawarra. Shoalhaven's net-migration varies significantly over time.

Table 2.2: **Net Migration by Locality: 1986-2001**

Locality	1986-1991	1991-1996	1996-2001	1986-2001
Nowra Bomaderry Urban Areas	1,489	468	1,370	3,327
Area 1: Northern Shoalhaven	3,567	1,964	1,096	6,627
Area 3: Bay & Basin	2,828	3,116	1,920	7,864
Shoalhaven	10,535	7,015	6,611	24,161

Source: ABS Census of Population & Housing 1986, 1991, 1996, 2001 & HSP Planners 2005

While there has been a decline in recent years, a substantial number of people continue to arrive. People over 55 years represent a significant proportion of those migrating to the Shoalhaven. (+3466) and are believed to retire to the area after holidaying previously. Other significant patterns are the increase in the 0-4 age group (+1,197), suggesting an increase in young families; and the net out-migration of the 15-24 age group (-1,760) (Table 2.3).

Table 2.3: **Net Migration by Age to the Shoalhaven: 1996-2001**

Age Group	Population 2001	Net Migration: 1996-2001		
		Males	Females	Persons
0-4	5,190	617	580	1,197
5-9	6,362	339	272	611
10-14	6,594	167	129	296
15-19	5,209	-312	-394	-706
20-24	3,362	-557	-497	-1,054
25-29	3,758	108	241	349
30-34	4,403	246	285	531
35-39	5,489	250	259	509
40-44	6,133	195	178	373
45-49	5,503	172	109	281
50-54	5,391	224	365	589
55-59	4,967	487	587	1,074
60-64	5,028	628	563	1,191
65-69	4,722	418	310	728
70-74	4,605	172	31	203
75+	6,587	55	215	270
Total	**83,303**	**3,209**	**3,233**	**6,442**

Source: ABS Census of Population & Housing 1996, 2001 & HSP Planners 2005

Recent Housing Approvals

Since the start of 2001 there has been a major increase in the number of dwelling approvals. Growth in this period is comparable to the historically highest growth period 1986-1991 however because of declining occupancy rates the actual increase in population is expected to be lower. The pattern of dwelling approvals across the City also indicates that Nowra Bomaderry is increasing its share of the City's growth.

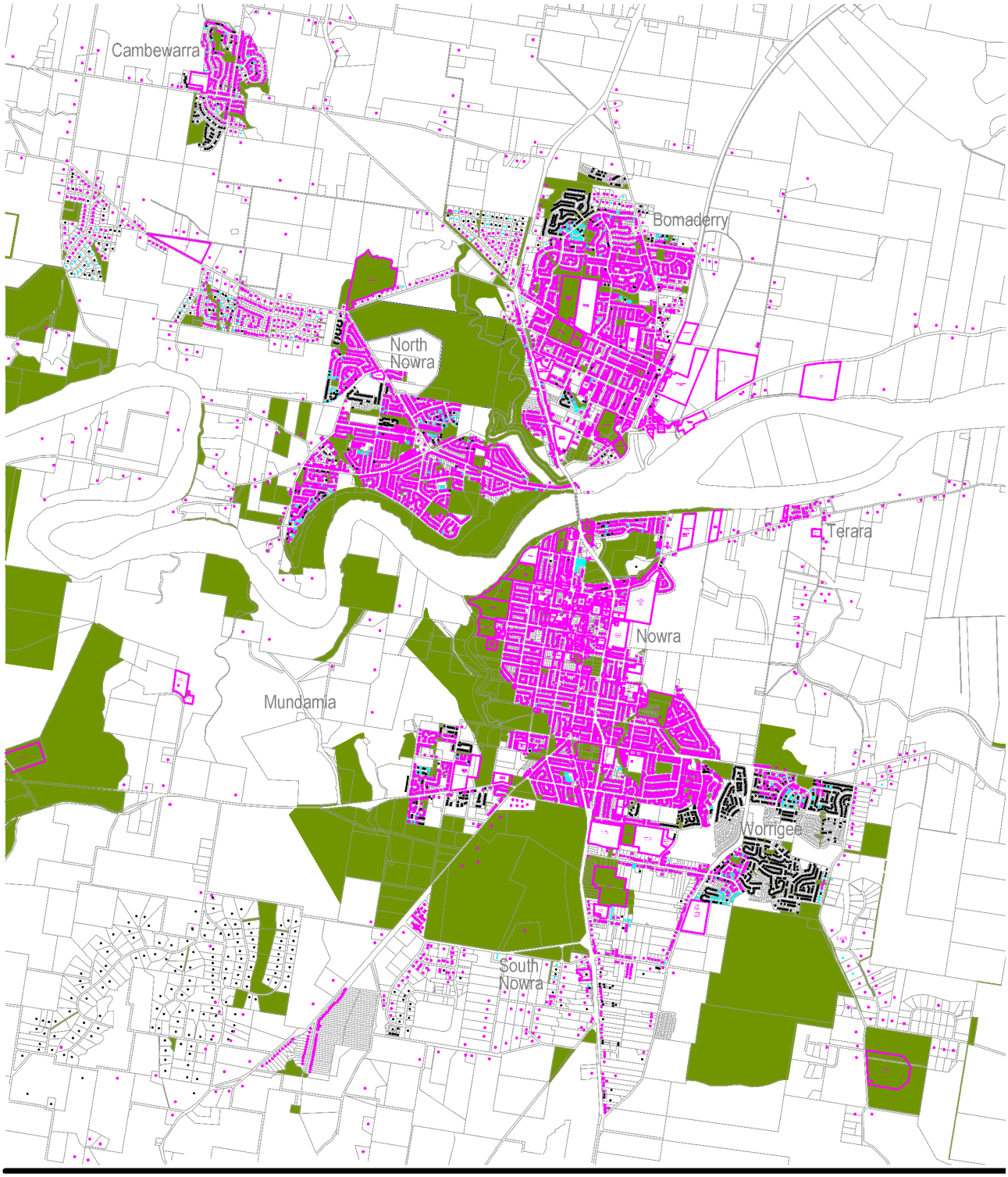
Distribution of Growth

The distribution of Nowra Bomaderry's population has experienced a steady increase in the proportion living to the north of the Shoalhaven River. In 1971 the north-south ratio was 41% : 59%. By 2001 this ratio had changed to 55%: 45% (Table 2.4). Recent house approval data indicates that the north-south share is swinging back to south of the river, particularly as a result of development in the Worrigee area. The extent of development between 1994 and 2004 is shown on Map 2.1.

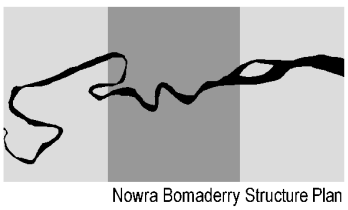
Table 2.4: **Population Distribution: North & South of River**

Area	1976	1981	1986	1991	1996	2001
North of River	7613	9621	11273	13408	15210	15592
South of River	10771	11561	10904	11940	12076	12976
Total Nowra Bomaderry	18384	21182	22177	25348	27286	28568

Source: ABS Census: 1976, 1981, 1986, 1991, 1996, 2001.



Recent Development 1994 - 2004



Nowra Bomaderry Structure Plan

Legend

- 1994 Landuse
- 1996 Landuse
- 2004 Landuse
- Open Space, Nature Reserves and National Park

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Map 2.1

2.2 SOCIO-ECONOMIC TRENDS

There are a number of socio-economic trends that are affecting and will continue to influence the supply and demand for urban facilities and services. The key trends relevant to Shoalhaven, and more particularly Nowra Bomaderry, include:

Demographic Trends

- Continuing but slowing population growth.
- General aging of the population.
- Increasing concentration of population and economic activity.
- Continuing polarisation between affluence and relative poverty.
- Increasing cultural diversity and sophistication.
- Rising education levels.
- Increasing interest in and responsibility for the standard of personal health.

Social Trends

- Recognition and acceptance of the personal rights and needs of all members of the community and in particular, of the rights and needs of women, the aged, people with disabilities and other specific interest groups.
- Changing social values and the reduced importance of community and the parallel re-emphasis on the importance of the family as a social unit.
- Introduction of equal opportunity initiatives (although at a slower rate than in past decades).

Socio-Economic Trends

- Changes in work structures and associated working hours.
- Changing retailing and trading hours.
- Continuing emphasis on deregulation and the user-pays principle.
- Greater individual responsibility for retirement funding.

Environmental Trends

- Recognition of the intrinsic rights of the natural environment and of the importance of the environment as an ecological, cultural, recreational, economic, educational and research resource. and
- Changes in the cost, form and density of housing and associated residential environments.

Technological Trends

- Changes and progress in the field of telecommunications.
- Changes in infrastructure/utilities provision.
- Changes in industrial production technologies.
- Changes in logistic techniques.

2.3 POPULATION PROJECTIONS

The population of Nowra Bomaderry has been projected using a 'cohort component model' which estimates future population on the basis of three components:

- Birth rate: children expected to be born in the area over a five year period.
- Survival rate: number of people who are expected to survive in the area over a five year period. and
- Net migration: the net result of inflows and outflows of people into the area.

The dynamics of these components and the resulting population projections are detailed in Appendix B.

Table 2.5: **Nowra Bomaderry Population Projection by Age Group**

Age	2001	2006	2011	2016	2021	2026	2031	2036
0-4	2269	2247	2491	2892	3227	3438	3565	3752
5-9	2519	2200	2218	2482	2903	3258	3469	3595
10-14	2505	2486	2209	2248	2531	2973	3328	3538
15-19	2250	2418	2702	2594	2619	2989	3430	3783
20-24	1678	2135	2472	2915	2817	2852	3220	3659
25-29	1753	1742	2351	2858	3308	3236	3270	3636
30-34	1898	1668	1686	2307	2821	3289	3216	3250
35-39	2089	1811	1624	1664	2291	2836	3302	3230
40-44	2322	2146	1942	1792	1808	2529	3070	3531
45-49	2039	2360	2270	2114	1943	2065	2780	3315
50-54	1848	2029	2431	2387	2204	2150	2271	2976
55-59	1442	1907	2120	2535	2484	2350	2297	2414
60-64	1244	1530	2011	2234	2645	2619	2490	2438
65-69	1224	1380	1672	2136	2345	2758	2733	2613
70-74	1162	1200	1344	1614	2035	2232	2609	2585
75+	1927	2424	2764	3095	3531	4162	4723	5394
Total	**30168**	**31681**	**34307**	**37866**	**41513**	**45736**	**49771**	**53710**

Source: Shoalhaven City Council (Ken Murray) 2005

Table 2.6: **Nowra Bomaderry Population Projection: Functional Age Groups** (No.)

Age Group	2001	2006	2011	2016	2021	2026	2031	2036
Young Dependent (0-14)	7293	6933	6918	7622	8661	9669	10362	10885
Working Age (15-64)	18562	19746	21609	23400	24940	26915	29346	32232
Elderly Dependent (65+)	4312	5004	5780	6845	7911	9152	10065	10592
Total	**30168**	**31683**	**34307**	**37867**	**41512**	**45736**	**49773**	**53709**

Table 2.7: **Nowra Bomaderry Population Projection: Functional Age Groups** (%)

Age Group	2001	2006	2011	2016	2021	2026	2031	2036
Young Dependent (0-14)	24.2	21.9	20.2	20.1	20.9	21.1	20.8	20.3
Working Age (15-64)	61.5	62.3	63.0	61.8	60.1	58.8	59.0	60.0
Elderly Dependent (65+)	14.3	15.8	16.8	18.1	19.1	20.0	20.2	19.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

On the basis of this projection (shown in Tables 2.5, 2.6 and 2.7 above), between 2001 and 2036 Nowra Bomaderry's population would have increased by 23,541, an increase of 78%. During this period:

- The 0-14 age group would have increased by 3,592 (+ 49 %)
- The 15-64 age group would have increased by 13,670 (+74%)
- The 65+ age group would have increased by 6,280 (+146%)

2.4 HOUSEHOLD FORMATION AND DWELLING DEMAND

2.4.1 Occupancy Rates

One of the major factors affecting the demand for dwellings, other than population increase, is the trend towards smaller household sizes. That is the number of persons in each household. In this context, a household is defined as 'a group of two or more related or unrelated people who usually reside in the same dwelling, who regard themselves as a household, and who make common provision for food or other essentials for living, or a person living in a dwelling who makes provision for his/her own food and other essentials for living, without combining with any other person' (Australia Bureau of Statistics 2001). Average dwelling occupancy in Nowra Bomaderry has declined from 3.32 in 1981 to 2.69 in 2001 (Table 2.8).

A significant reason for this is the increase of one person households. Lone person households have increased from 18% of total Shoalhaven households in 1986 to 25% in 2001.

Table 2.8: **Nowra Bomaderry Occupancy Rate Trends**

Indicator	1981	1986	1991	1996	2001
Population	19,201	20,715	25,437	27,137	28,325
Occupied Dwellings	5,773	7,222	8,713	9,818	10,520
Occupancy Rates	3.32	2.87	2.92	2.76	2.69

Source: ABS Census of Population & Housing: 1981, 1986, 1991, 1996 & 2001.

2.4.2 Vacancy Rates

The vacancy rates for Nowra Bomaderry as well as Area 1 have been characterised by significant inter-Censal fluctuations. Since the figures are too erratic to identify a clear trend, the most recent (2001) rate of 6.86 has been adopted for projection purposes (Table 2.9).

Table 2.9: **Nowra Bomaderry Vacancy Rate Trends**

Indicator	1981	1986	1991	1996	2001
Occupied Dwellings	5,773	7,222	8,713	9,818	10,520
Vacant Dwellings	348	470	783	870	775
Total Dwellings	6,121	7,692	9,496	10,688	11,295
Vacancy Rates	5.68	6.50	8.24	8.13	6.86

Source: ABS Census of Population & Housing: 1981, 1986, 1991, 1996 & 2001.

2.4.3 Dwelling Demand Projections

The future demand for dwellings in Nowra Bomaderry is a function of population growth modified by occupancy rates or household size (Table 2.10). Total dwellings in Nowra Bomaderry are projected to increase from 11,541 in 2001 to 25,515 by 2036, and occupied dwellings to increase from 10,745 in 2001 to 23,765 by 2036.

Table 2.10: **Population & Occupancy Rates**

Indicator	2001	2006	2011	2016	2021	2026	2031	2036
Population	30,168	31,681	34,307	37,866	41,513	45,736	49,771	53,710
Occupancy Rates	2.81	2.69	2.58	2.50	2.43	2.37	2.31	2.26
Occupied Total Dwellings	10,745	11,777	13,297	15,146	17,084	19,298	21,546	23,765
Vacancy Rates %	6.90	6.90	6.90	6.90	6.90	6.90	6.90	6.90
Total Dwellings	**11,541**	**12,645**	**14,276**	**16,262**	**18,342**	**20,719**	**23,133**	**25,515**

Source: Shoalhaven City Council 2005

2.4.4 Land Supply Issues

Another factor affecting the dwelling supply is the availability of land for urban development. This consideration involves two different factors at different stages of the development process.

Withholding Broadacre Land

The withholding of zoned broadacre land has, in recent times, been an issue in the Shoalhaven, particularly in the coastal villages where the major land bank is Crown Land, including Crown Land that is subject to Aboriginal land claims, many of which have been undetermined for a very long time. In addition there is uncertainty, if granted, whether the Aboriginal land owners wish to develop, bearing in mind the complex relationship with the land. Other Crown Land, although it might not be the subject to a claim under New South Wales legislation, still has Commonwealth based Native Title issues that may delay development.

Withholding Subdivided Land

Citywide surveys of non resident landowners conducted by Council in 1998 indicated the following:

- Some 80% of landowners held their vacant lots for 0-5 years while the remaining 20% held theirs for 21-30 years. Not surprisingly 80% of the lots were for sale and 20% were not.
- Only 40% of landowners purchased their land for development, whilst 60% acquired their land for investment purposes (rental investment 20%; other investment: 40%).

2.5 ECONOMIC TRENDS

As the economic hub of the Shoalhaven, Nowra Bomaderry is very much aligned to the overall economic health of the southern Illawarra. During the period 1996-2001 total employment in the Illawarra region grew by 9.1%, while employment in Australia as a whole grew by 8.7%. Employment in the Shoalhaven during this period grew by 13.1%, above both the National and regional average.

2.5.1 Employment Trends

The total employment in the Shoalhaven in 2001 was 31,146 compared with 28,634 in 1996. Leading industrial sectors comprise: retail trade (18.6%); health and community services (10.6%); manufacturing (10.2%); and construction on (9.8%). The proportion of employment in retail trade, health and community services, as well as property and business services grew while that of government administration and defence fell. Manufacturing, construction and agriculture on the other hand remained relatively stable over the period (Table 2.11).

Table 2.11: **Employment Trends: Shoalhaven 1991 > 2001**

	1991		1996		2001	
Industry Sector	No	%	No	%	No	%
Agriculture, forestry & fishing	890	4.3	960	4.0	880	3.3
Mining	67	0.3	63	0.3	61	0.2
Manufacturing	2234	10.8	2560	10.8	2751	10.2
Electricity, gas & water supply	259	1.3	303	1.3	199	0.7
Construction	2084	10.1	2224	9.3	2646	9.8
Wholesale trade	954	4.6	1017	4.3	925	3.4
Retail trade	3577	17.3	4122	17.3	5026	18.6
Accommodation, cafés & restaurants	1358	6.6	1734	7.3	2007	7.4
Transport & storage	618	3.0	718	3.0	858	3.2
Communication services	354	1.7	370	1.6	330	1.2
Finance & insurance	596	2.9	535	2.2	516	1.9
Property & business services	1231	5.9	1738	7.3	2257	8.4
Government administration & defence	2484	12.0	2115	8.9	2088	7.7
Education	1327	6.4	1668	7.0	1975	7.3
Health & community services	1740	8.4	2385	10.0	2862	10.6
Cultural & recreational services	300	1.4	442	1.9	593	2.2
Personal & other services	646	3.1	858	3.6	1047	3.9
Non-classifiable economic units	30		264		120	
Not stated	1320		423		563	
Total	**22069**		**24499**		**27704**	
Total (excluding NEC/NS)	**20719**	**100.0**	**23812**	**100.0**	**27021**	**100.0**
Total in labour force	**26383**		**28634**		**31146**	

Source: Australian Bureau of Statistics: Census of Population & Housing 2001

Participation Rates

The current average participation rate for the Shoalhaven is 47.8%. This is low compared with the Illawarra/ South Coast region and NSW (Table 2.12).

Table 2.12: **Labour Force Participation Rates: Shoalhaven 1991 > 2001**

Location	1991			2001		
	Male %	Female %	Total %	Male %	Female %	Total %
Shoalhaven	62.1	39.2	50.5	54.7	41.3	47.8
Illawarra South Coast region	69.2	43.9	56.5	61.3	45.8	53.4
Sydney Statistical Division	73.0	52.6	62.6	69.2	54.0	61.4
New South Wales	71.7	50.0	60.7	67.1	51.8	59.3

Source: Australian Bureau of Statistics: Census of Population & Housing 2001

2.5.2 Location Quotients

IRIS Research has used location quotients to indicate the degree of regional specialisation in the Shoalhaven's industrial structure. Location quotients show whether there is a disproportionately large or small employment in a regional industry. They are calculated as a proportion of the total regional employment in an industrial sector divided by the proportion of total national employment in that sector. A location quotient greater than one indicates a relative specialisation within a region in that industry. It can be used to identify economic base and comparative advantage industries in a regional area.

A time series analysis of the Shoalhaven's location quotients from 1991 to 2001 indicates the following trends as summarised in Table 2.13:

- Although the government administration and defence sector accounts for the highest location quotient, its relative importance in Shoalhaven's industrial structure has been subject to a consistent downward trend since 1991.
- The Shoalhaven's specialisation in accommodation, cafés and restaurants (hospitality), which remained stable for most of the period, has marginally declined towards the end of the period.
- The regional specialisation in construction has remained stable after a marginal decline in the middle of the period.
- The positioning of Shoalhaven's retail trade has remained constant during the period, with employment growth mirroring population expansion within the LGA.
- The health and community services sector exhibited steady expansion over the period and is becoming an important factor influencing overall employment growth in the Shoalhaven.
- The relative importance of personal and other services grew steadily between 1991 and 2001.
- Education together with cultural and recreational services grew steadily over the period.
- The degree of regional specialisation in the agriculture, forestry and fishing industry improved between 1991 and 1996 but declined sharply by 2001.
- The location quotient for manufacturing increased marginally between 1991 and 1996 and has remained steady since. However, Shoalhaven's manufacturing employment has remained well below both the regional and national average despite a significant competitive advantage effect on employment growth.
- The location quotient for communication services continued to decline over the 1991-2001 period. Much of this loss can be attributed to the relocation of Telstra's engineering and design workshop to Wollongong.
- The relative importance of the transport and storage sector continued to grow during the period, but remained well below the national average.

- The relative significance of the mining sector was very low, reflecting the shortage of exploitable mineral resources in the Shoalhaven.
- The location quotients for other industries remained relatively stable during the review period. It indicates a relative undersupply of finance, insurance, property and business services as well as the wholesale trade sector. This is a reflection of the relative small size of Shoalhaven's urban centres.

Table 2.13: **Industry Location Quotients: Shoalhaven 1991 > 2001**

Industry Sector	1991	1996	2001	Comment
Agriculture, forestry & fishing	0.8915	0.9226	0.7968	Declining sector
Mining	0.2495	0.2279	0.2430	Minor sector in relative decline
Manufacturing	0.7934	0.8267	0.8157	Relatively stable sector
Electricity, gas & water supply	0.9111	1.6090	0.9920	Declining sector
Construction	1.5896	1.4320	1.4188	Significant sector in decline
Wholesale trade	0.7271	0.7099	0.6338	Declining sector
Retail trade	1.2251	1.2394	1.2428	Growing significant sector
Accommodation, cafés & restaurants	1.5319	1.5213	1.4641	Significant sector in relative decline
Transport & storage	0.6182	0.6739	0.7196	Growing sector
Communication services	0.9696	0.7678	0.6657	Declining sector
Finance & insurance	0.6093	0.5624	0.4947	Minor sector in relative decline
Property & business services	0.7609	0.7221	0.7352	Relatively stable minor sector
Government administration & defence	1.9878	1.7674	1.6909	Significant sector in relative decline
Education	0.9035	0.9627	0.9936	Growing sector
Health & community services	0.9398	1.0251	1.0633	Growing sector
Cultural & recreational services	0.7636	0.7694	0.8773	Growing sector
Personal & other services	0.8845	0.9623	1.0440	Growing sector

Source: Adapted from IRIS Research 2005

2.5.3 Shift-Share Analysis

Shift-share analysis has been used by IRIS Research to isolate any significant regional influence on employment change within Shoalhaven's industrial sectors. According to this analysis, the regional change in employment in each industry (Table 2.14) is a function of three elements:

- **Share:** National growth effect, is part of the change in the region's total employment ascribed to the rate of employment growth in the nation as a whole. Between 1996 and 2001, Australia's total employment grew by 8.7%, thus employment in each of the Shoalhaven's industrial sectors could be expected to grow at that rate. In this way the hospitality sector has gained an additional 150 jobs as a reflection of national growth.

- **Mix:** An industry mix effect, which is the amount of change the region would have experienced had each of its industrial sectors grown at their national rate, less the national growth effect. The 'mix' component is negative if employment in that sector declined nationally over the review period. Accordingly, 120 jobs were created in the hospitality sector as a result of a favourable industry mix in the Shoalhaven.

- **Competitive:** A competitive effect, is the difference between the actual change in employment and the employment change to be expected if each sector grew at the national rate. A positive competitive component identified by this analysis indicates that the region has a competitive advantage in that sector. Thus the hospitality sector has derived an additional three jobs as a result of the Shoalhaven economy's competitive edge.

Growth Sectors

The Shoalhaven has a positive regional competitive impact on a number of industrial sectors, as listed below:

- Personal and other services
- Transport and storage
- Cultural and recreational services
- Education
- Health and community services
- Manufacturing

A significant part of the employment growth in the Shoalhaven has been a result of the attraction of the region and to in-migration of both retirees and families due to lifestyle factors. However, the two base sectors (transport/storage and manufacturing) have expanded as a result of local competitive advantage.

Table 2.14: **Shift-Share Analysis: Shoalhaven 1991 > 2001**

Industry Sector	Share	Mix	Competitive	Change
Agriculture, forestry & fishing	83.3	-64.2	-99.1	-80.0
Mining	5.5	-13.6	6.1	-2.0
Manufacturing	222.0	-102.3	71.2	191.0
Electricity, gas & water supply	26.3	-16.0	-112.3	-102.0
Construction	192.9	149.4	79.7	422.0
Wholesale trade	8.2	-109.6	-70.6	-92.0
Retail trade	357.5	337.1	209.4	904.0
Accommodation, cafés & restaurants (hospitality)	150.4	119.5	3.1	273.0
Transport & storage	62.3	-10.8	85.5	137.0
Communication services	32.2	-36.4	-36.8	-41.0
Finance & insurance	46.4	-17.6	-47.8	-19.0
Property & business services	150.7	243.4	126.8	521.0
Government administration & defence	183.4	-203.7	-6.8	-27.0
Education	144.7	26.2	136.1	307.0
Health & community services	206.8	59.5	210.6	477.0
Cultural & recreational services	38.3	19.4	93.2	151.0
Personal & other services	74.4	-4.2	119.8	190.0

Source: Adapted from IRIS Research 2005

Weaker Sectors

- Agriculture
- Electricity gas and water supply
- Communication services
- Wholesale trade
- Government administration and defence

Negative regional effects on employment growth accounted for a significant proportion of the overall decline in these industries exhibiting a low or negative employment growth. Employment in the Shoalhaven's dairy, electricity, communications and government administration sectors was to some extent, affected by restructuring, caused by changes in competitive policy and deregulation. The decline in the wholesale trade may be attributable to increased competition from Kiama and Shellharbour.

Size of Enterprise

The Shoalhaven is characterised by small to medium sized enterprises, with almost 90% having less than 10 employees. The smaller enterprise is predominate in the services to industry and business services groups (Table 2.15).

Table 2.15: **Size of Business Enterprise (Employees): Shoalhaven**

Industry Group	<5	5-9	10-19	20-49	50-99	100+	Total
Production Industry	93 48.4%	48 25.0%	28 14.6%	15 7.8%	5 2.6%	3 1.6%	192 100.0%
Services to Industry	679 81.2%	114 13.6%	31 3.7%	10 1.2%	2 0.2%	0 0.0%	836 100.0%
Business Services	460 77.8%	99 16.8%	20 3.4%	11 1.9%	0 0.0%	1 0.2%	591 100.0%
Services to Consumers	903 70.1%	243 18.9%	87 6.7%	39 3.0%	13 1.0%	4 0.3%	1289 100.0%
Community Services	227 61.2%	64 17.3%	33 8.9%	25 6.7%	17 4.6%	5 1.3%	371 100.0%
Total	**2362 72.0%**	**568 17.3%**	**199 6.1%**	**100 3.1%**	**37 1.1%**	**13 0.4%**	**3279 100.0%**

Source: Australian Bureau of Statistics Business Register (1998) & DIPNR (2005)

2.5.4 Projected Employment Growth

Employment in the Shoalhaven is projected to grow from 25,085 in 2001 to 39,512 by 2036. It is anticipated that a significant part of this growth will occur in Nowra Bomaderry. Thus employment in Nowra Bomaderry is projected to increase from 10,659 in 2001 to 20,145 by 2036 (Table 2.16).

Table 2.16: **Projected Employment Growth: Shoalhaven & Nowra Bomaderry 2001>2036**

	2001	2006	2011	2016	2021	2026	2031	2036
Shoalhaven:								
Population	52,260	57,650	61,700	64,443	67,056	69,699	73,638	79,024
Participation Rate	0.48	0.49	0.50	0.50	0.50	0.50	0.50	0.50
Employment	25,085	28,249	30,850	32,222	33,528	34,850	36,819	39,512
Nowra Bomaderry:								
Population	18562	19743.83	21609	23400	24941	26915	29344	32232
Participation Rate	0.57	0.63	0.63	0.63	0.62	0.63	0.62	0.63
Employment	10659	12340	13506	14625	15588	16822	18340	20145

Source: Shoalhaven City Council 2005

The level of employment (full-time equivalent) is projected to increase from 17,418 in 2001 to 23,528 in 2036 (Table 2.17). It should be noted that this employment dataset has been collected for landuse transport modelling purposes and is based on full-time equivalent employees at work on an average weekday. As such these figures tend to be conservative and since they have an urban centre bias they tend to under-represent the primary sector.

Table 2.17: **Projected Employment Growth: Shoalhaven 2001>2036**

Shoalhaven	2001	2006	2011	2016	2021	2026	2031	2036
Production Industry	1993	2210	2342	2404	2438	2449	2506	2588
Services to Industry	1977	2193	2197	2103	1933	1781	1708	1765
Business Services	1156	1282	1389	1460	1516	1559	1595	1647
Services to Consumer	5930	6577	7150	7512	7688	7794	7973	8235
Community Services	6362	7056	7647	7985	8391	8685	8998	9294
Total	**17418**	**19319**	**20725**	**21464**	**21967**	**22268**	**22779**	**23528**

Source: Shoalhaven City Council 2005

In preparing these forecasts it has been assumed that the employment role of Nowra Bomaderry would be further enhanced with the sub-regional centre in the future gaining a far greater share of the Shoalhaven's economic activity (Table 2.18). This is based on the availability of industrial and commercial land within the Nowra Bomaderry area; the need to achieve economies of scale in relation to support infrastructure and inter-enterprise synergies.

Table 2.18: **Projected Employment Growth: Nowra Bomaderry 2001>2036**

Nowra Bomaderry	2001	2006	2011	2016	2021	2026	2031	2036
Production Industry	1794	1985	2208	2388	2553	2687	2907	3127
Services to Industry	1599	1759	1957	2116	2263	2382	2577	2771
Business Services	713	800	890	962	1029	1083	1171	1260
Services to Consumer	4447	5000	5562	6014	6431	6768	7323	7876
Community Services	4029	4489	4994	5400	5774	6076	6575	7071
Total	**12582**	**14033**	**15611**	**16880**	**18050**	**18996**	**20553**	**22105**

Source: Shoalhaven City Council 2005

2.5.5 Conclusion

The Shoalhaven continues to experience above average employment growth, resulting from both population expansion and favourable developments in its economic base secondary industries. In part, this growth results from the life-style attractions of the region for retirees. However, other regional advantages, including the availability of residential and industrial land and a supportive business environment are also relevant factors.

The major sectors exhibiting employment growth in the Shoalhaven, including cultural and recreational services; retail; health and community services; construction and education were associated with population growth. Other significant economic base sectors are defence, hospitality, commercial fishing, as well as wood and paper manufacturing.

Based upon population projections as well as industrial and commercial land, it is predicted that there will be healthy employment growth in several sectors.

3. NATURAL ENVIRONMENT

The natural environment provides the physical setting for the collection of settlements that straddle the Shoalhaven River at its lowest bridging point. This chapter addresses Nowra Bomaderry's climatic conditions; landform, geology and soils; agricultural landscapes; water quality; the various plant communities that provide the area's biodiversity; and concludes by highlighting key conservation issues.

3.1 NATURAL LANDSCAPE

3.1.1 Climate

The climate of the Shoalhaven is best described as coastal temperate and is characterised by warm summers and mild winters.

Temperature: The mean daily maximum for the month of January is 25.8˚C and the mean daily minimum for the month of January is 16.2˚C. The mean daily maximum for the month of July is 15.8˚C and the mean daily minimum for the month of July is 6.2˚C.

Rainfall: The median rainfall for individual months ranges between 37.6mm in August and 88.4mm in January. The annual average rainfall is 1,142.1mm. Heavy or protracted falls of rain in the area seriously erode exposed soils and there are significant areas of soil in Nowra Bomaderry, which are particularly susceptible to erosion if left bare of vegetation cover.

Wind: During the spring and summer months the prevailing winds are easterlies in the afternoon. In the autumn and winter months this pattern changes to westerly and north westerly prevailing winds which are generally strongest in the morning.

3.1.2 Air Quality

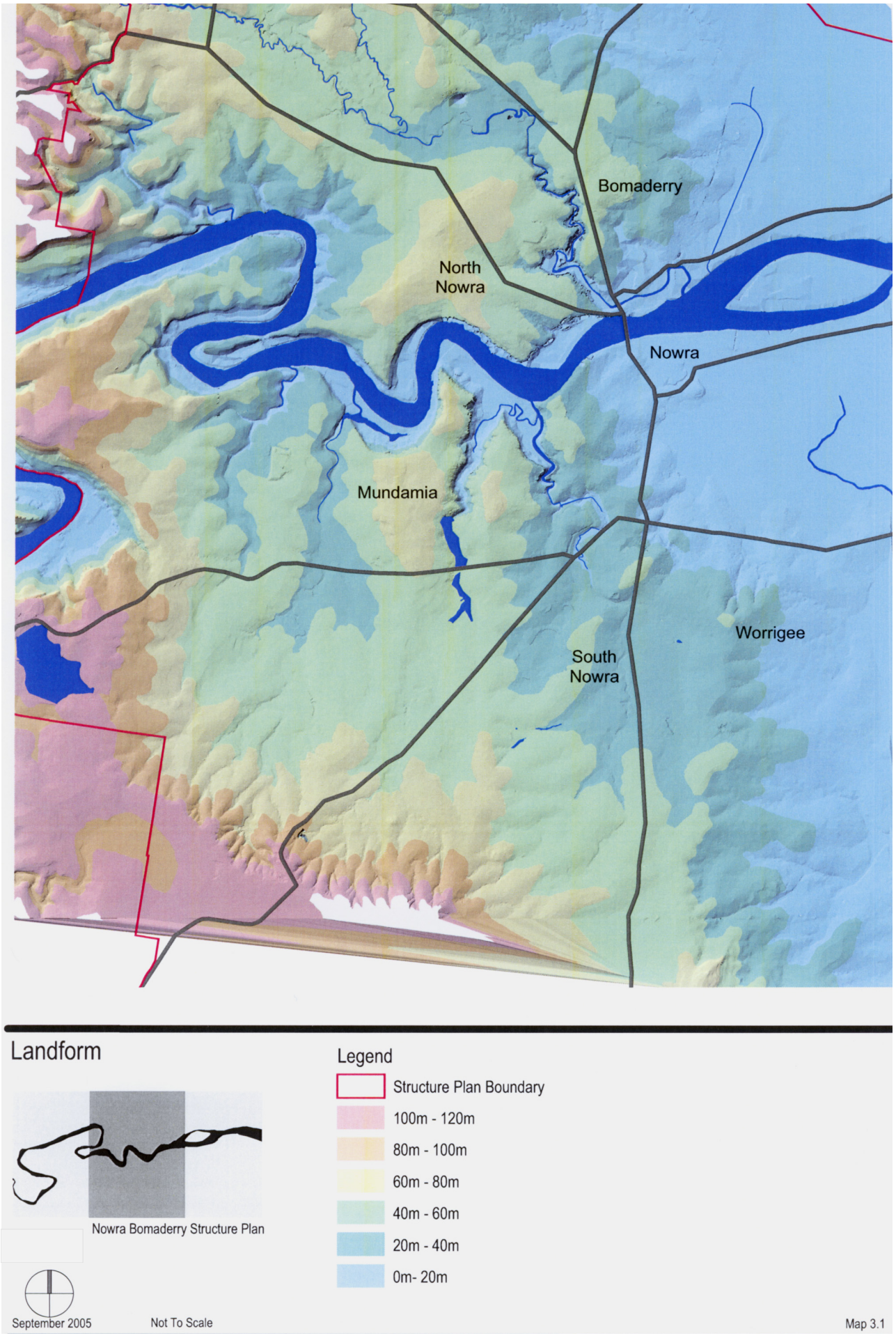
The results from the monitoring station to date indicate that the air quality in the Shoalhaven is of an excellent quality, well above both current and proposed standards. However, occasional unpleasant odours can be a concern, particularly in the Bomaderry area. To put this issue into perspective, odour complaints only constitute 7% of environmental complaints received for the Shoalhaven.

3.1.3 Landform

Located at the southern end of the Sydney Basin, the urban areas of Nowra and Bomaderry have developed on the western edge of the Shoalhaven coastal flood plain. The significant topographical features of the Nowra Bomaderry structure plan area include:

- Cambewarra Escarpment, which in turn forms part of the Illawarra Escarpment.
- Coolangatta Mountain to the east of Bomaderry.
- Nowra Hill to the south of Nowra.
- The Shoalhaven gorge, which has been incised by the Shoalhaven River and extends westwards from the Shoalhaven bridge for approximately 15 kilometres.
- Secondary waterways including: Nowra and Bomaderry Creeks, which have both incised to a sandstone formation creating secondary topographical features.

The overall landform of the Nowra Bomaderry area is shown in Map 3.1.


Bomaderry
North Nowra
Nowra
Mundamia
Worrigee
South Nowra
Landform
Nowra Bomaderry Structure Plan
Legend
Structure Plan Boundary
100m - 120m
80m - 100m
60m - 80m
40m - 60m
20m - 40m
0m- 20m
September 2005
Not To Scale
Map 3.1

Geology

To the north and south, Nowra Bomaderry is underlain by Permian Berry Siltstone. The older Permian Nowra Sandstone is found under the township of Nowra to the west. There are outcrops of Permian Wandrawandian Siltstone which underlie a section of the Shoalhaven River west of Nowra while in the east (including Bomaderry) more recent quaternary alluvium, gravel and swamp deposits are found.

Nowra Sandstone supports landforms where broad bedrock outcrops are common and there are many entrenched streams with low cliff lines. High cliffs are a feature along the Shoalhaven River and some of the larger side creeks have small gorges, for instance: Bomaderry Creek.

Soils

The soils of Nowra Bomaderry consist of, in order of abundance, the Nowra, Shoalhaven, Pulpit Rock and Disturbed Terrain soil landscapes.

Nowra Soil Landscape: Found on moderately to gently undulating rises to undulating low hills on sandstone within the Coastal Plain. Examples include Bomaderry and Falls Creek areas extending south and east of the of Nowra township. The soil is founded on Nowra Sandstone - medium to coarse-grained quartz sandstones which contain rounded pebbles scattered throughout the beds. Moderately deep (50-100cm) Brown Podzolic Soils occur on crests and upper slopes. Soloths and/or Yellow Earths occur midslope. Yellow Podzolic Soils occur on lower slopes and drainage lines. Limitations include run-on, rock outcrop (localised), stoniness, hardsetting, sodicity, low permeability and low wet bearing strength (subsoil). Fertility is generally low to moderate and topsoils are generally hardsetting. The soils are often moderately deep, stony, strongly to moderately acid with generally low cation exchange capacity (CEC). Existing erosion includes moderate rill type on batters. The erodibility of the topsoil is generally low, but for the subsoils is high. Erosion hazard for non-concentrated flows is moderate to high. The calculated soil loss for the first twelve months of urban development ranges up to 20 tonnes/hectare for topsoils and 60 y/ha for exposed subsoils. The erosion hazard for concentrated flows is low to moderate. The soil materials are generally stable, therefore surface movement potential is low. The Nowra Soil landscape has generally low limitations for urban development and low to moderate limitations for regular cultivation and grazing.

Shoalhaven Soil Landscape: The Shoalhaven soil landscape is located on level to gently undulating present river bed and banks, active floodplain with small levees, minor depressions, backwater swamps on the Coastal Plain and flat to gently undulating terrace surfaces of the Shoalhaven River. The geology is alluvium - gravel, sand, silt and clay derived mainly from sandstone and shale overlying buried estuarine sediments. Moderately deep (50-100cm) Prairie soils occur on levees, Red Earths and Yellow and Red Podzolic Soils occur on terraces and Alluvial Soils and Gleyed Podzolic (potential Acid Sulphate) Soils occur on the floodplain. Limitations include flood hazard, seasonal water logging, permanently high watertable, hardsetting, acid sulphate potential (subsoil), strongly acid and sodicity. Land use is predominantly grazing on improved pastures. Recreation areas include the Nowra Golf Course. General fertility is moderate to low. The soils on the upper terraces are moderately structured and better drained than those of the lower terraces. Soil materials are strongly acid with moderate CEC. The presence of acid sulphate soils when exposed would prevent plant growth. The floodplain is subject to scour or sheet and rill erosion during floods and may be covered by varying depths of alluvial materials as the water recedes. Minor streambank erosion is widespread. Erodibility of the topsoil is low while the erodibility of the subsoil is high. Erosion hazard for non-concentrated flows is slight. The calculated soil loss for the first 12 months of development ranges up to 10 t/ha for both topsoils and exposed subsoils. The erosion hazard for concentrated flows is low. There are generally high to severe limitations for urban development and low to moderate limitations for regular cultivation and grazing. However high to severe limitations exist for cultivation and grazing in flood-prone areas. Draining may result in highly acid soils.

Pulpit Rock Soil Landscape: The Pulpit Rock soil landscape is located on convex weathered rugged sandstone cliffs and concave weathered pinnacles with talus slopes on Nowra Sandstone within the Coastal Plain. The geology is Nowra Sandstone - medium to course-grained quartzose sandstones containing rounded pebbles of scattered quartz throughout the beds. Soil is often discontinuous. Lithosols occur on crests, midslopes and lower slopes. Moderate to deep (100 - >150cm) Yellow Podzolic Soils occur on midslopes and lower slopes. Limitations include steep slopes, mass movement hazard, rock fall hazard, rock outcrop, water erosion hazard, shallow soils, stoniness, hardsetting and low available water holding capacity. Land use is generally recreational areas, walking trails and undisturbed bushland. General fertility is low. The topsoil is hardsetting, the subsoils are often shallow and stony, strongly to moderately acid with a low CEC.

Existing erosion includes common rock falls on scree slopes, minor rill erosion and moderate slumping on batters. All the soil materials have very low erodibility ratings. Erosion hazard for non-concentrated flows is extreme.

The calculated soil loss for the first twelve months of urban development ranges up to 500 t/ha for topsoils and 750 t/ha for exposed subsoils. The erosion hazard for concentrated flows is low to moderate. There are generally high to severe limitations for urban development, regular cultivation and grazing.

Agricultural Land

The majority of Nowra Bomaderry's land area comes within the definition of NSW Agriculture Classes 1-5. These are defined as:

1. Arable land suitable for intensive cultivation where constraints to sustained high levels of agricultural production are minor or absent.
2. Arable land suitable for regular cultivation for crops but not suited to continuous cultivation. It has moderate to high suitability for agriculture, but edaphic (soil factors) or environmental constraints reduce the overall level of production and may limit the cropping phase to a rotation with sown pastures.
3. Grazing land or land well suited to pasture improvement. It may be cultivated or cropped in rotation with pasture. The overall production level is moderate because of edaphic or environmental constraints. Erosion hazard, soil structural breakdown and other factors including climate may limit the capacity for cultivation; and soil conservation or drainage works may be required.
4. Land suitable for grazing but not for cultivation. Agriculture is based on native pastures or improved pastures established using minimum tillage techniques. Production may be seasonally high but the overall production level is low as a result of major environmental constraints.
5. Land unsuitable for agriculture or at best suited only to light grazing. Agricultural production is very low to zero as a result of severe constraints, including economic factors, which preclude land improvement.

In addition, the following land classes also occur in Nowra Bomaderry: 7 (State Forest); 8 (Water); 9 (Urban); and 14 (Commonwealth Territory) (Table 3.1).

Table 3.1: **Agricultural Land Classification: Nowra Bomaderry**

Agricultural Land Class	Area (ha)	% Nowra Bomaderry
1: Arable land suitable for intensive cultivation:	248	1%
2: Arable land suitable for regular cultivation for crops:	1166	4%
3: Grazing land or land well suited to pasture improvement:	5664	21%
4: Land suitable for grazing but not for cultivation:	6409	24%
5: Land unsuitable for agriculture or at best suitable for light grazing:	8959	33%
7: State Forest:	2640	10%
8: Water:	859	3%
9: Urban:	619	2%
14: Commonwealth Territory:	421	2%
Total:	**26985**	**100%**

Source: NSW Agriculture 2005

Agricultural land classes 1, 2 and 3 constitute 'prime crop and pasture land' under the Illawarra REP. One of the objectives of the Illawarra REP is 'to retain the productive capacity of prime crop and pasture lands'. As Table 3.1 demonstrates, prime crop and pasture is limited to 26% of the area, a large proportion of which is located on the floodplain. Prime crop and pasture is considered to be a significant constraint on urban development. Accordingly these agricultural land classes are included in Chapter 8: Development Constraints (Maps 8.7 and 8.8). The majority of the Nowra Bomaderry area (57%) comes within the definition of Classes 4 and 5, land generally suitable for grazing.

3.1.4 Water Quality

Water is the prime agent that has shaped the landscape and is essential to all forms of life. Urbanisation has significant effects on the quality and balance of the hydrological cycle. Thus water quality is both a convenient measure of the health of the area and a key indicator of ESD when contemplating urban development.

Water quality sampling was undertaken on streams that may be impacted by potential urban development. An analysis of the sampling indicated a range of stream water quality. The creeks sampled are usually intermittent water courses with a chain of permanent ponds. Bomaderry Creek is possibly the only creek sampled that would maintain a consistent flow during dry periods. Generally, areas associated with unsewered residential development and high intensity agricultural activities scored negatively against the key indicators of water quality. The sampling analysis indicates that Bengalee Creek, in particular, performs poorly against these indicators, with high levels of faecal pollution and nutrients (nitrogen and phosphorous), coupled with very low levels of dissolved oxygen. The results of the water quality analysis are summarised in Table 3.2 and the location of the sampling sites (1-16) is shown on Map 3.2. Further details of the water quality sampling analysis are contained in Appendix D.

Table 3.2: **Nowra Bomaderry Water Quality**

Area	Streams & Sample Sites	Key Findings
Cabbage Tree Lane/ Timber Ridge Area	Mundamia Creek (4) Cabbage Tree Creek (2,3,5) Flatrock Creek (1,6)	Cabbage Tree and Mundamia Creeks displayed discolouration due to high levels of sedimentation from rural residential development and other land uses in the catchment. The creeks are at the guideline limit for Total Nitrogen levels and display depleted dissolved oxygen levels.
Crams Road/Koloona Drive Area	Bengalee Creek (7,8,9) Unnamed Creek 1 (10) Unnamed Creek 2 (11,12)	These creeks display high faecal coliform levels, which may be due to the unsewered residential areas and agricultural activities in the catchment. The creeks have low dissolved oxygen levels and elevated Total Nitrogen levels, particularly Bengalee Creek.
Moss Vale Road Area	Bomaderry Creek (13) Abernethys Creek (14)	Bomaderry Creek (at the sampling site) exhibited elevated Total Phosphorous levels. Otherwise water quality appeared good. Abernethys Creek displayed high levels of Total Phosphorous and heavily depleted levels of dissolved oxygen. This is most likely due to the low flow regime of the creek and runoff from rural activities in the catchment.
Worrigee Road Area	Unnamed Creek 3 (15) Unnamed Creek 4 (16)	Unnamed Creek 3 (tributary to Brundee Swamp) displayed elevated Total Nitogen and Total Phosporous levels as well as heavily depleted levels of dissolved oxygen. Unnamed Creek 4 (outlet creek to the Crookhaven River) displayed good water quality and very high levels of dissolved oxygen. This is most likely due to the excessive amount of plant and macroalgae growth in the creek.

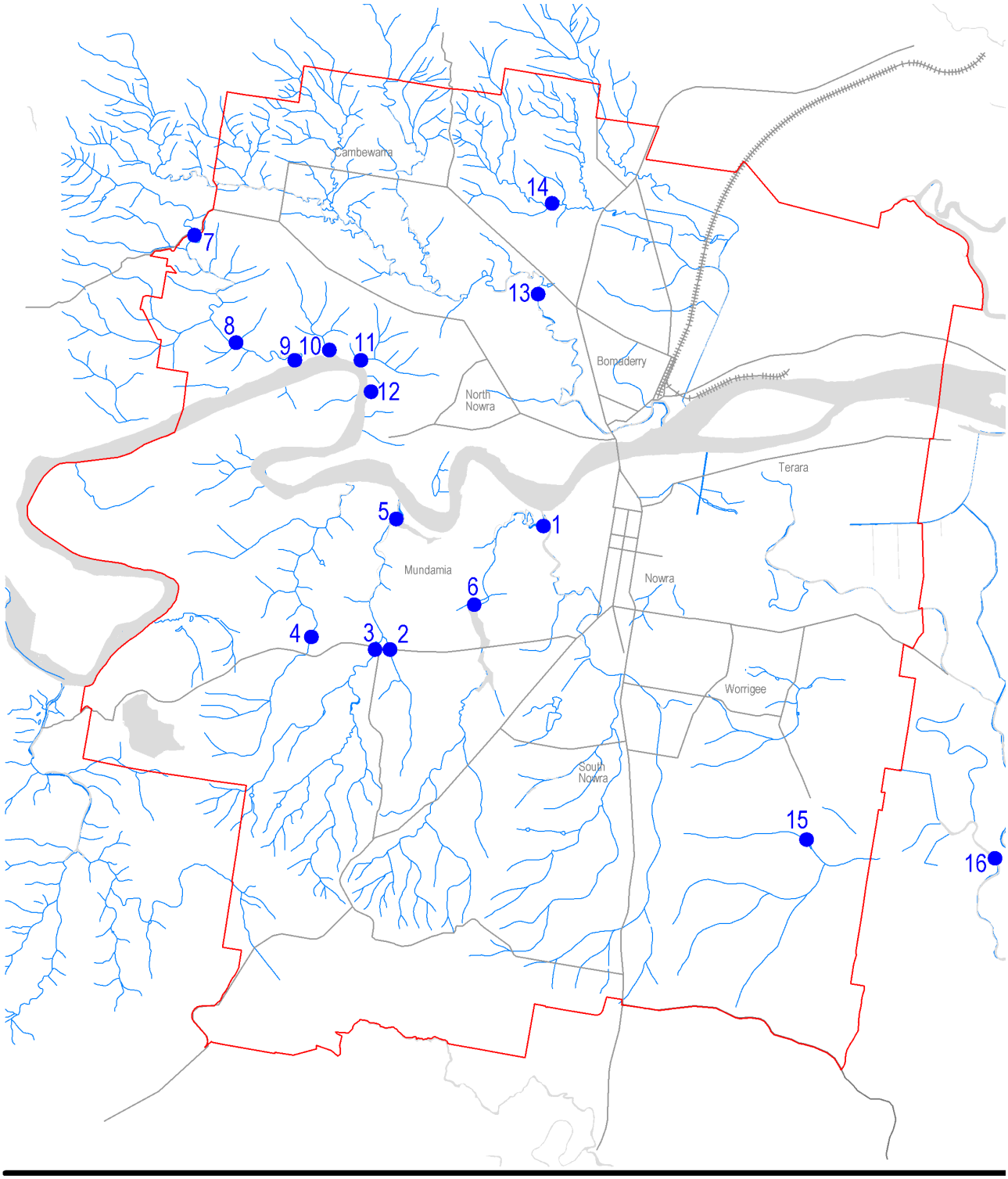
Source: Shoalhaven City Council 2005

Further sampling is required to identify if these sampling results are representative of the normal water quality in each of these creeks. Wet weather, or event based sampling with flow monitoring is also required to identify the relative input of each of these creeks to the water quality in the Shoalhaven River. It is anticipated that water quality monitoring would be an important feature of the on-going implementation of the structure plan.

3.2 BIODIVERSITY

3.2.1 Vegetation Communities

The Nowra Bomaderry structure plan covers a geographic area of approximately 18, 290 ha of which 16, 414 is land with the balance being water. Within the terrestrial area 8,173 ha of native vegetation or 50% remains uncleared. Twenty-four different vegetation communities have been identified as occurring in the Nowra Bomaderry area (Mills 1996) (Table 3.3). These vegetation communities are varied and include examples of rainforest, wetlands, shrublands, Paperbark, Casuarina and Eucalypt forest and woodland. The vegetation communities of the Nowra region are significant because they are in an overlap zone for the Sydney Basin flora and the South Coast flora (Mills 1996). While the same vegetation species are found elsewhere in the Shoalhaven, the particular community mixes in Nowra Bomaderry appear to be unique to the region.

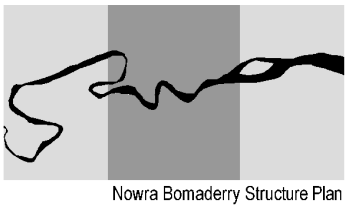


Drainage System and Water Quality

Legend

Structure Plan Boundary

Water Quality Sample Sites



Nowra Bomaderry Structure Plan

September 2005

0 1 2

Kilometres

Map 3.2

The most significant communities in terms of spatial extent comprise:

- Spotted Gum-Grey Ironbark Forest (29%)
- Scribbly Gum-Bloodwood Woodland/Open Woodland (17%)

Together these communities extend over 46% of the structure plan area. Map 3.3 shows native vegetation communities and Map 3.4 shows threatened flora and fauna communities.

Table 3.3: **Vegetation Communities in the Nowra Bomaderry Structure Plan Area**

Vegetation Community	Description	Area ha	Proportion %
1. ACM-WRF	Lily Pilly Warm Temperate Rainforest	2.56	0.03
2. CAS-CUN	River Oak Forest	22.96	0.28
3. CAS-GLA	Swamp Oak Forest	39.76	0.49
4. CER-WRF/BAC-WRF	Warm temperate Rainforest	18.33	0.22
5. JUN-FRH/ELE-SDG	Freshwater Wetlands	39.95	0.49
6 KUN-SHR	Kunzea Shrubland	18.07	0.22
7. MAC-LON	Spotted Gum – Woollybutt Forest	433.48	5.30
8. MAC-PAN	Spotted Gum – Grey Ironbark Forest	2378.31	**29.10**
9. MAC-PIL	Spotted Gum – Blackbutt Forest	784.14	9.60
10. MAC-SYN	Spotted Gum Tall Forest	21.10	0.26
11. MEL-ERI	Paperbark Shrubland (Fresh Swamp)	225.55	2.76
12. MEL-FOR	Paperbark Forest	70.05	0.86
13. MST-SRF	Moist Subtropical Rainforest	18.93	0.23
14. PIL-GUM	Blackbutt - Bloodwood Forest	141.85	1.74
15. PIL-PUN	Blackbutt Forest - Grey Gum	502.77	6.15
16. PUN-AGG	Grey Gum-Stringybark Woodland-Open Woodland	609.27	7.45
17. PUN-AGG/ SCL-CAS	Sandstone forest	21.92	0.27
18. ROB-MEL	Swamp Mahogany-Paperbark Forest	13.71	0.16
19. SAL-SYN	Blue Gum Tall Forest	805.10	9.90
20. EST-COM	Estuarine complex (Mangrove/Saltmarsh)	1.57	0.02
21. SCL-CAS	Scribbly Gum-Casuarina Forest	601.15	7.36
22. SCL-GUM	Scribbly Gum-Bloodwood Woodland/Open Woodland	1373.51	**16.80**
23. SST-SDG	Sedgeland/Shrubland	7.74	0.09
24. TER-ANG	Red Gum-Angophora Forest	21.15	0.26
	Total	**8172.93**	**100.00**

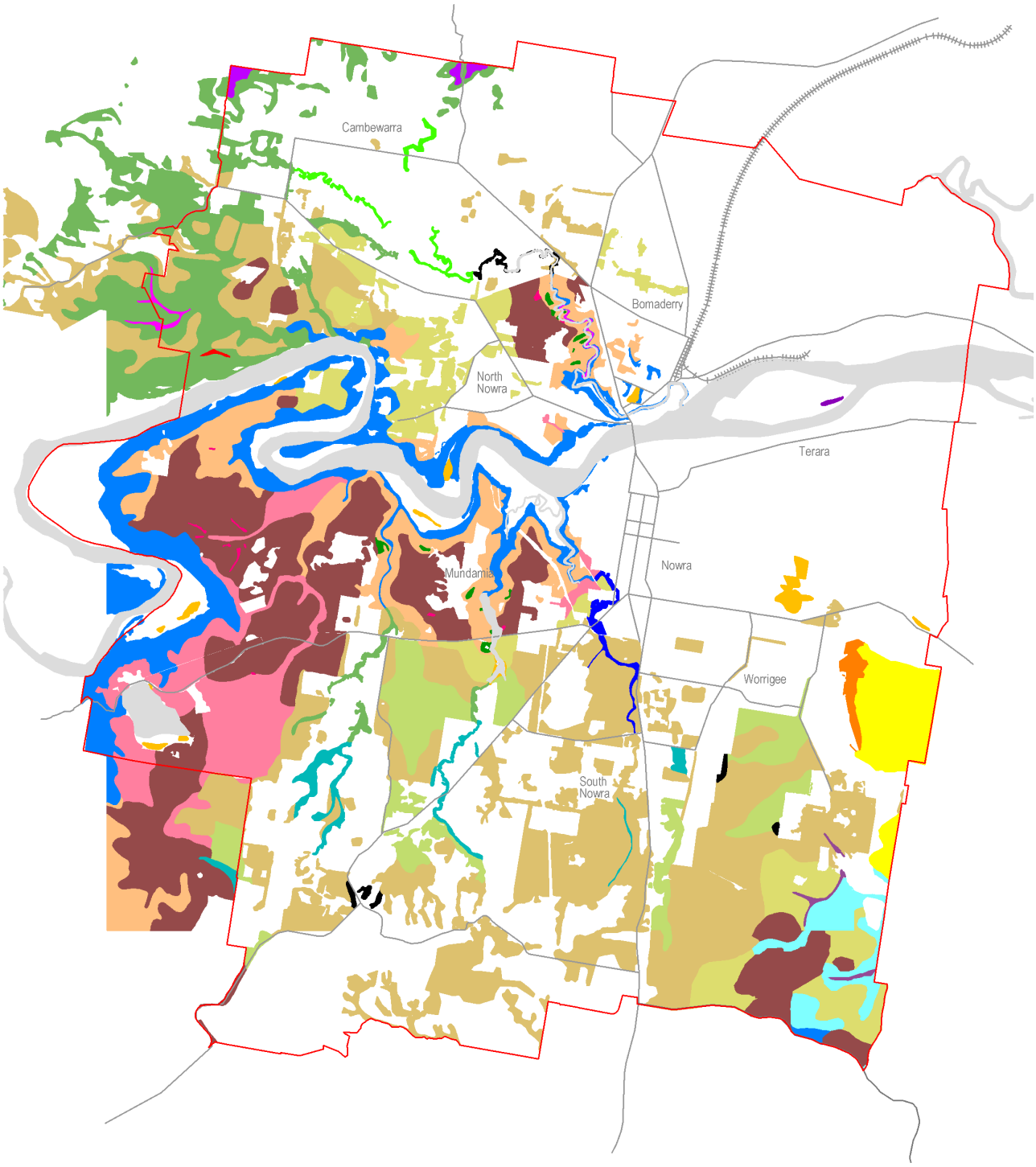
Source: Kevin Mills1996

The following discussion of vegetation communities has been taken from Mills, K. (1996) 'The Natural Vegetation of the Nowra Area: Vegetation Communities and Rare Plant Species'.

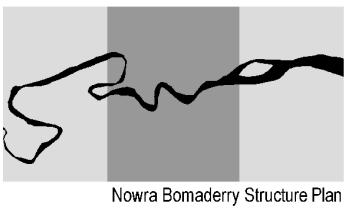
Communities on Shale Soils

The soils of the Berry Siltstone support mainly forest communities. These forests were once common around South Nowra and in the North Nowra to Cambewarra area, but most of them have now been cleared.

There is usually a clear demarcation between the shale communities, in which Spotted Gum *Eucalyptus maculata* is usually present, and the sandstone communities that contain species such as Scribbly Gum *Eucalyptus sclerophylla,* Red Bloodwood *Eucalyptus gummifera* and Grey Gum *Eucalyptus punctata.* Species rich heathland occurs on sandstone rather than on shale soils, where the understorey to the forests is dominated by grasses. The following are vegetation communities on the shale soils.



Native Vegetation Communities



Nowra Bomaderry Structure Plan

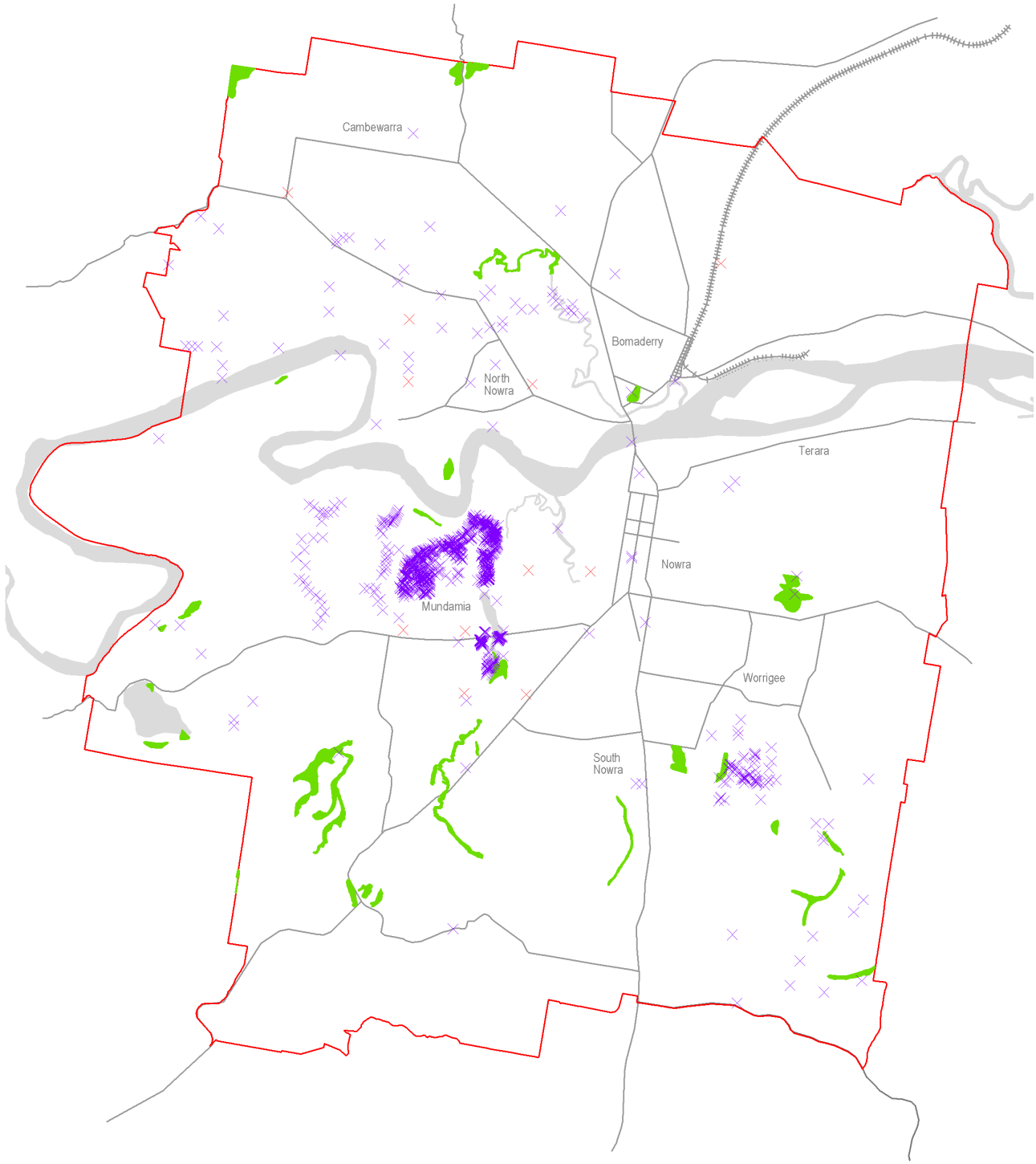
September 2005

0 1 2
Kilometres

Legend

- Structure Plan Boundary
- ACM-WRF
- BAC-WRF
- CAS-CUN
- CAS-GLA
- EST-COM
- JUN-FRH
- KUN-SHR
- MAC-LON
- MAC-PAN
- MAC-PIL
- MAC-SYN
- MEL-ERI
- MEL-FOR
- MST-SRF
- PIL-GUM
- PIL-PUN
- PUN-AGG
- ROB-MEL
- SAL-SYN
- SCL-CAS
- SCL-GUM
- SST-SDG
- TER-ANG

Map 3.3



Threatened Flora & Fauna Communities

Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Threatened Fauna & Flora
- ROTAP
- Threatened Communities

September 2005

0 1 2

Kilometres

Map 3.4

Blue Gum Tall Forest (SAL-SYN)
Dominant species of this community are *Eucalyptus saligna, Syncarpia glomulifera* and *E. tereticornis*. This tall forest reaches more than 30 metres in height and has a distinct sub-canopy, often composed of dense, medium sized trees. Blue Gum tall forest occurs on the floodplains and in the deep gullies of the larger streams in Nowra Bomaderry, and on the foothills of the escarpment at West Cambewarra, where rainfall is higher. It is usually asociated with clayey soils, such as along Cabbage Tree Creek and Flat Rock Creek, south-west of Nowra, and Tapitalee Creek in the vicinity of Illaroo road. Most of this community has been cleared to establish farms. Good examples with well developed rainforest understoreys occur in the Bangalee area.

Spotted Gum Tall Forest (MAC-TOF)
Dominant species in this community is *E. maculata*. Spotted Gum tall forest grows to more than 30 metres in height and has a well developed sub-canopy of smaller trees. Spotted Gum tall forest occurs on moist sites with deep soils, mainly on shale but sometimes in sandstone gullies. The main occurrence of this community is along the upper part of Nowra Creek.

Spotted Gum - Grey Ironbark Forest (MAC-PAN)
Dominant species of this community are *E. maculata* and *E. paniculata.* The Spotted Gum - Grey Ironbark forest grows to more than 25 metres in height, but is often about 20 metres in height. The understorey is usually quite open and contains scattered shrubs, although this depends on fire history. This community is common and widespread on the clayey soils of the Berry Siltstone, particularly in the state forests south of Nowra. The forest has been extensively cleared, particularly north of North Nowra and Bomaderry and in the vicinity of Currambene Creek.

Spotted Gum – Woollybutt Forest
Dominant species of this community are *E. maculata* and *E. longifolia.* The Spotted Gum - Woollybutt forest grows to about 20 metres in height and often has a distinct sub-canopy about 10 metres tall. The grassy understorey is usually quite open. This community occurs on clayey soils in association with the Spotted Gum - Grey Ironbark forest (Community 3), but it is situated on lower land that is poorly drained. This community is quite extensive in Currambene and Shoalhaven State Forests.

Spotted Gum - Red Gum Forest (MAC-TER)
Dominant species of this community are *E. maculata* and *E. tereticornis.* Spotted Gum - Red Gum open forest grows to about 25 metres in height and has an open understorey, although this depends on fire history. This small area of Spotted Gum - Red Gum forest is located in the north-eastern corner of Currambene State Forest. The high proportion of Forest Red Gum *E. tereticornis* probably reflects a change in the underlying soil type.

Paperbark Forest (MEL-STY)
Dominant species of this community are *Melaleuca styphelioides* and *M. ericifolia*. The Paperbark forest is usually a low and closed forest about 10m in height. It contains emergent taller trees and the understorey is generally quite shrubby. The main occurrences of this community are along Nowra Creek and Cabbage Tree Creek, where it grows on moist alluvial soil near the channel. Along Cabbage Tree Creek near Albatross Road, most of the surrounding forest has been cleared. The occurrences along Nowra Creek are in Shoalhaven State Forest. A broad low-lying area south of Quinns Lane at South Nowra is dominated by the paperbark *M. ericifolia.*

Swamp Mahogany Forest (ROB-MEL)
Dominant species of this community are *E. robusta and M. linariifolia.* The Swamp Mahogany forest is about 20 metres in height. Its sub-canopy is open in some places and closed in others, and the understorey is dense. The Swamp Mahogany forest was probably once quite extensive on the floodplains east of Nowra, although much of that area has been cleared. Small patches of this community were found in the far south-eastern corner of the study area, east of Currambene State Forest.

Casuarina Riparian Forest (CAS-CUN)
Dominant species of this community is *Casuarina cunninghamiana.* The Casuarina riparian forest grows to 30 metres in height, sometimes taller; it usually has an open, grassy understorey. This community only occurs on the alluvial soils of large streams. Most of this community has been cleared in Nowra Bomaderry, remnants can be found along Bomaderry Creek and Tapitallee Creek, north of North Nowra. Originally the community probably contained many rainforest species. The River Oaks (*C. cunninghamiana*) are important for bank stability but regeneration is hampered by grazing stock.

Communities on Sandstone Soils

The soils of the Nowra Sandstone support mainly woodland and heathland communities. The small outcrop of the Snapper Point Formation in Nowra Bomaderry also supports woodlands and heathlands. These communities are widespread to the west of Nowra and are extensive on the adjoining Crown land and in Morton National Park. As noted in Section 5.1, this vegetation contrasts markedly with the grassy forests on the shale soils. The sandstone soils support a more diverse range of communities than the shale soils, and they are floristically more diverse; that is, there is a higher number of plant species present.

The following are vegetation communities on the sandstone soils in Nowra Bomaderry.

Subtropical Rainforest (STR-RAF)
Dominant species of this community include *Acmena smithii, Guioa semiglauca, Ficus* spp. And *Cryptocarya glaucescens.* The subtropical rainforest (closed forest) grows to about 20 metres in height, usually with a shrubby understorey and a dense ground cover of ferns. Small patches of subtropical rainforest occur in fire protected niches among the cliffs along the Shoalhaven River, for example in Bangalee Reserve (site N75). Because of their small size, these areas were not mapped. Subtropical rainforest species are scattered along the Shoalhaven River.

Warm Temperate Rainforest (WTM-RAF)
Dominant species of this community include *Ceratopetalum apetalum* and *Backhousia myrtifolia.* The structure of this rainforest is similar to that of the subtropical rainforest, although the understorey is more open and the species diversity is lower. The best example of this community is in the gorge of Bomaderry Creek (site N74). Smaller patches occur along the main streams. This rainforest type can only survive in fire free sites. The community was not mapped because of the small size of the stands.

Spotted Gum - Blackbutt Forest (MAC-PIL)
Dominant species of this community are *E. maculata* and *E. pilularis.* This tall forest is well over 30 metres in height in some places. There is usually a well developed sub-canopy and shrubby understorey. The Spotted Gum - Blackbutt forest occurs on alluvial soils below clifflines of Nowra Sandstone, along the Shoalhaven River and its major tributaries, such as at Flat Rock Creek and Nowra Creek.

Blackbutt - Bloodwood Forest (PIL-GUM)
Dominant species include *E.* pilularis and *E. gummifera.* The Blackbutt - Bloodwood forest grows to more than 25 metres in height and has a shrubby understorey. This community is common in the southern part of Currambene State Forest, just outside the study area (Mills 1993). There is only one small occurrence of this forest type in the study area, in the far south-eastern corner.

Grey Gum - Blackbutt Forest (PUN-PIL)
Dominant species of this community are *E. punctata* and *E. pilularis.* The Grey Gum - Blackbutt forest grows to about 25 metres in height, although it is about 20 metres tall in most places. There is often an almost closed canopy of casuarinas below the tall open eucalypt canopy. The shrubby understorey is often dense. This forest occurs across a broad area between Bamarang Dam and Flat Rock Creek and extends northwards to the Shoalhaven River. It appears to be growing on deeper soils than the surrounding Scribbly Gum woodlands.

Grey Gum - Stringybark Woodland/Open Woodland (PUN-AGG)
Characteristic species of this community are *E. punctata* and *E. agglomerata.* This woodland/open woodland grows to about 20 metres in height and has a shrubby understorey that is usually quite dense. The Grey Gum - Stringybark community occurs on the rocky edges of gullies and clifflines where conditions are very dry. The shrubby understorey contains species characteristic of rocky sites, including some rare or threatened plant (ROTAP) species.

Scribbly Gum - Casuarina Forest (SCL-CAS)
Dominant species of this community are *E. sclerophylla, Allocasuarina littoralis,* and *E. gummifera.* This forest grows to about 20 metres in height, but is often lower; it has a dense canopy of casuarinas and often a dense growth of shrubs. The Scribbly Gum - Casuarina forest occurs on deep soils on the Nowra Sandstone at North Nowra, Flat Rock and in the south-eastern part of Nowra Bomaderry in Currambene State Forest. This community is common in the Jervis Bay region (Mills 1993).

Table 3.4 **Native Flora of Nowra Bomaderry, According to Habitat**

Habitat	No. of Species	Proportion of Total Flora (%)
Trees	79	16
Shrubs	194	38
Herbs	126	25
Ferns	40	8
Sedges/Rushes	17	3
Grasses	19	3
Vines and Creepers	35	7
Total No of Species	**510**	**100**

Source: Kevin Mills and Associates 1996

3.2.2 Koala Food Trees

State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44) commenced operation on 13 February 1995 (New South Wales 1995). The policy applies to the City of Shoalhaven, a local government area listed in Schedule 1 of the policy. The policy 'aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline:

[a] by requiring the preparation of plans of management before development consent can be granted in relation to areas of core Koala habitat;

[b] by encouraging the identification of areas of core Koala habitat; and

[c] by encouraging the inclusion of areas of core Koala habitat in environment protection zones.

The policy identifies 'potential Koala habitat' as native vegetation where trees of the species listed in Schedule 2 of the policy constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. If none of the tree species listed in Schedule 2 are present on a site proposed for development, or if these species constitute less than 15% of the total number of trees present, then no further provisions of the policy are applicable. If the area contains more than 15% of Koala food trees listed in Schedule 2, then an assessment by a qualified person must be undertaken to determine if the area contains 'core Koala habitat'. If core Koala habitat is identified, then a plan of management must be prepared; this may be a plan of management for the whole local government area or the particular site under investigation.

The Koala food trees occurring in Nowra Bomaderry include three food trees listed on Schedule 2 of SEPP 44 and another seven species recognised by researchers (Pahl, Wylie and Fisher 1990) as primary food trees for the Koala. Another four species are occasionally utilised.

3.2.3 Biodiversity Recommendations

The conservation recommendations outlined in Mills (1996) have been incorporated into the planning process. One of the targets of the Nowra Bomaderry conservation strategy is to include all biodiversity recommendations in the identification of areas that require conservation.

***Recommendation 1*:** The reservation of complexes of adjoining and associated vegetation communities is a more mature conservation goal, than the reservation of only the rare communities. A holistic approach should be adopted when reserving bushland in the Nowra area. It is more appropriate to preserve one or more large areas containing intact examples of most of the local vegetation communities than to reserve the same communities in a large number of small separate patches in urban areas.

***Recommendation 2*:** Rocky gullies dominated by Grey-Gum – Stringybark Woodland/Open Woodland (PUN-AGG) and Kunzea Shrubland (KUN) contain most of the rare plant species in the study area. These communities must be protected and appropriately managed because of their botanical significance. These areas are also important because they provide habitat for at least one threatened species, the Yellow-bellied glider, *Petaurus australis*.

***Recommendation 3*:** Most of the tall forests on the floodplains around Nowra, characterised by Blue Gum *Eucalyptus saligna – E. botryoides*, Forest Red Gum *Eucalyptus tereticornis*, Rough-barked Apple *Angophora floribunda* and Prickly-leaved Paperbark *Melaleuca styphelioides*, have been cleared. Stands of this forest and the associated River Oak *Casuarina cunninghamiana* community should be protected. In the long term, this stream side vegetation should be restored along cleared sections of the main streams.

***Recommendation 4*:** Spotted Gum *Eucalyptus maculata* forests have been extensively cleared from the shale soils in the Nowra district; the conservation reserves in the region contain virtually none of this forest type. Substantial stands should be reserved in the Nowra area, preferably containing all four communities dominated by Spotted Gum.

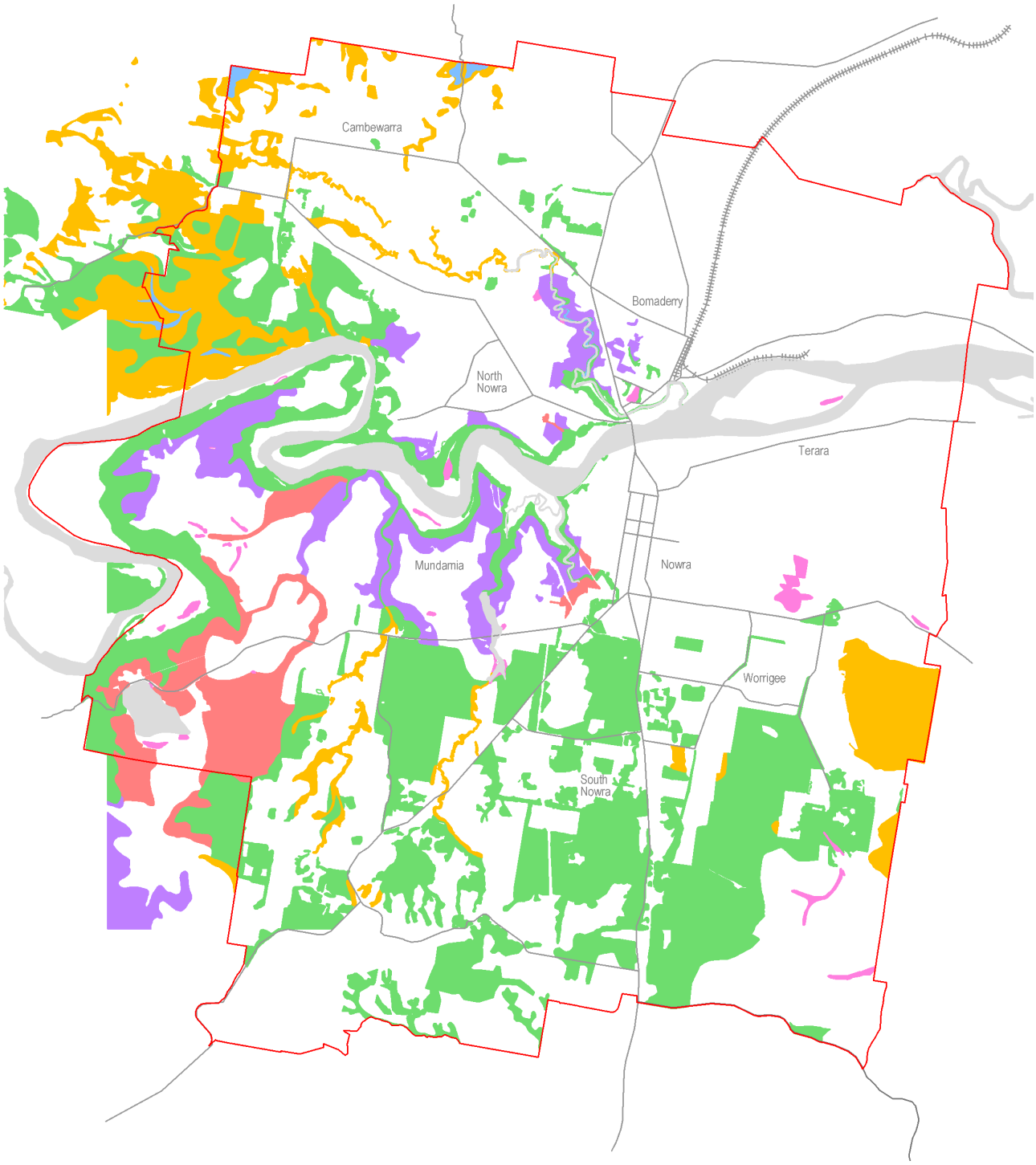
Recommendation 5: All areas of rainforest at Nowra are important, because they are restricted to small sites and they contain a significant proportion of the native flora of the Nowra area. Because the rainforest occurs in such small patches, it cannot be mapped at a scale of 1:4,000. Most of the rainforest occurs along the Shoalhaven River, where cliff lines provide protection from fire.

***Recommendation 6*:** The small areas of mangrove and saltmarsh along the Shoalhaven River, for example at Depot Farm, are of botanical interest. These communities are uncommon in the Shoalhaven region and inland occurrences at Nowra are very uncommon. Full protection should be given to these sites.

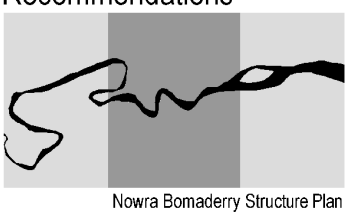
***Recommendation 7*:** The Blackbutt Forest-Grey Gum (PIL-PUN) is quite extensive west of Nowra, as shown on the vegetation map, but it has not been recorded elsewhere in the region, at least not in such large stands. This community does not appear to be reserved in the region, so consideration should be given to reserving a large area. This community provides habitat for the threatened species, the Yellow-bellied Glider *Petaurus australis* and the Glossy Black Cockatoo *Calyptorhynchus lathami.*

***Recommendation 8*:** East and west of Nowra, the original forests have been extensively cleared from the floodplains of the Shoalhaven River. In some locations, there are areas of freshwater swamp and saltmarsh vegetation surrounded by cleared land mainly used for grazing. These wetlands should be fenced to protect their botanical and wildlife habitat values because they are being severely affected by stock grazing. Landholders should be encouraged to erect protective fencing.

Where appropriate, the spatial extent of these biodiversity recommendations is indicated on Map 3.5.



Biodiversity Recommendations



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Biodiversity Recommendation 2
- Biodiversity Recommendation 3
- Biodiversity Recommendation 4
- Biodiversity Recommendation 5
- Biodiversity Recommendation 6 & 8
- Biodiversity Recommendation 7

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Kilometres

Map 3.5

3.3 CONSERVATION ISSUES

The conservation issues surrounding the protection of biodiversity in Nowra- Bomaderry are influenced by both past and current landuse patterns. Much of the fertile land associated with the Shoalhaven River floodplain was cleared of its native vegetation in order to support intensive agricultural use such as cropping, vegetable growing and dairying. In many of these areas, only small remnants or a few paddock trees are all that remains of previous vegetation cover. Any remnants that occur in these environments therefore often have significant conservation value. Urban areas of Nowra, particularly north of the river have been built in close proximity to the natural environment. The natural areas adjacent to and within these urban areas often have high conservation value, examples being the Shoalhaven River corridor and escarpment of the Shoalhaven River and sandstone plant communities.

3.3.1 Urban Edge Biodiversity Issues

The more significant urban edge biodiversity issues are highlighted in Table 3.5. This is often a symptom of the conflict between 'urban culture' and 'nature', where the natural environmental is viewed with suspicion and as a source of hazard.

Thus parents may fear for the safety of their children near water courses and reed-beds; unwanted plants and animals may be described as weeds and vermin; domestic pets and children may destroy valuable groundcover and understorey vegetation and rubbish may be dumped on communal land.

Table 3.5: **Urban & Urban Edge Biodiversity Conservation Management**

Threats	Impact on Biodiversity	Potential Impact Management
Loss of Trees	Loss of nesting hollows. Loss of food resources. Loss of habitat. Loss of species.	Retain existing trees. Plant more local trees in appropriate areas. Promote regeneration of local species.
Loss of Understorey Plants	Loss of habitat. Weed invasion. Loss of species. Erosion and loss of soil.	Restore understorey with local species. Retain leaf litter, fallen logs and branches in habitat areas.
Weed Invasion	Displacement and smothering of native plants.	Discourage dumping in bushland areas. Undertake weed control.
Problem Animals	Loss of small animals to predators. Prevention of regeneration by native plants. Loss of species.	Control rabbits, goats, deer, foxes and feral cats. Encourage responsible pet ownership.
High Frequency Fires	Loss of local animal, bird and plant populations. Increased weed invasion.	Consider flora and fauna in hazard reduction activities.
Human Impact	Weed invasion from dumped garden rubbish. Removal of habitat from wood collection. Destruction of rare and threatened plants. Disturbance of breeding and roosting sites.	Ensure future development avoids rare and threatened species. Plan development away from key biodiversity areas
Isolation of Habitat Patches	Disruption of animal breeding.	Create links to nearby patches of vegetation. Protect riparian vegetation.

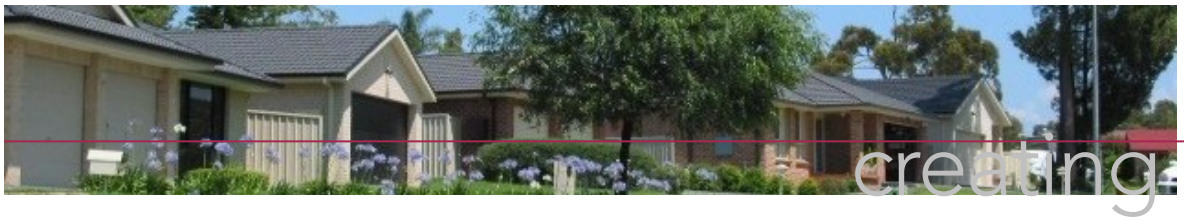
Conservation of biodiversity issues for the Nowra Bomaderry structure plan centre around the conflict of provision of infrastructure and areas of urban expansion while protecting significant vegetation and threatened species habitat. The high numbers of threatened species in the Nowra Bomaderry area mean that much of the surviving vegetation provides habitat for these species. Compounding this are the issues of incremental loss of habitat within and around the natural bushland setting of Nowra's existing suburbs. This loss is occurring through the provision of bushfire protection requirements, invasion of native vegetation by weed species, (many of which are garden escapees), and the loss of habitat trees from both Council reserves and private property.

3.3.2 Impact of Bushfire Hazard Reduction

The introduction of recent bushfire legislation has unfortunately had some detrimental impact on the existing biodiversity resources within the Nowra Bomaderry area. The provisions in rural fires amending legislation mean that planning that has previously facilitated a characteristic bushland setting for the Nowra Bomaderry area, is now being impacted to some degree by hazard reduction requirements. In addition asset protection requirements mean that much more land has to be cleared to allow for urban development, substantially increasing the development footprint required.

3.3.3 Urban Trees

Council has recently amended the Tree Preservation Order and implemented a Tree Management Policy which will possibly increase the number of native trees removed in urban areas. To maintain the amenity and biodiversity attributes of the Nowra Bomaderry area it will be necessary for the supplementary planting program which is advocated in the Policy to be fully implemented. Risk management of trees has become a significant issue for all local government areas following recent court determinations on a council's responsibilities and a proactive replacement/supplementary program is essential.



4. LIVING AREAS

Living areas represent the prime focus of the Nowra Bomaderry structure plan. This chapter tracks the development of Nowra Bomaderry from its genesis to its current role as a sub-regional centre of the southern Illawarra. It addresses the factors that influence the supply and demand for housing and looks in some detail at the network of community facilities that under-pin the quality of life for the residents of Nowra Bomaderry.

4.1 SETTLEMENT DEVELOPMENT

Nowra Bomaderry has been developed on the western edge of the Shoalhaven flood plain at the lowest bridging point of the Shoalhaven River.

4.1.1 Aboriginal Settlement

The local Aboriginal people were first seen by Europeans in 1770 when James Cook and Joseph Banks saw fire on the Murramarang shore. After settlement, Aboriginals and their canoes were first sighted by the crew of a whaling boat in 1791. By 1801, when Barralier aboard the Lady Nelson landed at Jervis Bay, smallpox was already rife on the South Coast and the indigenous population already reduced in numbers. Over the following two decades the Aboriginal camps in the Shoalhaven were significantly impacted by European appropriation of land. Nevertheless local Aboriginal people remained very visible through the 1830s with some assisting the Europeans explore and find suitable pasture and arable land. Many Aboriginals found sporadic employment on the increasing number of European estates, particularly at Coolangatta. Small camps were scattered around the Shoalhaven, with concentrations at Coolangatta, Greenwell Point and Jervis Bay.

By 1900 two Aboriginal centres occupied marginal locations in the Shoalhaven area: Roseby Park at the mouth of the Crookhaven River and Jervis Bay near Huskisson. About 15 years later a self-oriented Aboriginal settlement was established at Wreck Bay. The settlement at Huskisson was slowly abandoned until the only reserves in the area were at Roseby Park and Wreck Bay. An increasing number of Aboriginal children were 'rescued' by missionaries and accommodated in the United Aboriginal Mission home in Bomaderry. The home opened in 1908 and closed in the 1980s. At one point the home accomodated over 30 children, either orphaned or deemed to come from a difficult home environment. Today there is a significant Aboriginal community in Nowra Bomaderry.

4.1.2 Township Development

The first grant in the district was 'Cooloomagatta' of 10,000 acres to Messrs Alexander Berry and Edward Wollstonecroft in 1822 with a further 2,000 acre grant on the south side at 'Numbaa'. Berry expanded his landholding with additional grants of two 4,000 acre lots, one lot north of the first grant and one west of Broughton Creek. Downstream on the south side of the Shoalhaven River, Berry secured a 2,000 acre grant on either side of the Numbaa grant and other ground in the vicinity of the Crookhaven. Along the river to the west of Terara, Prosper de Mestre was granted 1,300 acres and 640 acres was promised to John Layton. William Elyard was granted Brundee (2,516 acres), whilst 2,000 acres promised to Hamilton Hume in 1825 was granted to Berry in 1842.

Coolangatta became the focus of the Berry Estate with early agriculture and dairying south of the Shoalhaven River at Jindiandy. Private townships were established at Numbaa and Broughton Creek (Berry) on the Berry Estate with Terara established by the de Mestre family and Greenhills by the Graham family. Greenwell Point became the crucial link with ocean going vessels plying the route to Sydney.

From 1852 to 1858 the Shoalhaven Court of Petty Sessions met in the Numbaa courthouse. By 1866 Numbaa had nearly 200 residents, a store, a busy wharf and a windmill to grind the corn of the Berry Estate tenants. In 1868 Numbaa became a municipality and ten years later Terara became the headquarters of the new municipality of Central Shoalhaven. Nowra was established as a government-planned village, becoming the centre for administration and governance.

4.1.3 Ascendancy of Nowra

Both Numbaa and Terara were sited on the floodplains adjacent to the Shoalhaven River. The two major floods of 1860 and 1870 significantly damaged both towns. After the floods the decision was made to establish the main settlement of the district on higher ground at Nowra. Land was designated and the 'Village of Nowra' was laid out by surveyor Thomas Mann in 1852, initially taking the form of a 200 x 200 metre square. Its positioning was further enhanced by the construction of the Shoalhaven River Bridge in 1881 and the construction of the railway to Bomaderry in 1893.

The dramatic rise in population which took place after the 1860s peaked in the 1890s and early 1900s. This resulted in the development of Nowra as a fully fledged township with private residences; school buildings; river wharfs; a post office; a school of arts; hotels and inns; churches; banks; commercial and industrial enterprises; roads; and cemeteries.

4.1.4 Post War Development

Following World War II, Nowra's role and character was transformed dramatically. During the war it had become a military town: defence service personnel became part of the population and considerable expansion in industry and tourism changed the social and economic character of the town. The Royal Australian Naval Air Station HMAS Albatross was established as a base for the fleet air arm. The English paper manufacturing firm of Wiggins Teape and Nash decided to establish a paper mill at Bomaderry. John Bull, the English rubber manufacturing firm also established a factory at Bomaderry, whilst Horlick's (Manildra) extended its milk processing facility.

In spite of redevelopment during the 1970s and 1980s, Nowra retains considerable evidence of the periods of prosperity during the late 19th Century and early 20th Century by way of buildings which define and articulate the character of the town's commercial and administrative centre within the original town plan. The construction of a second bridge across the Shoalhaven River and the long planned highway realignment, known as the East Street deviation was opened in the early 1980s. The Nowra Fair retail centre, built on part of the Worrigee Swamp east of the Nowra CBD opened soon after in 1983. Nowra has since developed as the commercial, administrative and community facility hub of the Shoalhaven.

4.2 PLANNING PRECINCTS

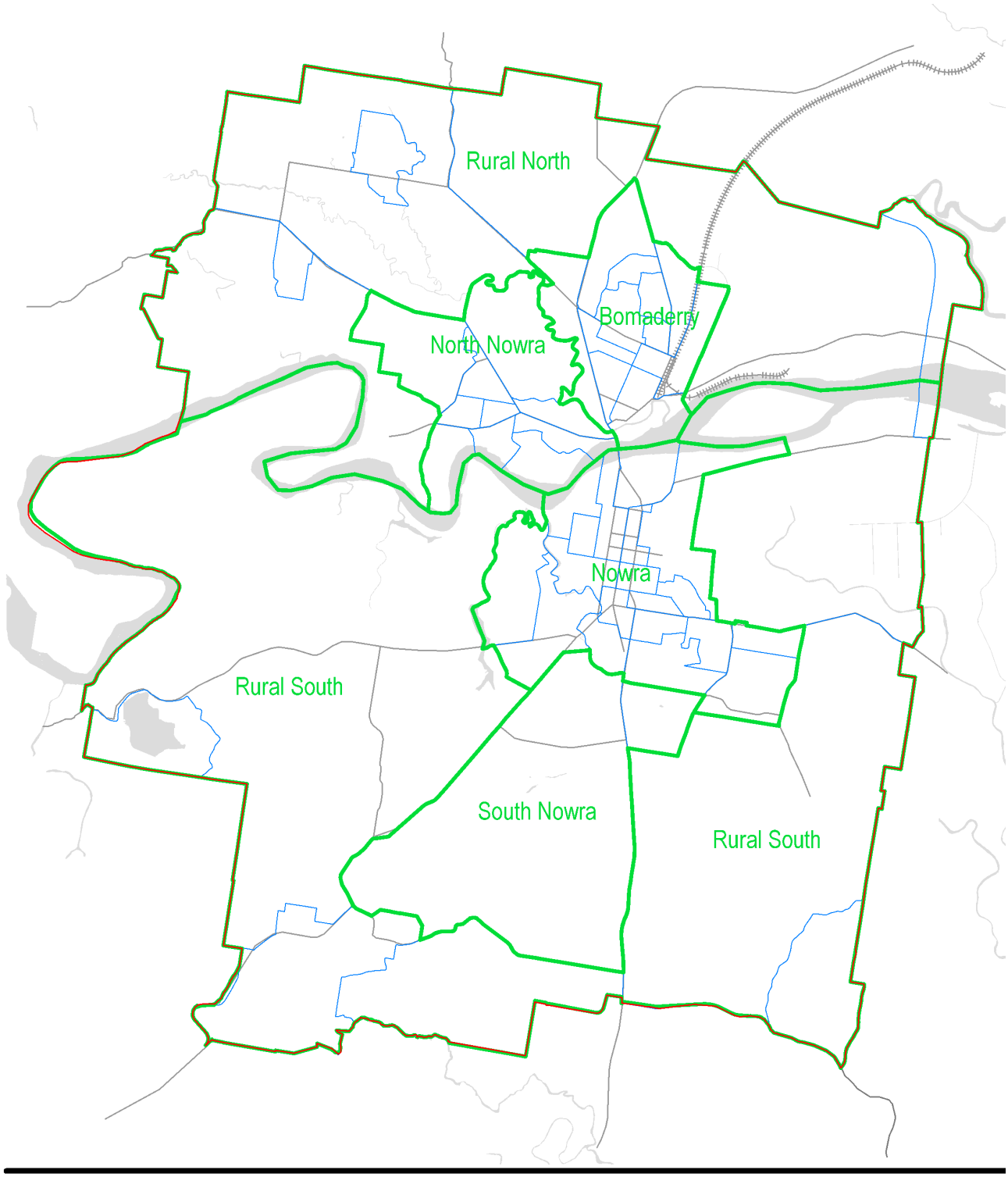
Nowra Bomaderry comprises six planning precincts: Bomaderry, North Nowra, Nowra, South Nowra, Rural North and Rural South (Map 4.1). Demographic and socio-economic profiles of the six precincts are provided in Tables 4.1 to 4.5.

4.2.1 Bomaderry

The Bomaderry precinct has an area of 792 hectares. It has a mix of heavy industry, commercial and residential landuses. The residential component comprises both older and new residential areas. The precinct contains 23% of the structure plan area's population and 24% of its dwellings. It has the highest population and dwelling density (8.3 persons and 3.55 dwellings/ha) in Nowra Bomaderry.

4.2.2 North Nowra

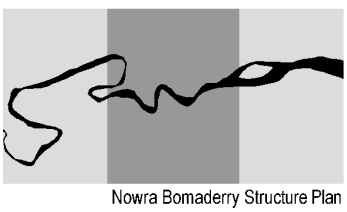
The North Nowra precinct is located to the north of the Shoalhaven River and separated from Bomaderry by Bomaderry Creek. North Nowra has a total area of 908 hectares. Although it has a neighbourhood shopping centre and a small industrial area, it is primarily a residential precinct. The precinct accounts for 21% of the structure plan area's population, 20% of its dwelling stock and a gross density of 6.57 persons per hectare and 2.60 dwellings per hectare.



Planning Precincts

Legend

- Structure Plan Boundary
- Planning Precincts
- 2001 Census Collection Districts



Nowra Bomaderry Structure Plan

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Map 4.1

4.2.3 Nowra

The Nowra precinct contains a number of suburbs: Nowra, Nowra CBD and the developing residential suburb of Worrigee. With a total area of 1,478 hectares, it contains Shoalhaven's primary commercial centre and a mix of older and new dwellings (Worrigee). The precinct accounts for 41% of the structure plan area's population and 42% of its dwellings. It has a gross population density of 8.04 persons per hectare and 3.32 dwellings per hectare.

4.2.4 South Nowra

The South Nowra precinct is primarily an industrial area and has a total area of 1,619 hectares. It accounts for only 2% of the structure plan area's population and dwellings. The precinct has a gross population density of 0.46 persons per hectare and 0.17 dwellings per hectare.

4.2.5 Rural North

The Rural North precinct comprises the non-urban land to the north of the Shoalhaven River and includes the village of Cambewarra, Meroo Meadow and Bolong. It has a total area of 4,564 hectares. The precinct accounts for 9% of the structure plan area's population and 7% of its dwellings. The precinct has a gross population density of 0.55 persons per hectare and 0.18 dwellings per hectare.

4.2.6 Rural South

The Rural South precinct includes all the non-urban land to the south of the Shoalhaven River and has a total area of 9,063 hectares. It includes Terara, Currambene State Forest, Nowra Hill, Mundamia, Longreach and HMAS Albatross. The precinct accounts for 4% of the structure plan area's population and 3% of its dwellings. The precinct has a gross population density of 0.13 persons per hectare and 0.04 dwellings per hectare.

Table 4.1: **Planning Precincts Profile**

Indicator	Bomaderry	North Nowra	Nowra	South Nowra	Rural North	Rural South	Total
Total Persons	6,572	5,962	11,887	746	2,500	1,209	28,876
Total Dwellings	2,808	2,357	4,912	282	817	365	11,541
Total Area (ha)	792	908	1,478	1,619	4,564	9,063	18,424
Gross Population Density	8.30	6.57	8.04	0.46	0.55	0.13	1.57
Gross Dwelling Density	3.55	2.60	3.32	0.17	0.18	0.04	0.63

Note 1: Gross Population Density: total persons/ha
Note 2: Gross Dwelling Density: total dwellings/ha
Source: Australian Bureau of Statistics: Census of Population & Housing 2001

Table 4.2: **Demographic Profile: Planning Precincts**

Indicator	Bomaderry	North Nowra	Nowra	South Nowra	Rural North	Rural South	Total
Persons <15	1440	1492	2857	160	722	280	6951
Persons Aged 15+	5132	4466	9021	585	1782	923	21909
Persons Aged 65+	1075	784	1824	76	241	65	4065
Median Age	37	34	34	37	35	33	35
Employed Persons	2498	2487	3865	300	54	31	9235
Unemployed Persons	270	187	597	38	1105	617	2814
Participation Rate	54.1	60.1	49.5	57.8	65.1	70.7	357.3
Unemployment Rate	9.8	7	13.4	11.2	4.7	4.8	50.9
Resident >5 Years	3035	2730	5127	427	1268	541	13128

Note: Gross Population Density: persons/ha
Source: Australian Bureau of Statistics: Census of Population & Housing 2001

Table 4.3: **Dependency Ratios: Planning Precincts**

Age Band	Bomaderry %	North Nowra %	Nowra %	South Nowra %	Rural North %	Rural South %	Total %
Age 0-14	22.1	24.9	24.0	21.6	28.5	23.6	24.1
Age 15-64	61.4	61.5	60.6	67.7	61.6	70.4	61.6
Age 65+	16.5	13.6	15.4	10.7	9.9	6.1	14.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Australian Bureau of Statistics: Census of Population & Housing 2001

Table 4.4: **Household Socio-Economic Indicators: Planning Precincts**

Indicator	Bomaderry	North Nowra	Nowra	South Nowra	Rural North	Rural South	Total
Median Annual Income	$31560	$41390	$27660	$34060	$51580	$52360	$33,540
Average Annual Income	$40,900	$50,050	$36,830	$42,670	$61,350	$61,580	$43,270
Median Monthly Mortgage	$779	$865	$778	$684	$990	$1224	$830
Median Weekly Rent	$119	$143	$103	$133	$177	$162	$117
Average Household Size	2.5	2.7	2.5	2.8	3.2	3.3	2.6
Average Motor Vehicles	1.4	1.6	1.3	1.9	2.1	2.3	1.5

Note: All indicators relate to households
Source: Australian Bureau of Statistics: Census of Population & Housing 2001

Table 4.5: **Occupation: Planning Precincts** (Employed Persons)

Occupation	Bomaderry %	North Nowra %	Nowra %	South Nowra %	Rural North %	Rural South %	Total %
Managers & administrators	5.1	6.0	4.1	5.0	10.6	**12.8**	5.9
Professionals	13.2	18.3	12.2	10.7	**23.9**	13.5	15.0
Associate Professionals	12.2	13.9	11.5	14.1	11.4	**16.6**	12.6
Tradespersons	17.0	15.2	16.7	**20.8**	13.0	19.1	16.3
Advanced Clerical	3.0	3.9	3.1	6.0	4.0	**6.4**	3.6
Intermediate Clerical	**17.8**	16.3	16.1	13.1	13.2	8.4	15.7
Intermediate Production	8.1	6.7	10.1	**12.1**	6.3	7.7	8.4
Elementary Clerical	11.3	10.9	**12.4**	9.1	10.3	6.4	11.2
Labourers	9.8	7.4	**11.8**	5.0	5.9	7.6	9.3
Non Specific	2.5	1.3	2.0	4.0	1.4	1.5	2.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Australian Bureau of Statistics: Census of Population & Housing 2001

4.3 HOUSING

Nowra Bomaderry accounts for just over 23% of Shoalhaven's private housing stock.

4.3.1 Housing Stock

The vast majority of the Nowra Bomaderry housing stock comprises separate dwellings. These total 9,139 dwellings or 85% of the total housing stock (Table 4.6). Semi-detached, row, terraced houses or townhouses total 435 or 4% of the total housing stock. Medium density (flats, units and apartments) accounts for 851 or 8% of the total housing stock. Other dwelling types (caravans, cabins or boathouses) account for 239 dwellings (2% of total housing stock).

Table 4.6: **Nowra Bomaderry Dwelling Structure by Tenure** (2001)

Dwelling Structure	Fully Owned	Being Purchased	Rented Public	Rented Private	Other Tenure & Not Stated	Total Occupied Dwellings
Separate House	3690	2627	806	1572	444	9139
Semi-Detached, Row, Town	100	22	98	191	24	435
Flat, Apartment, Unit	100	44	111	510	86	851
Other Dwelling Type	116	6	0	69	48	239
Not Stated	12	16	3	6	12	49
Total	**4018**	**2715**	**1018**	**2348**	**614**	**10713**

Note: Data based on occupied private dwellings
Source: Australian Bureau of Statistics: Census of Population & Housing 2001

The Nowra precinct contains the greatest share of the structure plan area's dwelling stock (42%). It has the largest proportion of separate houses as well as flats and units (Table 4.7). Bomaderry has the largest number of semi-detached/row/town houses accounting for 10% of that precinct's housing stock. Predictably separate houses accounted for well over 90% of the dwelling stock in the Rural North and Rural South precincts.

Table 4.7: **Dwelling Structure: Planning Precincts**

Dwelling Structure	Bomaderry	North Nowra	Nowra	South Nowra	Rural North	Rural South	Total
Separate House	2073	1992	3778	232	754	322	9151
Semi/Row/Town House	254	41	123	9	6	0	433
Flat/Unit/Apartment	187	149	500	3	6	3	848
Other Dwelling	107	13	106	19	6	6	257
Not Specified	0	9	38	3	6	0	56
Total	**2621**	**2204**	**4545**	**266**	**778**	**331**	**10745**

Note: Data based on occupied private dwellings
Source: Australian Bureau of Statistics: Census of Population & Housing 2001

Medium Density

The majority of medium density housing (flats, units and apartments) are in one or two storey configuration, with a minimum in three storey form. Currently there are no dwelling units located within blocks of apartments that are four storeys or higher.

4.3.2 Housing Tenure

Almost 92% of Nowra Bomaderry's dwelling stock is occupied by households, giving a vacancy rate of just over 8%. Approximately 63% of occupied housing is either fully owned or being purchased by the occupant. Public and private rental housing accounts for approximately 31% of the occupied housing stock (Table 4.6).

Approximately 69% of separate houses are owner occupied (fully owned or being purchased), with almost 26% rented. Medium density housing (row, terraced houses or townhouses) in Nowra Bomaderry is predominantly rental, accounting for 71% of the occupied stock. Owner occupation accounts for 21% of the occupied stock.

Dwelling Occupancy

The average household size for the Nowra Bomaderry area is 2.59 (Table 4.8). This ranges from 1.52 persons per dwelling for medium density housing (flat/unit) to 2.75 for a separate house. Semi-detached, row, terraced houses or townhouses have an average household size of 1.77, whereas other dwellings (caravans, cabins and boathouses) have an average household size of 1.79.

Table 4.8: **Dwelling Structure Occupancy Rates: Planning Precincts**

Indicator	Bomaderry	North Nowra	Nowra	South Nowra	Rural North	Rural South	Total
Separate House	2.68	2.77	2.66	2.95	3.12	3.23	2.75
Semi/Row/Town House	1.68	1.66	1.96	2.22	1.50	0.00	1.77
Flat/Unit/Apartment	1.54	1.62	1.46	2.67	1.50	3.33	1.52
Other & Not Specified	1.55	2.18	1.96	1.41	1.42	2.83	1.79
Total	**2.46**	**2.67**	**2.48**	**2.80**	**3.07**	**3.24**	**2.59**

Note: Persons in occupied private dwellings (excluding overseas visitors).
Source: Australian Bureau of Statistics Census of Population & Housing 2001

4.3.3 Housing Demand

The demand for housing has traditionally been driven by the family household. This household type currently accounts for 73% of all households in Nowra Bomaderry, this is particularly the case in the rural areas and North Nowra (Table 4.9). Of the family households, couples with children have maintained their pre-eminence, although families comprising of couples without children have become more prevalent (Table 4.10).

Table 4.9: **Household Type: Planning Precincts**

Indicator	Bomaderry %	North Nowra %	Nowra %	South Nowra %	Rural North %	Rural South %	Total %
Family Household	70.2	77.8	68.8	77.4	88.4	92.5	73.3
Lone Person Household	27.3	19.4	28.2	18.8	10.4	6.6	24.0
Group household	2.4	2.8	3.0	3.8	1.2	0.9	2.7
Total Households	**100.0 (2578)**	**100.0 (2164)**	**100.0 (4381)**	**100.0 (261)**	**100.0 (747)**	**100.0 (320)**	**100.0 (10451)**

Source: Australian Bureau of Statistics Census of Population & Housing 2001 (Table B32)

Table 4.10: **Family Type: Planning Precincts**

Indicator	Bomaderry %	North Nowra %	Nowra %	South Nowra %	Rural North %	Rural South %	Total %
Couple with children	41.1	44.7	40.8	40.9	58.0	58.0	43.8
Couple without children	38.7	39.3	33.8	38.9	32.5	30.3	36.1
Sole parent with children	18.8	15.2	24.1	18.8	8.4	10.7	18.9
Other Family	1.4	0.8	1.3	1.4	1.1	1.0	1.2
Total Families	**100.0 (5319)**	**100.0 (5089)**	**100.0 (9012)**	**100.0 (642)**	**100.0 (2183)**	**100.0 (974)**	**100.0 (23219)**

Source: Australian Bureau of Statistics Census of Population & Housing 2001 (Table B17)

Over the period 1986-2001 there has been a significant shift away from the couple with children household. The share of this household type has declined from 46% in 1986 to 33% in 2001. The major growth sector has been the lone person household, increasing its share from 15% in 1986 to 24% in 2001 (Table 4.11). This change has not been matched by the supply of dwellings.

Table 4.11: **Changes in Household Type: Nowra Bomaderry 1986>2001**

Household Type	Household Sub-Group	1986	1991	1996	2001	Change
Family Household:	Couples with Children	46.2	41.4	35.3	32.5	-13.7
	Couples without Children	25.0	25.6	25.5	26.7	+1.7
	One Parent Family	8.2	11.5	12.9	14.0	+5.8
	Other Families	2.1	1.0	1.7	0.6	-1.5
Group Household:		3.4	3.1	3.1	2.2	-1.2
Lone Person Household:		15.1	17.4	21.6	24.0	+8.9
Total		**7796**	**8700**	**10104**	**10451**	

Source: Australian Bureau of Statistics Census of Population & Housing 1986-2001

Matching Supply with Demand

To assist forecast demand for the different dwelling forms, household types were theoretically matched with the range of dwelling types. This process is summarised in Table 4.12. On the basis of this matching and the two decade trends in household formation, the demand for mainstream residential accommodation has been projected to 2036. The projected demand for detached houses, attached house and units/flats is provided in Table 4.13.

Table 4.12: **Nowra Bomaderry: Household & Dwelling Type Matching**

Household Type	Household Sub-Group	Dwelling Type	%
Family Household:	Couples with Children	Detached House Attached House	60% 40%
	Couples without Children	Detached House Attached House Unit/Flat	30% 40% 30%
	One Parent Family	Detached House Attached House Unit/Flat	30% 50% 20%
Group Household:		Attached House Unit/Flat	40% 60%
Lone Person Household:		Attached House Unit/Flat	30% 70%

Notes: (1) Households = Private Households
(2) % allocation of dwelling types to household types is subject to further analysis.

Table 4.13: **Nowra Bomaderry: Dwelling Type Demand Projection**

Dwelling Type	2001	2006	2011	2016	2021	2026	2031	2036
Detached House	3289	3470	3752	4085	4432	4954	5528	6102
Attached House	4173	4544	5081	5728	6450	7221	8058	8893
Unit/Flat	3267	3781	4483	5347	6358	7132	7959	8784
Total	**10729**	**11795**	**13316**	**15160**	**17239**	**19308**	**21545**	**23779**

Note: Based on theoretical demand.

4.3.4 Special Needs Housing

There is a need to provide housing for the key special needs groups: the aged; youth; Aboriginals; sole parents and people with disabilities. The Special Needs Housing Groups are shown in Table 4.14.

Older Households and the Aged

Appropriate housing and services are critical for older residents. Currently (2001) 31% of Shoalhaven's population is over 55 years of age, and 13% are over 70 years, a proportion in excess of that for Sydney metropolitan area or indeed NSW as a whole. Further this proportion of older people is anticipated to rise to 42% for those over 55 and 18% for those over 70 years of age by 2021. Indicative of this trend, some 35% of current applications to the Department of Housing are from older people and people with disabilities. Unfortunately the department has very limited housing stock, particularly of a form suitable for the aged. There has been an increase in the number of aged care dwellings since the 1996 census. Nonetheless, unmet demand for independent living units, hostels and nursing homes in the Shoalhaven is considerable.

Youth

Council's Community and Operations Group confirms that young people in the Shoalhaven have significant unmet needs. These needs are difficult to resolve in any area apart from Nowra Bomaderry, where the youth refuge and long-stay accommodation for homeless youth are located. In Nowra Bomaderry there are well-structured short and medium term facilities available for homeless young people.

Table 4.14: **Special Needs Housing Groups**

	Aged		Youth		Aboriginals		Sole Parent	
Locality	No	%	No	%	No	%	No	%
Nowra Bomaderry	2,731	10.8	3,277	13.0	1,542	6.1	1,376	5.4
Area 1: Northern Shoalhaven	4,446	11.4	4,791	12.2	1,738	4.4	1,788	4.6
Shoalhaven LGA	11,192	13.4	8,571	10.3	3,002	3.6	3,659	4.4

Source: ABS: Census of Population & Housing 2001

Aboriginals

Nowra Bomaderry has the highest number of Aboriginal residents in the Shoalhaven. Recent consultation with the Aboriginal community for the 2000 Housing Strategy indicated that the population is relatively static, although there is substantial seasonal movement of people into and out of the area, particularly young people. The Aboriginal community express similar housing-related concerns to those of the wide community, with housing for young singles a particularly vexed issue for the local land council.

Sole Parents

There has been a significant increase in numbers of sole parent families within the Shoalhaven LGA between 1996 and 2001. The Nowra Bomaderry urban area has both the largest number and the highest proportion of sole parent families (20%). This group tends to have difficulty finding satisfactory long-term private rental accommodation.

People with Disabilities

On the basis of the ABS Survey of Disability, Aging and carers in 1998 and preliminary findings from the 2003 survey, approximately 23.9% of the Illawarra population has a disability that restricts a person's ability to function fully within the community. Applying this percentage to the Nowra Bomaderry population suggests that some 7,210 people in Nowra Bomaderry have such disabilities, including people of 55 years and over.

Social Housing

Over 80% of Shoalhaven's public rented housing is located in the Nowra Bomaderry urban area. Detached dwellings are by far the largest component of the public housing stock, whilst semi-detached and medium density housing represents a very small proportion (Table 4.15).

Table 4.15: **Type of Public Housing Stock**

Locality	Type of Public Housing Stock			
	Detached	Semi-Detached	Flat/Unit	Total
Nowra Bomaderry	806	98	111	1,015
Area 1: Northern Shoalhaven	815	101	120	1,036
Shoalhaven LGA	915	153	167	1,235

Source: ABS: Census of Population & Housing 2001

Shoalhaven Community Housing now operates 364 properties (2004) including those head-leased from the private sector. In Nowra-Bomaderry the organisation manages 130 detached houses and 109 villas.

4.3.5 Housing Affordability

Over the past 20 years, affordable housing has become an important planning issue in NSW. The NSW Department of Housing measures affordability as the ratio of average disposable income to the qualifying income required to meet repayments on a typical dwelling. Hence an increase in the index represents an improvement in affordability. The Department publishes the Rent and Sales Report quarterly, indicating changes in dwelling rent and sales price in each NSW LGA. The March 2003 Quarter report suggests that the Shoalhaven had a 44% increase in median sale price and 7-8% increase in median weekly rent over the previous 12 months. Table 4.16 provides the most recent available figures (September Quarter 2004) showing Nowra Bomaderry with a median of $290,000 and annual growth of 6.9%. It should be noted that these figures are for all dwellings sold, so dwelling types sold will reflect those available in the area. Hence Sydney and Wollongong sales include a significant number of flats and units, which have the effect of reducing the median price. On the other hand the Shoalhaven sales are predominantly detached dwellings.

Table 4.16: **Median Sales Price: All Dwellings September Quarter 2004**

Locality	Median Sale Price		
	Price	Quarterly % Change	Annual % Change
Nowra Bomaderry	$280,000	4.9%	5.7%
Illawarra SD Balance (1)	$348,000	-5.2%	-1.1%
Wollongong City	$355,000	0.0%	4.4%
Sydney Metropolitan Region (2)	$425,000	0.0%	1.2%

Note: 1) Includes Wingecarribee & Shoalhaven, less Nowra Bomaderry
(2) Covers the 'Greater Metropolitan Region'
Source: Department of Housing: Rent and Sales Report No 70: Median price for all dwellings sold

Although Nowra Bomaderry's housing prices have increased significantly, they still remain highly competitive with those of the Sydney Metropolitan Region and Wollongong. HSP Planners have monitored recent sales in Bomaderry and Worrigee. In Bomaderry the median sale price has increased from $96,000 in 1997 to $252,500 in 2004 (Table 4.17). The comparative analysis of median sale prices for Worrigee revealed a less clear pattern, since there are two distinct markets: conventional dwellings and dual occupancies/town houses on markedly different price structures.

Table 4.17: **Median Sales Prices in Suburban Bomaderry: 1997-2004**

Year	Median Sale Price		
	Price	Annual % Change	Turnover
2004	$252,500	12.9%	156
2003	$223,700	44.3%	30
2002	$155,000	20.2%	42
2001	$129,000	17.3%	22
2000	$110,000	1.9%	26
1999	$108,000	-9.6%	20
1998	$119,500	24.5%	26
1997	$96,000	20.%	21

Source: Sales data from Residex, analysis by HSP Planners

Housing Stress

Approximately 10% of Shoalhaven households are now in housing stress and this appears to be on the increase amongst both home purchasers and tenants (HSP Planners 2005). Housing stress has been defined by the 1991 National Housing Strategy as those households with a pressing need for a higher income or more affordable accommodation. It counts low income household paying more than 25% of their income on rent or 30% of their income on mortgage payments making their domestic finances very difficult. However, it takes little account of contributory factors such as travel to work costs and rent assistance in the case of low income tenants.

By far the largest concentrations of households experiencing housing stress live in Area 1, much of it attributable to Nowra Bomaderry (Tables 4.18 and 4.19).

Table 4.18: **Median Monthly Repayments Changes 1986 - 2001**

Locality	1986	1991	1986	2001	Change 1986-2001	% Change 1986-2001
Bomaderry	336	530	701	779	443	183.8%
Cambewarra	331	574	908	964	633	191.2%
North Nowra	392	573	777	865	473	120.7%
Nowra	595	1098	1439	1434	839	141.0%

Source: ABS – Census of Population and Housing 1986, 1991, 1996, 2001.

Table 4.19: **Median Weekly Rental Changes 1986 - 2001**

Locality	1986	1991	1986	2001	Change 1986-2001	% Change 1986-2001
Bomaderry	66	102	114	119	53	80.3%
Cambewarra	115	155	167	190	75	65.2%
North Nowra	83	131	138	143	60	72.3%
Nowra	105	149	200	221	116	110.5%

Source: ABS – Census of Population and Housing 1986, 1991, 1996, 2001.

Affordability Conclusions

Using the housing stress measure, the Shoalhaven has experienced little change in housing affordability conditions between 1996 and 2001. However, circumstances since 2001 are unprecedented. Typical dwelling prices have risen by 30% per annum in each of 2002 and 2003. This level of change in the Shoalhaven has not been evident before (HSP Planners 2005).

Underlying demand is unlikely to be the cause of rapidly increasing prices. There is no identifiable reason for local demand to rise so dramatically, although unexpected levels of migration into the area are a possibility. However, expressed demand has not risen sharply, that is demonstrated evidence of demand, such as applications for dwelling approval. Indeed dwelling approvals in 2003 and 2004 were below the prevailing levels of the last eight years.

Current land supply conditions are not so constrained that they would be expected to result in dramatic price rises. The supply of zoned land for housing exists to 2011 in most areas although some like North Nowra are more constrained. A potential causal factor (but certainly not the only one) seems likely to be community perception that there is a land supply constraint. On-going analysis of the characteristics of recent dwelling sales will assist the verification of this assertion. Substantial activity by local residents and larger developers would suggest an important speculation component.

4.3.6 Housing Supply and Demand

Housing Land Supply

Currently (2005) there are an estimated 11,559 dwellings, of which 10,100 are detached dwellings and 1,459 are medium density dwelling (flats, units, townhouses and dual occupancies). Within currently zoned areas of Nowra Bomaderry there is a realistic potential for a further 1,622 dwellings (1,497 detached and 366 medium density dwellings), as shown in Table 4.20.

Table 4.20: **Theoretical Capacity of Existing Residential Zoned Land**

	Existing Development			Potential Development			Total Dwelling Capacity		
	Detached	Medium	Total	Detached	Medium	Total	Detached	Medium	Total
Locality	Dwellings	Density	Dwellings	Dwellings	Density	Dwellings	Dwellings	Density	Dwellings
Bomaderry	2,351	503	2,854	80	161	241	2,431	664	3,095
Cambewarra	395	3	398	205	17	222	10	405	408
North Nowra	2,170	282	2,452	205	17	222	2,375	299	2,674
Nowra	5,184	671	5,855	1,202	188	1,390	6,386	859	7,245
Total	**10,100**	**1,459**	**11,559**	**1,497**	**366**	**1,622**	**11,597**	**1,825**	**13,422**

Notes: Includes recent urban rezonings.
Excludes development in the Bomaderry Creek area & some State land.
Excludes state land north of the water treatment plant at West Nowra
Allows for further medium density development but not redevelopment or dual occupancy in 2(a1) zones.
Nowra includes all the urban land south of the Shoalhaven River.

4.3.7 Conclusions

Critical housing supply and demand issues in the Shoalhaven and Nowra Bomaderry can be summed up as follows:

- Rapid population growth, much of it attributable to in-migration.
- Many older people moving into the Shoalhaven, now comprising a large and growing segment of the population in some centres.
- Increasing number of small households: retired couples, lone person households and sole parent families.
- Special needs groups are growing rapidly in numbers, particularly older household and the aged.
- Dwelling prices rose in the 2002-2003 and future rises are anticipated - local people are experiencing difficulty affording local housing.
- Rents have increased, but increases have been far below increases in dwelling prices over same two year period (2002-2003).
- Estimated 10% of Shoalhaven and Nowra Bomaderry households are now experiencing housing stress and this is expected to continue growing amongst both home purchasers and tenants.
- Large undeveloped residential land stocks are diminishing in their potential yield as constraints are identified.

4.4 COMMUNITY FACILITIES

Nowra's role as a medium size regional centre serving a system of dispersed coastal and rural settlements provides both opportunities and constraints for the creation of a sustainable and equitable society.

The adequate provision of community facilities and services serves to complement the residential and working environments by providing the other physical, social and cultural needs of the community. The cornerstone of provision adequacy is the social justice principles of access and equity. The following assessment includes: education; health services; community support; community security; recreation; culture and entertainment; religious facilities; and cemeteries.

The main community facilities in the structure plan area are shown on Map 4.2.

4.4.1 Education

Nowra Bomaderry acts as the education hub of the Shoalhaven, with educational facilities in the district serving both regional and local roles. However, with the growth of many of the satellite settlements in the northern half of the Shoalhaven, there is a trend to greater self-containment and hence a lowering in dependence on Nowra for this community service.

Educational services are provided to the residents of Nowra Bomaderry by the State Government (Department of Education and Training); the Catholic Education Office (Diocese of Wollongong); the Anglican Church of Australia; the Nowra Baptist Church; and Shoalhaven City Council with respect to libraries. Education is provided from kindergarten to university in the Shoalhaven.

Pre-School Education

In 2001 a total of 567 children, living in Nowra Bomaderry, attended pre-schools (Table 4.20). There are currently four community pre-schools (140 places); two community long day care centres (74 places); and eight private long day care centres (267 places) within the district. In addition there is a large long day care centre at HMAS Albatross (79 places); as well as a mobile pre-school (20 places) that services Cambewarra and other settlements outside Nowra Bomaderry.

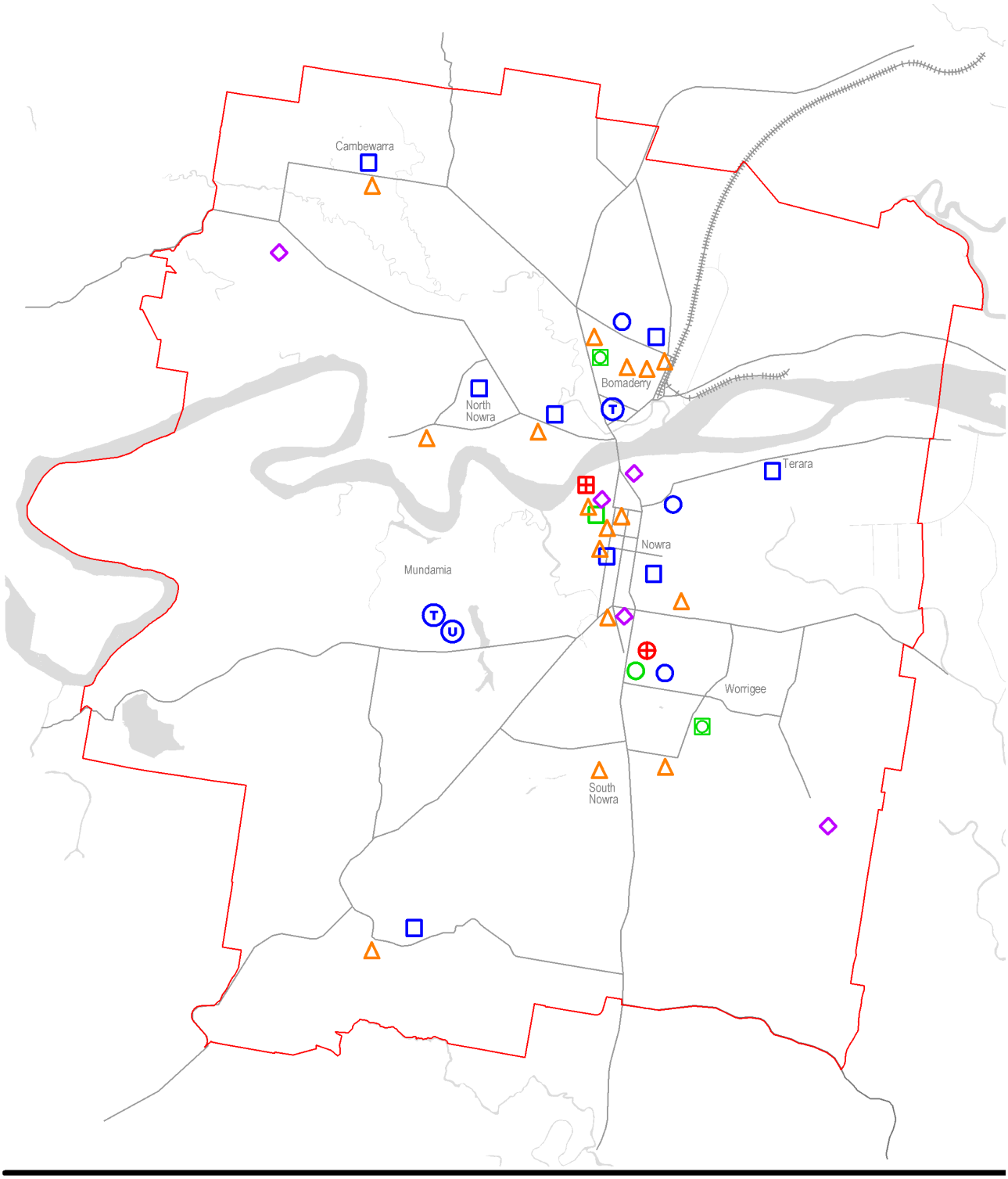
Primary Education

In 2001 there was a total of 3,168 children, living in Nowra Bomaderry attending primary school (Table 4.21). Of these 77% attended government schools; 15% attended Catholic schools; and 8% attended other non-government schools.

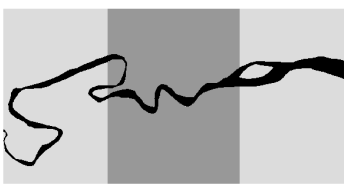
Table 4.21: **Nowra Bomaderry Residents Attending Pre-Schools & Primary Schools**

Educational Group	Males	Females	Persons	Proportion of Population %	Proportion of Sub-Group %
Pre-School	286	281	567	2.0	100.0
Primary Schools:					
Government Primary Schools	1270	1158	2428	8.6	76.6
Catholic Primary Schools	234	235	469	1.7	14.8
Other Non-Government Schools	137	134	271	1.0	8.6
Total Primary Schools	**1641**	**1527**	**3168**	**11.2**	**100.0**

Source: Australian Bureau of Statistics: Census of Population & Housing 2001.



Community Facilities



Nowra Bomaderry Structure Plan

September 2005

0 1 2
Kilometres

Legend

- Structure Plan Boundary
- Government Primary School
- Government High School
- Non Government Primary School
- Non Government High School
- Non Government Primary & High School
- TAFE
- University
- Church
- Cemetery
- Public Hospital
- Private Hospital

Map 4.2

State Primary Schools

Currently there are eight State operated primary schools in the Nowra Bomaderry area, with a total enrolment of 2,571 students. These include:

- Bomaderry Public School (440).
- Cambewarra Public School (221).
- Illaroo Road Public School (534).
- North Nowra Public School (275)
- Nowra Public School (588).
- Nowra East Public School (333).
- Nowra Hill Public School (88)
- Terara Public School (92).

Table 4.22: **Nowra Bomaderry State Primary School Enrolments: 1996-2005**

Primary School	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Bomaderry	654	697	630	651	626	570	517	484	435	440
Cambewarra	206	222	221	237	220	205	203	205	213	221
Illaroo Road	785	792	506	507	482	517	526	534	544	534
North Nowra	0	0	285	306	316	312	313	321	307	275
Nowra	572	599	600	618	584	626	622	633	637	588
Nowra East	527	520	515	501	483	438	464	424	370	333
Nowra Hill	65	65	75	72	73	78	102	101	91	88
Terara	93	91	90	98	95	100	95	91	94	92
Total	**2902**	**2986**	**2922**	**2990**	**2879**	**2846**	**2842**	**2793**	**2691**	**2571**

Source: NSW Department of Education & Training 2005

Total enrolment for Nowra Bomaderry State primary schools over the last decade has decreased by 12% (Table 4.22). Total enrolments in fact peaked in 1997 at 2,921, 438 above the current figure. The primary schools in Bomaderry and Nowra East have sustained significant declines in student numbers. Bomaderry had an enrolment of 697 in 1997, dropping to 440 in 2005, a decline of 37%. Similarly Nowra East had a peak enrolment of 626 in 1992, falling to 333 in 2005, a decline of 47%. The significant decline in enrolments at Illaroo Road after 1997, was attributable to the transfer of students from that school to the new school at North Nowra, which opened in 1998. Student numbers in the primary schools at Cambewarra, Nowra and Terara have remained relatively stable, rising and falling within a limited range.

Table 4.23: **Nowra Bomaderry Non-Government Primary School Enrolments: 1999-2005**

Non-Government Primary School	1999	2000	2001	2002	2003	2004	2005
St Michael's Catholic School	634	631	629	611	603	582	601
Nowra Anglican College	0	145	230	310	406	408	404
Nowra Christian Community School	211	211	209	201	204	205	204
Total	**845**	**987**	**1068**	**1122**	**1213**	**1195**	**1209**

Source: Non-government school principals 2005.

Non-Government Primary Schools

Non-government primary schools in the district are operated by the Catholic Education Office; the Australian Anglican Church and the Nowra Baptist Church. There are currently three primary schools, with a total enrolment of 1,209 students:

- St Michael's Catholic School (601).
- Nowra Anglican College (404).
- Nowra Christian Community School (204).

The long established St Michael's Catholic School, located to the west of the Nowra CBD, has in recent times experienced fluctuating student levels within a 580-640 range. The Nowra Anglican College, located in Bomaderry, was opened in 2000 and experienced an initial rapid increase in enrolments (Table 4.22). However since 2003, student levels have plateaued at the 400 mark. Located in Worrigee, the Nowra Christian Community School has since 1999 maintained a steady level of enrolments in the 201 to 211 range.

Since 1999 the non-government sector has experienced an increase in its share of total primary school enrolments, increasing from 22% in 1999 to 33% in 2005. Much of this increase is attributed to the opening of the Nowra Anglican College.

High School Education

In 2001 there was a total of 2204 resident young people living in Nowra Bomaderry, who attended secondary school (Table 4.24). Of these 76% attended government high schools; 15% attended Catholic schools; and 8% attend other non-government schools.

Table 4.24: **Nowra Bomaderry Residents Attending High Schools**

Educational Group	Males	Females	Persons	Proportion of Population %	Proportion of Sub-Group %
Government High Schools	847	831	1678	5.9	76.1
Catholic High Schools	173	161	334	1.2	15.2
Other Non-Government High Schools	91	101	192	0.7	8.7
Total Primary Schools	**1111**	**1093**	**2204**	**787**	**100.0**

Source: Australian Bureau of Statistics: Census of Population & Housing 2001.

State High Schools

There are three State operated high schools in the Nowra Bomaderry area, with a total 2005 enrolment of 3,061 students. These include:

- Bomaderry High School (942).
- Nowra High School (1130).
- Shoalhaven High School (989).

The catchments of these schools extend well beyond Nowra Bomaderry. Total enrolments in the three Nowra Bomaderry high schools have declined by 10% over the last decade (Table 4.25). In the remainder of the Northern Shoalhaven there is only one high school at Vincentia. This school was opened in 1993 and operates on a double shift principle (963). The decline in Nowra Bomaderry high school enrolments is attributable to the opening of the Vincentia high school and the transfer of students to that school. This transfer affected Nowra and Shoalhaven high schools. Enrolments in Nowra Bomaderry in fact peaked in 1992 at 3560. Overall, enrolments for the Northern Shoalhaven have increased by 17%.

Table 4.25: **Nowra Bomaderry State High School Enrolments**

Primary School	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Bomaderry High	1058	1056	1030	1013	986	966	909	918	965	942
Nowra High	991	1064	1090	1149	1177	1155	1134	1104	1104	1130
Shoalhaven High	967	970	1067	1093	1108	1074	1055	1099	1034	989
Total	**3981**	**4114**	**4150**	**3255**	**3271**	**3195**	**3098**	**3121**	**3103**	**3061**

Source: NSW Department of Education & Training 2005

Non-Government High Schools

Currently there are three non-government high schools offering independent secondary education to students in Nowra Bomaderry and the northern Shoalhaven (Table 4.26). These comprise:

- St John the Evangelist High School (750).
- Nowra Anglican College (450).
- Nowra Christian Community School (188).

The non-government sector has experienced an increase in its share of total high school enrolments since 1999, increasing from 21% in 1999 to 31% in 2005. Much of this increase is attributable to the opening of the Nowra Anglican College.

Table 4.26: **Nowra Bomaderry Non-Government High School Enrolments: 2000-2005**

Non-Government Primary School	1999	2000	2001	2002	2003	2004	2005
St John the Evangelist High School	701	709	698	695	719	734	750
Nowra Anglican College	0	30	100	200	276	355	450
Nowra Christian Community School	154	159	180	174	155	174	188
Total	**855**	**898**	**974**	**1069**	**1150**	**1263**	**1388**

Source: Non-government school principals 2005.

Tertiary Education

In 2001 a total of 1679 Nowra Bomaderry residents attended a tertiary education institution. Of these, 1065 attended a technical and further educational institution; 421 attended a university; and 193 attended another form of tertiary education institution (Table 4.27).

Table 4.27: **Nowra Bomaderry Resident Population Attending TAFE & University: 2001**

Educational Group	Male	Female	Persons	Proportion	% of Sub Group
Technical & Further Education:					
Full-Time	92	128	220	0.8	20.7
Part-Time	370	469	839	3.0	78.8
Not Stated	3	3	6	0.0	0.6
Total TAFE	**465**	**600**	**1065**	**3.8**	**100.0**
University:					
Full-Time	48	106	154	0.5	36.6
Part-Time	122	145	267	0.9	63.4
Not Stated	0	0	0	0.0	0.0
Total University:	**170**	**251**	**421**	**1.5**	**100.0**
Other Institution:					
Full-Time	6	22	28	0.1	14.5
Part-Time	59	100	159	0.6	82.5
Not Stated	3	3	6	0.0	3.1
Total Other Institution:	**68**	**125**	**193**	**0.7**	**100.0**
Total Tertiary Sector	**703**	**976**	**1679**	**6.0**	**100.0**

Source: Australian Bureau of Statistics: Census of Population & Housing 2001.

Nowra TAFE: The Nowra TAFE comes under the auspices of the Illawarra Institute of Technology. The Illawarra Institute of Technology operates a network of TAFE colleges throughout south eastern NSW. The Nowra TAFE functions as two campuses: Bomaderry and the University of Wollongong Shoalhaven Campus at Mundamia. Raw enrolments tend to fluctuate between 3,000 and 4,000 per year. However better indicators are the corresponding activity levels, which tend in recent years to be in the vicinity of 900 to 950 per annum. Activity levels represent full-time equivalent students, that is being enrolled on a course that involves attending college for 20 hours or more per week. The Bomaderry campus offers the following courses: Aboriginal training; arts and media; building and construction; engineering (electrical and welding); general education; information technology; textiles and clothing; personal, community and health services; welfare; rural studies; tourism and hospitality; and automotive engineering.

University of Wollongong Shoalhaven Campus: The University of Wollongong Shoalhaven Campus at Mundamia was conceived as a fusion between a university and an institute of technology. Certain courses have been structured so as to facilitate a process of osmosis between the university and TAFE components. The university component has a current enrolment of 263 students, complemented by 790 TAFE students (Table 4.28). The Mundamia campus functions as the tertiary education hub of the South Coast. It is anticipated that the new Shoalhaven campus will reduce some of the outflow of young people to universities outside the region, particularly as the campus expands and offers more courses.

Table 4.28: **University of Wollongong/TAFE Mundamia Campus Enrolments**

Campus Component	2000	2001	2002	2003	2004	2005
University	68	85	123	160	246	263
TAFE	0	667	711	774	780	790
Total Campus	**68**	**752**	**834**	**934**	**1026**	**1043**

Source: University of Wollongong & Illawarra Institute of Technology 2005

Library Services

Nowra Bomaderry is served by Shoalhaven's central library at Nowra, located on Berry Street. The library is the hub of the Shoalhaven library system, which includes library facilities at Sanctuary Point, Milton and Ulladulla.

During Fiscal 2003/04 the Nowra library had a circulation of 304,000 books; 10,450 periodicals; 65,409 audio-visual items; 3,048 games and toys; and 36 CD ROMs (Table 4.29). The library has eight public access personal computers, providing Internet access. Internet access for a range of purposes has become an important function of the library. The library is performing an increasing educational role with a significant proportion of the library staff's time being devoted to providing advice of information access.

The Nowra library also operates a housebound service via a book mobile in and out of town to frail and elderly residents, with some 36,491 books in circulation during Fiscal 2003/04. This represents an expanding service provided by the library. Unfortunately theft of books is an increasing issue.

The prime purpose of visiting the library is recreation, hobbies, educational purposes, job or business purposes and relaxation. In an electronic information age, the future role of the Nowra library is changing. To some extent its function as an interface for the Internet may be marginalised as more homes have direct access to this network. However, value adding by library staff (advice etc) is becoming an important factor in attracting patrons to the use of its personal computers and Internet access.

In addition, the library is having a greater social function: featuring book launches; children's activities; exhibitions; and trivia nights. The range of possible activities is only limited by available space and staff.

Table 4.29: **Shoalhaven Library: Circulation 2003-04**

Library	Books	Periodicals	Audio-Visual	Games	CD ROM
Nowra	304,359	10,450	65,409	3,048	36
Ulladulla	104,594	7,362	10,589	351	3
Sanctuary Point	78,698	3,742	7,992	271	2
Mobile	55,765	0	0	0	0
Milton	15,786	2,027	580	739	0
Total	**559,202**	**23,581**	**84,570**	**4,409**	**41**

Source: Shoalhaven City Council

Education Trends and Future Needs

Nowra Bomaderry has traditionally acted as the education hub of the northern Shoalhaven. Thus educational facilities in the district have served both a regional and a local role. However with the growth of many of the satellite settlements in the northern Shoalhaven, they are becoming more self contained and are becoming less dependent on Nowra for this community service. There is an increasing trend towards private schooling.

The location of educational facilities is, perhaps, the most fundamental community component, after housing, in shaping urban structure. This is particularly so in the case of primary schools, where the optimum location is within 30 minutes walking distance for 80% of residences.

School Age Population Forecasts

By the year 2036, Nowra Bomaderry is anticipated to have a crude school aged population of 10,917, an increase of 3,643 over 2001 (Table 4.30). However, as a proportion of the total population the rate is anticipated to drop from 24% in 2001 to 20% in 2036.

Table 4.30: **Nowra Bomaderry School Age Population Projections**

Age Group	2001	2006	2011	2016	2021	2026	2031	2036
Primary School (5-9)	2519	2200	2218	2482	2903	3258	3469	3595
High School (10-19)	4755	4904	4911	4842	5150	5962	6757	7322
Total	**7274**	**7104**	**7129**	**7324**	**8053**	**9220**	**10226**	**10917**

Source: Shoalhaven City Council Planning Group 2005

4.4.2 Health

Nowra Bomaderry has witnessed a steady increase in the extent and quality of health services since 1951. The focus of the Shoalhaven's health facilities and services is based in Nowra. The Shoalhaven falls within the area serviced by New South Wales Illawarra Health, which serves over 341,000 people.

Health Priorities

The priority areas for the Illawarra Health reflect state goals and national priority areas. These are, in alphabetical order:

- Aboriginal people.
- Asthma.
- Cardiovascular disease.
- Cancer (particularly cervical, breast, skin and lung).
- Diabetes.
- Infectious diseases (particularly immunisation and HIV/AIDS in the context of sexual health and other communicable diseases).

- Injury (particularly suicide, falls in the elderly, transport accidents, assault, childhood injuries and sport injuries).
- Mental health.

These areas have been chosen as they represent the greatest opportunities for health gain within the Illawarra population. These priorities are either a common cause of premature death or a common reason for hospitalisation, are a major cost to both the health system and the community, have effective prevention or treatment methods to prevent and control it, or major inequalities between population groups exist.

Underpinning these priority areas are lifestyle issues: nutrition, physical activity, smoking, alcohol and other drugs. Other demographic segments with specific needs are: children and youth, men, people from non English speaking backgrounds, socio-economically disadvantaged people, and women.

Major Health Problems

The major reasons for hospitalisation in the Illawarra are heart disease, stroke, asthma, kidney and urinary tract disorders, musculoskeletal disorders, pregnancy and childbirth. (2003/2004).

The major causes of death in the Illawarra are heart disease, stroke, cancer, asthma, injury and poisoning and digestive system disorders. Suicide is the most common cause of death among the young, cancer among the middle aged, and cardiovascular diseases among older people.

Hospitals

The Nowra Bomaderry area and surrounding districts are served by two hospitals: Shoalhaven District Memorial Hospital, located on Shoalhaven Street in Nowra and Nowra Community Hospital (private), located on Weeroona Street in East Nowra.

Table 4.31: **Shoalhaven District Memorial Hospital: Activity Data 2003/2004**

Indicator	Actual 02/03	Actual 03/04	Increase	% Increase
Bed Days	47,010	49,830	2820	6.0%
Occupancy	95.4%	96.12%	0.7%	0.7%
Admissions	15,244	16,121	1.5%	
ALOS	3.0	3.1		
Operations	4,666	3,986	-14.6%	-14.6%
CWT* Episodes	10,346	10,399	53	5%

Source: Shoalhaven District Memorial Hospital, 2005

Shoalhaven District Memorial Hospital

The Shoalhaven District Memorial Hospital, a publicly owned facility, was opened in May 1951, in memoriam to the fallen of World War II. Initially the hospital had 20 beds; an operating theatre and an x-ray room (Clark 1990). It currently has a total of 141 beds and is an acute Level 4 hospital. It provides emergency; surgical; elective orthopaedic and plastic surgery; medical; intensive care; obstetric; gynaecology; paediatric; neonatal care; renal (outpatients); oncology (outpatients) and rehabilitation services.

In 2003/2004 the Emergency Department saw 20,800 patients and the hospital performed 3986 operations and delivered 770 babies.

The major goal of the hospital in 2003 was to complete Stage 2 of the redevelopment and move clinical and non-clinical services into the new accommodation. This was completed in April 2004 with the new stage of the hospital was opened by the Minister for Health in July 2004.

Nowra Community Hospital

The privately owned Nowra Community Hospital was opened in May 1980. Initially the hospital had 80 medical /surgical beds, three operating theatres, a central sterilising unit and a six bed recovery ward. As at 2005 the hospital had 91 medical/surgical beds. Access to the Nowra Community Hospital is sub-optimal, with access from a small residential cul de sac.

Medical Centres

Community Health Centres

Nowra Bomaderry is served by the Nowra Community Health Centre, located in Lawrence Avenue. It functions as the base community health centre for the northern Shoalhaven.

Aboriginal Health Centre

The Aboriginal Health Centre, located on Berry Street, specialises in: aging and disability; self healing; and women's health and welfare.

General Practitioners, Dentists and Associated Services

There are approximately 50 general practitioners in Nowra Bomaderry. There are a total of ten dentists operating in Nowra Bomaderry. In addition there are a number of other associated services including psychologists, physiotherapists, acupuncturalists, homeoepaths, naturopaths and chemists.

Ambulance Service

NSW Ambulance Service operates an ambulance service from a depot located at the Princes Highway/West Bunberra Street intersection, Bomaderry.

Trends and Future Needs

The current trends in health service provision are:

- Greater capital investment in hospitals
- Greater cost of medical care
- Greater incidence of day surgery and non-inpatient services
- Shorter periods of time spent in hospitals, but greater number of admissions to hospital
- Increased medical research
- Health promotion and health protection
- Development of long-term population health programs.

This is tending to have the following implications in terms of spatial distribution and the development of medical plant:

- Fewer mid-size institutions.
- Creation of highly resourced centres of excellence.
- Working in partnership with the community in relation to health services.

With the aging population, there will be a greater emphasis on facilities supporting the needs of the elderly, for instance: medical centres attached to retirement homes and hospices.

4.4.3 Recreation

Active and passive recreation, together with housing and industry, is one of the largest consumers of urban land in Nowra Bomaderry. In conjunction with educational facilities, the pattern of open space provision has a significant influence on the future development of Nowra Bomaderry's urban structure. In the case of active open space, its provision in Nowra Bomaderry is enhanced by its function as the sports field recreation hub of the northern Shoalhaven. For the purposes of this analysis, recreation is defined as those sporting and leisure pursuits undertaken by the Shoalhaven/Nowra Bomaderry community that have a significant land component.

Factors Affecting Participation

There are a number of socio-recreational trends that influence the community's participation in recreation. A number of trends were identified in the 1996 Shoalhaven Recreation Study and the 2001 Shoalhaven Sporting Facilities Plan, undertaken by Strategic Lesiure. Drawing from these studies, the following trends are considered to affect the provision of recreation facilities in the Nowra Bomaderry area:

- Changing work patterns and declining availability of 'uncommitted time' is placing greater emphasis on the quality of the leisure experience. For many, the leisure experience is one of limited time availability with an expectation of instant 'gratification'.
- A demand for a greater diversity of sport and recreation opportunities and venues which permit a greater diversity of socially-oriented and health focussed activities.
- A willingness and ability on the part of an increasing proportion of the community to pay for quality commercially delivered facilities and services.
- Expectations of higher standards of facilities (quality, ease of access and safety) and of quality programming, servicing and management.
- Higher rates of participation and levels of use.

Other community-based trends identified by Strategic Leisure (2001) include:

- Lower propensity for people to provide voluntary services to sports clubs, resulting in higher workloads for those that do.
- Lower level of volunteer involvement on large multi-use facilities resulting in users having a reduced sense of 'ownership'.
- Lower tolerance of communities to accept the environmental impacts of active recreation such as the alienation of public land, traffic congestion and noise, and light spill from evening activities.

User Age Group Profiles

Different age groups have different social and recreational requirements. An understanding of the impact of age group profiles and how these groups use open space is essential to meeting equity goals for provision. However, Strategic Leisure (2001) identified one trend that transcends all age groups. The consultants found that there was a higher participation trend in a non-organised manner than for organised activities for both males and females and in all age groups. Furthermore it becomes the dominant form of participation for all persons aged over 25 years. To meet these evolving trends the open space system needs to be variable and robust enough to absorb the peaks and troughs anticipated in the future.

Young People

In the Shoalhaven there tends to be a high interest in active recreation, whether centred on beach and ocean activities or the inland playing field. Many young people do both. This situation is being influenced by emerging urban youth recreation/leisure patterns, where:

- Sport is often perceived by young people as being increasingly institutionalised in its delivery and locked into traditions that may not be so relevant to young people. There is thus a need for organisations to provide less structured, socially-oriented forms of delivery with less emphasis on skilled performance as a prerequisite to involvement (Cormack 1999).

- There is a distinct possibility that this trend may lead to a decline in participation in the more traditional sports such as cricket and rugby. However, soccer is emerging as a popular participation sport, as a result of its World Cup profile and its non-contact nature – a safety issue for children as well as young adult females.
- Young people tend to treat recreation more as a lifestyle than a discrete sporting or leisure activity. This is particularly evident for the aficionados of surfing, skate boarding, basketball and, to a lesser extent, cycling. The holistic approach to these activities embraces equipment, apparel, accessories, food and beverage. All are greatly influenced by fashion and merchandising brands, as portrayed by the media. For instance, the Coca Cola brand has been able to position itself as being emblematic of many of these popular leisure pursuits.

Seniors

Traditionally as people get older there has been a tendency to participate in activities that require less physical effort, such as lawn bowls, where skill is the prerequisite. However, with the current trend for fitness and health, people are staying active much longer into old age. Golf, lawn bowls, croquet and tennis are key activities engaged in by people 50 years and over. Even in traditional field team sports such as rugby and soccer there is increase participation in 'golden oldies' and 'over 35' type competitions. Moreover, people of all ages enjoy walking, swimming, fishing, boating, cycling, observing nature and visiting National Parks. Catering specifically for active retirees will become more important as Nowra Bomaderry's retiree age cohort becomes larger.

The ten most popular sport and physical activities in NSW are: walking, swimming, aerobics/fitness, golf, tennis, running, fishing, cycling, ten pin bowling and lawn bowls (Table 4.32). The age factor, together with gender, length of residence, working hours, residential density and car ownership are summarised in Table 4.33.

Table 4.32: **Participation in Sport & Physical Activities in NSW: Top Ten Activities**

Activity	Males		Females		Total	
	%	Rank	%	Rank	%	Rank
Walking	12.6	3	22.3	1	17.5	1
Swimming	14.4	2	14.5	2	14.4	2
Aerobics/Fitness	7.2	6	13.7	3	10.5	3
Golf	16.4	1	4.2	5	10.2	4
Tennis	8.0	4	8.0	4	8.0	5
Running	6.6	7	3.1	7	4.8	6
Fishing	7.5	5	2.0	9	4.7	7
Cycling	5.5	8	1.7	11	3.6	8
Tenpin Bowling	3.4	11	1.9	10	2.6	9
Lawn Bowls	3.5	10	1.6	13	2.5	10

Note: Based on population aged 18 years & over in 1998/99 & 1999/00
Source: ABS Participation in Sport & Physical Activities: Catalogue 4177.0, Canberra

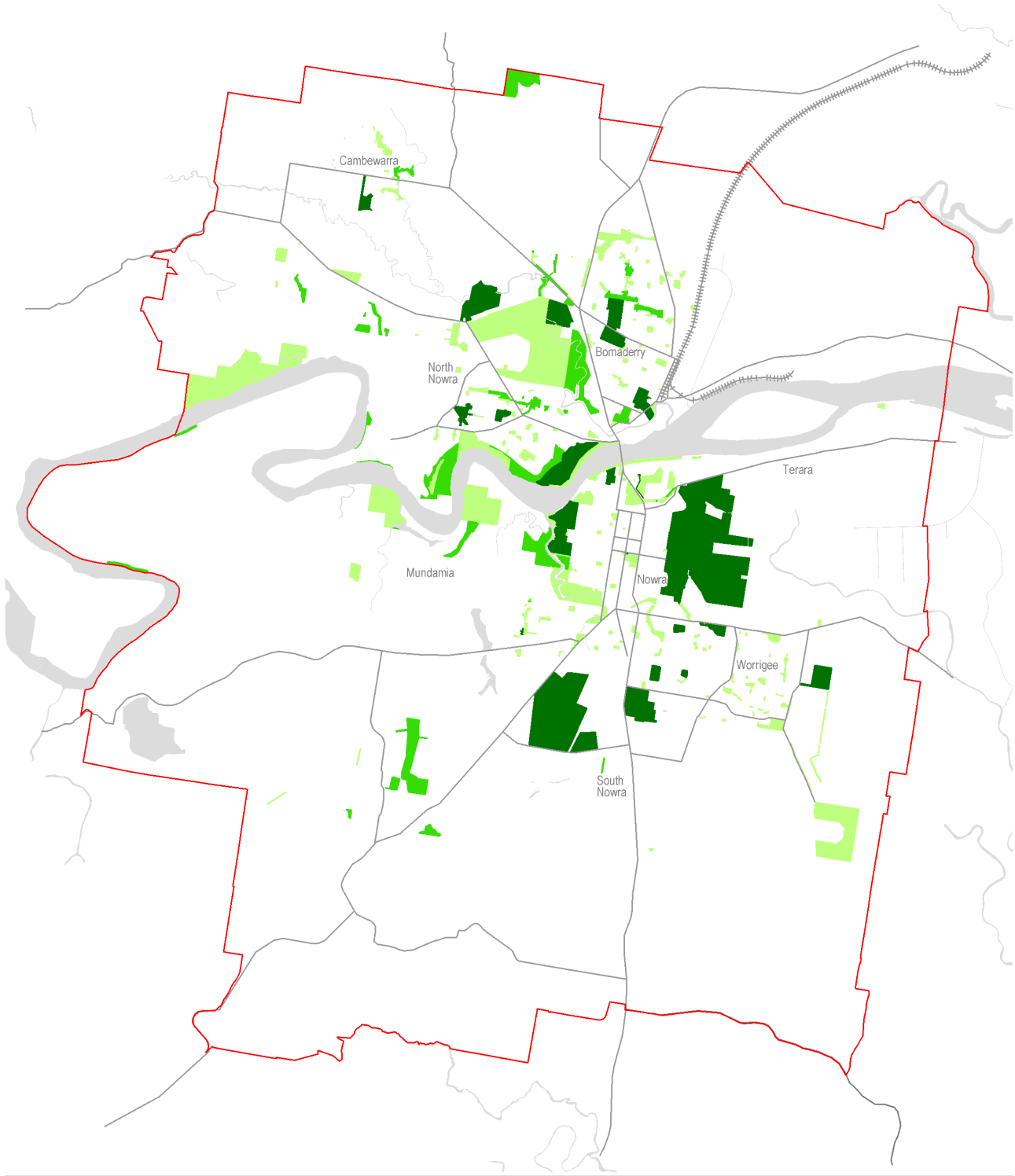
Urban Open Space

Public open space, both green and paved, provides the base-line facility for most forms of recreation. Open space in urban areas serves a number of important functions: recreational, social, ecological, climatic, hydrological, conservation and as land for urban services. Open space is also an important component of the overall 'amenity' of an area and the value placed on proximity to open space is often reflected in residential land values. Open space in urban areas caters for many different cultural needs (including family barbeques, weddings, sport and meditation to name a few) and a range of open space types is required to provide sufficient choice and diversity of experience to the residents of Nowra Bomaderry. Community needs include formal and informal recreation, celebration, performance, peace and tranquillity and communing with nature.

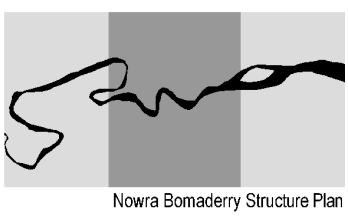
Green Space: Nowra Bomaderry is relatively well endowed with public open space (Map 4.3). The system of urban open space is focused on the Shoalhaven River. The Bomaderry and Nowra Creeks represent important secondary linear systems of open space. There is a total of 1090 hectares of Council owned and managed public open space in Nowra Bomaderry. Nowra is the most endowed precinct with respect to designated public open space (Tables 4.34). However, it should be noted that a significant proportion of Nowra Bomaderry's public open space is not usable often acting purely as a visual asset. Much of the designated land is constrained by its functional use as a drainage corridor, drainage basin or bushfire buffer.

Table 4.33: **Summary of Socio-Economic Factors Influencing Recreation Participation**

Indicator	Recreational Needs of the Population	Provision Implications
Age	Age is the important determinant of recreational patterns. Younger people are more active in a variety of recreational pursuits, preferring to use organised sporting facilities. As people get older tend to participate in activities that require less physical effort, such as lawn bowls, where skill is the prerequisite. People of all ages enjoy walking, observing nature, cycling, swimming, golf and visiting National Parks. For children aged 5-14 years soccer, touch football, basketball, netball and dance/ballet classes are most popular. The popularity of soccer, touch football and basketball is maintained for youth aged 15-24 years however involvement in other activities such as golf, aerobics and cricket increases. Between the ages of 25-39 years participation in golf, touch football, gym, aerobics, tennis and squash increases whilst involvement in other activities declines. Golf, lawn bowls and tennis are key activities engaged in by people 40 years and over.	A range of open space and recreation opportunities need to be provided to cater for all age groups, taking into account the need for informal settings and facilities for an aging population, and the specific needs of children and youth.
Gender	Gender has historically been a significant variable in defining the patterns of sport participation. Males are likely to use and participate more often in active recreational pursuits than females. For example, traditional sports such as rugby league/union, golf and cricket tend to be a male preserve, whilst netball, aerobics and dance/ballet are associated with females. This polarization also tends to be applied to general recreation such as cycling and surfing. Bucking this trend is the significant recruitment of young females to soccer.	Recognise the need to cater for the different recreation needs and preferences of males and females.
Length of Residence:	Long term residents tend to use open space more often than short term residents, probably due to a greater degree of knowledge about recreation facilities in their area. Also permanent residents tend to make more use of sports facilities than non-permanent residents.	Ensure new residents & non-permanent residents are aware of the recreational opportunities in their local area.
Hours worked by employed persons	The higher the number of hours worked, the less time that may be spent on recreational activities	Long working hours & high incidence of part-time work requires access during evenings > late opening times & night lighting.
Dwelling structure and density	Detached dwellings generally have play space for children. Medium density dwellings and flats have little play space which increases reliance on local public play facilities.	Need to provide sufficient open space, particularly children's play space, in medium density & small lot detached housing areas.
Vehicle ownership	Vehicle owners have mobility to use open space more frequently for active recreation, and use a greater variety of open space types. People without access to a vehicle tend to visit local parks within walking distance of their homes or on a public transport route.	Need to cater for those residents without private transport, especially living away from public transport routes.



Open Space System



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Natural bushland / foreshore areas (Crown and other reserves)
- Active recreation areas (sportsgrounds)
- Passive recreation areas (town parks etc)

NOTE:
Data received from Council's Recreation and Stragegy Officer and dated 28th July 2005

September 2005

0 1 2
Kilometres

Map 4.3

Table 4.34: **Nowra Bomaderry Public Open Space**

Indicator	Bomaderry ha	North Nowra ha	Nowra ha	South Nowra ha	Rural North ha	Rural South ha	Total ha
Passive Open Space	30.0	155.6	83.7	0.0	87.6	101.9	458.8
Active Open space	39.0	54.5	138.4	120.1	7.1	99.9	459.0
Bushland/Foreshore	29.2	63.1	18.9	2.95	22.6	35.0	171.8
Total	**98.2**	**273.2**	**241.0**	**123.1**	**117.3**	**236.8**	**1089.6**

Source: Shoalhaven City Council 2005

Urban Spaces: The social and cultural needs of the community for urban spaces can be summarised under the objectives of easy access; safety and crime prevention; identity and cultural relevance; and equity for youth and the elderly. The most significant of Nowra's paved urban spaces, apart from its streets are in the form of malls in retail centres such as Nowra Mall and Nowra Stocklands. Here access is denied after closing time and there is a perceived resistance to welcoming young people into these corporately owned precincts.

Outdoor Sports

Nowra Bomaderry has sports grounds for all the popular Australian field sports: cricket: rugby league and union; hockey; netball; soccer; touch football; AFL, athletics and swimming. Outdoor sports are catered for by four centres in Bomaderry; three centres in North Nowra and ten centres to the south of the Shoalhaven River.

Table 4.35: **Nowra Bomaderry Outdoor Sport Facilities: 2005**

Facility	Area (ha)	Current Sporting Activities
Bomaderry:		
Arte Smith Oval	7.85	Hockey (3); AFL (1); Cricket (2); Indoor basketball courts (2)
Thurgate Oval	6.14	Soccer (1); Cricket (1)
Bomaderry Oval	1.91	Rugby League (1) or Mini Soccer (1); Cricket (1)
Bomaderry Sports Complex	9.60	Rugby League/Touch Football (3); Cricket (2)
North Nowra:		
Drexel Park	3.55	Mini Soccer (1); Cricket (1)
Sharman Park	1.59	Mini Soccer (1); Cricket (1)
Bernie Regan Sports Complex	22.55	Hockey (3) or Soccer (2); Cricket (2)
Nowra:		
Lyrebird Park	9.10	Rugby League (2); Mini RL (1) Soccer (2); Mini Soccer (3) Cricket (2)
West Street Oval (Part)	5.88	AFL (1)
Ratcliffe Park	3.87	*No designated formal sport*
Park Road Reserve	3.27	Hard Netball Courts (12); Grass Netball Courts (6)
Nowra Showground	14.76	Rugby League (1); Cricket (2)
South Nowra:		
Ison Park	20.85	Soccer (5); Cricket (1)
Rugby Park	9.81	Rugby Union (2); Touch Football (4); Cricket (1)

Source: Shoalhaven City Council September 2005

Swimming Pools: There are four swimming facilities in Nowra Bomaderry, two public (Bomaderry and Nowra) and two private (Meadows Swim School and Riverhaven Motel). The Bomaderry Aquatic Centre has a heated outdoor 50 metre pool and an indoor 25 metre pool. Both pools are open throughout the year. Access to the 50 metre pool in Nowra is restricted to the summer months (November-March). Thus outside the summer season, the Bomaderry Aquatic Centre is Nowra Bomaderry's only public swimming venue.

Tennis Courts: There are four tennis court centres in Nowra Bomaderry, located at: Nowra Showground (6 hard courts); Bomaderry Sports Complex (6 hard courts); and Nerang Road Tennis Centre (10 synthetic turf courts).

Basketball: There are two indoor basketball courts located in the Shoalhaven Basketball Stadium in Bomaderry. In addition there are several open basketball courts in the Nowra Bomaderry area.

Netball Courts: Netball courts are located at: Park Road Netball Centre (12 hard and 6 grass courts). In addition, some of Nowra Bomaderry's schools have netball courts.

Golf Courses: There are three golf courses in Nowra Bomaderry: Nowra Golf Club (18 hole); Shoalhaven Ex-Servicemen's Club (18 holes); and Vineyard Golf Links (18 hole). There is also a golf range and putt-putt centre at East Nowra.

Lawn Bowls: There is a total of three bowling clubs in Nowra Bomaderry: Bomaderry Bowling club (3 greens); Nowra Bowling Club (2 greens). Shoalhaven Ex-Servicemen's Club (2 greens).

Horse and Greyhound Racing: A racing precinct is located at South Nowra, on land specifically dedicated by State Government, containing a horse racing course, paceway and greyhound racing course.

Equestrian Centres: Nowra Bomaderry has a wide range of equestrian organisations: Cambewarra and Shoalhaven pony clubs; dressage clubs; jumping clubs; endurance riding clubs; a polo club; as well as clubs focussing on a specific breed (eg Arabians and Apollosa). The key equestrian centres are: the Equestrian Common at Worrigee; the Shoalhaven Polo Club near Nowra Hill and the Cambewarra Pony Club.

Water Sports: The waters of the Shoalhaven River are utilised for rowing, sailing and water skiing. Each activity has designated riverside facilities.

School Sports Facilities

Some of Nowra Bomaderry's high schools provide sports facilities with limited public access. These facilities include: hockey, cricket, athletics and tennis.

Current Standard of Provision

The Shoalhaven City Council Recreation Study prepared in October 1996 concluded that there are major inequities in the Shoalhaven between the provision of outdoor recreation venues and indoor venues with the bias clearly towards outdoor sports. The study found that this imbalance be addressed through the provision of indoor sport venues, serving a range of sport, fitness, cultural and recreational needs.

Shoalhaven City Council's 1999 survey of community attitudes to the City's sports fields found that the residents of Nowra Bomaderry were more or less on par with the population of the Shoalhaven as a whole, regarding the importance they attach to playing fields (79%) and their satisfaction with the provision (79%). They were only topped by the residents of Milton-Ulladulla who registered 84% and 86% respectively for these indicators.

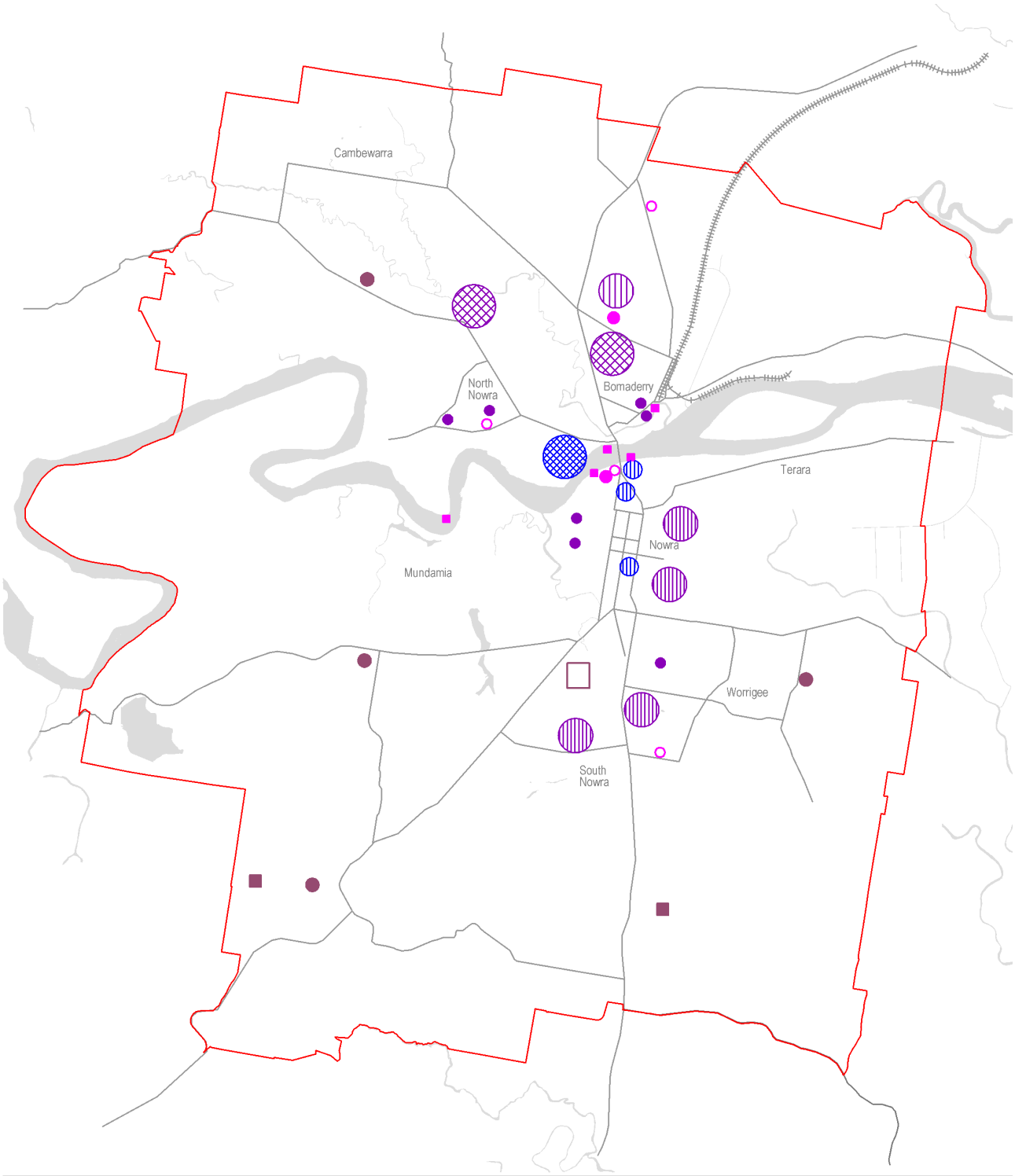
The Shoalhaven Sporting Facilities Plan (2001) identified a number of planning issues associated with the sports facilities in Area 1. These included: conflicts of interest at multi-purpose venues; quality of sports fields degrade through overuse; capacity limitations at the Bomaderry Indoor Sports Complex; and a need for indoor netball courts.

The current open space system is shown on Map 4.3 and the current provision of recreation facilities is shown on Map 4.4. Along with the issues raised above the location of the open space system and various facilities needs to be taken into consideration when addressing future needs.

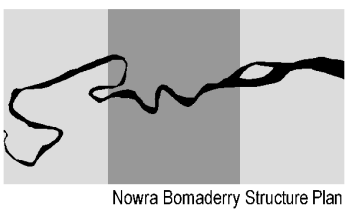
Future Recreation Needs

Whilst it is possible to estimate general land requirements for the longer term, it is difficult to nominate specific activities for periods beyond ten years. Thus to provide for the longer term needs of the Nowra Bomaderry community, a standards approach identifying in general terms the future demand for passive and active open space is deemed appropriate. Thus on the basis of the current open space to population ratio the following standards have been adopted:

Passive open space: 14.61 ha/1,000 persons
Active open space: 14.62 ha/1,000 persons
Bushland/foreshore: 5.47 ha/1,000 persons



Recreation Facilities



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Aquatic Centres
- Swim Schools
- Boat Ramps
- Equestrian Facilities
- Gun Club Facilities
- Nowra Raceway

Passive Recreation
- Icon Park
- District Park

Active Recreation
- Regional Park
- District Park
- Local Park

September 2005

0 1 2
Kilometres

Map 4.4

On the basis of these current ratios, Table 4.36 summarise the projected requirements for passive and active open space together with bushland/foreshore land. It is acknowledged that these are based on high, potentially unsustainable standards.

Council, in assessing its future needs for open space, has tended to move away from a purely standards approach, focussing instead on developing a hierarchical structure of recreation facilities. The reason for this shift was based on a number of factors:

- Relatively large amount of open space in the Shoalhaven, particularly considering the amount of National and State Parks within and surrounding the area, and the proximity of foreshore and waterways, contributing to the open space needs of local communities.
- Need to limit Council's maintenance costs (which are not covered by s94 contributions), particularly for small, widely separated and non-connected parcels of open space land.
- Trend for subdivision developers to allocate smaller and less useful parcels of land for open space, with the temptation to include drainage reserves as part of the open space allocation.
- Changes in the way families use open space.
- Need to reduce Council's exposure to risk (eg injuries to people using poorly designed or located lands; vandalism and other anti-social behaviour).

Table 4.36: **Projected Land Requirements for Open Space**

Indicator	Current	2006	2011	2016	2021	2026	2031	2036
Population:	31,400	31,681	34,307	37,866	41,513	45,736	49,771	53,710
Passive Open Space (ha)	458.8	462.9	501.3	553.3	606.6	668.3	727.2	784.8
Active Open Space (ha)	459.0	463.1	501.5	553.5	606.8	668.6	727.5	785.1
Bushland/Foreshore (ha)	171.8	173.3	187.7	207.2	227.1	250.2	272.3	293.9

Passive Open Space Provision Requirements and Design Standards

Council has developed a system of passive open spaces that range from icon parks, district parks and local parks.

Icon and District Parks: The concept of icon parks has been developed in recognition of the importance of certain high profile locations to the economic and social fabric of the City. Council, State Government and key stakeholders support the concept of Icon Parks in recognition of improved access and standard of facilities to be enjoyed both by the local community and visitors to the Shoalhaven. It is envisaged that icon and district parks will become the 'flagship parks of the Shoalhaven and will be the equal of high profile locations on the NSW North and South Coast. A number of locations have been identified as suitable for development as icon and district parks, based on the following criteria:

- Current high levels of visitation.
- Impact on visitor perceptions of the Shoalhaven.
- Likelihood of flow-on commercial benefits.
- Proximity to supporting attractions.
- Significance to tourism.

The planned significant upgrade and embellishment of the icon and district park sites supports Council's aim of broadening the tourist season, lengthening average duration of tourist visits, increasing opportunities for coach-compatible tourism and providing a higher standard of amenity for existing and future residents. These parks are detailed in Council's Section 94 Contributions Plan 2004 - Passive Open Space: City Wide (Shoalhaven City Council 2004). Currently there is one icon and three district parks in Nowra Bomaderry (Table 4.37). The development requirements for these parks is summarised in Table 4.38.

Table 4.37: **Passive Open Space: Icon & District Parks**

Park Status	Name of Park	Type	Area
Icon Park	Greys Beach, North Nowra	River Foreshore	7.96 ha
District Park	Riverview Road/Scenic Drive Reserve, Nowra	River Foreshore	6.48 ha
	Marriott Park, Nowra	Urban Park	3.03 ha
	Harry Sawkins Park, Nowra	Urban Park	4.57 ha

Source: Shoalhaven City Council 2004

Table 4.38: **Passive Open Space Requirements**

Park Status	Development Requirements
Icon Park	Current high levels of visitation; ability to impact on visitor perceptions of the Shoalhaven; likelihood of flow-on commercial benefits; proximity to supporting attractions; and high significance to tourism.
District Park	An area of substantial size, which is well developed, offering a broad range of quality recreation opportunities and receives a high level of resident and tourist visitation. District playgrounds need to be central to populations of 3,000 people and be sited within 1.5km of another playground of a similar size. Infrastructure associated with district parks includes a range of facilities to cater for a variety of users including toilets, landscaping, BBQ facilities, shade, seating, car parking, and playground equipment suitable for toddlers, juniors and older children, and a hard surface area for ball games. lighting, bins, signage, paths, Minimum acceptable area: Not less than 10,000 m2.
Local Park	Defined as primarily serving local neighbourhood of approximately. 250 people, and within walking distance, 400-800 m radius from the local park, of the surrounding residential area. A playground function will not be provided in land categorised as linkages and buffers. Minimum acceptable area: Not less than 3,000 m2. The infrastructure associates with Local Parks includes, playground equipment suitable for toddlers and juniors, minor landscaping reflecting existing vegetation, limited seating, shade, limited paths to enhance the play opportunities, signage.

Source: Shoalhaven City Council 2005

Consideration will be required in the planning of Nowra Bomaderry regarding unique features or opportunities which may result in the development of an additional Icon park within the area, eg within proximity to Bomaderry railway station as part of the significance as a public transport interchange, and the entry point for rail users to the city of Shoalhaven, and linear link to Nowra and the CBD.

Active Open Space Provision Requirements and Design Standards

Council has developed a system of passive open spaces that range from regional parks, district parks and local parks.

Regional and District Parks: Regional parks provide competition standard facilities for both residents and visiting competitors. They represent Shoalhaven's 'flagship facilities' and will have profiles equal to that of similar status facilities in the Illawarra and South Coast region. A number of locations have been identified as suitable for development as regional and district parks, based on the following criteria:

- Central and accessible location
- Competition standard facilities
- Impact on visitor perceptions of the Shoalhaven
- Likelihood of flow-on commercial benefits
- Proximity to support facilities

The two designated regional parks in Nowra Bomaderry are the existing facility at Artie Smith Sports Complex in Bomaderry and the Bernie Regan Sporting Complex in North Nowra. In addition to these higher level facilities, there are five district parks and seven local parks (Table 4.39). The development requirements for these parks is summarised in Table 4.40.

Table 4.39: **Active Open Space: Regional District & Local Parks**

Park Status	Name of Park	Main Sporting Activities	Area (ha)
Regional Park	1: Artie Smith Sports Complex, Bomaderry	Hockey & Cricket & Basketball	7.85
	2: Bernie Regan Sporting Complex, North Nowra	Hockey/Soccer & Cricket	22.55
District Park	1: Bomaderry Sports Complex, Bomaderry	Rugby League/Touch & Cricket	9.60
	2: Lyrebird Park, Nowra	Rugby League/Soccer & Cricket	9.10
	3: Ison Park, South Nowra	Soccer & Cricket	20.85
	4: Rugby Park, South Nowra	Rugby Union/Touch & Cricket	9.81
	5: Wondalga Sports Complex, Nowra	Soccer/Rugby League & Cricket	*20.00*
Local Park	1: Thurgate Oval, Bomaderry	Soccer & Cricket	6.14
	2: Bomaderry Oval, Bomaderry	Rugby League/Mini Soccer & Cricket	1.91
	3: Drexel Park, North Nowra	Mini Soccer & Cricket	3.55
	4: Sharman Park, North Nowra	Mini Soccer & Cricket	1.59
	5: West Street Oval, Nowra	AFL	5.88
	6: Park Road Reserve, Nowra	Netball	3.27
	7: Nowra Showground, Nowra	Rugby League & Cricket	14.76

Source: Shoalhaven City Council 2005

Table 4.40: **Active Open Space Requirements**

Park Status	Development Requirements
Regional Park	Minimum requirement: • Multiple sports fields with at least one with a stadium structure. • Regional competition standard facilities
District Park	Minimum requirement: • Accommodate 4 full sized football fields, with 2 sets of fields side by side allowing 2 cricket pitches to be provided, with 10m between the playing field boundaries to accommodate the pitch. • Playing field boundary fence • Adequate space around the playing fields to enable appropriate location of floodlight poles to meet Australian Standards for night time competition. • Adequate space to accommodate 6 Tennis courts • Adequates space to accommodates 6 Netball courts • Toilets facilities, canteen, change room to comply with BCA code of Australia. • Storage facilities to accommodate equipment to for each set of 2 fields • Pedestrian circulation space between amenities and playing fields • Seating for spectators which can be in the form of grassed mounds • Access and parking
Local Park	Minimum requirement: • Located within the residential area to be serviced. • Accommodate 2 full sized football fields, in a side by side configuration, with a 1% fall, which would enable a cricket pitch to be located between the two fields, with an allowance of 10m between the playing field boundaries within which the pitch can be located. • Playing field boundary fence • Adequate space around the playing fields to enable appropriate location of floodlight poles to meet Australian Standards for night time competition. • Amenities building of approx. 400sq m in size, to comply with BCA code of Australia, accommodating toilets facilities, canteen, Storage room, and change room. • Irrigation and drainage systems • Pedestrian circulation space between amenities and playing fields Access and parking, for approx. 50 spaces per hectare.

Source: Shoalhaven City Council 2005

Walking Tracks

A comprehensive system of linkages is a key element of any open space system. Accordingly Council has developed a system of walking tracks throughout the Shoalhaven, comprising of icon, district and local walking tracks. The walking tracks within the icon and district categories located in the Nowra Bomaderry area are listed in Table 4.41.

Table 4.41: **Icon & District Walking Tracks**

Track Status	Name of Track	Connectivity	Length
Icon Walking Track	Two Rivers Walk	Section 1: Shoalhaven River to Yalwal	16.5Km
		Section 2: Yalwal to Braidwood Road	24.5 Km
		Section 3: Braidwood Road to Tianjara Creek	15.0 Km
		Section 4: Tianjara Creek to Little Forest	18.0 Km
		Section 5: Little Forest to Clyde River	27.0 Km
District Walking Track	Bomaderry Creek Walk	Nowra Bridge to Moss Vale Road	4.0 Km
	Bens Walk	Nowra Hospital >	5.5 Km
	The Grotto Walk	North Nowra: Shoalhaven River	2.5 Km
	Bangalee Reserve Walks	Weir Graves, Condie Graves & Forest Walk	7.5 Km

Source: Shoalhaven City Council 2004

Two Rivers Walk: In the early 1990s an inter-agency committee, known as the Two Rivers Walking Track Committee was established to develop a walking track from the Shoalhaven River to the Clyde River. Now known as the Two Rivers Walk, the northern end of this recreational link is located at Coolendel, on the southern bank of the Shoalhaven River to the west of Nowra (Table 4.41).

Proposed and Potential Recreation Facilities

Wondalga Sports Complex: The most significant recreational project identified for Nowra Bomaderry is the Wondalga Sports Complex earmarked for land to the east of Nowra Stocklands. This is intended to be a predominantly outdoor sporting facility with capacity for 15 playing fields (rugby league or soccer). The proposed facility is located on land that is subject to flooding and has a high likelihood of the presence of acid sulphate soils on the site. This constraint has the potential to put significant limitations on the development of structures to accommodate facilities for this sporting complex.

Other potential sports facilities include:

- New skate park at Nowra Stockland
- Augmented indoor sports centre at Bomaderry
- Rugby Park stadium
- Potential new aquatic centre at Mundamia

4.4.4 Community Support

Community support facilities and services include: children's services; youth and young adult services; and services for the aged and disabled. These services are for the most part funded by state and federal government, with a number of providers, including Council.

Children's Services

The following children's services are available in Nowra Bomaderry: Family Day Care; Long Day Care; Long Day Care/Pre-Schools; Pre-Schools; Playgroups; Occasional Care; Vacation and After School Care; Support for Children with Special Needs.

Youth and Young Adult Services

Youth and young adult services include a Youth Centre and Crisis Accommodation.

Services for the Aged and Disabled

The Commonwealth funded Home and Community Care (HACC) Program operates in the Shoalhaven to supply the extra home-based care required by the frail aged and those with disabilities. Approximately 1.5 community nurses, as well as generalist nurses are employed by Illawarra Area Health Service to care for the HACC target group. The following HACC services are currently available to the elderly in Nowra Bomaderry: Home care services; home maintenance and modification; food services (Meals on Wheels); community respite care; community transport, including a paramedical service; community nursing; assessment and referral; coordination - worker the aged and younger disabled; disability service (interchange); community options; Telecross.

4.4.5 Community Security

Community security facilities in Nowra Bomaderry include: police stations; courthouses; and security firms.

Police Stations

Nowra Police Station: The Nowra police station functions as the Department of Police's local area command, overseeing policing operations throughout the Shoalhaven. The current staffing of the Nowra police station totals 73 sworn officers: Detectives (8); Highway Patrol (8); and General Duties (57). The station processes all reported crimes in the Nowra Bomaderry area. The station has six cells to hold suspects held in custody pending a court appearance. All suspects held in custody pending trial, are sent to Long Bay in Sydney. All police radio communications in the Shoalhaven is operated from the regional police centre at Warilla in Shellharbour. The radio antennae at Nowra police station is currently unused by NSW Police. However, the antennae is leased to Optus and Vodafone for their cellular phone service.

Bomaderry Police Station: The Bomaderry police station is operated on an ad hoc basis by Nowra-based officers and is not permanently manned. Its facilities are regularly used by highway patrols. It is also used as a taskforce venue, such as a specific crime investigation.

Community Policing: Community policing is currently being implemented via two taskforces: Youth Liaison and Community Safety.

Nowra Courthouse

The Nowra Courthouse is located on Plunkett Street. It comprises a court and an office. The court and office operates five days per week. It performs both a local court and a district court function.

Local Court: The Nowra courthouse operates as a local court throughout the year: five days per week, including a children's court.

District Court: A magistrate operates a district court circuit that presides in Nowra three times per year and sits for two weeks. The Distinct Court adjudicates on all serious crimes, such as homicide, rape and culpable driving.

Family Court: Family Court matters concerning the residents of Nowra Bomaderry are addressed at the Australian Family Court in Wollongong.

Private Security Services

With the increasing need to be responsible for their own corporate security, the number of private security organisations have increased significantly over the past 20 years. There are two key Nowra based security firms, that perform all manner of security functions, guard and electronic surveillance (including armed escorts). Wollongong based firms perform armoured vehicle delivery/collection services to Nowra's banks.

Trends and Future Needs

The creation and maintenance of safe neighbourhoods and shopping centres is an on-going issue for the Nowra Bomaderry community. This needs to be addressed at both the macro and local levels.

4.4.6 Culture and Entertainment

Nowra acts as the culture and entertainment hub of the Shoalhaven. Facilities provide for the needs of the Nowra Bomaderry population, as well as those for the majority of residents in at least the northern Shoalhaven. As with many regional centres of NSW cultural and entertainment tend to be low key, with an emphasis on amateur enterprise. The 1960/70s trend to domestic isolation for entertainment and cultural stimulation (TV and video) has in recent years tended to decline, with a commensurate increase in visits to traditional public venues, such as theatres and cinemas.

Theatres and Cinemas

Theatre facilities in Nowra Bomaderry include: Roxy Cinema; and West Theatre. In addition there are a number of community buildings that are used for cultural activities, that include the dramatic arts. These include: School of Arts, Greens Hall, Bomaderry Hall and the South Nowra Community Hall.

Roxy Cinema: The Roxy Cinema was built in 1935 as a one screen theatre. In the 1980s it was converted into a twin screen then a triple screen theatre, in line with the trend for simultaneous showing of films in boutique theatres. Currently the three theatres seat: 90, 120 and 180 patrons.

Licensed Clubs

Licensed Clubs in Nowra Bomaderry tend to come within the ambit of two categories: service and sporting. All clubs have licensed bars, restaurants and an array of poker machines, whilst some have TAB facilities and satellite television. Licensed clubs represent important venues for dining and entertainment for a significant proportion of Nowra Bomaderry's population. Clubs in Nowra Bomaderry comprise: Nowra Ex-Servicemen's Club (7000); Bomaderry RSL Club (2600); Bomaderry Bowling Club (5000); Nowra Bowling Club (1000).

Museums and Galleries

There are four historical museums in the Nowra Bomaderry district:

- Old Nowra Police Station Museum.
- The Nowra Museum.
- Royal Australian Air Station Museum.
- Meroogal Historic House Museum.

Galleries

Currently there are two galleries in Nowra Bomaderry: the Norton Gallery, Bomaderry and the Nowra Galleries, located in the Cress Centre, on Kinghorne Street. In addition there is a proposal to convert Graham Lodge into an art gallery.

Bundanon/Riversdale

Although not within the Nowra Bomaderry structure plan area, the Bundanon/Riversdale property must be considered to be an integral part of its array of cultural assets. The property has been developed as part of the trust administering Arthur and Yvonne Boyd's gift to the nation, Bundanon. Whilst the Bundanon property itself has not been developed, the nearby property of Riversdale has been developed in a controlled manner, in keeping with the context of the existing site. Incorporated features include:

- Amphitheatre for live performances.
- Increased accommodation allowance.
- Facilities allowing for artists workshops and site visits.
- Multi purpose Entertainment Centre.

Shoalhaven Multipurpose Cultural/Convention Centre

Council is currently working towards provision of a multi purpose cultural/convention centre on the Civic Centre site fronting Bridge Road.

The magnitude of the centre will allow the area to attract many touring groups and activities which are not currently viable to hold in existing facilities.

4.4.7 Religious Facilities

The spiritual life of Nowra Bomaderry is to a large extent provided for by 15 Christian communities, with their centres of focus being some 19 churches and places of worship. These are, for a number of religious traditions, supported by pastoral care facilities and services. For the most part they are concentrated in Nowra (Table 4.42).

Religious Affiliation

According to the 1996 Census of Population and Housing, the religious traditions with the largest number of followers are: the Anglican Church (32.1%); Catholic Church (23.1%); Presbyterian and Reformed Church (7.5%); Uniting Church (7.0%); the Baptist Church (2.4%); and the Pentecostal Church (1.3%). Non Christian religious traditions accounted for only 0.7% of the population. Census figures represent stated religious affiliations and do not necessarily represent regular church attendance, which tend to be far lower. A total of 12.7% stated that they did not practice any religion.

Religious Affiliation Trends

The religious affiliations of the Nowra Bomaderry population, over the past four Census periods, are indicative of a number of trends. The gradual decline in the proportion expressing allegiance to the Anglican Church (known as the Church of England at the 1981 Census), can be attributed to both the drift to other Christian Churches and the preparedness of the population to register the fact that they do not practice any form of religion. The gradual growth in the proportion of the population expressing an allegiance to the Catholic Church can, in part, be attributed to migration from non Anglo-Celtic countries with a strong affiliation to the Catholic tradition. This is a causal factor in the declining influence of the Irish culture within the original Australian Catholic Church. Within the non mainstream Christian religions, there has been sustained growth in the Pentecostal, Salvation Army and the Jehovah Witness traditions. Several religious traditions, exhibiting significant growth, reflect the fact that the expansion in numbers originates from a small base. This is particularly the case with the non-Christian religions, where, although the absolute numbers are small, the most significant growth has been in Buddhism.

Christian Churches

The following mainstream Christian traditions are represented in the form of permanent places of worship and pastoral care facilities within the Nowra Bomaderry area: Anglican, Baptist, Catholic, and Uniting Churches. Other Christian traditions with an active presence in Nowra Bomaderry include: Churches of Christ; Christian Bretheren, Christian Life Centre, Christian Outreach, Gospel Chapel; Jehovah Witnesses; Latter Day Saints; Presbyterian, Salvation Army, Seventh Day Adventists and Union Church.

Table 4.42: **Churches in Nowra Bomaderry**

Christian Tradition	North Nowra	Bomaderry	Nowra	South Nowra	Rural	Total
Anglican	-	1	1	-	-	2
Baptist	-	-	-	1	-	1
Catholic	-	1	1	-	-	2
Churches of Christ	1	-	-	-	-	1
Christian Bretheren	-	-	1	-	-	1
Christian Life Centre	-	-	-	1	-	1
Christian Outreach	1	-	-	-	-	1
Gospel Chapel	-	-	1	-	-	1
Jehovah Witnesses	-	-	-	1	-	1
Latter Day Saints	-	-	1	-	-	1
Presbyterian	-	1	1	-	-	2
Salvation Army	-	-	1	-	-	1
Seventh Day Adventists	-	-	1	-	-	1
Union Church	-	-	-	-	1	1
Uniting Church	-	1	1	-	-	2
Total	**2**	**4**	**9**	**3**	**1**	**19**

Note: The Presbyterian Church in Bomaderry is also used by the Baptist Church.
Source: Shoalhaven City Council 1998.

Other Spiritual Traditions

Although as yet, there are no places of worship for non Christian spiritual traditions, within the Nowra Bomaderry area, there is a growing number of adherents to other faiths such as Islam and Buddhism.

Trends and Future Needs

Since World War II, religion has gradually moved from the centre of community life to the margins. Paradoxically in recent years there is an increasing interest in the spiritual side of life. This is, however, marked by a degree of disenchantment with traditional church institutions and structures.

In 1996 the Anglican, Protestant and Catholic Churches undertook surveys of the current spiritual and pastoral lives of their churches. The report on these surveys, 'Taking Stock' (Kaldor 1999) provides an overview of the beliefs, attitudes and religious practices of Anglican, Protestant and Catholic church attendees throughout Australia and articulates the challenges faced by the mainstream churches.

Planning Implications

On balance it can be concluded that religious facilities will continue to be an important element of community facility planning, providing for both spiritual and pastoral needs. The planning of these facilities would, however, need to take account of the following differences to previous community planning models:

- Lower involvement in church life across the community, to a degree counter-balanced by a stronger commitment of adherents (Kaldor 1999).
- Wider range in the type of religious facilities (Buddhist temples, Islamic mosques and informal places of spirituality/worship).

4.4.8 Cemeteries

The Shoalhaven Memorial Gardens and Lawn Cemetery (SMGLC) at Worrigee represents the Shoalhaven's principal place for the committal and remembrance of its dead. Approximately 80% of all deaths in the Shoalhaven are cremated at the SMGLC. A further 10% of local deaths are interred in the SMGLC's burial sections. Most bereaved families choose to use the SMGLC chapel for the funeral service. The facility was opened in 1987, with the chapel, administration and crematory becoming operational in 1992.

There are no specific areas set aside for the various religious traditions. The rate of cremations has been steadily increasing, whilst the rate of burials has decreased.

In 1992, the first year of the cremator's operation, cremations accounted for 61% of all committals. Since then, the proportion of cremations have increased to 80%.

Capacity

Of the 650 funerals (average: 1996 to 2004) conducted at the SMGLC each year, 80% (average: 520) held the service in the chapel or in the grounds of the cemetery. Council's cemeteries administration estimates that the average attendance at chapel services at the SMGLC is 80 persons. However, this average is the product of a wide variation in the numbers attending. Services vary from just a few people attending to several hundreds. The administration also estimates that approximately 10,000 visitors attend the facility each year for purposes other than attending a funeral service/burial. Overall, it is estimated that there are over 55,000 visits to the lawn cemetery annually.

Trends and Future Needs

Under NSW law all licenses issued for burial cannot be revoked, meaning that the burial is in perpetuity. The industry continues to lobby for a practical system of reuse similar to those that exist in Western and South Australia (25 years tenure). However, there is little support from governments on this matter. Consequently the inevitable expansion of cemeteries in NSW will continue. The SMGLC has finalised design plans and initiated development approval that will assure the facility's continued operation for the next 60 years. Nevertheless, it is anticipated that, as the number of cremation/burial services approach 1,000 per year, a competitor facility would be established in the Shoalhaven.

4.4.9 Community Facility Conclusions

Community facility provision can be summed up as follows:

- Community needs are changing and this will affect the type and location of facilities provided;
- The location of education facilities is integral to the urban structure of new living areas;
- Health facilities will need to meet the demands of an ageing population;
- The design of any new living areas will need to address community security and support;
- Future recreation provision will need to adapt with changes in activity choices and preferences; and
- Overall, community facility provision as outlined in this structure plan, should inform government policy and in turn community facility provision will need to be dynamic and responsive to government policy.

5. EMPLOYMENT AREAS

Employment areas provide the economic base to Nowra Bomaderry and to a large extent the Shoalhaven. Economic value is injected into the Nowra Bomaderry economy by the direct transfer of capital and through the creation of employment. This chapter highlights the significance of the retail, commercial, hospitality, industrial and primary sectors and addresses the economic trends that under-pin their development.

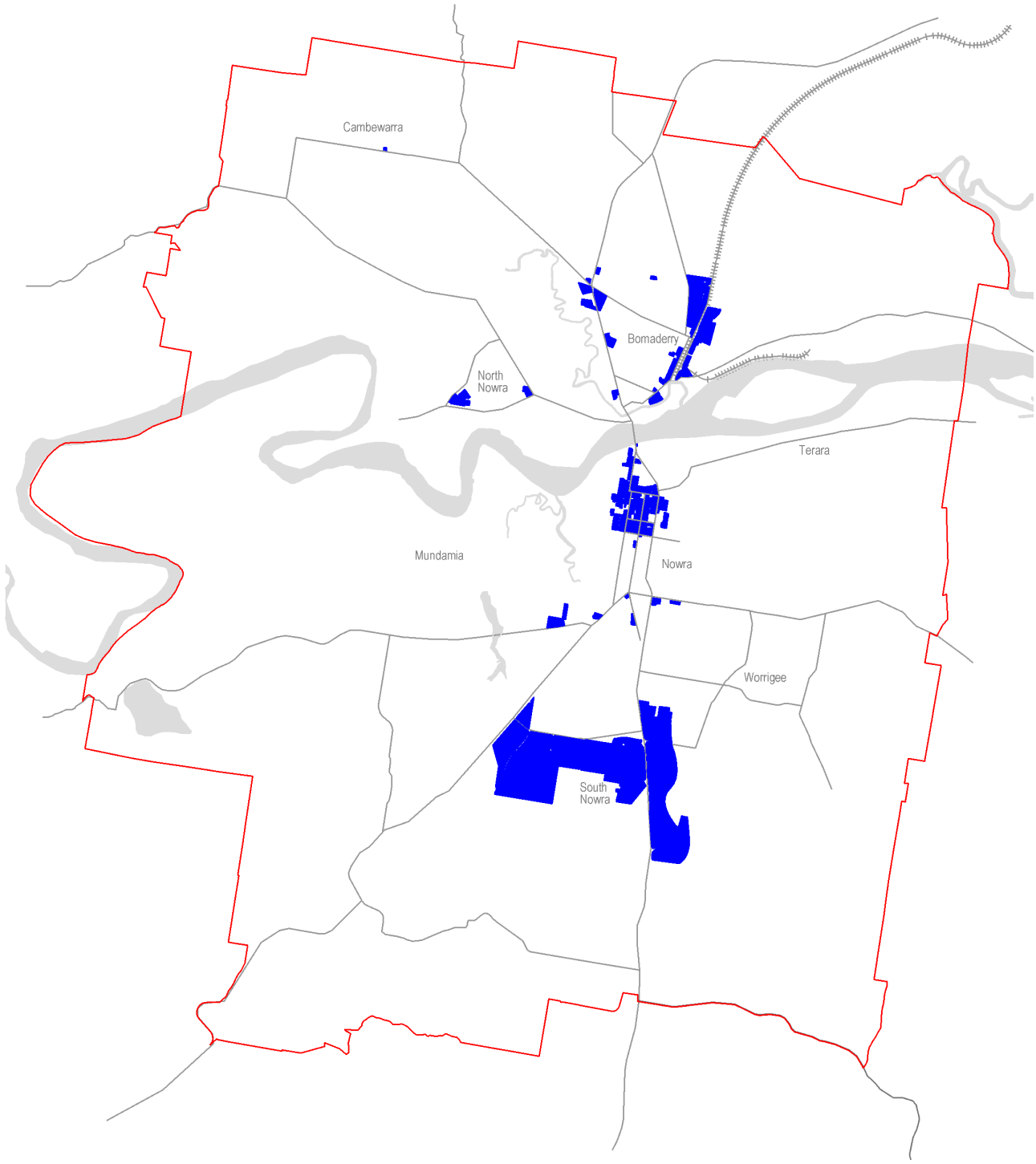
5.1 RETAIL AND COMMERCE

Retailing in the Nowra Bomaderry area is structured in the form of a subregional centre in the Nowra CBD, complemented by three district/neighbourhood centres at: Bomaderry, East Nowra and North Nowra. Map 5.1 shows the areas zoned for retail and bulky goods landuses.

Table 5.1: **Nowra Bomaderry Retail Establishments**

Retail Group	Shopping Centre						
	Nowra CBD West	Nowra CBD East	Bomaderry	Lyndhurst	North Nowra	East Nowra	Total
Discount Dept Store	0	1	0	0	0	0	1
Supermarket	4	1	0	0	0	0	5
Food & Beverage	18	2	5	2	4	5	36
Cafes, Restaurants	40	10	5	0	2	4	61
Fashion	32	17	0	0	0	0	49
Homeware	23	2	0	0	1	0	26
Personal Services	29	2	1	1	3	3	39
Stationery, Office & Books	13	1	2	0	1	1	18
Personal Accessories	5	4	0	0	0	0	9
Sport, Recreation	14	2	1	0	0	1	18
Chemist	5	1	1	0	1	1	9
Communications	6	3	1	0	0	0	10
Entertainment	7	1	1	0	1	1	11
Banking, Finance	8	1	0	0	0	0	9
Auto/Farm/Marine Sales	9	2	0	0	0	0	11
Hardware	13	1	1	0	0	0	15
Textiles & Fabrics	5	0	1	0	0	0	6
Bulky Goods	25	0	0	0	0	0	25
Service Stations	2	0	0	0	0	0	2
Other Retail	0	0	0	0	0	0	0
Non-Retail (eg real estate)	19	2	1	0	5	1	28
Vacant Retail	18	1	20	1	0	2	42
Total Retail	**295**	**54**	**40**	**4**	**18**	**19**	**430**

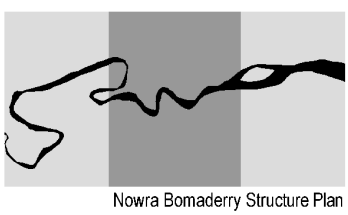
Source: Shoalhaven City Council 2005



Retail & Bulky Goods

Legend

- Structure Plan Boundary
- Existing Retail & Bulky Goods Zoned Capacity & Availability



Nowra Bomaderry Structure Plan

September 2005

0 1 2

Kilometres

Map 5.1

5.1.1 Nowra CBD

There are some 310 retail establishments in the Nowra CBD, with a total traditional retail floor area of approximately 48,000 m^2(Table 5.1). This has grown considerably from 21,501 m^2 in 1979. Retailing has traditionally focussed on Kinghorne and Junction Streets. This was significantly augmented with the opening of Nowra Fair in 1983 (now Stockland Nowra), which with the increasing level of activity on the Princes Highway is not effectively linked to the traditional CBD. The Kinghorne/Junction Street centre is anchored by Woolworths, Coles and Aldi; whilst Stockland Nowra (16,040 m^2) is anchored by a KMart DDS and Woolworths (originally Franklins Big Fresh). In addition the centre (excluding South Nowra) contains approximately 8,640 m^2 of bulky goods retail, which includes some automotive-related uses.

Retail Duplication/Competition Margins

Parts of Nowra and Bomaderry's CBDs are characterised by a certain degree of retail duplication/competition, with several shops selling the same commodities. It is believed that some traders are prepared to operate on relatively low margins to achieve a more desirable lifestyle.

Recent Development Proposals

In 1999 there were two development approvals for additional retail floorspace in the Nowra CBD. One was for a centre of 14,333 m^2 to be anchored by a Big W DDS on a site off Collins Way on the north-western edge of the centre. The other approval involved the expansion of Nowra Mall by an additional 7,061 m^2 to add a Target DDS to the centre. Neither of these approvals has proceeded to construction.

More recently there has been a proposal to expand the Stocklands Nowra shopping centre eastwards with some additional 12,000 m^2 of retail floorspace (DDS and associated specialty shops) as a first stage of a larger development of the site.

5.1.2 Bomaderry Centre

Bomaderry has three retail centres: the Meroo Street strip shopping centre, the Bolong Road retail clusters and the Lyndhurst Centre on Lyndhurst Drive. The Meroo Street centre (dating back to the 1880s) contains a total of 40 retail premises. The centre comprises the Railway Parade strip, the Bomaderry Plaza (completed in the early 1980s) and the Railway Terrace professional office suites (completed in the late 1990s), containing two shops. The centre has some 20 vacant shop units, and there are indications that a number of outlets are sustaining reduced turnovers.

Lyndhurst Centre

The Lyndhurst Centre, opened in September 1993, is the result of integrated planning: incorporating a pre-school/after school centre with a neighbourhood shopping centre. The centre has four shop units.

5.1.3 North Nowra Centre

The North Nowra shopping centre was completed in the mid 1980s. Like the later Lyndhurst centre, it is the result of integrated neighbourhood centre planning: incorporating a health centre with a covered retail mall. A tavern (with a bottle shop) together with a service station, have been developed adjacent to the centre.

5.1.4 East Nowra

The East Side shopping centre, located on Kalandar Street was developed in the 1970s. It has 19 retail outlets, focusing for the most part on food, take-aways and personal services. Parts of the catchment are in competition with Nowra Stocklands less than five minute drive away. Growing residential and tourist traffic to some of the eastern villages will continue to utilise this as a convenience centre.

5.1.5 Retail Expansion

An assessment of the retail floor space and bulky goods components has been undertaken by Leyshon Consulting (2005) based on Council's population projections.

Assumptions

In making these projections account was taken of recent developments outside Nowra Bomaderry, which are considered to potentially impact on retail floorspace demand and sales activity levels in the Nowra Bomaderry area. These are:

- Upgrading of retailing in Ulladulla (Coles and Aldi supermarkets).
- Expansion of Batemans Bay's shopping centre (KMart DDS, Aldi and approximately 40 specialty shops).

It is anticipated that these developments would have weakened the market penetration of the Nowra CBD in Area 5.

In projecting the demand for retail floorspace in the Nowra Town Centre, Bomaderry and suburban parts of Nowra to 2021, an expenditure-based market share analysis was conducted of the trade area to derive an estimate of the likely future retail floorspace demand.

Average per capita retail spending has been projected to 2021 on the assumption that the real growth in average household retail spending of +1.0% per annum in Area 1 and +0.5% per annum in each of Areas 2 to 5. This is significantly below the long-term growth rate for retail spending recorded in New South Wales over the past decade, which has averaged +2.0% to +3.0% per annum. A lesser growth rate has been adopted for the Shoalhaven to take account of, firstly, lower household and per capita income levels of Shoalhaven resident compared with those in New South Wales a a whole and, secondly, the older age structure of the region's population.

Future Retail Spending and Floorspace: 2021

Based on these and other market share assumptions, Leyshon Consulting estimates that average retail expenditure will increase by an additional $382.5 million by 2021. The potential retail expenditure pattern is summarised in Table 5.2. This would translate into a minimal demand for an additional 27,800m^2 to 29,630m^2 in the Nowra Bomaderry trade area by 2021. The range is dependent on whether a major regional type shopping centre expansion goes ahead in the short term, since it is conjectured that the inclusion of the additional DDS would augment Nowra's market share and also appreciates the intention to establish a district centre at the cross roads Vincentia at an early date.

This, coupled with an existing identified shortfall of 12,410m^2, requires an additional 40,210m^2 to 42,034m^2 of floor space to meet demand by 2021 (Table 5.3).

Table 5.2: **Projected Retail Spending by Category: Nowra Bomaderry Trade Area 2021**

Retail Category	Area 1	Area 2	Area 3	Area 4	Area 5	Total
Food/Groceries	$286.1M	$48.0M	$116.9M	$27.4M	$127.9M	$606.3M
Clothing & Related	$47.6M	$8.0M	$19.5M	$4.5M	$21.3M	$100.9M
Household	$118.3M	$19.9M	$48.4M	$11.3M	$52.9M	$250.8M
Services	$49.1M	$8.2M	$20.1M	$4.7M	$22.0M	$104.1M
Total	**$501.1M**	**$84.1M**	**$204.9M**	**$47.9M**	**$224.1M**	**$1062.1M**

Source: Leyshon Consulting 2005

Table 5.3: **Indicative Retail Floorspace Demand: Nowra Bomaderry Trade Area 2006-2021**

Retail Indicator	2006	2021	Change 2006-2021
Available Retail Spending:	$867.1 M	$1249.6 M	+$382.5 M
Existing Situation			
Estimated Nowra Retail Sales	$348.4 M	$487.4 M	+$139.0 M
Supportable Retail Floorspace	69,680 m^2	97,475 m^2	+27,795 m^2
Existing Floor Space	60,440 m^2		
Alternative Scenario: Major Regional Attraction			
Estimated Nowra Retail Sales	$364.2 M	$512.4 M	+$148.2 M
Supportable Retail Floorspace	72,840 m^2	102,474 m^2	+29,630 m^2
Floorspace Shortfall	(12,410 m^2)	(42,034 m^2)	(29,630) m^2

Source: Leyshon Consulting 2005 and Shoalhaven City Council
Note: These scenarios includes allowance for development of a supermarket based centre at Vincentia.
In relation to the above analysis, it should be also noted that:

- no allowance has been made for any underlying retail floorspace vacancies: if such an allowance was made then the floorspace estimates could be inflated by +5.0%; and
- no allowance has been made for redundant retail floorspace which could further increase net demand by up to +5.0%.

5.2 BULKY GOODS

There are three key trade centres in Nowra Bomaderry: South Nowra, Bolong Road and the John Bull Centre at Bomaderry. Map 5.1 shows the area zoned for retail and bulky goods land uses.

South Nowra Trade Centre

The fast developing South Nowra Centre has an increasing number of traders, ranging from car showrooms to bulky goods outlets retailing household goods. Since 1999 approximately 20,000m^2 of new space has been approved and constructed in this area. Harvey Norman, The Good Guys and Home Mart have each opened major new stores there.

Nowra plays an important role with respect to bulky goods retailing. Nowra's potential to attract bulky goods retail spending extends well beyond the borders of the Shoalhaven LGA. This is principally because the nearest concentrations of bulky goods retailing are located in the Australian Capital Territory (Fyshwick and Mitchell) and in the Wollongong area (Warrawong South). As a consequence, Nowra has the potential to serve a market which includes the Shoalhaven plus Eurobodalla Shire to the south.

Assessing the potential demand for additional bulky goods floor space in Nowra during the period 2006-2021 is problematic. Firstly, the estimates of future demand could vary substantially depending on what is defined as falling within the ambit of 'bulky goods floor space'. Secondly, traditional bulky goods retail spending estimates in categories such as furniture and electrical goods relate to spending at small stores in traditional centres as well as that in larger stores in peripheral or quasi-industrial locations. It is accordingly difficult to accurately determine the allocation of spending between traditional retail centres and non-centre locations.

Taking the above into account, and the volume of available spending in the Nowra Bomaderry trade area, Leyshon Consulting estimates that Nowra will attract an additional $97.6 million in bulky goods sales by 2021. This translates into an additional 15,240m^2 in bulky goods supportable floorspace (Table 5.3). However, if provision is made for additional trade/wholesale sales together with a trend towards a higher ratio of floorspace to sales, Leyshon Consulting considers it reasonable to increase this figure by 20%, or an additional 3,050m^2 by 2021. This would mean a total additional demand for some 18,300 m^2 by 2021.

Table 5.4: **Indicative Bulky Goods Floorspace Demand – Nowra Bomaderry 2006-2021**

Retail Indicator	2006	2011	2016	2021	Change 2006-2021
Available Bulky Goods Spending	$221.1M	$249.3M	$281.3M	$318.7M	+$97.6M
Estimated Nowra Bulky Goods Sales	$124.5M	$142.1M	$163.2M	$188.0M	+$63.5M
Supportable Floorspace	35,571m^2	38,406 m^2	44,095 m^2	50,815 m^2	+15,244 m^2

Source: Leyshon Consulting 2005

On this basis an indicative provision for 10,000 to 12,000 m^2 of additional bulky goods floor space should be made in South Nowra. It should be noted, however, that if an expanded bulky goods precinct is established in South Nowra, such retailers elsewhere in Nowra Bomaderry may seek to relocate to the new facility. In this event, actual demand for new floor space in South Nowra could exceed 10,000 to 12,000 m^2.

5.3 HOSPITALITY

The Nowra Bomaderry district functions as a service centre for the Shoalhaven's tourism industry and associated activities. The locations of some major tourism and hospitality sites within the structure plan area are shown on Map 5.2.

5.3.1 Market Profile

Tourism Australia's figures for the 12 months to September 2004 for NSW confirmed that Shoalhaven had 1,281,000 visitor nights, making it the most popular tourist destination outside of Sydney.

Visitors to the Shoalhaven tend to come within five categories:

- Day visitors: no overnight stay.
- Through travellers: those travelling through the Nowra/Shoalhaven enroute to another location.
- Holiday makers: those visitors taking all or part of their holidays in the Shoalhaven.
- Business people: those coming to the Shoalhaven purely for business purposes.
- Visiting friends and relatives (VFR): visitors who come to the area to visit friends and relatives.

Seasonality

Since the commercial accommodation in the Nowra Bomaderry district tends to be non-holiday, the area does not suffer the extreme seasonality pattern as the remainder of the Shoalhaven.

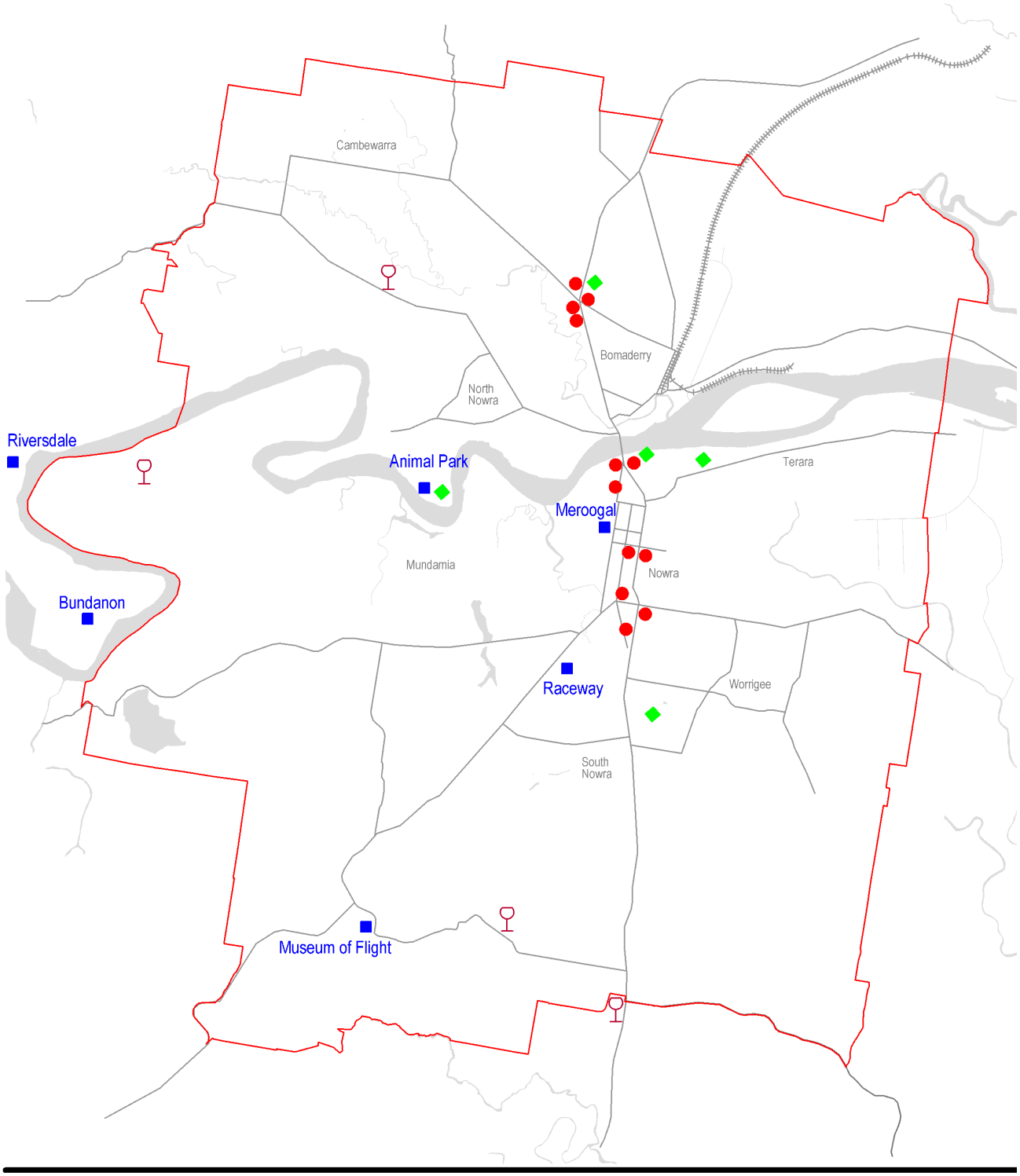
5.3.2 Accommodation

The majority of the district's accommodation is located within Nowra Bomaderry urban area and primarily offers short-stay accommodation. The standard of accommodation ranges from budget (camping and shared facilities) to above average standard (executive, self-contained, leisure and conference facilities).

Table 5.5: **Commercial Visitor Accommodation in Nowra Bomaderry**

Accommodation Form	Nowra	Bomaderry	North Nowra	Rural	Total
Licensed Hotels	3	1	0	0	4
Motels & Serviced Apartments	9	4	0	0	12
Guest Houses/B&Bs	4	1	0	3	8
Caravan Parks/Camping Grounds	3	1	2	0	6

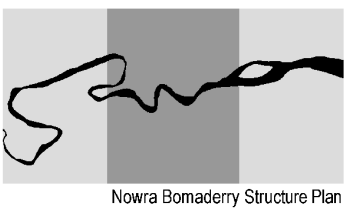
Note: Only hotels with accommodation are included.
Source: Shoalhaven City Council 2005



Tourism and Hospitality

Legend

- Structure Plan Boundary
- Motels
- Wine Cellar Door Tastings and Sales
- Tourist Attractions
- Caravan Parks



Nowra Bomaderry Structure Plan

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Kilometres

Map 5.2

Conference Facilities

There are currently eight conference facilities located within the Nowra Bomaderry urban area. These are made up of stand alone conference venues (3) and venues within accommodation establishments (5)

New Corporate Hotel

There is considered to be a need for a corporate hotel in Nowra that can met the needs of the local business market and provide facilities for meetings, dining and local events. The envisaged facility is a business style hotel of 4-4.5 star standard. It would provide between 60-90 rooms.

Ideally, the hotel would be located in, or within close proximity to, the Nowra CBD so that guests can easily walk to restaurants and pubs in town. It should be located to the West of the Princes Highway, with visibility from the highway considered a bonus. Riverside sites in Nowra are attractive alternatives.

5.3.3 Restaurants and Cafés

The Nowra Bomaderry district offers a range of cuisine styles and experiences, with a proliferation of cafe's, cafe/restaurants, restaurants, family restaurants and takeaway establishments. The major fast food chains currently operating in Australia are represented in Nowra Bomaderry, with the exception of Hungry Jacks and Sizzler. McDonalds has two family restaurants (Bomaderry and South Nowra), KFC, Pizza Hut both have one.

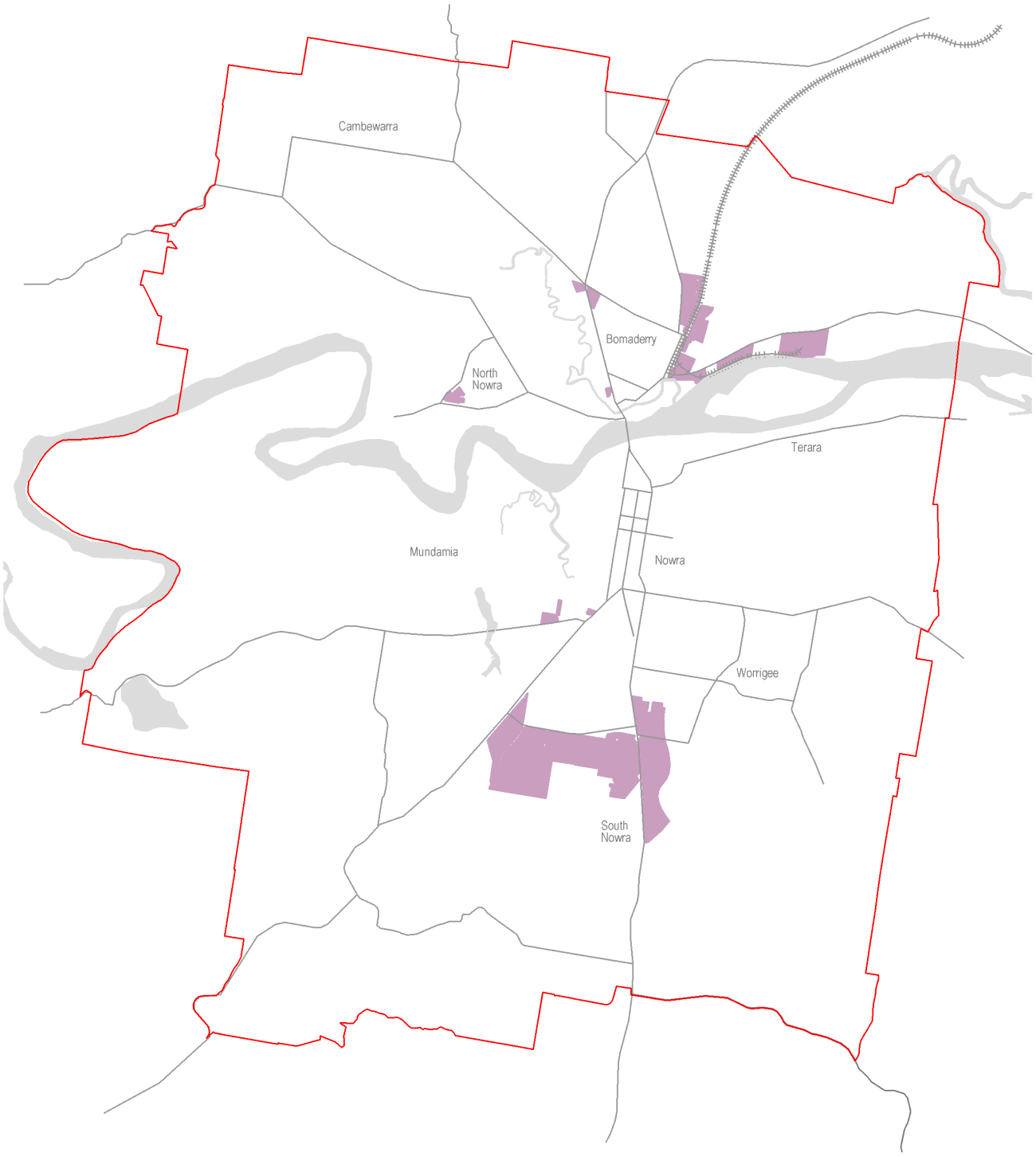
5.4 INDUSTRY

5.4.1 Context

Nowra's current economic function is principally that of a regional manufacturing centre and a service node for the agricultural and tourism activities of the Shoalhaven, particularly the northern part of the LGA and to some extent the southern portion of the Kiama LGA. However, this role has evolved from the development of a number of base activities, which have acted as anchors and generators to the local economy.

5.4.2 Base Activities

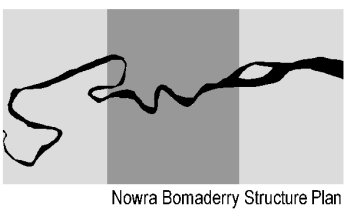
Base activities are essentially those enterprises that owe their existence to outside forces, either by providing goods and services that are exported from the immediate region, or have a major government function that provides a service for the nation as a whole. Major enterprises in the Nowra Bomaderry area that perform a base/export function include: HMAS Albatross, Australian Paper, Manildra Group, Gates Rubber, Tyco, Dairy Farmers, Sydney Yachts, Fosroc Chemfix, Ocean and Earth, Hanlon Windows, BAE Systems and Kaman Aerospace International. The planned closure of the Dairy Farmers plant will have significant repercussions on the local economy.



Employment Land

Legend

- Structure Plan Boundary
- Existing Industrial Land



Nowra Bomaderry Structure Plan

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Map 5.3

In addition to these enterprises, the agricultural activities of the subregion also perform an export function. The flood prone land to the east of Nowra is a prime dairying area. The economic impact of these activities is focused on the Dairy Farmers processing and distribution plant at Bomaderry.

5.4.3 Economic Trends

The economy of Nowra Bomaderry and the Shoalhaven is a microcosm of the general economy, in that there is a pronounced mismatch between product value and employment in the various industrial sectors. This is a reflection of the general movement from a predominantly 'goods' based to a 'service' based economy. 'Goods' based industries tend to be capital intensive and are characterised by high gross turnover and relatively low employment, whilst 'service' industries tend to be founded on lower gross turnover, are predominantly information-based and employment intensive.

To maintain a high value base, Shoalhaven City Council has placed strong emphasis on developing the local manufacturing sector. This policy has led to a significant rise in the number of firms relocating to, or setting up in the area.

5.4.4 Existing Employment Land

Nowra Bomaderry has a total of 426.4 hectares of zoned industrial land. Of this 280.7 ha are located in South Nowra (Flinders Estate and highway); 94.8 ha in Bomaderry, 4.9 ha in North Nowra, 6.0 ha in West Nowra and 40.0 ha at Albatross Aviation Technology Park (Table 5.6). Of this supply a total of 339.6 ha have been developed (80%), with 86.8 ha remaining. The largest supplies of vacant industrial zoned land are located in South Nowra (45.5 ha) and at the Albatross Aviation Technology Park (35.0 ha).

Industrial Land Requirements

Assessing the demand for industrial land in Nowra Bomaderry is fraught with difficulty. Currently demand for industrial land in Nowra Bomaderry is relatively robust. Current demand is strong for 3,000-4,000m^2 lots, with the most popular location being Bomaderry, where supply is limited.

5.4.5 Forecast Demand

The demand for industrial land can be forecast in a number of ways. Unfortunately the most methodologically authentic form of projection is difficult to put into practice at the local level, that is tracking growth in 'export' or 'base' industries. It is this growth that generates wealth locally and provides the impetus for further industrial growth through the industry to industry multiplier and via industries and services serving the population generated by these 'export' industries, through a second round multiplier.

Table 5.6: **Nowra Bomaderry Zoned Industrial Land**

Locality	Total Zoned	Total Developed		Total Available	
	Ha	Ha	%	Ha	%
Bomaderry: North Shore:	67.0	62.4	93.1	4.6	6.9
Bomaderry: Central:	20.9	19.4	92.8	1.5	7.2
Bomaderry: West:	6.9	6.9	100.0	0.0	0.0
North Nowra:	4.9	4.7	95.9	0.2	4.1
West Nowra	6.0	6.0	100.0	0.0	0.0
South Nowra: Flinders & Highway:	280.7	235.2	83.8	45.5	16.2
Albatross Aviation Technology Park	40.0	5.0	12.5	35.0	87.5
Total:	**426.4**	**339.6**	**79.6**	**86.8**	**20.4**

Note: (1) Zoned industrial land based on 4(a),4(b),4(c)&4(d) zonings.
(2) In the case of Flinders Estate, Developed = Sold
(3) Total available industrial land includes zoned subdivided & en globo.
Source: Shoalhaven City Council: Planning Services Division 2005.

Alternatively, secondary indicators can be used as a surrogate, such as observed growth in industrial estate-type employment, which includes manufacturing, utilities, construction, wholesale, transport and storage employment (production industry and services to industry).Table 5.7 summarises the growth evident in these sectors, between 1991 and 2001.

Over the 10 year period (1991/01) annual change varied from a decline of -2.8% for utilities to +2.9% for construction. Overall the rate of growth was +1.2% for this period. During the latter half of the period, the overall rate of growth was 2.47%. For forecasting purposes an annual growth rate of 1.5% has been adopted.

Table 5.7: **Industrial Estate Employment Growth Trends: 1991 - 2001**

Industrial Sector:	1991	1996	2001	1991/96 Annual Change %	1996/01 Annual Change %	1991/01 Annual Change %
Manufacturing:	1146	1206	1263	1.05	2.04	1.02
Electricity, Gas & Water:	121	139	87	2.98	-5.62	-2.81
Construction:	653	769	841	3.55	5.76	2.88
Wholesale Trade:	419	466	327	2.24	-4.39	-2.20
Transport & Storage:	233	287	371	4.64	11.85	5.92
Total:	**2572**	**2867**	**2889**	**2.29**	**2.47**	**1.23**

Basis for Forecasting Demand

Total industrial employment was correlated with total developed industrial land throughout Nowra Bomaderry in 2001 to produce an employee per industrial land ratio. The demand for industrial land was then forecast on the following basis:

- Forecast industrial employment (production industry and services to industry)
- Forecast proportion of the remaining industrial sectors (business services, services to consumers and community services), applied at a declining rate over the projection period, on the assumption that the use of industrial land will be more restrictive in the future.
- A declining employment to industrial land ratio over the projection period, as industry becomes more capital intensive.
- Non-industrial uses occupying industrial estate land includes government instrumentalities, community facilities, hospitality and recreation activities, as evidenced in Flinders estate (Table 5.8).

Table 5.8: **Flinders Estate - Mix of Occupants**

Activity Type	Establishments No.	Employment Full-Time Equivalent
Manufacturing and Fabrication	20	354
Utilities: Electricity, Gas, Water, Telstra	2	76
Construction and Building	22	130
Wholesale and Distribution	13	59
Transport and Storage	21	59
Total Industrial Estate Type Establishments	78	794
Government (Roads and Traffic Authority Registry)	1	11
Community, Hospitality and Recreation	5	35
Total Non Industrial Estate Type Establishments	6	46
Total	**84**	**840**

Source: Shoalhaven City Council 1996

The forecast demand for industrial land in Nowra Bomaderry is summarised in Tables 5.9. The projections for 2001 and 2006 can be compared with the actual amount of residual zoned industrial land surveyed in 2004 (86.8 ha).

Table 5.9: **Nowra Bomaderry Industrial Land Demand Forecast: 2001-2036**

Indicator:	2001	2006	2011	2016	2021	2026	2031	2036
Industrial Estate Employment:	4771	5030	5310	5432	5478	5765	6237	6708
Employment/Land Ratio:	14.20	13.49	12.82	12.18	11.57	10.99	10.44	9.92
Industrial Land Demand:	336.0	372.9	414.2	446.0	473.4	524.6	597.5	676.2
Total Zoned Land (ha):	426.4	426.4	426.4	426.4	426.4	426.4	426.4	426.4
Residual Zoned Land (ha):	90.4	53.5	12.2	-19.6	-47.0	-98.2	-171.1	-249.8

5.5 PRIMARY INDUSTRY

The major primary industrial activity in the Nowra Bomaderry area is the dairy industry. To put this in context the Shoalhaven contributes some 30% of the Illawarra and South Coast region's agricultural turnover. The main location of primary industry is around the inside edges of the structure plan area, as shown on Map 5.4.

5.5.1 Dairy Farming

The fertile Shoalhaven River flood plain supports a total of 39 dairy farms in the Nowra Bomaderry area. Of these, 16 are located within the Structure Plan area, occupying a total area of 1,730 hectares, some 24% of the total district's prime crop and pasture land (7,078 ha). They range in size from 22 hectares to 208 hectares, with an average size of 108 hectares. The dairy herds range in size from 80 to 800 and are predominantly Holstein Friesian, with a sprinkling of Illawarra's and Jerseys. The average herd size is 193 cows in milk, with an average of 188 other cattle. Milk production from these 16 dairies ranges from 8,300 litres per week to 107,000 litres per week.

Bomaderry Cattle Saleyard

A cattle sale yard and associated stock holding pens is located in Bomaderry. Cattle auctions are held every week on Thursdays, with some 350-600 cattle yarded. In addition cattle auctions are held every six weeks on Saturdays with an average of 300 cattle yarded. Cattle are sourced from as far away as Bodalla to the south, Kangaroo Valley to the west and Dapto to the north. Cattle are sold on to abattoirs at Ulladulla and as far away as Wodonga, Cooma and Inverell (all export facilities).

5.5.2 Vineyards

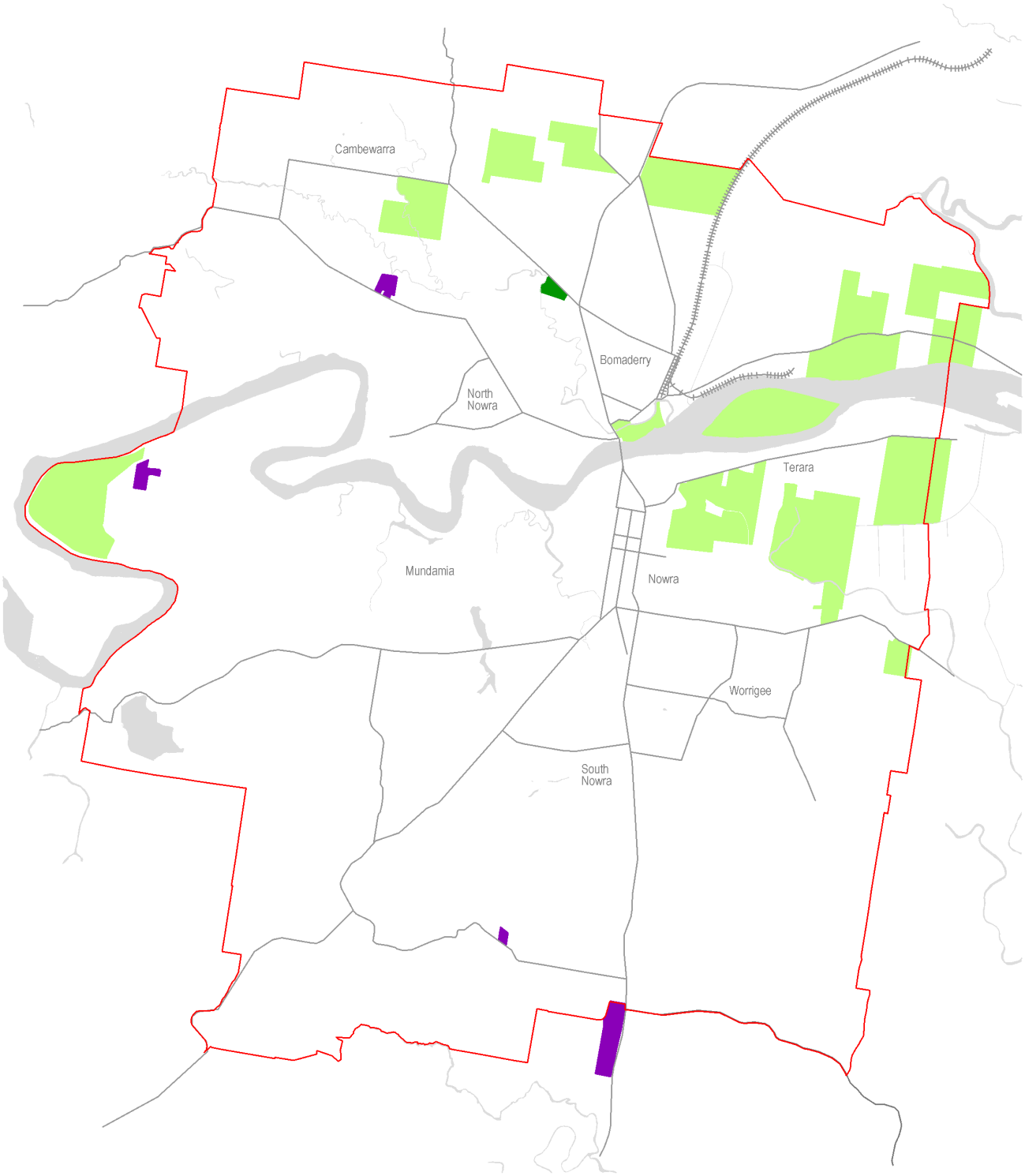
There are a number of boutique vineyards in the vicinity of Nowra Bomaderry at Cambewarra, Jaspers Brush, Coolangatta, The Silos and the Shoalhaven Winery at South Nowra. These boutique wineries total an area of 40-50 hectares. The two wineries (Cambewarra and Falls Creek) located within the Structure Plan area total some 12-15 hectares.

5.5.3 Hobby Farms

There are a number of hobby farms in the Nowra Bomaderry area at Cabbage Tree Lane. Most run beef cattle and horses. There are, however, some nursery enterprises, for instance producing potted plants/cut flowers.

5.5.4 Forestry

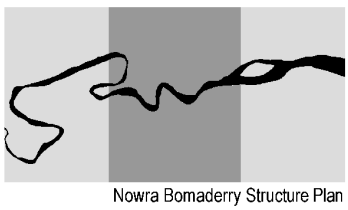
Large state forest reserves are located to the south and south east of Nowra: Shoalhaven State Forest; Nowra State Forest and Currambene State Forest. These in total cover an area of approximately 1,480 hectares.



Primary Industry

Legend

- Structure Plan Boundary
- Dairy Farm
- Vineyard
- Cattle Sale Yard



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Map 5.4

6. TRANSPORT

Transport is the product of landuse activity, representing the spatial interaction within and between 'living' and 'employment' areas. This chapter addresses Nowra Bomaderry's connectivity context; travel patterns; current and potential road networks; road freight transport; road-based public transport; rail transport; parking; and cycleways/pedestrian routes.

6.1 CONTEXT

Developed at the lowest crossing point of the Shoalhaven River, Nowra Bomaderry is located at the intersection of a number of strategic routes:

- Northern route to Wollongong and Sydney.
- Southern route to Bateman's Bay, Bega, Gippsland and Melbourne.
- South western route to Goulburn, Canberra, Snowy Mountains, Riverina and Melbourne.
- North eastern route to the Southern Highlands.

Nowra has a military air base (HMAS Albatross), but it has no civil airport, the nearest civil facility being at Albion Park, about 45 minutes by road to the north. The South Coast railway terminates at Bomaderry, on the northern bank of the Shoalhaven River. Although navigable by shallow to medium draught vessels, there is currently no scheduled commercial water borne transport serving the Nowra Bomaderry area.

6.1.1 Relative Remoteness

Shoalhaven's strategic positioning is, however, constrained by a perception of remoteness. The quality of the road networks connecting strategic destinations, makes Nowra Bomaderry, given its geographic proximity, relatively remote from major commercial and administrative centres such as Sydney and Canberra. However, the lower standard of road is specific to the sections between Nowra and Sutton Forest in the case of the Hume Highway connection and between Nowra and Albion Park Rail in the case of the Princes Highway. In the latter case, the construction of the Kiama-Dunmore bypass has resolved a significant bottleneck in this road link, and there have been minor intersection and road improvements, however much more needs to be done to improve the safety and efficiency of these two vital road corridors.

6.2 TRAVEL PATTERNS

Travel patterns establish the need, frequency and mode of movement and focuses on trip purpose, travel mode (influenced by provision of Infrastructure and services), car ownership rates, and freight transport issues. The extent to which the provision of infrastructure may influence mode choice and whether this is critical in determining road infrastructure needs is a key component of on-going detailed analysis associated with the Nowra Bomaderry Structure Plan.

6.2.1 Trip Purpose

On the basis of the Sydney 'Household Interview Survey' (HIS 1991/92) undertaken by the (now) NSW Transport and Population Data Centre, it is assumed that the majority of trips are 'non home based' (32.3%), followed by 'home based other', which includes education and recreation (26.0%), 'home based business' (25.0%), and 'home based work trips' (9%).

Whilst the trip data has been sourced from the original Sydney survey (HIS 1991/92), considerable efforts have been made to calibrate this data to local Nowra Bomaderry levels. The data forms the basis behind the trip generation equation in the transport modelling process, with base models first being validated to appropriate levels of vehicle traffic generation (vehicle productions/vehicle attractions), that is taking into consideration person trips assigned to other modes of travel (eg. walking/cycling/public transport), vehicle trip length and vehicle travel time to ensure the models are appropriately replicating actual observed transport conditions.

The Nowra Bomaderry transport (traffic) models are very detailed models validated to replicate transport conditions in the year 1996. This has provided a stable base model from which input land-use data can then be incorporated to update the model to later years. Validation levels have been checked and accepted at the year 2001 (the Nowra Bomaderry Structure Plan base year). This has allowed future land-use data to then be incorporated into the Nowra Bomaderry Structure Plan traffic models to test the impacts of future growth on the transport/road network. Table 6.1 provides trip end generation information from the original base 1996 TRACKS model of Nowra Bomaderry.

Table 6.1 **Nowra Bomaderry: Household Trip Purposes**

Nowra Bomaderry 1996 - All Day Trip End Production Summary				
Trip Purpose	Trip Ends	% of Private	Private Trips/HH	% of Total
Home Based Work	5262	7.73%	0.547	
Home Based Business	14069	20.68%	1.463	
Home Based Other	14453	21.24%	1.503	
Non Home Based	18273	26.86%	1.900	
Additional Household Generation	12710	18.68%	1.322	
Parking Circulation	3276	4.81%	0.341	
Private Trips	**68043**	**100.00%**	**7.077**	**51.13%**
External Non Home Based	3523			2.65%
External and Special Generator Inbound	17215			12.94%
External and Special Generator Outbound	17215			12.94%
External Throughs	8138			6.12%
Light Commercials	13289			9.99%
Heavy Commercials	5642			4.24%
Total Trips	**133071**	Intrazonals	**3212**	**100.00%**

Note: Home Based Business: Shopping, employers business, or personal business.
Home Based Other: Education, recreation & other trips.
Source: Transport & Traffic Systems– 'Building the Transportation Model – Technical Background Report 1996 TRACKS Model' April 2002.

6.2.2 Travel Mode

The predominant mode of travel to work in Nowra Bomaderry is the private car, either as driver or passenger. Car travel accounts for a total of 69% of daily work trips: 60% as driver and 9% as passenger (Table 6.2). Walking is the next most significant means of travel accounting for 4% of all work trips. Travel by truck accounts for 2.3%, bicycle accounts for 1.4%, and motor cycle or scooter 1.1%. The use of public transport is insignificant with 0.3% using the train (presumably travelling north to Kiama, Shellharbour or Wollongong), 0.6% using the bus, and 0.2% making use of Nowra Bomaderry's taxi service.

Current travel to work patterns in Nowra Bomaderry, emphasise the dominance of the private motor vehicle as the principal mode of work travel (73%). This includes 'car as driver', 'car as passenger', truck and motor bike/scooter (Table 6.2). Cycling accounts for 1.4% and walking (as the only means of transit) accounts for 4%. Public transport accounts for a mere 1%. The corresponding mode pattern for Shoalhaven echoes the dominance of the private motor vehicle (70%), with cycling accounting for 1%, walking 4% and public transport 0.9%.

Since 1986 dominance of the private motor vehicle has been maintained. Cycling or walking to work peaked in 1991 and has been in decline since. The use of public transport has declined marginally from a high in 1986 (1.3%) to 0.9% in 1996 and 1.0% in 2001 (Table 6.3). The number of employed persons working from home experienced a significant increase between 1981 (3.1%) and 1985 (5.0%), but has counter-intuitively been in decline since, accounting for 4.2% in 2001. Both the absolute number and the proportion of employed residents not at work on the day of the Census (on leave or sick) have increased steadily between 1981 and 2001.

Table 6.2: **Nowra Bomaderry: Travel to Work by Gender**

Travel Mode	Male		Female		Total	
	No	%	No	%	No	%
One Mode Only:						
Train	10	0.1%	9	0.1%	19	0.2%
Bus	22	0.2%	18	0.2%	40	0.4%
Taxi	13	0.1%	9	0.1%	22	0.2%
Car as driver	3642	34.3%	2793	26.3%	6435	60.5%
Car as passenger	472	4.4%	441	4.1%	913	8.6%
Truck	246	2.3%	3	0.0%	249	2.3%
Motor bike/motor scooter	106	1.0%	12	0.1%	118	1.1%
Bicycle	139	1.3%	12	0.1%	151	1.4%
Other	43	0.4%	12	0.1%	55	0.5%
Walked only	244	2.3%	182	1.7%	426	4.0%
Total one mode only:	**4937**	**46.4%**	**3491**	**32.8%**	**8428**	**79.3%**
Two or More Modes:						
Train & bus	3	0.0%	0	0.0%	3	0.0%
Train & other (excluding bus)	9	0.1%	3	0.0%	12	0.1%
Bus & other (excluding train)	3	0.0%	6	0.1%	9	0.1%
Other multiple modes	101	1.0%	44	0.4%	145	1.4%
Total multiple modes	**116**	**1.1%**	**53**	**0.5%**	**169**	**1.6%**
Worked at home	156	1.5%	280	2.6%	436	4.1%
Absent from work	577	5.4%	814	7.7%	1391	13.1%
Not stated/adequately specified	97	0.9%	108	1.0%	205	1.9%
Total	**5883**	**55.3%**	**4746**	**44.7%**	**10629**	**100.0%**

Note: Data based on employed persons counted at home on Census night.
Source: Australian Bureau of Statistics: Census of Population & Housing: 2001.

Table 6.3: **Nowra Bomaderry: Travel To Work Trends: 1986-2001**

Travel Mode	1986		1991		1996		2001	
	No.	%	No.	%	No.	%	No.	%
Public transport	97	1.3	99	1.0	95	0.9	83	1.0
Private transport	5371	74.2	6716	69.8	7335	69.4	7896	72.5
Taxi	41	0.6	18	0.2	36	0.3	22	0.2
Cycled or walked	546	7.5	825	8.6	850	8.1	603	5.5
Other/multiple modes	0	0.0	145	1.5	259	2.5	200	1.8
Worked at Home	223	3.1	484	5.0	490	4.6	463	4.2
Absent from Work	734	10.1	968	10.1	1339	12.7	1411	13.0
Not Specified	231	3.2	371	3.8	156	1.5	217	2.0
Total	**7243**	**100.0**	**9626**	**100.0**	**10560**	**100.0**	**10895**	**100.0**

Note: Data based on employed persons counted at home on Census night.
Source: Australian Bureau of Statistics: Census of Population & Housing: 1981, 1986, 1991, 1996 & 2001.

6.2.3 Motor Vehicle Ownership

There has been a general increase in the number of motor vehicles owned by the Nowra Bomaderry household. In relative terms, the number of households without a motor vehicle has decreased (Table 6.4). However, there was a significant rise in non motor vehicle owning households in 1996. It is conjectured that this trend was correlated with an economic downturn and the growing incidence of single parent families. The recent decrease in non motor vehicle owning households and the higher average motor vehicle ownership rate can be, in part, attributed to a strong economy and the lower relative cost of cars and other motor vehicles. It is too early yet to assess what effect the current upward movement in petroleum prices will have on car usage.

Table 6.4: **Nowra Bomaderry: Car Ownership 1986-2001**

Household	1986		1991		1996		2001	
Car Ownership	No	%	No	%	No	%	No	%
No Car	836	13.1	1098	12.7	1306	13.3	1196	11.1
One Car	3210	50.3	4211	48.6	4771	48.6	4659	43.4
Two Cars	1835	28.8	2621	30.3	2942	29.9	3217	29.9
Three Cars+	495	7.8	727	8.4	807	8.2	1015	9.4
Average Cars/Household	1.3		1.4		1.4		1.5	

Note: Totals exclude households that have not specified car ownership.
Source: ABS: Census of Population & Housing: 1996, 1991, 1996 & 2001.

In overall terms there were more motor vehicles per households in 2001 than in previous years. The average number of motor vehicles per household has increased from 1.3 in 1981 to 1.5 in 2001. The total number of motor vehicles owned by residents of Nowra Bomaderry is estimated to be in the region of 16,120.

Motor Vehicle Ownership Variation

Currently household motor vehicle ownership within the Nowra Bomaderry structure plan area varies between 1.3 in the Nowra precinct to 2.3 in the Rural South precinct. The average motor vehicle ownership for Nowra Bomaderry is 1.5 per household (Table 6.5).

Table 6.5: **Nowra Bomaderry Car Ownership by Localities**

Vehicles/Household	Bomaderry	North Nowra	Nowra	South Nowra	Rural North	Rural South
0 Vehicles	12.1%	7.0%	17.2%	7.0%	1.2%	1.8%
1 Vehicles	50.2%	44.4%	50.3%	33.9%	28.8%	23.2%
2 Vehicles	28.7%	38.3%	25.8%	38.1%	49.5%	47.6%
3+ Vehicles	9.0%	10.2%	6.7%	21.0%	20.5%	27.4%
Average Vehicles	1.4	1.6	1.3	1.9	2.1	2.3

Source: Census of Population & Housing 2001

6.3 ROAD NETWORK

Nowra Bomaderry's road network is the primary means of movement and access. This section focuses on the districts primary network; problems associated with access to the Nowra CBD; existing road travel patterns; general system (network) deficiencies; need for an additional river crossing as well as general safety and capacity improvements along the Princes Highway through Nowra Bomaderry, the role of land use on transport; and network improvement opportunities.

6.3.1 Context

Nowra Bomaderry is a significant strategic regional centre and is the main commercial and residential centre located within the northern Shoalhaven. The Princes Highway is the only continuous north-south route through the Shoalhaven as well as through Nowra Bomaderry. It links Nowra Bomaderry to Wollongong and Sydney in the north, Ulladulla, Batemans Bay and Canberra in the south. The Shoalhaven River bridge is the only connection between Nowra and Bomaderry/North Nowra.

The role of Nowra Bomaderry as a strategic regional centre has significant transport implications. Whilst the resident population of Nowra Bomaderry is just 30,168 (2001), the town centre serves at minimum the greater total population of Northern Shoalhaven with a population of 41,202 (2001). Given that the Princes Highway is the only available road crossing of the Shoalhaven River, local and regional traffic flows converge at the river with significant concentration and the resultant traffic volumes on the Princes Highway (Shoalhaven River Bridges) amass some 45,000 vpd (2005 estimate) which ranks amongst some of the highest traffic volume roads in the Illawarra. Only the controlled access, 'un-interrupted flow' road 'F6 Freeway' between Albion Park and the Wollongong University in Wollongong City Council LGA has higher volumes. There are no 'interrupted flow' roads in the Illawarra (with the exception of the Princes Highway at the Shoalhaven River crossing) has traffic volumes near or above this volume.

North of the river, the other roads connecting Nowra Bomaderry to the greater road network are Moss Vale Road to the north west and Gerroa Road ('the 'sandtrack") to the north east. The other external road on this side of the river is Illaroo/Bugong Road which is a minor low traffic flow connection.

Moss Vale road is an RTA controlled main road (MR 261) also designated as part of the State road network. It provides a crossing of Cambewarra and Barrengarry Mountains to connect with the Hume Highway via Kangaroo Valley and Moss Vale. Bolong Road is a designated regional road between the Princes Highway and Shoalhaven Heads (MR 293). North of Shoalhaven Heads, Gerroa Road (or the 'sandtrack") is a direct extension of Bolong Road and provides alternative access to the Princes Highway between Bomaderry and Kiama, linking through the townships of Gerroa and Gerringong. It is a local road (not a classified road). As the Princes Highway is progressively widened and upgraded between Gerringong and Bomaderry, it is expected by some that some traffic that has diverted on to the 'sandtrack' would gradually shift back to the Princes Highway. This comment has not been substantiated with any evidence and the extent of this potential shift in traffic has not been determined. It is evident that the limited capacity of the existing Princes Highway road network has been a major contributing factor causing a significant diversion of traffic onto the 'sandtrack'. However, there is also limited capacity on the 'sandtrack', which will curb sustained traffic growth. The extent to which traffic is divided between the two routes in the future is primarily a function of road network capacity at any given time.

The section of Illaroo Road outside the urban area, is a low volume rural road which provides access to Nowra Bomaderry from scattered dwellings and rural properties, from West Cambewarra through to Budgong.

South of the Shoalhaven River, major connections with outlying areas to Nowra Bomaderry are provided via Albatross Road and Greenwell Point Road. Albatross Road links Nowra to Braidwood Road and Turpentine Road which leads south west along Braidwood Road towards Braidwood, with the entire route classified as Main Road 92. This route received federal status early in 1998, when it was proclaimed as a 'route of national importance'. Approval has just been granted to progress the upgrading and sealing of MR 92 to completion in the section between Nowra and Nerriga. Beyond Nerriga, there are a number of alternative options being investigated to continue the road further to the south and southwest. Shoalhaven Council's preference is for a strong strategic road link between Nowra and the Hume Highway corridor and Canberra, to bolster economic growth and tourism in the area.

Greenwell Point Road provides a connection from the eastern villages of Greenwell Point, Culburra, Currarong and Callala to Nowra. It is a designated regional road with relatively high volumes. Due to the presence of low lying land between Nowra and the coast, these villages can be cut off during floods. For this reason an alternative east-west route has been proposed and is being investigated further to the south of Greenwell Point Road. Forest Road is currently Council's preferred flood free access route for connecting the eastern villages to the Princes Highway.

Minor road connections to the southern part of the Nowra network are Yalwal Road to the west, and Terara Road to the east. Yalwal Road provides access to recreation areas at Yalwal and the upper Shoalhaven River and the extractive industries at Burrier. As well as providing access to expanding residential areas in the south west sector, Yalwal Road is also the access to regional services including the new university (via George Evans Road) and the waste depot (via Flat Rock Road). Terara Road services the rural settlements of Terara, Numbaa and Comerong Island and is unlikely to see any significant increase in traffic in the foreseeable future. Some traffic increases have been observed and recorded along Terara Road, primarily due to increasing traffic congestion on Kalandar Street. The proposed construction of ENSA linking the Princes Highway (Nowra CBD) with Greenwell Point Road (near or at Old Southern Road) is expected to attract the majority of traffic using Terara Road as an alternative access road back onto main road network.

6.3.2 Existing Road Network

The Shoalhaven Road Network

Shoalhaven City Council provides approximately 1643 kilometres of roads that play a critical role in the LGA's transport network. Many of the services included in the programs and strategies identified in Council's strategic City Plan rely on the effectiveness and availability of the road transport network. Approximately 1156 kilometres of Council's total road network are sealed, 487 kilometres are unsealed or gravel roads, with only 14 kilometres of this in urban areas.

The Nowra Bomaderry Structure Plan Road Network

In the Nowra Bomaderry Structure Plan area Council provides approximately 235 kilometres of roads. Approximately 223 kilometres of this road network is sealed, with some 12 kilometres comprising unsealed or gravel roads.

Road Network Structure

The Nowra Bomaderry road system has the following basic structure:

- Princes Highway spine.
- Sub-arterial network.
- Access to Nowra CBD.
- East west linkages.

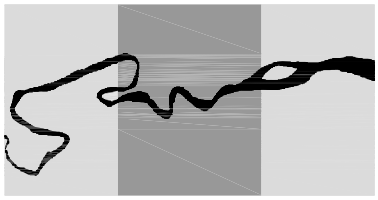
The salient features of Nowra Bomaderry's road network are shown on Map 6.1.

Princes Highway

The Princes Highway forms the north-south spine for the Nowra Bomaderry road network. It is the busiest and most important road through Nowra Bomaderry and the only connection across the Shoalhaven River. Through Nowra Bomaderry, the highway width varies from two lanes through South Nowra to six lanes through the CBD and four lanes through Bomaderry. Additional lane capacity is provided at many of the Intersections.

The current major problem areas include the section of highway between Moss Street and Bolong Road (Shoalhaven River Bridges) and South Nowra. Whilst a number of studies have been undertaken and interim improvement measures have been identified to improve capacity, the RTA does not have firm plans or funding for improvements to the highway in the vicinity of the Shoalhaven River bridges. At South Nowra, Council has raised concerns with RTA's proposed Interim Road Safety strategy.

Road Network



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Future Western Bypass
- Main Roads
- Local Road Network
- East Nowra Sub-Arterial (ENSA)

October 2006

0 1 2

Kilometres

Map 6.1

The main areas of concern relate to Flinders Road, provision of reasonable access to service roads, and provision of adequate lane capacity. Council has been persistent in their endeavours to work with RTA to resolve these issues, however many of the issues remain outstanding, making preparation of developer contributions plans difficult. Due to slow timing in the provision of RTA's Interim Road Safety strategy, road safety problems are arising with access to development.

Sub-Arterial Network

North of the Shoalhaven River

North of the river, the main northern links are Illaroo Road, Bolong Road and Meroo Road/Meroo Street. Illaroo Road is currently the only major connection between North Nowra and the Princes Highway at Bomaderry.

North Nowra Bomaderry Link Road: Preliminary transport analysis has again established technical justification for a North Nowra Bomaderry link road. It also supports the construction of a new road link between Illaroo Road and Moss Vale Road and local connections to the future western bypass (together with the link road) as a minimum requirement to cater for increased development, whilst restricting Illaroo Road from carrying levels of traffic above current levels. In addition, the preliminary transport analysis has indicated that, even without considering further development potential, the traffic conditions along Illaroo Road (on the approach to the Princes Highway) will continue to worsen as a result of sustained traffic growth on the Princes Highway. Thus, in order to protect the integrity of the Princes Highway, Council is duty-bound to give high priority to the alternative link to North Nowra, irrespective of future development considerations. Therefore, the North Nowra link is considered to be a key element of the Nowra Bomaderry structure planning process.

Moss Vale Road: This is a State Main Road (MR 261) which intersects with the Princes Highway in northern Bomaderry. It is an external connection as well as a connection to the village of Cambewarra.

Meroo Road: This road provides an alternative north-south link between the Bomaderry industrial area and the Princes Highway. It is used by heavy vehicles between the highway to the north and the industrial areas in the eastern sector of Bomaderry. There are on-going community concerns relating to the inappropriate use of Meroo Road by heavy vehicles using Meroo Road as a short cut to the southern industrial areas of Bomaderry, including those along Bolong Road. Council has long been investigating an alternative heavy vehicle bypass despite there being a low ratio of benefits to costs for such a link. Establishment of an appropriate route has proven difficult and potentially very costly. Council is currently investigating alternative ways of mitigating the impacts of heavy vehicles along Meroo Road and Cambewarra Road. This situation was exacerbated when the State Government issued development consent to Manildra in 2003 recommending that Manildra's heavy vehicle fleet utilise Bomaderry's local road network to reduce the potential impacts on the Princes highway/Bolong Road intersection. Council has held numerous discussions with RTA over the years in a bid to have the Bolong Road/Princes Highway intersection upgraded to accommodate increased numbers of heavy vehicles as part of a wider strategy to improve the amenity of the local road network in Bomaderry. Currently the RTA has no plans to upgrade the intersection.

Cambewarra Road: This road is the eastern extension of Moss Vale Road and is the major east-west collector road and link between the highway and Meroo Road.

Bunberra Street: This road is also a significant collector road and important access between the Princes Highway and the Bomaderry CBD.

South of the Shoalhaven River

South of the river, significant road links to the east of Princes Highway are: Kalandar Street, Hillcrest Avenue, Quinns Lane, Moss Street/Terara Road and Old Southern Road. To the west of the highway are: Albatross Road, Yalwall Road and Flinders Road.

Kalandar Street: This road provides the main access between East Nowra and the Princes Highway and between Greenwell Point Road at the eastern edge of town. The combination of traffic from the eastern villages, together with substantial increases in local traffic have made Kalandar street the busiest major road east of the highway (south of the river). At the highway, Kalandar Street (approx: 16,000 vpd), Illaroo Road (approx: 17,000 vpd) and Bolong Road (approx: 19,000 vpd) have similar very high traffic volumes.

Hillcrest Avenue and Quinns Lane: These links currently service expanding residential and industrial areas respectively and carry low to moderate traffic volumes. They also provide an alternative access to Kalandar Street for east Nowra and traffic accessing the villages to the east. They are both likely to experience additional growth in the medium term, as residential areas are developed and conditions worsen along Kalandar Street.

Old Southern Road: This road runs parallel to the highway and will become increasingly important as residential development occurs around it.

Albatross Road and Yalwal Road: These are the major roads west of the highway. In addition to providing access from outlying areas, both roads also service an amount of fringe residential development. Albatross Road also provides access to Flinders Industrial Estate and the development at and around HMAS Albatross.

Flinders Road: This road provides an east-west link along the northern side of the industrial estate between the highway and Albatross Road, and is seen as a key strategic link between MR 92 and the Princes Highway.

There are currently a number of fundamental network accessibility issues south of the river relating to:

- Access between East Nowra and West Nowra (currently indirect access exists either along the busy Kalandar Street, or indirectly via Flinders Industrial Estate).
- Access between East Nowra and Stockland Nowra (currently trips between East Nowra and Stockland Nowra access the highway, cross the Princes Highway to the western side, then seek to gain access back to the eastern side to access the development). This leads to unnecessary increases in traffic on the highway and on local streets to the west of the highway.

The Nowra Bomaderry structure plan process is seeking to resolve these legibility and accessibility issues.

Access to Nowra CBD

The Central Business District is located south of the river in Nowra. Its primary road network comprises: Junction Street, Kinghorne Street and Berry Street. The main points of access from the highway to the CBD are via Bridge Road, Moss Street/North Street, Worrigee Street, or Plunkett Street. Several other streets intersect with the highway but only permit left-in, left-out movements.

The 'main street' (as the locals refer to Junction Street) is closed to traffic east of Kinghorne Street. There has been much discussion over whether the 'mall' should remain or be removed to allow through traffic along Junction Street once more. Council as a roads authority is committed to providing a safe pedestrian-friendly town centre, which means a calm traffic environment (a natural deterrent to through vehicle flows). The Nowra CBD Strategy includes the construction of the ENSA to link with the Princes Highway at North Street and Junction Street. Removing Nowra Mall (opening Junction Street to traffic again) would accordingly result in undesirable increases in traffic along Junction Street and impact on traffic and pedestrian safety levels in the town centre. Council's current position is to retain the mall to protect the safety and amenity of the town centre.

Given the physical restrictions for improvements to access in the Nowra CBD (being located between the Princes Highway and the Nowra Creek), this will be one of the more challenging transport issues facing Council as part of the Nowra Bomaderry structure planning process. Continued population growth in Nowra Bomaderry and the northern Shoalhaven will result in significant increases in traffic volumes on all north-south roads between the Princes Highway and Nowra Creek.

As intersection upgrades and pedestrian treatments are provided, this will place increasing pressure on Kinghorne Street, Berry Street, and Osborne Streets and inevitably lead to substantial increases in traffic on north-south roads to the west of the CBD (Osborne Street and Shoalhaven Street) where there is excess capacity in the network.

Preliminary modelling has demonstrated that regardless of any direct connections to Osborne Street being investigated (to improve traffic conditions on CBD streets), Osborne Street will potentially receive similar high traffic volumes without those direct connections, purely as a result of there being limited longer term spare capacity on Kinghorne Street and Berry Street. In 2036 for example, the projected traffic volume on Osborne Street (without a direct connection) would be comparable to existing volumes on Kinghorne Street. At that time, the estimated traffic volume on Shoalhaven Street (without a direct connection to Osborne Street) would be similar to present day volumes on Berry Street. With a direct connection to Osborne Street yields similar results, indicating that the network is not sensitive to a new direct connection to Osborne Street, but more to deteriorating conditions on Kinghorne and Berry Streets.

Alternative direct access to Osborne Street may be required in any event to resolve capacity issues along Berry Streets and Bridge Road in the future.

East West Linkages

The predominant north-south traffic movement, together with the north-south orientation of Bomaderry Creek and Nowra and Browns Creeks have resulted in a limited number of east-west links in the road network. This state of affairs has not been an issue in the past, since the predominantly north-south direction of development and the ability of existing east-west links to cater for the levels of traffic volumes attracted to them. However, this is no longer the case, as the number of east-west trips has increased dramatically during the past decade. This has placed significant strain on the network with many of the high traffic volume arterial road links having no reasonable alternative routes available to divert some traffic in order to improve overall network capacity. Accordingly, significant intersection problems result, which would otherwise not have occurred had there been reasonable alternative network choice.

Illaroo Road provides an indirect link between North Nowra and Bomaderry. There are currently no reasonable alternatives. Moss Vale Road provides a direct link between Cambewarra and Bomaderry. Here there are also no reasonable alternatives. The other main east-west links north of the Shoalhaven River include Cambewarra Road and Bunberra Street through the centre of Bomaderry and Bolong Road - upon which there is a distribution of traffic between these routes in Bomaderry.

Central Nowra is constrained by the Nowra Creek gorge to the west and the floodplain to the east. Since there are currently no north-south roads either side of the Nowra CBD, it would be reasonable to assume that there is no need for a strategic east-west link near the central area. However, that is not to deny there is a latent demand for such a link. With the consideration of alternative river crossings to the east and west, from both of these strategic demand corridors, there is strong traffic demand for alternative east-west access into the CBD, particularly in the future when all of the existing north-south routes would be congested. Finding a suitable location for additional east-west access points is, without doubt, a considerable challenge.

To the east, an alternative access would be achievable, connecting into the planned extension of the road network to the east of the highway (ENSA). The most likely location for an alternative access would be via Plunkett Street, where spare capacity may be available in the longer term as problems evolve at Junction Street and North Street. Access via Plunkett Street would also minimise any impact on CBD streets for such a connection. To the west, an alternative access would be more difficult to achieve. Possible locations include Worrigee Street (the environmental and traffic impacts of such a link may be considered unreasonable by the community and costs are likely to be very high), or Osborne Street (southern end). This (Osborne Street) is the most likely location and as discussed earlier, a direct connection is unlikely to result in higher traffic volumes than would otherwise naturally occur on Osborne Street due to congestion on Kinghorne and Berry Streets. More detailed analysis will be expected to further investigate the viability and likely benefits of an alternative access.

South of Central Nowra, there is an indirect east-west link between Kalandar Street and Yalwal Road, via Albatross Road. The need to resolve this fundamental legible and accessibility issue, as well as provide much needed additional network capacity, will be more closely examined throughout the structure plan analysis process. The viability of improving east-west access in the Flinders Industrial Estate will also be more closely examined throughout this on-going process.

6.3.3 Existing Road Travel Patterns

Traffic Data

From a planning and management perspective, both RTA and Council record traffic volumes, within available resources, to monitor current traffic demands and infrastructure needs of roads within their areas of responsibility. The data is also used for the purpose of validation of traffic/transport models that will then enable those models to be used with confidence to test the responsiveness of the landuse transport system to changes, such as changes in land uses, changes in travel behaviour, changes to the road network, or a combination of these factors. The data summarised in Tables 6. 6 and 6.7 has been compiled from Council and RTA records and is indicative of current demand levels for important road links in the Nowra Bomaderry area.

Table 6.6: **Current Traffic Volumes on Major Road Links**

Location	Traffic Volumes	Traffic Volumes
Princes Highway Locations (RTA AADT Data)	2003 Estimate	2005 Estimate
07048 SH1, Bomaderry, North of MR261 Cambewarra Road	11475	12100
07050 SH1, Bomaderry, South of MR261 Cambewarra Road	18314	18600
* 07051 SH1, Nowra @ Shoalhaven River Bridge	44726	46000
07659 SH1, Nowra, North of Junction Street	31044	32000
07707 SH1, Nowra @ Browns Creek	26366	28500
* 07053 SH1, Falls Creek, North of MR312 Jervis Bay Road	19652	21000
AADT = Annual Average Daily Traffic Volume (in vehicles per day). If not permanent site, includes adjustment for seasonal variation.		
Classified Main Roads (RTA AADT Data)	2000 Estimate	2003 Estimate
07354 MR261 Moss Vale Road, West of Cambewarra Road	5102	6838
07448 MR293 Bolong Road, East of Railway Street	10334	10878
07449 MR293 Bolong Road @ Broughton Creek Bridge	7888	8398
AADT = Annual Average Daily Traffic Volume (in vehicles per day). If not permanent site, includes adjustment for seasonal variation.		
Peripheral Nowra Bomaderry Locations (Externals) (SCC ADT Data)	2001 Estimate	2005 Estimate
Bolong Road, East of Papermill	7167	7550
SH1 (Princes Highway), North of Meroo Road	10477	12230
Moss Vale Road, North of Barfield Road	2403	2500
Illaroo Road, West of Bangalee Road	948	1000
Yalwal Road, West of Longreach Road	250	250
Albatross Road, South of Cabbage Tree Lane	2985	3200
SH1 (Princes Highway), North of Warra Warra Road	16580	18000
Greenwell Point Road, West of Apperleys Lane	6647	7500
Comerong Island Road, East of Bryant Street	1298	1400
ADT = Average Daily Traffic Volume (in vehicles per day). Approximate off-peak estimates with no adjustment for seasonal variation.		
General High Traffic Volume Nowra Bomaderry Locations (SCC ADT Data)	2001 Estimate	2005 Estimate
Illaroo Road, East of Greys Beach Access Road (Fairway Drive)	16000	17000
Kalandar Street, East of SH1 (Princes Highway)	13000	15000
Bolong Road, East of SH1 (Princes Highway)	16000	18000
Albatross Road, North of Yalwal Road	9500	11000
Bridge Road, South of SH1 (Princes Highway)	12,000	13,000
Kinghorne Street, North of Kalandar Street	10,000	10,000
Berry Street, North of Albatross Road	3,000	4,000
ADT = Average Daily Traffic Volume (in vehicles per day). Approximate off-peak estimates with no adjustment for seasonal variation.		

** = Permanent Count Station*
Source: Council and RTA traffic data 2005.

It is noted again that a substantial proportion of traffic flow (in excess of off peak traffic flow levels) is 'direct' through traffic (potential bypass traffic). It is estimated that this is often as high as 95%. Figure 6.1 depicts graphically the seasonal fluctuations occurring on the Princes Highway every year, illustrating what is actually implied by the application of the term 'annual average'. The percentage differences along the Princes Highway relate to variation in base flow rates. This means that a 10% increase in traffic on the Shoalhaven River bridges equates to an approximate 20% increase in traffic flow through Bomaderry and South Nowra. This is an important relationship to consider when assessing the benefits of a potential bypass road.

Table 6.7: **Current Traffic Volumes on Shoalhaven River Bridges: Seasonal Variations**

Northbound - Average Weekday (off-peak > excludes peak tourist periods) : 22,290 vpd Southbound - Average Weekday (off-peak > excludes peak tourist periods) : 23,325 vpd Total Average Weekday (off-peak > excludes peak tourist periods) : 45,615 vpd		
Reported Annual Average Weekday (All Weekdays) : 47,708 vpd Reported Annual Average Daily Traffic (All Days) : 44,726 vpd Reported Peak Daily Traffic Flow (Highest Flow of the year) : 63,970 vpd (December, 2003) This is 18355 vpd higher than the Average Weekday Off-peak flow rate of 45,615 It is also 19244 vpd higher than the Average Weekday Off-peak flow rate of 44,726		
Since the off peak flow rate is most typical of average conditions for at least 50% of the year, it is considered more representative of an appropriate non-peak flow rate. The annual average daily rate is a hypothetical average rate that bears little resemblance to actual real time flows in an area affected by significant seasonal fluctuations like the Shoalhaven. ** Note: an estimated 95% of peak loading above the Average Weekday off-peak flow rate is potential 'direct' through traffic (potential Bypass traffic).* This is a significant fact in understanding the transport problem in Nowra Bomaderry. Whilst traffic models are established appropriately to replicate average off peak conditions (where predictable direct relationships between land-use and travel demand exist with little 'less predictable quantities' of outside influence such as tourist fluctuation), seasonal variations need to be carefully examined to better understand the true impacts on the road/transport network under conditions that occur with higher volumes for 50% of the year with very high flow periods for an estimated 20% of the year. These factors and the subsequent impact on the Nowra Bomaderry community and the Shoalhaven tourist economy could have significant bearing on the timing of provision of additional river capacity. *Note the facts below regarding the traffic flow levels on the Shoalhaven River Bridges from 2003 RTA data :*		
2003 RTA Data		
Traffic Flow > 30,000 vpd	364 Days of the year	100 %
Traffic Flow > 35,000 vpd	336 Days of the year	92.31 %
Traffic Flow > 40,000 vpd	285 Days of the year	78.30 %
Traffic Flow > 45,000 vpd	183 Days of the year	50.27 %
Off Peak Traffic Flow 45,615 vpd	165 Days of the year	45.33 %
Annual Average Traffic 47,708 vpd	102 Days of the year	28.02 %
Traffic Flow > 50,000 vpd	70 Days of the year	19.23 %
Note : Substantial Delays and Congestion begin to occur at this level (>50,000 vpd)		
Traffic Flow > 55,000 vpd	9 Days of the year	2.47 %
Traffic Flow > 60,000 vpd	2 Days of the year	0.55 %
Traffic Flow > 63,000 vpd	1 Days of the year	0.27 %

*Source: RTA 2003 Traffic Volume Data – * 07051 Shoalhaven River Bridges. Seasonal Variations.*

Travel Patterns: Origin Destination Surveys

Extensive origin-destination number plate surveys have been conducted in 1994 and again in 2003. These studies have highlighted significant information relating to strategic travel patterns in the Nowra Bomaderry area. The results of these surveys have significantly changed the direction of thought with respect of managing the transport problem in Nowra Bomaderry into the future.

The repeated key outcome of the studies is the very minor amount of 'direct' through traffic travelling through the Nowra Bomaderry area. This is an important finding as it means that the construction of a bypass road around Nowra Bomaderry will not result in a substantial shift in traffic onto such a road, if constructed as a traditional bypass with connections only at the northern and southern ends.

Under that scenario, the extent of traffic shift on to a traditional bypass could not be expected to be higher than an estimated 5% of current Princes Highway volumes at the Shoalhaven River Bridges.

Preliminary modelling analysis has identified that to maximise the diversion of traffic from the Princes Highway onto a bypass corridor will require a reasonable number of central local access points at strategic locations in order to offer reasonable alternatives to traffic other than accessing the Princes Highway as (currently) the only north-south spine road. This will also require construction of additional east-west links, linking a bypass road back to the Princes Highway and other strategic locations onto the local road network.

The extent to which a reasonable diversion of traffic off the existing highway can be achieved at least cost will be subject to more detailed examination throughout the Nowra Bomaderry Structure Plan implementation process. The outcomes of the origin-destination number plate surveys and preliminary traffic analysis have also identified that due to the layout and travel demand patterns in Nowra Bomaderry in the longer term, additional strategic crossing points of the Shoalhaven River are likely to be required both east and west of the existing crossing. This would provide alternative relief following significant congestion that would be unavoidable along the existing Princes Highway route with only a single alternative north-south arterial route (to the west).

The 1994 origin-destination survey was designed to provide substantial origin-destination data, that included not only counts on the peripheral (external) routes into and out of Nowra Bomaderry, but also on the Shoalhaven River Bridges. This enabled all trips across the Shoalhaven River Bridge on the day of the survey to be disaggregated into categories of local trips (not detected at any of the external stations), as well as regional movements (into and out of Nowra Bomaderry), and through traffic movements. The 2003 origin-destination survey was designed only to update and check any changes since 1994 of through traffic movements, and accordingly focused on stations on the peripheral (external) routes into and out of Nowra Bomaderry. An additional station was also provided on Illaroo Road for assessment for the 2003 study and comparison of 1994 movements into and out of the urban area that had a destination in North Nowra or Bomaderry.

Origin Destination Survey Results

The actual daily traffic volume on Wednesday 24th September, 2003 (day of later OD survey) was 47,176 vpd. The actual maximum recorded travel times between the furthest survey stations on Tuesday 6th December, 1994 (day of original OD survey) was in the range between 12-14 minutes. This indicated that it was possible to drive directly through the Nowra Bomaderry area within 15 minutes. The actual maximum recorded travel times between the furthest survey stations on Wednesday 24th September, 2003 (day of later OD survey) was in the range between 14-16 minutes. This indicated that it is sometimes possible to drive directly through the Nowra Bomaderry area within 15 minutes, however it is unlikely that it is possible to do so in peak periods.

With respect of the above travel times, it is also noted that the later survey attempted to station survey locations precisely where they were during the 1994 study. The southern Princes Highway location on the fringe of Nowra Bomaderry was the only station where this was not possible – being relocated from north of Warra Warra Road (1994) to the vicinity of BTU Road (2003) on the advice of RTA. This was recorded as being approximately 70-80 seconds of travel time longer in 2003 over that extra distance. This should be kept in mind if attempting to compare travel times. The results of the origin-destination survey are summarised in Table 6.8.

The findings of the survey suggest that there has been an overall increase in through traffic movements throughout the study area. Given the general increase in through traffic movements, the minor reduction noted in 'direct' through traffic movements (for the 15 minute time cut-off period) suggests that some traffic may have had difficulty traversing the study area within the allowable 15 minute cut off period. With respect of the 30 minute time cut off period, there is an apparent increase of 572 through movements representing an 18.8% increase, that is, an annual increase of approximately 1.9% over the 11 year period between surveys.

Table 6.8: **Results of Origin Destination Surveys: 1994 & 2003**

Indicator	Origin Destination Survey Results
No Time Cut-Off	**2003**: Total 'Through Traffic' Movements (No Time Cut-Off) recorded within the survey period and factored to approximate daily movements: 6921 movements (ie an estimated 14.67% of total traffic on the Shoalhaven River bridge on the day of the survey - 47,176 vpd). **1994**: Total 'Through Traffic' Movements (No Time Cut-Off) recorded within the survey period and factored to approximate daily movements: 4430 movements (ie an estimated 12.92% of total traffic on the Shoalhaven River bridge on the day of the survey – 34,276 vpd).
2 Hour Time Cut-Off	**2003**: Total 'Through Traffic' Movements (2 Hour Time Cut-Off) recorded within the survey period and factored to approximate daily movements: 4847 movements (ie an estimated 10.27% of total traffic on the Shoalhaven River bridge on the day of the survey - 47,176 vpd). **1994**: 2 Hour Time Cut-Off not previously assessed.
30 Minute Time Cut-Off	**2003**: Total 'Through Traffic' Movements (30 Min Time Cut-Off) recorded within the survey period and factored to approximate daily movements: 3609 movements (ie an estimated 7.65% of total traffic on the Shoalhaven River bridge on the day of the survey - 47,176 vpd). **1994**: Total 'Through Traffic' Movements (30 Min Time Cut-Off) recorded within the survey period and factored to approximate daily movements: 3037 movements (ie an estimated 8.86% of total traffic on the Shoalhaven River bridge on the day of the survey – 34,276 vpd).
15 Minute Time Cut-Off	**2003**: Total 'Through Traffic' Movements (15 Min Time Cut-Off) recorded within the survey period and factored to approximate daily movements: 2166 movements (ie an estimated 4.59% of total traffic on the Shoalhaven River bridge on the day of the survey - 47,176 vpd). **1994**: Total 'Through Traffic' Movements (15 Min Time Cut-Off) recorded within the survey period and factored to approximate daily movements: 2310 movements (ie an estimated 6.74% of total traffic on the Shoalhaven River bridge on the day of the survey – 34,276 vpd).

Source: Shoalhaven City Council 1994 and 2003 Surveys

Summary of Origin Destination Findings

A detailed analysis of 'direct' and 'indirect' through traffic on the Princes Highway (2003 data) revealed the following:

- Approximately 5-6% of total traffic on the Shoalhaven River bridges is potential 'direct' through traffic (potential bypass traffic)
- Of the estimated 14.67% total through traffic on the Shoalhaven River bridges:
  - Only 52% of these total through trips travelled through the study area within 30 minutes (includes bypass traffic but not all may be bypass traffic).
  - Only 31% of these total through trips travelled through the study area within 15 minutes (all bypass traffic).
  - Approximately 35-40% of these total through trips can therefore be assumed to be potential bypass traffic.

The above summary assessment of bypass traffic is general based on all movements recorded and requires a detailed breakdown of 'direct' through traffic movements to determine which of the existing routes may use an eastern versus a western bypass.

Estimate of Bypass Candidate Traffic

Based on a detailed breakdown of 'direct' through traffic that would have the potential to divert onto a bypass, Table 6.9 provides a summary of that assessment. It should be noted that based on the actual estimated travel time recorded between the furthest survey stations on Wednesday 24th September, 2003 (an average of 14-16 minutes) the use of 15 minute time cut-off would therefore not likely be indicating the full range of 'direct' through traffic (potential bypass trips) recorded throughout the study period. Particularly peak period trips are likely to have been included within the 30 minute assessment, given that it is unlikely that they could have traversed between the study area externals within 15 minutes. The summary assessment has therefore also included the 30 min time cut-off range. However it should be noted that some of these trips (30 minute time cut-off) may have also stopped briefly within the study area, and accordingly may not be strictly bypassable trips without commercial zoning potential along a possible bypass corridor.

Table 6.9: **Assessment of 'Direct' Through Traffic**

Indicator	Potential 'Direct' Through Traffic
15 Minute Time Cut-Off	Estimate of traffic that would use eastern versus western bypass (estimates based on detailed recorded trip patterns on Wednesday 24th September, 2003) Trips that would use far eastern bypass on day of survey : 1979 4.19% (of 47,176 vpd) Trips that would use far western bypass on day of survey : 1616 3.43% (of 47,176 vpd)
30 Minute Time Cut-Off	Estimate of traffic that would use eastern versus western bypass (estimates based on detailed recorded trip patterns on Wednesday 24th September, 2003) Trips that would use far eastern bypass on day of survey : 3260 6.91% (of 47,176 vpd) Trips that would use far western bypass on day of survey : 2779 5.89% (of 47,176 vpd)

Source: Shoalhaven City Council 2003 Survey.

2036 Strategic Traffic Demand Corridors

Map 6.2 depicts graphically the forecast potential traffic demand (2036) based on the population and employment projections for Nowra Bomaderry and the assessment of the demand for possible east and west bypass corridors. It should be noted that the diagrams depict the travel demand at 2036 based on all of the shown river crossing links being provided and available to traffic. It also assumes only extrapolated through traffic movements based on the 2003 15 minute time cut-off range. It is likely that the actual figures would be marginally higher had the 30 minute time cut-off range been adopted as a basis for projections.

Only 1% annual growth factor has been applied to the through traffic movements in the displayed model run, despite actual recorded growth rates in through traffic being approximately 1.6% over the previous 11 year period. No adjustments have been made to the base through traffic movements to account for a future possible MR 92 corridor link between Nowra and Canberra/Hume Highway. Whilst it is acknowledged that this will have a positive impact on traffic movements through Nowra Bomaderry, the extent to which that may occur as opposed to increased regional movements (including 'in-direct' through traffic) is difficult to quantify. At this stage, it has been simply documented to highlight the potential impact of the road, in the absence of a more rigorous analysis.

Other Origin Destination Issues

The removal of through-traffic from the Princes Highway in the Nowra Bomaderry urban area will have approximately twice the benefits in the South Nowra and Bomaderry precincts as would be sustained at the existing Shoalhaven River bridges. This is an important consideration when determining the benefits of a possible bypass route around Nowra Bomaderry, since the Shoalhaven River Bridges and adjoining intersections would not necessarily be the main beneficiaries of a bypass. For instance, a reduction of approximately 10% through traffic on the bridges would equate to a reduction of approximately 20% through-traffic from the Princes Highway through Bomaderry and South Nowra.

Both origin destination surveys commenced at 6am and accordingly included trips to and from Wollongong and Sydney. However since the surveys were completed at 6pm, some motorists returning from Wollongong and Sydney may not have reached the Shoalhaven within the survey period. Whilst this is an important fact in the understanding of the strategic through movements, the timing of those returns to the Shoalhaven would not otherwise coincide with critical peak traffic conditions. Accordingly, it was not considered critical to extend the survey for the purpose of capturing those return movements.

6.3.4 System Deficiencies

As with any urban road system, Nowra Bomaderry has a number of current network deficiencies that require remedial action both at the strategic and local levels. The extent of these problems in the 'base case' scenario need to be carefully considered, since these constraints are a major contributing factor in identifying the need for additional road and transport infrastructure.

In the context of the Nowra Bomaderry structure planning process, the need and timing for additional road and transport infrastructure needs to be clearly articulated. Is the transport infrastructure and services required in the short term - driven by background traffic growth relating to existing zoning levels, or is the need and timing primarily related to potential future zonings and development?

Traffic Bottlenecks

A preliminary analysis of the existing network shows that a number of critical Princes Highway intersections are currently operating at or near practical capacity during peak periods. This includes the section of Princes Highway between Bolong Road and Bridge Road intersections, which is a well known bottle neck in both AM and PM peak periods, and the Kalandar Street intersection. Significant queuing and delays have become a daily occurrence for commuters at these areas and in particular along the intersecting side roads.

Given that approximately 67% of all trips generated north of the river have a destination south of the river, and that approximately 38% of all trips generated south of the river have a destination north of the river, it is evident that this significant bottleneck at the Shoalhaven River Bridges is affecting almost 55% of all residents in Nowra Bomaderry and the Northern Shoalhaven. This is clearly having an impact on people's daily lives.

The Nowra Bomaderry Structure Plan traffic analysis is seeking to examine current and future network deficiencies and identify feasible solutions to improve network capacity. There is an important relationship between roadway capacity and road safety levels. Improvements to roadway capacity leads to less risks being taken by motorists and accordingly reduced crash rates being observed. The analyst needs to balance up the benefits of reduced crash rates with the disbenefits of increased severity levels that could be brought about by increases in vehicle speeds. Generally Level of Service (LOS) has been accepted as a design target for roadway capacity, with LOS often being accepted as an appropriate target in times of peak tourist activity. These design levels and other environmental and safety considerations will be the target objectives for determining necessary improvements to the road and transport network in Nowra Bomaderry.

East Nowra Sub-Arterial (ENSA)

With respect of Kalandar Street, Council is currently undertaking detailed investigations into the provision of an East Nowra Sub-Arterial Road (ENSA) to reduce volumes on Kalandar Street and substantially improve the life of the Princes Highway between Kalandar Street and Junction Street. This has been considered on strategic and detailed terms, having been a key recommendation of the Nowra CBD Traffic Strategy and on-going later detailed traffic modelling studies that consider also a substantial expansion of the CBD on the eastern side of the Princes Highway. The studies to date have assumed a 2016 design target year on the assumption that there would be no additional river crossing up to that point, and thereby more confidence in forecast travel patterns. This Nowra Bomaderry Structure Plan is carefully examining the land-use transport problem, out to and beyond the year 2036, and accordingly is re-examining the impacts and possible solutions for the Princes Highway through Nowra Bomaderry and the Nowra CBD. The provision of ENSA is likely to significantly defer the need to upgrade the Kalandar Street / Princes Highway intersection and the section of Princes Highway between Kalandar Street and Junction Street for up to 10 years.

Shoalhaven River Bridges: Additional River Crossing Feasibility Study

The RTA has been undertaking studies on the feasibility of providing additional capacity for the Shoalhaven River crossing. Stage 1 of the Shoalhaven River feasibility study examined strategic travel demand corridors however was generally inconclusive. It again revealed a much stronger demand corridor to the east, whilst acknowledging that additional river capacity would still be required in the short-medium term at the existing bridge location. An inner western bridge could be an option. However for obvious financial reasons maximising the life of the existing bridges also seems to have some opportunity (Stage 2). These could possibly involve:

Illaroo Road

- Short term: Construct left slip lane on the approach to the Princes Highway
- Short term: Construct North Nowra – Bomaderry Link Road

Bridge Road

- Short term - Restrict movements into and out of Pleasant Way (ban right turn in from Princes Highway, ban left turn out from Pleasant Way, retain left turn in). Relocate lost access further south to new traffic signal location. Retain pedestrian crossing as staged crossing.
- Short term - Construct new traffic signals mid-block between Bridge Road and Moss Street, allowing left turn in off Princes Highway, left turn out to highway, and right turn in off highway only. Provide staged pedestrian crossing.
- Medium term - Construct pedestrian overpass linking from Shoalhaven Council to the tourist centre site immediately south of the Bridge Road intersection utilising existing embankments.

The release of the draft report is expected in the near future.

Seasonal Fluctuations

It is currently anticipated that additional river crossing capacity will be required between 2016 and 2021. This is subject to review and subject to a review of the appropriate design parameters for investigation. Studies to date have adopted 'annual average daily traffic' flows or 'average off-peak weekday' traffic flows as the appropriate 'base case' for traffic modelling studies and analysis. Whilst this is appropriate and a more accurate means of validating the land-use transport demand relationship, it needs to be re-iterated and emphasised by the analyst that on 50% of the days of the typical year, traffic volumes will exceed those levels and often substantially in an attractive tourist destination like the Shoalhaven (Figure 6.1). For example, in 2003 terms, the peak traffic flow throughout 2003 was recorded as being as high as 18,000 vpd above the annual average flow rate. Incorporating these higher flows into the analysis (to replicate reality) has often devastating impacts on the Princes Highway and the local road network relying on access to the Princes Highway. These unusually high flow rates and resultant untenable congestion is precisely what Shoalhaven residents experience for an estimated 20% of the year. The RTA has a permanent traffic counting station on the Shoalhaven River Bridge that allows detailed analysis of seasonal fluctuation.

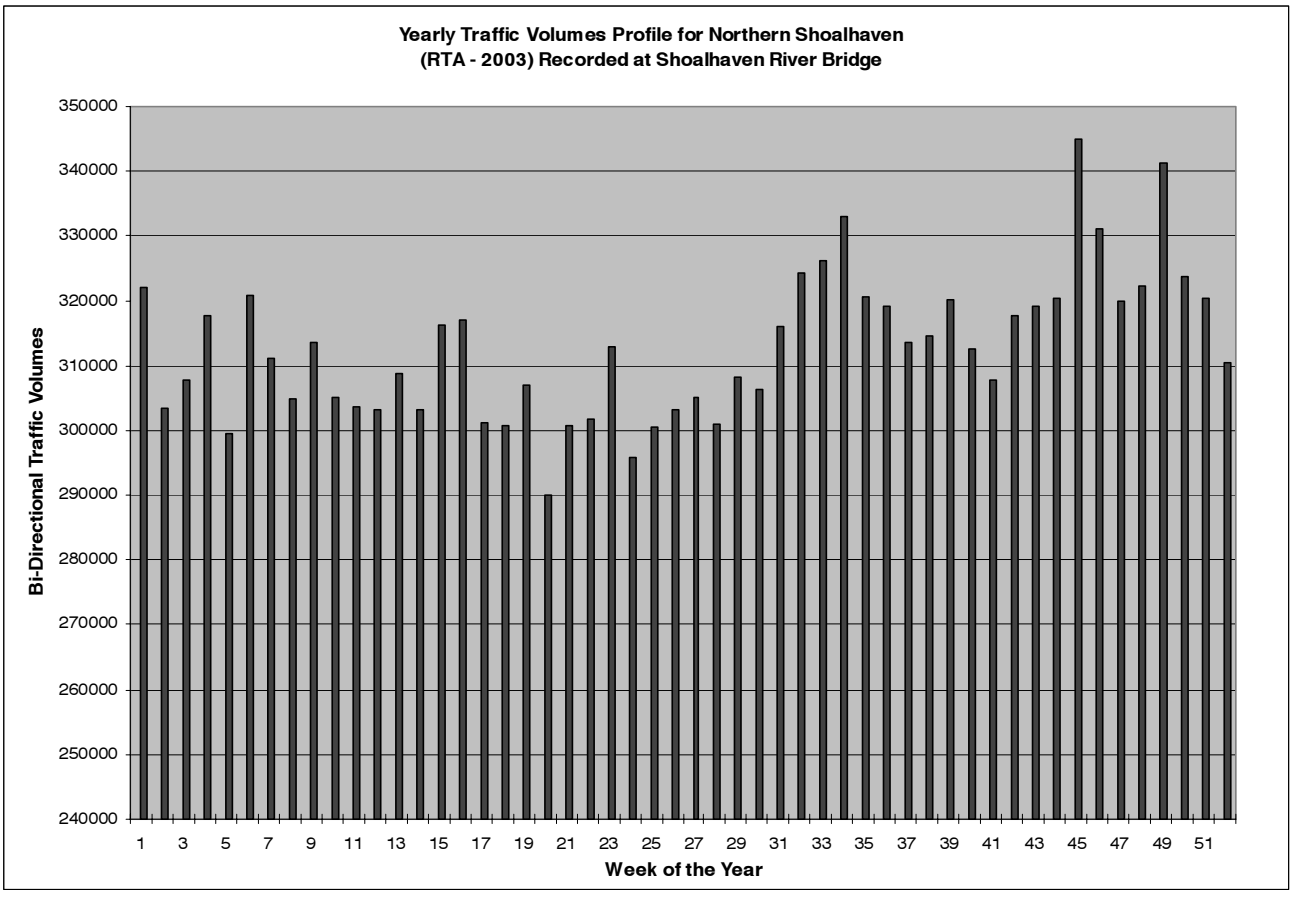


Figure 6.1: **Princes Highway – Seasonal Traffic Variations**

Reduced Bridge Design Capacity and Breakdown Vulnerability

The existing southbound bridge over the Shoalhaven River falls well below acceptable design standards, which contributes to the reduction in capacity in that direction. Low clearance at both ends (4.4 under outer flanges and 4.8m in the centre of the bridge) falls well below the RTA's current recommended 5.3m clearance for new bridge design. Higher vehicles occasionally seek approval for use of northbound travel lanes to cross the river. This occurs occasionally in the morning peak period given the travel time from Sydney and RTA recommendation to avoid Sydney peak times.

Very narrow traffic lanes also reduce capacity. The effective available width of 5.5m for the two southbound lanes (2.75m lanes) falls well below current standards of 3.5m traffic lanes. These factors cause difficulty for large heavy vehicles, often effectively occupying both lanes.

In the interim, whilst the southern bridge remains in service, the capacity of the crossing remains extremely vulnerable to interruptions in traffic flow due to crash incidents on the bridges. This was demonstrated to the extreme in late 1998, when the south bound bridge, which has deficient horizontal and vertical clearances, sustained serious structural damage as a result of a traffic accident (heavy vehicle collecting the bridge at northern end). As a consequence, one southbound lane was closed for a period of several weeks, as repairs were made. This caused serious congestion and disruption to traffic flow, with delays of up to 40 minutes occurring at peak periods. In the five years to June 2004, there was a reported three rear end accidents on the bridges which also created substantial disruption. It is known that other accidents have occurred during peak periods that have not been reported or have not appeared in accident records.
It has also been known that due to high traffic volumes on Illaroo Road in peak periods, that occasionally upstream accidents on Illaroo Road have caused traffic queuing that has extended back impacting flow on the Princes Highway.

As indicated above, substantial congestion is common on the bridges during peak tourist times and during the summer months. 2003 RTA traffic data indicates that extreme volumes have affected flows on the bridges for an estimated 20% of the year.

Safety Concerns and Accident Blackspots

Commensurate with the high volumes of traffic carried by the Princes Highway, the highway intersections with the Nowra Bomaderry local road network tend to rank as the districts' major accident blackspots. Table 6.10 provides an indication of accident levels in Nowra Bomaderry compared with the broader Shoalhaven LGA pattern.

Table 6.10: **Shoalhaven & Nowra Bomaderry Road Crashes: 1998-2003**

Shoalhaven LGA	Nowra Bomaderry
There was an average of 3078 reported road crashes in the Shoalhaven LGA throughout the 5 year period to September 2003. This corresponds to an average crash rate of approximately 616 reported road crashes every year. Almost 45% of these reported crashes (1384) were casualty crashes that resulted in a total of 2006 casualties at an average rate of approximately 402 casualties each year. Of the 1384 total casualty crashes, this included 1332 Injury accidents resulted in a total of 1943 injuries at an average rate of approximately 389 injuries each year. Of the 1384 total casualty crashes, this also included 52 Fatal accidents resulted in a total of 63 fatalities at an average rate of approximately 13 fatalities each year. Of the 1384 total casualty crashes, 532 of these (38%) occurred on RTA roads (458 on SH1 Princes Highway and 74 on MR261 Moss Vale Road). Of the 52 total fatal crashes, 23 of these (44%) occurred on RTA roads (22 on SH1 Princes Highway and 1 on MR261 Moss Vale Road).	There was an average of 1056 reported road crashes in the Nowra Bomaderry Structure Plan study area throughout the 5 year period to September 2003. This corresponds to an average crash rate of approximately 212 reported road crashes every year, and represents 34.31 % of all reported road crashes in the Shoalhaven LGA. Ironically, this corresponds with the percentage of population in Nowra Bomaderry compared with the broader Shoalhaven LGA (28,325 population Nowra Bomaderry, being 33.90 % of total population Shoalhaven City 83, 548 2001 ABS Census, 2001). Almost 47% of these reported crashes (495) were casualty crashes that resulted in a total of 669 casualties at an average rate of approximately 134 casualties each year. Of the 495 total casualty crashes, this included 483 Injury accidents resulted in a total of 657 injuries at an average rate of approximately 132 injuries each year. Of the 495 total casualty crashes, this also included 12 Fatal accidents resulted in a total of 12 fatalities at an average rate of approximately 3 fatalities each year. The proportion of fatal accidents occurring in Nowra Bomaderry compared with the

Shoalhaven LGA	Nowra Bomaderry
	broader Shoalhaven is and would be expected to be considerably lower than the general rate of reported road crashes. Fatal crashes are typically a symptom of rural road networks where speeds and accordingly resultant crash severity are greater than urban road networks. Of the 495 total casualty crashes, 179 of these (36%) occurred on RTA roads (164 on SH1 Princes Highway and 15 on MR261 Moss Vale Road). Of the 12 total fatal crashes, 2 of these (17%) occurred on RTA roads (2 on SH1 Princes Highway and 0 on MR261 Moss Vale Road).

Source: Roads and Traffic Authority 2005: Road crash records for 5 year period to September 2003

The data in table 6.10 indicates that there are current road safety problems on the Nowra Bomaderry road network that require detailed examination to determine whether any feasible solutions could reduce road crash rates.

A high percentage of accidents including casualty accidents occur along the Princes Highway and some of the higher accident locations occur where there is already signal control. It should be noted also that given the subject time period being examined, remedial work has been undertaken at some of these intersections, both during and after this period, thus reducing their propensity to contribute to further reported crashes. As previously discussed, an understanding of the existing road network problems is required before a thorough assessment of the real impacts of the Nowra Bomaderry Structure plan investigations areas can be understood. This includes both deficiency (capacity analysis) as well as road safety investigations.

Highest Casualty Crash Locations in Nowra Bomaderry

Table 6.11 lists the latest RTA 'reported' road crash records (5 year period to June 2004). The criterion for this particular data extraction is more than three injury accidents in the five year period which accordingly qualifies for current black-spot examination. It should be noted that other criteria also needs to be satisfied prior to a valid application being lodged and reviewed by RTA.

The crash data summarised in Table 6.11 includes accidents that have occurred within a specified distance from an intersection. Typically this is between 50-100 metres of an intersection, so long as there is a demonstrated link between the crash and the operation of the intersection, that is, whether the accident was affected by merge, queue, sudden deceleration, or similar features. An analysis of this data needs to take into consideration the time range and should bear in mind the fact that in some cases, there have already been improvements undertaken or remedial action implemented. This is likely to lead to a reduced number of crash rates at those specific locations in future reports. Where applicable, brief comments have been included in Table 6.11 to provide additional information and indicate whether remedial action has been identified or implemented.

Table 6.11: **Nowra Bomaderry: Major Crash Locations: 1999-2004**

Intersection	Crashes	Casualties	Comment & Remedial Action
Highway/Illaroo Road	32	16	Filter option for right turn into Illaroo Road recently removed to address the dominant reported accident type.
Highway/Moss Street	23	17	East-west movements still operate on same phase despite numerous requests by Council to separate phasing.
Highway/Kalandar Street	20	12	Intersection at or near practical capacity. Construction of ENSA likely to significantly improve intersection capacity & reduce accident rate.
Highway/Plunkett Street	16	7	East-west movements operate on same phase (the resulting conflicts contributing to the majority of accidents).
Highway/Worrigee Street	15	4	At or near capacity. Upgrading may reduce accident rate.
Highway/Central Avenue	13	4	Currently upgrading to roundabout 2000. Accident rate has reduced.
Bridge Road/Berry/North Street	12	5	Currently upgrading to traffic signals. Anticipated accident reduction.
Moss Vale Road/Main Road	9	6	Council has repeatedly brought high accident rate to RTA's attention. Upgrading previously discussed with RTA.
Illaroo Road/McMahons Road	9	6	High traffic volumes lead to high accident accidents at roundabouts. North Nowra–Bomaderry Link Road likely to reduce accident rates on Ilaroo Road.
Highway/Quinns Lane	7	7	Intersection upgraded to roundabout 2002. Accident rate has reduced
Highway/Flinders Road	7	4	Remains a high accident location in South Nowra. Council wishes to realign the intersection 75m to north and construct new roundabout. Right turn out of Flinders Road banned in June 2005 as part of Highway upgrade to 4 lanes between Browns and Quinns roundabouts. Retention of all other movements remains a high priority for Council. When intersection is ultimately upgraded, all movements to be catered for.
Highway/ Bridge Road	7	4	Intersection at or near practical capacity.
Highway/Cambewarra Road	7	3	High traffic volumes typically lead to high accident accidents at roundabouts. Future forecast traffic volumes through Nowra Bomaderry likely to result in need for 6 lanes & traffic signals through South Nowra and Bomaderry. No Interim upgrade likely at this point.
Worrigee Street/Haigh Avenue	6	4	Existing signals. Accident rate can be connected to non-compliance with banned turns at this junction however banned turns appropriate given close proximity to the highway.
Kinghorne Street/Plunkett Street	6	3	Traffic Signals installed 1998 followed by substantial crash reduction.
Bolong Road/Meroo Street	6	3	High traffic volumes lead to high accident rates at roundabouts. No upgrade planned. Traffic signals a likely solution and would provide welcome pedestrian benefits. A significant upgrade of highway capacity would potentially result in a shift of traffic back to the highway from the 'sandtrack'. This should result in improved road safety levels on Bolong Road.
Cambewarra Road/Jasmine Street	6	3	Traffic signals a likely solution & would provide welcome pedestrian benefits if crash rates continue to increase.
Illaroo Road/Crescent Street	5	5	North Nowra–Bomaderry Link Road likely to lead to reduction in accident rates along a substantial length of Illaroo Road.
Illaroo Road/Phillip Street	5	4	North Nowra–Bomaderry Link Road likely to lead to reduction in accident rates along a substantial length of Illaroo Road.
Greenwell Point Road/Old Southern Road	5	3	Construction of ENSA will requires substantial upgrade of this junction which should improve network capacity & road safety at this intersection. Resultant impact on crash rate dependent on intersection form adopted.
Kalandar Street/ Wallace Street	4	6	Intersection upgraded to roundabout in 2003 as part of a package of works targeting road safety along Kalandar Street through East Nowra. The works are likely to lead to reduction in accident rates in the area.
Bolong Road/Railway Street	3	3	Increased use of Bolong Road has led to reduction in safety. A significant upgrade of capacity on the highway would potentially cause a shift of traffic back to highway from the 'sandtrack'. This could result in improved road safety levels along Bolong Road. Should crash rates continue to increase, It is likely that an intersection upgrade would be considered. Installation of traffic signals may be an appropriate treatment & provide additional down stream benefits at Meroo Street/Bolong Road intersection.

Note: Crashes: reported crashes; Casualties: injuries & fatalities

6.3.5 Need for an Additional River Crossing

The sustained increased demand for motor vehicle travel across the Shoalhaven River has given rise to an annual average of approximately 45,000 vehicles per day in 2005, with higher flows in the year exceeding 60,000 vpd. To continue to support population and economic growth rates in Shoalhaven, both local and State governments should be seriously looking to mitigate the impacts of increasing traffic congestion on the Nowra –Bomaderry bridges given the significant impacts this has on the Nowra Bomaderry community. Over and above annual average daily conditions, the very real impacts of tourism traffic along the Princes Highway but particularly on the Shoalhaven River bridges, should also be a careful consideration in determining appropriate levels of future infrastructure to be provided. As the existing bridges across the Shoalhaven River continue to approach capacity, there is a growing need to pursue a strategy for resolving additional capacity for crossing the Shoalhaven River.

TRACKS Transport Modelling

Since the development of the Nowra Bomaderry TRACKS transportation models in 1995, Council's ability to model the impacts of land-use and transport changes has been significantly enhanced. The TRACKS models have been updated over time and will be used to assess the impacts of the proposed Nowra Bomaderry urban expansion areas. The TRACKS landuse transport zone system is shown on Maps 6.2 and 6.3.

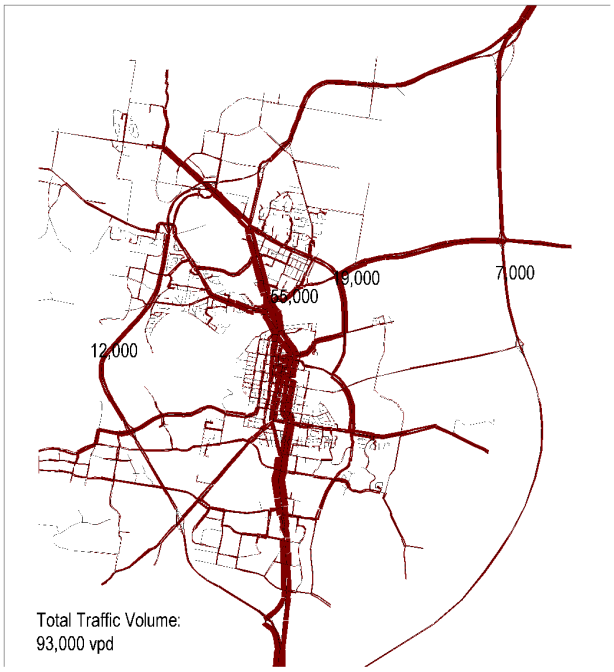
Since the TRACKS models have been available for use, the relative merits and travel demand of a bypass corridor to the east or to the west of Nowra Bomaderry has been analysed under numerous scenarios. The preparation of future population and employment projection data out to 2036 has recently been prepared with great detail and will be input into the TRACKS models in five year increments to carefully analyse the build up of traffic relating to background traffic growth and the resultant impacts of new development, and identify network deficiencies and possible solutions.

Eastern Versus Western Bypass

There has for some time been a debate over the relative merits of an eastern versus a western bypass. It should be noted that whilst an eastern bypass has the greatest travel demand corridor based on current travel demand patterns, a major contributing factor (not the sole factor) to this outcome is the large shift of through traffic off the Princes Highway onto the 'sandtrack'. The extent to which traffic can be diverted back onto the Princes Highway is subject to careful detailed regional transport modelling which is integral to the structure plan traffic modelling investigations.

This is critical to the outcomes of the local traffic analysis and will no doubt result in clearer strategic direction for pursuing an eastern versus western bypass. The future traffic volumes on Greenwell Point Road and Kalandar Street, affected by local development, the capacity for development potential at Culburra, the upgrade of Forest Road and associated connections at the Princes Highway, also have a significant impact on the relative magnitude of demand for an eastern corridor. So long as Bolong Road and Greenwell Point Road/Kalandar Street remain important arterial roads with adequate network capacity, there will always be strong demand for use of these roads. To minimise the cost of infrastructure provision, there will need to be important joint regional decisions made and significant investment in the existing Princes Highway for a western bypass corridor to be a sole solution to address the river crossing transport problem.

If sustained traffic growth continues with current travel demand patterns, it is likely that by 2036, up to three additional river crossings may be required to address high levels of traffic congestion and unreasonable impacts on local roads. This would include a western bypass, an inner eastern bypass, and an inner western bypass. An inner eastern bypass is likely to lead to unreasonable traffic congestion along Old Southern Road, however this option provides substantial relief to the existing bridges. A refinement could eventually involve a far eastern bypass road. Under all scenarios, a substantial upgrade of the existing Princes Highway will be necessary which may also include additional river crossing capacity (likely to be inner western).

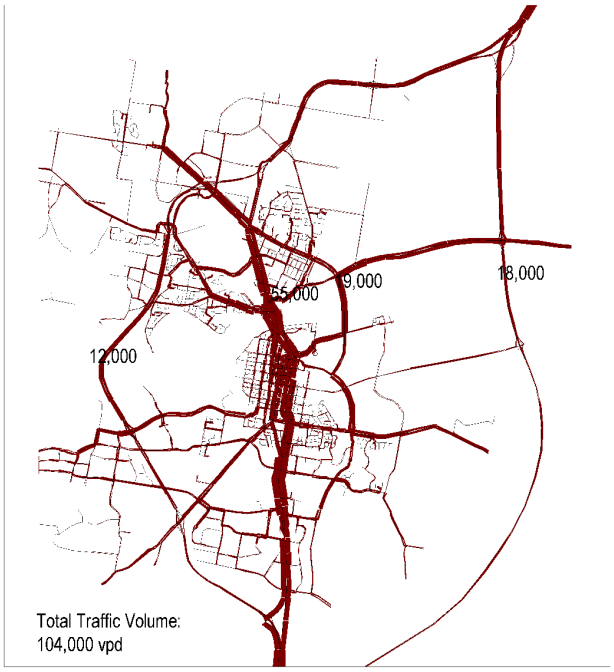


6.2a Average Weekday Traffic Volumes
(50% of the year volumes > 93,000 vpd)

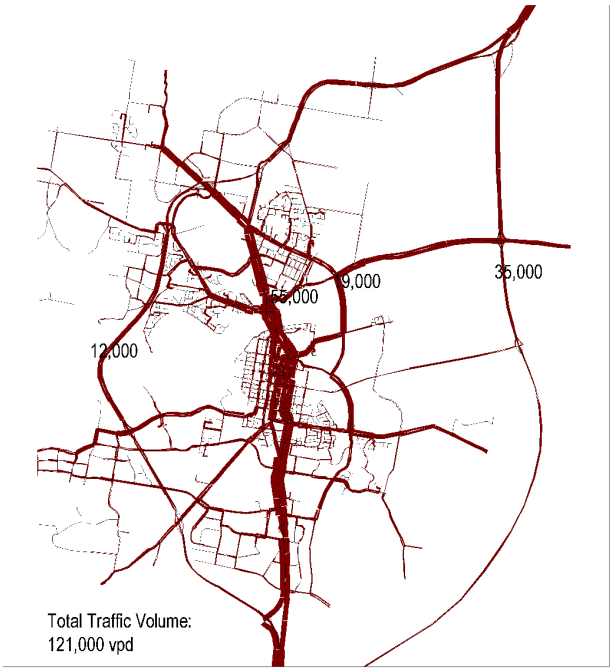
Notes:
The Volumes shown in 6.2a represent preliminary 2036 forecasts of 'constrained' travel demand across the Shoalhaven River (Total 93,000 vpd).

Note 1: Of the traffic across the Shoalhaven River Bridge (existing location):
* 26,000 is on the new link to Bridge Road
* 29,000 is on the existing bridges

Note 2: If there was no eastern crossing of the Shoalhaven River Bridge:
* 30,000 is on the new link to Bridge Road
* 51,000 is on the existing bridges

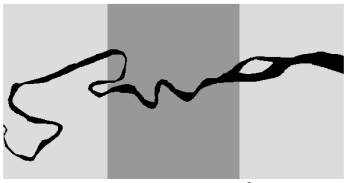


6.2b Average Holiday Traffic Loading
(20% of year volumes > 104,000 vpd)



6.2c Peak Holiday Traffic Loading
(No day of year volumes > 121,000 vpd)

Forecast River Crossing Holiday Traffic 2036

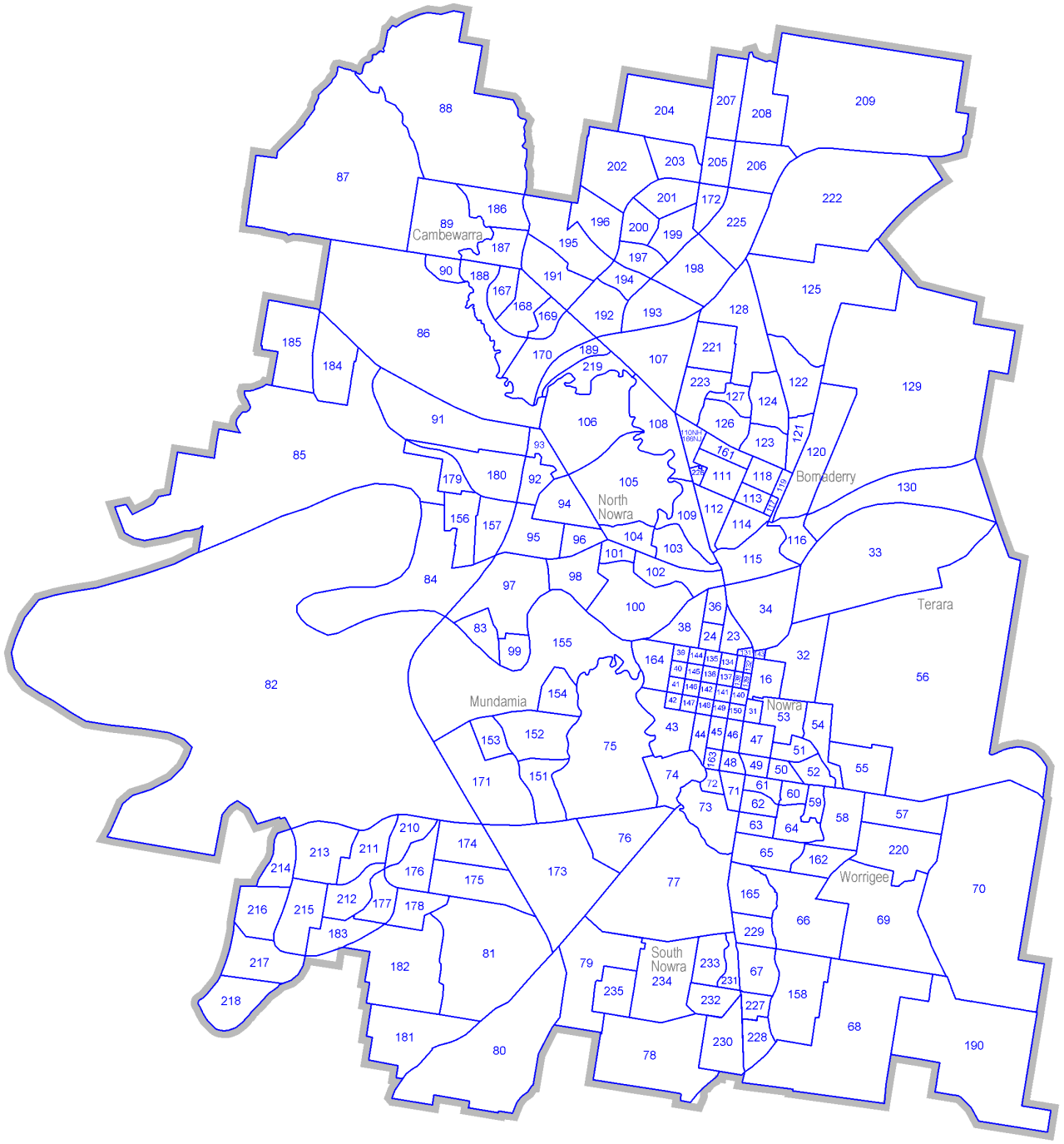


Nowra Bomaderry Structure Plan

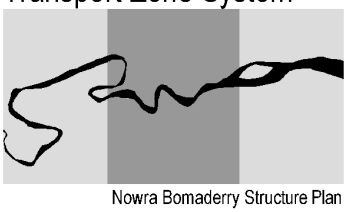
September 2005

Not To Scale

Map 6.2



TRACKS Landuse
Transport Zone System



Nowra Bomaderry Structure Plan

Legend

LTZ System Structure Plan Boundary

Tracks Zone Boundary

September 2005

Not To Scale

Map 6.3

Whilst It is generally accepted that new link(s) must for all practical purposes, remove as much traffic as possible from the existing bridges to reduce growing congestion and improve the efficiency and performance of key intersections at both ends of the existing crossing, the impact of this on the local road network and the possible financial impacts on Council must be carefully assessed. RTA funding would be essential. Without significant local connections between the bypass and the major residential and employment centres a western bypass would attract little traffic. An eastern bypass would also require significant local road infrastructure to maximise its use.

Impact on Local Road Network

With respect of local road links necessary for maximising the benefits of additional river crossing capacity, any new links should be designed to address as many of the existing and forecast problems along the entire length of the highway as possible. This is anticipated to mean a more even distribution of north/south and east/west movements into and out of large residential and employment centres including Nowra CBD. The likely future upgrading of MR 92 to connect Shoalhaven with Canberra and the Hume Highway should also be carefully considered in determining strategic future demand corridors and appropriate connections to cater for potential significant increases in heavy goods transport.

Even with this increased level of additional infrastructure, the major employment centres in Nowra Bomaderry are built around access from the existing Princes Highway spine, with substantial residential areas on both sides of the central highway. As a result, the transport modelling evidence is indicative that regardless of additional river crossing capacity, there will always be strong demand for access to and use of the existing Princes Highway, and that a substantial upgrade of the existing Princes Highway route would be required regardless of a future bypass road.

Need for Additional Modelling

To summarise, the identification of network deficiencies and the need for additional road transport infrastructure is subject to on-going detailed analysis. All levels of traffic modelling will be employed for the analysis including the use of the Illawarra Strategic TRACKS models, that will provide important inputs to the Nowra Bomaderry TRACKS models, which in turn will provide detailed inputs to the aaSIDRA Intersection models. This modelling will provide the necessary tools for closely examining the likely impacts of future development and background traffic growth on the road transport network, to enable feasible solutions to be identified. More recent transport modelling studies by RTA and Council on the Shoalhaven River bridges have only focused on relatively short time periods for analysis (not further out in time than 2016). Given the likely cost of providing a reasonable transport network, this very short term view is appropriate only for determining possible Interim treatments to address road safety and capacity, however is not considered appropriate in context of the Nowra Bomaderry structure plan.

6.3.6 Land Use Impacts on Transport

Demand for travel is a function of the spatial separation of landuse activity. In the case of Nowra Bomaderry, the spatial separation between residential areas and places of employment is having a dramatic effect on the capacity of the existing transport network. The morning and evening peak periods is the primary cause of congestion during these periods.

Growth will continue to place increasing pressure on the existing road network with the resultant traffic congestion at critical intersections. Traffic management initiatives aimed at solving these isolated problems may prove to be of limited effect in the longer term. If so, it is likely that increased costs will result in diminishing benefits, as mid-block capacity becomes the dominant issue rather than intersection capacity.

Nowra's Regional Centre Role

The role of Nowra Bomaderry at a more strategic level has been identified and can explain why such a large number of motor vehicle trips enter and leave Nowra Bomaderry on a typical weekday. The population catchment area for the Nowra town centre is far greater than just the confines of the Nowra Bomaderry urban area and is an estimated minimum of 41,202 (ABS Census 2001) with an actual likely catchment population of approximately 60,000 (planning areas 1,2 and 3).

The employment base of the Northern Shoalhaven is an estimated 13,000 average weekday Jobs (this is less than ABS Census reported workforce that comprehensively includes total workforce and is not indicative of jobs on an average weekday). Approximately 80% of these jobs are located in the Nowra Bomaderry urban area, this is despite there being only 45% (approximate) of the catchment population that actually reside in that urban area.

To summarise, these figures demonstrate that a great demand for travel would occur on all strategic arterial links, connecting the coastal villages and country towns to Nowra, which is clearly functioning as a major commercial, service and employment (regional) centre, not only for Nowra Bomaderry, but for the entire Northern Shoalhaven.

To re-iterate the survey results of previous origin destination studies of Nowra Bomaderry, approximately 50% of all the traffic on the Shoalhaven River bridges is local traffic (generated within the confines of the Nowra Bomaderry area), approximately 5% only is 'direct' through traffic (no origin or destination within the Nowra Bomaderry area) leaving a significant 45% of all the traffic on the Shoalhaven River bridges being 'in-direct' through traffic or representing traffic with either an origin or destination within Nowra Bomaderry and the other trip end being external to Nowra Bomaderry. A significant proportion of trips in that category are trips from coastal and other village areas surrounding Nowra Bomaderry that travel into and out of the Nowra Bomaderry area to work, shop, attend educational facilities and access services for recreational or other purposes.

The Nowra CBD sceenline estimated average weekday traffic counts (2005) are summarised in Table 6.12. An estimated 76,500 traffic movements have been recorded coming into and out of Nowra CBD on a typical average weekday. TRACKS transport models estimate that approximately 70% of all of these trips are generated within the Nowra Bomaderry urban area (local component) and significantly that approximately 30% of all of these trips have an origin or destination outside of the Nowra Bomaderry study area. These relationships and specific local and regional movements will be more closely examined throughout the Nowra Bomaderry Structure Plan transport analysis process.

Table 6.12: **Nowra CBD Average Weekday Traffic**

Traffic into and out of Nowra CBD (West) – West of the Princes Highway Location (Starting Bridge Road and rotating anti-clockwise) :	2005 Estimate
Bridge Road, North of North Street	12,000
Osborne Street, North of North Street	1,000
North Street, West of Osborne Street	1,500
Junction Street, West of Osborne Street	1,500
Worrigee Street, West of Osborne Street	1,000
Plunkett Street, West of Osborne Street	1,000
Osborne Street, South of Plunkett Street	1,000
Berry Street, South of Plunkett Street	4,000
Kinghorne Street, South of Plunkett Street	11,000
Plunkett Street, West of Princes Highway	7,000
Worrigee Street, West of Princes Highway	12,000
Jane Street, West of Princes Highway	6,000
Junction Street, West of Princes Highway	1,500
North Street, West of Princes Highway	2,000
Moss Street, West of Princes Highway	8,000
Graham Street, North of North Street	2,000
Sub-Total – Total Traffic into/out off Nowra CBD (West of the Princes Highway) :	72,500
Traffic into and out of Nowra CBD (East) – East of the Princes Highway Location (All trips into/out of Stockland Nowra) :	**2005 Estimate**
Jane Street, East of Princes Highway *(Note – already counted above)*	6,000
Junction Street, East of Princes Highway	2,000
Left Slip in from Highway to Stockland Nowra + Left Slip out to Highway from Stockland Nowra	2,000
Sub-Total – Total Traffic into/out off Stockland Nowra (East of the Princes Highway) :	10,000
Total Traffic into/out off Nowra CBD (East + West) :	**76,500**

Council Average Weekday (Daily) Traffic Data for the Screen line around Nowra CBD
** Note includes no adjustment for seasonal variation.*
** Note that the data are estimates only based on latest available count data and local knowledge of likely variations since count data recorded.*

6.3.7 Possible Network Improvements

Major Infrastructure: Required in the Short to Medium Term

There are four key road projects that should assist to resolve capacity issues in the short to medium term.

- **North Nowra to Bomaderry Link Road:** This will provide a much needed alternative route from North Nowra to the Princes Highway, thus taking pressure off the Princes Highway/Illaroo Road and Princes Highway/Bolong Road intersections. This will have the important additional benefit of improving traffic capacity, road safety, and environmental capacity (importantly noise, pedestrian and access concerns) along the length of Illaroo Road south of the link road connection. Preliminary analysis has determined that the link is required in the short term regardless of new development, as well as an essential additional link to facilitate any new development of new living areas to the north of the Shoalhaven River. The construction of this link is expected to substantially defer the need for major infrastructure upgrade (another river crossing - inner western) of the Shoalhaven River.
- **Shoalhaven River bridge intersections**: Prior to an additional Shoalhaven River bridge crossing - the significant upgrades of the two intersections to the north of the bridge (highway/Bolong Road and highway/Illaroo Road) and the highway/Bridge Road intersection to the south of the bridge would significantly increase the capacity of the existing river crossing substantially put back the need for another (inner western) Shoalhaven River bridge crossing. The intersection of Bolong Road/Princes Highway requires additional lane capacity on the approach to the Princes Highway. The intersection of Illaroo Road/Princes Highway requires a left slip lane to be constructed to compliment the traffic benefits of a North Nowra–Bomaderry Link Road.

The intersection of Bridge Road/Princes Highway requires a new signalised junction between Moss Street and Bridge Road to enable phasing improvements to be carried out at the existing Bridge Road intersection (requires relocation of existing movements into / out of Pleasant Way to the new southern intersection via extension of Hawthorn Avenue).

- **East Nowra Sub-Arterial (ENSA):** The construction of a new road link connecting Greenwell Point Road (in the vicinity of Old Southern Road) to the Princes Highway (at North Street and at Junction Street). This would provide a much needed alternative connection to the highway from the East Nowra, Worrigee, and coastal villages areas. This link will relieve pressure along the Kalandar Street / Princes Highway route to the Nowra CBD and would substantially reduce the extent of works required in the short-medium term at Kalandar Street/Highway intersection and along the highway between Kalandar Street and the Nowra CBD. It is likely that the need for the ENSA work will be significantly brought forward by commercial development in Nowra CBD (east) on the eastern side of the h ighway.
- **South Nowra Road Strategy:** The gradual deterioration of levels of service and safety on the Princes Highway through South Nowra is of particular concern. Preliminary modelling has shown that the RTA's 'Interim' road safety strategy for the Princes Highway (South Nowra) has limited spare capacity beyond 2016. Council is currently working with RTA to review necessary elements of the Strategy to address accessibility and capacity issues however the further development of that strategy is integral to the structure planning process.

Other major new network links identified for further investigation include:

- Those relating specifically to urban expansion areas (Nowra Bomaderry Structure Plan proposed future road network).
- New East-West Road in South West Sector (from Flatrock Road in the west, extending east connecting with a proposed extension of Cabbage Tree Lane, the West Bypass, George Evans Road near the University site, and on to Nowra CBD south with possible connection into Osborne Street or Berry Street) to improve network capacity and reduce impacts of traffic congestion on Yalwal Road and Illaroo Road. Access to Nowra CBD is a key issue for resolution in conjunction with Nowra Bomaderry Structure Plan.
- New East-West Road connecting Hillcrest Avenue at Princes Highway to Yalwal Road at Albatross Road to improve network capacity and resolve readability and accessibility issues.
- Extension of Flinders Road to Cabbage Tree Lane and further west to the proposed new north-south road (extending south of Yalwal Road at Long Reach Road) as a primary collector road to provide necessary capacity and alternative access for the expansion areas of Mundamia and Bamarang to Albatross Road and the Princes Highway via Flinders Road.
- Warra-Warra Road to Flinders Industrial Estate: to provide necessary capacity and accessibility for the future expansion of Flinders Industrial Estate.

Major upgrades to existing networks to cater for the development of the new living areas include:

- Yalwal Road: Details subject to modelling analysis however likely minimum upgrade to a four lane road (in particular the section from Flat Rock Road to Albatross Road).
- Moss Vale Road: Details subject to modelling analysis however likely minimum upgrade to a four lane road (in particular the section from Main Road to the Princes Highway).

Further modelling analysis will identify a complete deficiency analysis of the existing road network when considering likely background traffic growth and future traffic generation from urban expansion areas and urban consolidation.

Major Infrastructure: Longer Term

In the longer term the critical Princes Highway spine road would need to be supplemented at minimum by a western bypass road. Since only a minority of Princes Highway trips are bypassable, the new west bypass road would need to perform a much needed major collector road role, with several grade separated intersections providing access to the greater urban road network and linking back to the Princes Highway (if to be successful in diverting a maximum number of trips from the existing Highway).

This adopted function of the road could greatly assist the staged construction of the bypass (subject to detailed traffic modelling analysis and concept design review by RTA). Depending on significant 'other' factors affecting the ability of the western bypass to provide a longer term solution to growing traffic congestion along the Princes Highway, additional river capacity at and to the east of the existing bridges may also be required. It is likely that additional river crossing capacity at the existing bridges will be required well prior to a western bypass being constructed.

One of the key priorities of the Nowra Bomaderry structure plan process is to confirm and further 'lock in' the lands required north of the Shoalhaven River for the Western Services Corridor and accordingly the indicative design location for the western bypass road.

Other Major Road Infrastructure of importance to Nowra Bomaderry

There are a number of network improvements which have been proposed and investigated over recent years however Council has not previously carried out a strategic study of the impact of all or several of these measures on the wider road network. These proposals are at various stages of investigation. They will be further considered in detail and include the following:

Main Road 92 (Nowra to Nerriga): This involves a significant upgrade of an existing gravel road (involves realignment and sealing) of the strategic Main Road 92 road corridor to a target design 100km/hour design standard. The section between Nowra and Nerriga will soon commence. Investigations are continuing into the extension of the route, with ultimate destinations including Braidwood, Canberra and the Hume Highway. The longer terms impacts and benefits of the road upgrade need to be carefully considered through the Nowra Bomaderry structure plan process and in particular the strategic impacts of local connections.

Snowwood Road (Eastern Villages Access Road): This project was originally a priority of Council and was intending to provide an alternative access route between the eastern villages (Culburra, Callala Beach, Callala Bay, Currarong, etc) and Nowra Bomaderry. Council is currently undertaking detailed investigations into the upgrade and sealing of Forest Road as an alternative flood free access road between the eastern villages and the Princes Highway at South Nowra. The Snowwood Road project is no longer being pursued by Council.

Forest Road: Council is currently undertaking detailed investigations into the upgrade and sealing of Forest Road as an alternative flood free access road between the eastern villages and the Princes Highway at South Nowra. For all intents and purposes, and throughout the Nowra Bomaderry transport modelling investigations, the Forest Road route will be assumed to be the alternative access road between the eastern villages and Nowra Bomaderry.

Bomaderry Heavy Vehicle Bypass: There are on-going concerns relating to the inappropriate use of Meroo Road by heavy vehicles using Meroo Road as a short cut to southern industrial areas in Bomaderry including those along Bolong Road. This is a sensitive community issue. Council have long been investigating an alternative heavy vehicle bypass which is included in Council's existing LEP and section 94 plan, despite there being very low cost-benefit returns for such a link to be constructed. Establishment of an appropriate route has also proven difficult and potentially very costly. Council is currently investigating alternative ways of mitigating the impacts of heavy vehicles along Meroo Road and Cambewarra Road.

6.4 ROAD FREIGHT TRANSPORT

Nowra Bomaderry has become a significant regional logistics centre. The vast majority of freight is moved into and out of Nowra Bomaderry by road transport. Much of this freight movement is short haul, where the fast delivery of goods becomes the primary objective. According to a study conducted in 1994 (IRIS Research 1995), over half of the Nowra Bomaderry industries make use of their own vehicles or company fleet. However, this is not necessarily their sole or major transport use. They may mix this with contract hire. Overall 56% of businesses use their own or company fleet, 41% term contract and 57% spot contract.

6.4.1 Location of Transport Operators

A total of 55% of businesses use Shoalhaven based transport operators to carry their freight. A little over 41% used transport operators in Nowra Bomaderry. The other major locations of freight haulage companies used by Nowra Bomaderry business are Wollongong and metropolitan Sydney (IRIS Research 1995).

6.4.2 Road Freight Transport Operators

There are 29 freight transporting companies based in Nowra Bomaderry, fourteen heavy haulage companies, nine light carriers, three livestock transporter and three refrigerated transport companies (Table 6.13). Heavy freight transporters include: Toll, Mayne Logistics, Godlewski and Jim Hitchcock Haulage. Light carriers include: Economy Express Transport, Ipec, Lyrebird Express and Great Southern Couriers.

Table 6.13: **Road Freight Transport Companies in Nowra Bomaderry**

Road Haulage Type	Bomaderry	North Nowra	Nowra	Rural	Total
Heavy Carriers	2	-	10	2	14
Light Carriers	4	1	4	-	9
Livestock Carriers:	1	-	1	1	3
Refrigerated Carriers:	1	-	2	-	3
Total	**8**	**1**	**17**	**3**	**29**

Note: Rural includes Cambewarra.
Source: Yellow Pages 2005

6.4.3 Origin and Destination of Transported Freight

NSW is the prime source of freight transported into the Shoalhaven (72.7%), with the balance (27.3%) coming in from interstate and Australia-wide locations (Table 6.14). Of the NSW locations of origin, Country NSW accounts for almost 40% of total imported tonnages.

Table 6.14: **Shoalhaven: Origins & Destinations of Transported Goods**

Location: Origin/Destination	Origin		Destination	
	Tonnes	%	Tonnes	%
Sydney	2,347	13.5	5,871	34.9
Wollongong	1,795	10.3	831	4.9
Shoalhaven/South Coast	1,640	9.4	545	3.2
Other NSW (including ACT)	6,881	39.5	954	5.7
Interstate/Australia-Wide	4,753	27.3	8,695	51.2
Total	**17,418**	**100.0**	**16,806**	**100.0**

Note: (1) Transported tonnes per month
(2) Australia-wide can include Sydney
Source: IRIS Research 1995

6.4.4 Volume of Freight Transported

In all the 68 Nowra Bomaderry establishments surveyed would move some 32,800 tonnes of goods into the area by road transport on average over a monthly period (Table 6.15). The major north shore industries (Shoalhaven Paper Mill and Dairy Farmers) account for the majority of road freight movement. In fact the paper mill accounts for over a third of the average monthly tonnage brought in by the surveyed firms. The high volume non-road using Manildra Group, transports some 5,000 tonnes of flour a week to its plant by rail. The other high volume movers in the district are timber mills, concrete plants and major supermarkets, that have the equivalent of at least ten semi-trailer loads delivered per week

Table 6.15: **Nowra Bomaderry: Tonnages Moved in per Month**

Industrial Sector	Establishments No	Total Tonnage	% of Total	Average Tonnage
Manufacturing Sector:	58	21,097	59.2	364
Retail/Wholesale Sector:	10	11,708	32.9	1,171
Total	**68**	**32,805**	**92.1**	**1,535**

Source: IRIS Research 1995

Some 50% of Nowra Bomaderry businesses move into the district 20 tonnes or less of goods per month (an average of one tonne or less a day). Some 84% of businesses move 400 tonnes or less per month, representing one semi-trailer load (a nominal 20 tonnes) or less per working day (Table 6.16). This indicates that a number of establishments would not utilise heavy (articulated) transport modes to bring goods into the area. In fact 63% of manufacturing businesses and all the retail businesses contacted used heavy road transport to move at least one or more type of goods into their establishment.

Table 6.16: **Nowra Bomaderry: Frequency of Tonnages Moved in By Road**

Monthly Tonnes	Firms (No)	Firms (%)	Cumulative %	Semi-Trailers
0-4 Tonnes	19	27.9	27.9	
4-12 Tonnes	9	13.2	41.1	
12-20 Tonnes	6	8.8	49.9	<1
20-100 Tonnes	16	23.5	73.4	1-5
100-400 Tonnes	7	10.3	83.7	5-20
400-2000 Tonnes	4	5.9	89.6	20-100
2000-3000 Tonnes	6	8.9	98.5	100-150
Over 3000 Tonnes	1	1.5	100.0	>150
Total	**68**	**100.0**		

Note: Semi-Trailers based on nominal 20 tonnes.
Source: Developed from IRIS Research 1995

6.5 PUBLIC TRANSPORT

Public transport is an important element of ecological sustainability and the provision of the social justice principles of access and equity. However for an integrated public transport system to be viable, a critical population mass is a prerequisite.

6.5.1 Public Transport Context

As a factor of intra-urban movement public transport is currently an undeveloped resource in Nowra Bomaderry. A private car-dependency culture has developed in the district, which will be difficult to change without substantial infrastructure investment. The actual cost-benefits of such investment will need to be carefully examined as part of the Nowra Bomaderry structure plan process, however on the outset, it is unlikely given world wide examples of public transport 'effort' that large enough shift of travel modes would result in reduction of necessary expenditure on road infrastructure for private motor vehicle travel in an area like Nowra Bomaderry.

One of the changing phenomena is one of greater female participation in the workforce, and similarly increased presence of both working parents, and the resultant increase in use of the private car. Unlike their male counterpart, there is demonstrated evidence that women tend to make greater multi-functional use of the car. For instance a trip to work may be accompanied by a stop at a childcare centre or primary school. The trip home from work may likewise be characterised by a trip to their child's daycare/primary school; the shops; library and then extramural activities for their children (Abraham, 1998).

Whilst many of these trips may have otherwise been made prior to increased women joining the workforce, the trips were traditionally spread out over a typical weekday and not concentrated in peak commuter periods. It is these increased concentrations of weekday trip sequence in commuter peak periods (demand for multiple movements) that is very difficult to cater for by traditional forms of public transport.

The high dependence on the private motor vehicle is assumed to continue at least until the short to medium term. This will have a profound impact on parking demand, accessibility to and circulation in the Nowra CBD. To remedy this situation, alternative approaches will be investigated to ascertain the potential for mode shift to alternative travel opportunities including 'healthy modes' and various forms of public transport.

Options for possible investigation include requirement for larger developments to provide showers and bike racks as mandatory conditions of consent. This would need to be supplemented by greater funding (potential for section94 planning) for increased expenditure to improve cycling safety on our roads, including higher speed regional arterial roads linking village areas in the Northern Shoalhaven to Nowra Bomaderry.

One other alternative approach recommended by RTA would be to investigate suitable areas for establishing park and ride type systems with major parking facilities being established North of Bomaderry, and South of South Nowra. A shuttle bus or public bus service utilising bus priority lanes would transport car occupants from these parking nodes to the Nowra CBD. This is entirely dependent on capacity being available within the road system to allow such lane infrastructure to be dedicated to bus travel in the peak periods and as such it is envisaged that timing for such a facility could follow construction of the Western Bypass (which dependent on adopted design and accordingly impact of the Bypass, would be assumed to result in spare capacity being provided in the existing road network).

The RTA supports any system likely to encourage/attract higher levels of public transport usage and resultant lower traffic volumes in the longer term.

Table 6.17 provides an indication of the likely maximum shifts to public transport that could be achieved at certain population levels given likely availability of public transport infrastructure. Note that public transport Usage Summary (Table 28) refers to the number of persons using Public Transport 1 or more times (1 method, 2 method, three or more methods, etc) to get to work. The table would indicate that even considering a reasonable level of investment in public transport Infrastructure, the 'maximum' shift in travel mode to public transport usage in an area like Nowra Bomaderry is likely to be still low – possibly in the range 2-4%. The transport modelling analysis will need to test a range of possible target shifts to public transport and determining whether the resultant shift would lead to a reduction in the necessary road transport infrastructure (provision of roads/lanes/intersections) and the likelihood of that target level of public transport Infrastructure could actually be provided. The 'disjointed' geographical nature of the catchment population of Northern Shoalhaven certainly makes for a greater public transport challenge than would otherwise be the case in other areas of similar population size.

Table 6.17: **Comparative Public Transport Usage: 2001**

LGA or Region	Resident Population	Use of Public Transport
Nowra Bomaderry	28,325	1.0 %
Shoalhaven City LGA	83,548	1.0 %
Eurobodalla LGA	33,137	0.9 %
Kiama LGA	18,827	2.5 %
Shellharbour LGA	57,071	3.5 %
Wollongong City LGA	181,612	8.1 %
Wingecarribee LGA	40,840	2.8 %
Wollondilly LGA	37,123	4.8 %
Illawarra	381,898	5.2 %
Newcastle	132,569	4.9 %
Greater Newcastle / Hunter	470,610	3.9 %
Sydney Metropolitan Area	3,997,321	19.3 %
Canberra (ACT)	311,947	6.0 %

ABS Census Data 2001 extracted from C.data and C.Lib 'The census @ your Library' databases
Extraction from Tables B01 (population) and B28 (public transport usage)
** PT = Public Transport*
** LGA = Local Government Area*

6.5.2 Road Based Transport

Road based public transport includes local buses, interstate coaches, taxi, community and licensed club courtesy mini buses.

Local Bus Services

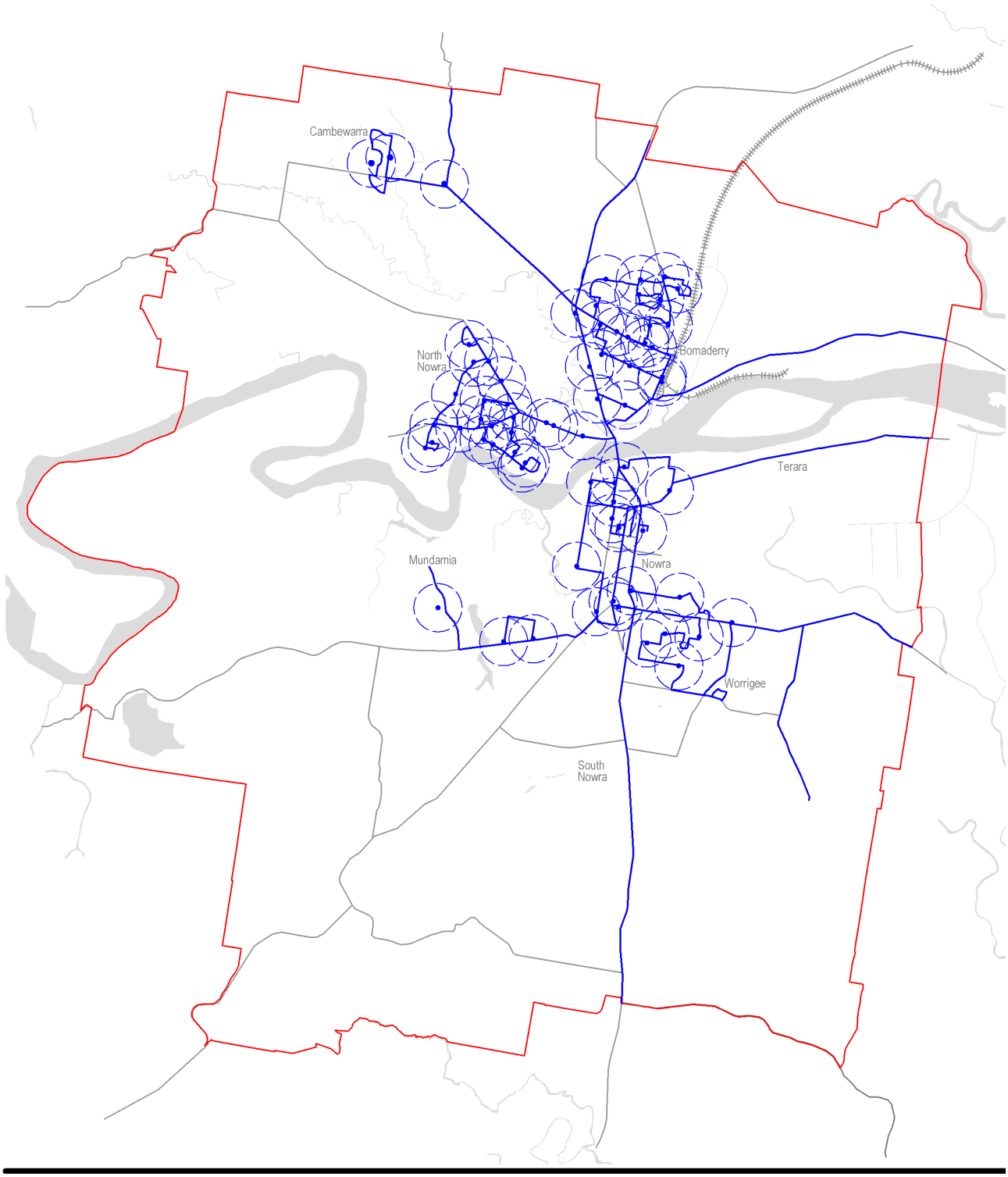
Under the provisions of the NSW Passenger Transport Act 1990 settlements with a population in excess of 7,500 are considered suitable for the operation of a 'country town service'. Within the Shoalhaven only Nowra Bomaderry and Milton-Ulladulla come within this definition.

The local Nowra Bomaderry bus service is essentially a home to school service. Currently Nowra Bomaderry has six local bus services and two intertown services. Local bus service operators include: North Nowra Bus Lines, Nowra Coaches, McIntyres Bus Service and Stuart's Coaches. The urban area is relatively well served in terms of route network. However, service frequency and duration of service during the day tends to be limited. Under the provisions of the Act, at least 85% of the population should reside within 400 metres of a bus route. The sections of Nowra Bomaderry that are within 400 metres of a bus stop are shown on Map 6.4.

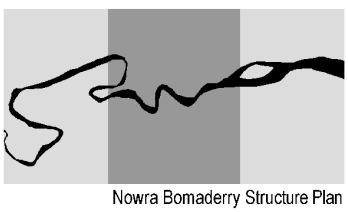
At weekend, services are limited and evening services non existent. However, to be fair to the operators, there have been attempts, on a number of occasions to run additional weekend and special workers services with little or no success. These addition services were reportedly cancelled due to lack of patronage.

Long Distance and Interstate Buses

Until 2002, apart from tour companies and local bus companies available for charter, one interstate coach company (Greyhound Pioneer) provided a scheduled long distance service that stopped at Nowra on Kinghorne Street outside Coles (Southbound) and the Commonwealth Bank building (Northbound). Currently only Premier (based in Nowra) and Priors Bus Service (based in Batemans Bay) provide a regular service between the South Coast and Sydney that stop at Stewart Place and Bomaderry Train Station. Other private companies operate between the South Coast and Sydney International Airport. Currently only Premier provide regular interstate services. In Nowra Bomaderry, these services also stop at Nowra CBD (Stewart Place).



Bus Routes



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Bus Route
- Bus Stop
- 400m Radius from Bus Stop

Note:
Bus Route information dated May 2002
from Council Internet Site

September 2005

0 1 2
Kilometres

Map 6.4

Challenges for Bus Services

The draft Shoalhaven Integrated Transport Strategy (Shoalhaven City Council 1999) identified a number of challenges for bus operators in order to make the rail service more attractive to patrons. These included the lack of timetable suitability; lack of appropriate route structure; lack of coordination between bus operators; lack of comfort whilst waiting for buses; change of approach to minimum service levels from the 'ideal' to a starting point; greater appreciation of the notion of 'service'; greater realisation that the service must be available, advertised and visible before people will use it.

Taxi Services

Taxi services in Nowra Bomaderry are provided by the Nowra Radio Taxi Cooperative. The company operate a total of 13 taxis in Nowra Bomaderry: nine general purpose taxis and four special purpose taxis (SPTs). The cooperative operates a 24 hour service and has a total of 57 licensed drivers. All taxis are radio controlled. The taxi service operates from four designated taxi ranks: Nowra Mall, Bomaderry Station, East Nowra shopping Centre, and North Nowra Shopping Centre. Of the four special purpose taxi's, two (2) of which can carry two (2) x Wheelchair + six (6) people each, two (2) of which can carry a combination of ten (10) people, or two (2) x Wheelchair + eight (8) people, or four (4) wheelchairs + six (6) people each etc. The five (5) station wagons available can all carry wheelchairs in the back.

Community Buses

There are a number of community buses and courtesy bus services provided by several of the licensed pubs, and social and sporting clubs in Nowra Bomaderry. There are no regular services provided except In the case of the Shoalhaven Ex-Servicemen's Club, where a courtesy bus service operates on a frequent basis servicing several destinations in Nowra Bomaderry. Unfortunately this very valuable mode of small scale local transport tends to be uncoordinated and duplicated.

The Shoalhaven Community Transport Service (SCTS) provides an invaluable low cost service to the community, particularly the sick and the elderly. The service is available to transport disadvantaged people in the Shoalhaven especially those who are frail aged and people with a disability and their carers - taking them to day care, medical appointments, social/recreational outings, and can include shopping trips, etc. Disadvantaged groups and communities are also able to use S.C.T.S. The SCTS operates three cars and seven buses of which six are in Nowra / one is in Ulladulla. Five of the Nowra Community buses are 20 seaters and one is a 23 seater. The Ulladulla Community bus is a 22 seater. All of the buses (except Ulladulla) are equipped to provide for disabled access. Wheelchairs are installed in each van dependent on requirements at the cost of normal seating (maximum practical 2-3 wheel chair accessible per bus). There are currently ten available volunteer drivers utilised by the service.

6.6 RAIL TRANSPORT

The rail head for Nowra Bomaderry and the Shoalhaven is located at Bomaderry, positioned at the southern end of City Rail's south coast network. The rail service to Bomaderry provides for both passenger and freight on a single, non electrified line south of Dapto. The service has, since 1994 consisted of Endeavour Class two-car diesel commuter modules, either operating singly or in pairs.

6.6.1 Current Services

The current service comprises a daily total of 17 arrivals and departures on weekdays and a daily total of 12 arrivals and departures on weekends and public holidays. Buses provide the Nowra to Kiama connection for the late night and early morning services.

A significant number of people use the train to commute to work and university. The potential to use the train to commute to Kiama, Albion Park, Wollongong, Sutherland and Central is indicated in the am and pm peak hour rail services (Table 6.18). These indicate services with through connections between Nowra and Central. Thus the 5:51am train would enable the commuter to arrive at Central at 8:29 am, in time for work in the Sydney CBD.

The 7:02am train would arrive at Central too late, although it would be suitable for Wollongong or even Sutherland. The 8:10 am train would be suitable for Kiama, Albion Park or even Wollongong for a late start.

Table 6.18: **AM & PM Peak Hour Rail Timetable: Nowra>Central**

Station	Morning Outward			Station	Evening Return		
Nowra	05:51	07:02	08:10	Central	16:21	17:36	18:07
Kiama	06:19	07:30	08:38	Sutherland	16:49	18:05	18:37
Albion Park	06:37	07:48	08:57	Wollongong	17:57	19:04	19:47
Dapto	06:44	07:55	09:04	Dapto	18:19	19:18	20:18
Wollongong	07:05	08:13	09:22	Albion Park	18:26	19:26	20:25
Sutherland	08:01	09:09	10:18	Kiama	18:45	19:52	21:00
Central	08:29	09:36	10:47	Nowra	19:16	20:23	21:31

Source: City Rail: South Coast Line Timetable: Effective 4 September 2005

The number of cars parked at the Bomaderry Station in the early morning provides an indication of this (Table 6.19). The ratio of passengers to parked cars for Wednesday and Thursday mornings is given in Table 6.20. From observation, the majority of passengers catching the 5:51 am train appeared to be on a work journey. Passengers on the 7:02 am train tended to be a mix of workers and tertiary students travelling to Wollongong. Passengers on the 8:10 train were a mix of workers, students, families and seniors.

Table 6.19: **Bomaderry Station Commuter Parking**

Time	Weekdays: August 2005						
	Monday	Tuesday	Wednesday	Thursday	Friday	Average Weekday	Potential Commuter Destination
6:00 am	12	11	15	17	14	13.8	Sydney Central
7:05 am	31	37	27	30	31	31.2	Wollongong
8:15 am	43	60	55	41	52	50.2	Kiama/Albion Park
9:00 am	49	59	60	58	56	58.8	Too Late

Source: Shoalhaven City Council survey August 2005

Table 6.20: **Bomaderry Station: Passenger-Parked Car Ratio**

Time	Wednesday (17/08/05)			Thursday (18/08/05)		
	Passengers	Parked Cars	Ratio	Passengers	Parked Cars	Ratio
6:00 am	21	15	1.40	25	17	1.47
7:05 am	28	27	1.04	43	30	1.43
8:15 am	83	55	1.51	48	41	1.17

Source: Shoalhaven City Council survey August 2005

6.6.2 South Coast Line Electrification

In accord with the State Government's NSW integrated transport plan 'Action for Transport 2010', City Rail has extended the electrified network from Dapto to Kiama and has established a new station and interchange at Oak Flats. A part of this commitment is the future extension of the electrification traction mode to Bomaderry. Until then diesel cars would continue to operate between Kiama and Bomaderry.

There are currently no plans by City Rail to extend the rail network south of the Shoalhaven River. The future crossing of the river has been raised as a major issue by the draft Shoalhaven Integrated Transport Strategy (Shoalhaven City Council 1999).

6.6.3 Rail Freight

The freight rail spur into Bomaderry now only serves the Manildra Group. The company imports some 5,000 tonnes of flour a week from the Group's flour mills at Manildra and Gunnedah, transported by 4-5 trains (each carrying 900-1,000 tonnes). However, finished product is transported by road.

Although the Dairy Farmers plant has access to the rail spur, the company has not used rail for at least five years. This has been mainly due to lengthy delivery times of milk products. By rail it would usually take 24 hours from the plant to the distribution point in Sydney. However, by road, milk products can reach their destination in three hours. Delivery time and milk shelf life is a crucial factor in an increasingly competitive market.

6.6.4 Challenges for City Rail

The draft Shoalhaven Integrated Transport Strategy (Shoalhaven City Council 1999) identified a number of challenges for City Rail in order to make the rail service more attractive to consumers. These included frequent and lengthy delays to the service, which is deemed to be unreliable; overcrowding during peak periods; perceived lack of security; a fare structure that penalises family groups; attitude of front line staff; and no obvious coordination with bus operators to provide an integrated transit system.

6.7 PARKING

6.7.1 Context

As stated earlier, the private vehicle represents the dominant form of transport within Nowra Bomaderry and surrounding areas. Accordingly, adequate car parking is required to be provided in the vicinity of most land-use activity areas to ensure reasonable efficiencies and to minimise capacity, safety, or social problems that can arise if insufficient parking is provided.

Studies conducted in 1993 for Council's Section 94 Contribution Plan found that at the time, parking supply and demand were generally in balance in all centres. However, there was a general perception of some localised shortfalls in supply. At that time, those perceptions were often realised during peak holiday times and the pre-Christmas period. In the absence of a policy to the contrary, Council has never attempted to (nor is it reasonable to expect Council to do so) satisfy peak holiday season or tourist demands with provision of adequate off-street parking areas within Nowra Bomaderry's commercial areas. Shoalhaven's roads and carparks come under enormous strain during peak holiday periods, and whilst complaints increase during this period, it is generally accepted by the community that Council can not possibly expect to provide infrastructure to meet peak levels. In Nowra CBD, Council modifies some of its main off street car parks (imposes time restrictions on otherwise all day car parks) over the busy Christmas period in an attempt to provide higher turnover parking closer to the core CBD. This displaces 'all day' parkers to more peripheral off street parking areas and to on-street peripheral locations around the CBD. Whilst this initiative helps, it falls well short of limiting the confines or the parking problem to the CBD.

Since 1994, Council has been undertaking detailed parking surveys in order to better understand the status of supply versus demand for parking within the Nowra CBD other commercial centres. There have been numerous changes to levels of parking supply in the Nowra CBD. Whilst some new parking areas have been provided, parking spaces throughout the CBD have also been lost due to on street parking restrictions (to improve road network safety and efficiency), or due to off street car park upgrades (landscaping impacts, increase in space size to meet Council's parking code). In general terms, the supply of car parking spaces has not kept pace with the demand for car parking in the Nowra CBD. As a result, parking infringements have increased (currently on annual average - approximately 10 parking infringements are issued every day in the Nowra CBD), and there has been an increase in on street parking in peripheral areas and on private vacant lands around the CBD.

6.7.2 Nowra CBD

There are approximately 5,927 car parking spaces provided in the Nowra CBD in the area between Plunkett Street and North Street (including properties with access to North Street) and between Osborne Street in the west and Stockland Nowra to the east. This includes 4,753 off street car parking spaces and 1,174 on street car parking spaces. These figures include Stockland Nowra and adjacent overflow parking on vacant private lands. Whilst drivers in the Nowra CBD core may park their vehicles and access several destinations in Nowra CBD, in general, drivers using the Stockland Nowra car park (east side of Princes Highway) are visitors to Stockland Nowra only and those people will be most likely to shift their car in order to visit any other businesses within the CBD (East). It is currently estimated that on average approximately 30% of Fair patrons also visit other destinations in the Nowra CBD (west side of highway) whilst in the town centre.

Off Street Parking

The total off-street car parking supply is approximately 4,753 car parking spaces. This comprises:

- Off street public spaces: approximately 2634 spaces of which approximately 855 (32%) are un-restricted spaces and approximately 1779 (68%) are time restricted spaces. Of the total off street (public) supply - this also includes 57 disabled spaces (at an average rate of approximately 2.2%) well above the minimum Australian Standard rate of 1 %.
- Off street vacant land spaces: approximately 500 spaces
- Off street private business spaces: approximately 1619 spaces of which approximately 599 are staff car parking spaces, 521 are customer car parking spaces, and 499 are shared use staff / customer car parking spaces.

On Street Parking

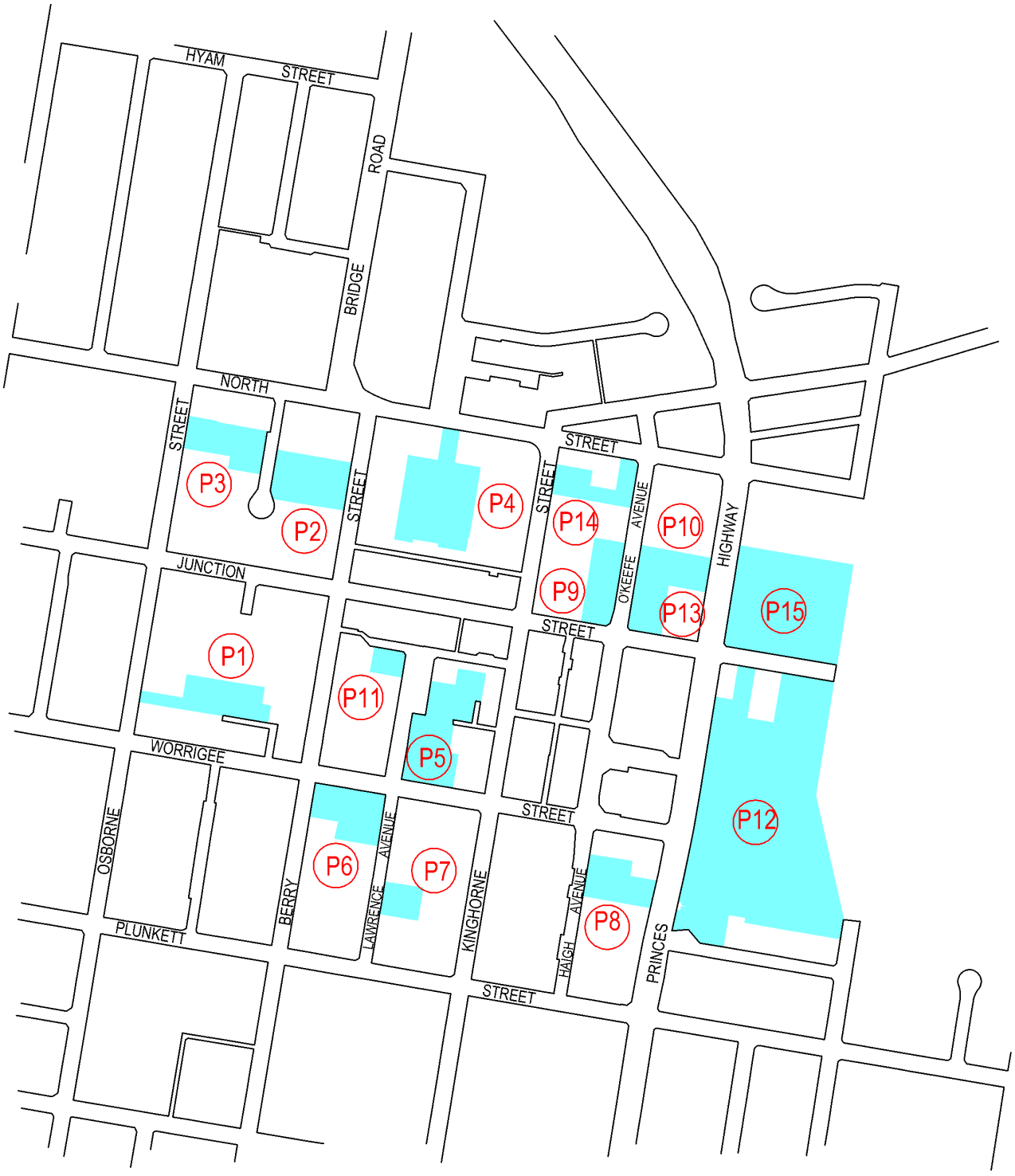
Total on street car parking spaces approximately 1174 spaces of which approximately 523 (45%) are un-restricted (all day) spaces and approximately 651 (55%) are time restricted spaces.

Car Park Occupancies

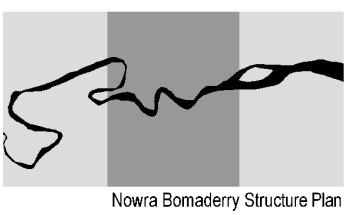
Both off-peak and peak car park occupancies have steadily increased over the time that parking data has been recorded (since 1994). Whilst peak data can often be very inconsistent, trends in off peak data tends to be more consistent and can be reported with confidence that the data is indicative of typical off-peak (average weekday) conditions. The results of occupancy surveys can be summarised as follows:

- 1996 : 54 %
- 2001 : 62 %
- 2005 : 72 %
- 2016 (forecast: 121 % indicates a deficiency of 1500 car parking spaces at this time).

This trend represents an annual average increase of approximately 4.8%. This is consistent with forecast traffic growth in the CBD – compared with forecast annual average increases in traffic flows throughout Nowra Bomaderry of approximately 4 %. A slightly higher figure is expected in the CBD due to extra-circulatory traffic movements that occur whilst motorists search for a car park. These average occupancies are calculated based on the full quantum of available car parks in the Nowra CBD, and accordingly within the CBD at any given time, some car parks will be 100% utilised whilst others may have spare capacity. The occupancies reflect peak parking time period that occurs within the Nowra CBD between approximately 10am and approximately 1pm (pronounced peaks can occur within this time period and typically occur between 12pm and 1pm). The current capacities of Nowra Bomaderry CBD's more popular car parks are summarised in Table 6.21 and their corresponding locations shown in Map 6.5.



Nowra CBD Parking Areas



Nowra Bomaderry Structure Plan

Legend

Parking Areas

- P1 95 Parking Spaces
- P2 145 Parking Spaces
- P3 144 Parking Spaces
- P4 254 Parking Spaces
- P5 268 Parking Spaces
- P6 179 Parking Spaces
- P7 60 Parking Spaces
- P8 93 Parking Spaces
- P9 86 Parking Spaces
- P10 & P13 258 Parking Spaces
- P11 61 Parking Spaces
- P12 828 Parking Spaces
- P14 117 Parking Spaces
- P15 420 Parking Spaces

September 2005

Not To Scale

Map 6.5

Table 6.21: Popular Off-Street Parks in Nowra CBD

Off-Street Parking Location		Time Limit					
CBD West	Total	5 Mins	15 Mins	2 Hours	3 Hours	All Day	Staff
P1: Osborne Street	95	-	3	27	-	65	-
P2: Berry Street	145	-	-	113	-	32	-
P3: Collins Way	144	-	-	-	-	144	-
P4: Egans Lane	254	-	-	254	-	-	-
P5: Stewart Place	268	-	-	117	151	-	-
P6: Worrigee Street	179	-	-	-	-	179	-
P7: Lawrence Avenue	60	-	-	-	-	60	-
P8: Haigh Avenue	93	-	-	93	-	-	-
P9: O'Keefe Avenue (East)	86	3	-	83	-	-	-
P10&P13: O'Keefe Avenue (West)	258	-	-	258	-	-	-
P11: Stewart Place (Spotlight)	61	-	-	61	-	-	-
P14 O'Keefe Avenue (Aldi)	117	-	-	105	-	-	12
Total CBD West	**1760**	**3**	**3**	**1111**	**151**	**480**	**12**
CBD East							
P12: Stockland Nowra	828	-	-	-	599	-	229
P15: AMP Land	420	-	-	-	-	420	-
Total CBD East	**1248**	-	-	-	**599**	**420**	**229**

Source: Shoalhaven City Council

6.7.3 Bomaderry

There are approximately 200 car parking spaces provided within the core retail area of Bomaderry. In addition there are 62 spaces in the Railway Station car park and 46 spaces in the RSL Club car park. Analysis of the supply and demand for parking carried out in 1993 for the Section 94 plan indicated that there was adequate parking available. It appears from observation that this would still be the case.

The Railway Station car park is the busiest car park in the Bomaderry CBD, much of it attributable to commuter usage (Section 6.6.1). Apart from commuter demand, the car park provides additional car parking to the Bomaderry CBD (staff and customers) and is also well used by traffic as a more convenient turn around area than alternative local streets.

Although the Railway Station car park is unrestricted (available for all day parking), it would appear that most shopkeepers recognise the importance of the car park for customers of the CBD and park at the rear (west) of the CBD shops with access via Coomea Street, including use of the Public Off Street Car Park. Only a relatively small number of shop owners have been observed parking in the Railway Station car park all day. From past discussions, security concerns are the main reasons provided to explain this parking behaviour.

6.7.4 Future Parking Opportunities

Council's parking strategy for the Nowra CBD and its supporting projects in the Section 94 Contribution Plan need to be reviewed as a result of recent and proposed developments as well as previous Council resolutions which adversely affect proposed future car parks. The Nowra CBD Traffic and Parking Strategy (completed December, 2003) identified a shortfall of 1500 car parking spaces in the Nowra CBD by 2016.

Of these spaces – 500 spaces were identified as needing to be provided by private development outside the core section 94 planning area in the CBD. The remaining 1000 car parking spaces were identified as needing to be provided by Council. The analysis undertaken for the CBD Strategy tested numerous locations in and around the CBD for areas where car parking was at greatest deficiency and where the location of car parking provision would not adversely affect local traffic conditions.

The report concluded that additional car parking should be provided in a number of locations. These included spaces to be located and provided in the precinct bordered by the Princes Highway and Nowra Lane and by North Street and Plunkett Street. That area was determined to have the greatest deficiency in car parks. This is evident even in 2005 terms where up to 60 employees of this precinct are parking on former ex-servicemen's land on the eastern side of the highway and between 50-60 cars were formerly parked on the former Council owned Haigh Avenue site. Further additional car parking was recommended under the strategy to be provided in the Berry/Worrigee Street car parks, the Lawrence Avenue car park, and the Collins Way car park.

The following car parking space numbers can be provided under those general areas identified in the strategy:

- 350 new car parking spaces to be provided in the precinct bordered by the Princes Highway and Nowra Lane and by North Street and Plunkett Street (multi-storey). (3-4 level multi-storey dependent on land available for provision of car parking).
- 250 new car parking spaces to be provided in the Berry/Worrigee Street car park (3 level multi-storey).
- 150 new car parking spaces to be provided in the Lawrence Avenue car park (3 level multi-storey).
- 250 new car parking spaces to be provided in the Collins Way car park (3 level multi-storey).

The above analysis was based on detailed traffic modelling that used a typical off-peak average weekday conditions for the purpose of simulation. Accordingly, it should be noted that for 50% of the year, traffic conditions and resultant parking conditions are somewhat worse than that being reported in the CBD strategy. In particular during busy peak periods, car parking provision should at least be adequate in the off-peak period, with some strategy for maximising turnover during peak periods and employing the use of temporary overflow car parks where available. This aspect needs to be carefully considered when determining an overall strategy for the provision of car parking versus provision of public transport infrastructure, versus provision of showers and bicycle racks in CBD developments etc. Development of a major retail centre will require provision of significant carparking which will require reassessment of the current strategy dependent upon the location of the centre.

Given the need to locate appropriate locations for available overflow parking during peak periods in addition to the above, the location of adequate overflow car parks could include:

- Maximise parking availability on former gas works site on Bridge Road
- Maximise parking availability on residual Nowra High school lands between the proposed ENSA and Junction Street (opposite the proposed commercial expansion of Nowra (CBD) East).

6.8 CYCLEWAYS AND PEDESTRIAN NETWORKS

The off-road-movement network includes pedestrian paths, cycleways and equestrian trails. (In an ESD environment these networks offer an important alternative at the local level to fossil energy consuming forms of transport.) With the increasing awareness of personal fitness, health as well as the quality of the environment, there has been a corresponding interest in walking, cycling and to a lesser extent horse riding.

6.8.1 Pedestrian Routes

Pedestrians are catered for in two ways:

- Sidewalk footpaths.
- Dedicated off-road footpaths.
- Shared cycle/footways.

6.8.2 Cycle Routes

Over the past two decades or so in Australian towns and metropolitan cities, cycling has increased in popularity among both recreational riders of all ages, and to a lesser extent, workplace/school commuters. According to the Roads and Traffic Authority (1996) there are approximately two million bicycles in New South Wales and 40% of all households have bicycles.

User Groups

There are three broad user groups:

- School aged children (aged 9 to 18, travel to and from school);
- Commuters (adults aged 16+ travel to and from work/study); and
- Recreational cyclists (various ages, cycle for recreation/sport).

Shoalhaven Bicycle Strategy

Council has adopted a city-wide Bicycle Strategy. Its objectives are:

- To recognise the needs of cyclists and to ensure that suitable provisions are made for them within the city.
- Help ensure that Shoalhaven is a 'cycle friendly' city. This does not only mean the construction of more cycleways, but is an attempt to recognise that the needs of cyclists are taken into account in the planning and development of facilities, and that cycling is a legitimate and sustainable form of transport.
- Identify a realistic network of cycleways for implementation.

The strategy acknowledges/identifies a hierarchy of cycle routes:

Regional Route: The proposed Coastline Cycleway Strategy (1994) linking Wollongong/Shoalhaven and the Far South Coast.

Arterial Roads: Linking main urban centres to smaller settlements (eg Bolong Road, Nowra to Shoalhaven Heads).

Urban Routes: Three main urban centres are identified: Nowra Bomaderry urban area; Ulladulla urban area; and Huskisson Vincentia/St Georges Basin district.

Nowra Bomaderry Urban Cycleway Network

The designated cycleway network in Nowra Bomaderry serves to link shopping centres, schools and centres of recreation and sport.

6.8.3 Equestrian Routes

There are currently no dedicated equestrian trails in the Nowra Bomaderry area. Worrigee is the major focus for non race course equestrian activities close to the Nowra Bomaderry urban area.

6.8.4 Off-Road Network Opportunities

Cycleways

Completing urban cycleway network:

- Princes Highway (Bolong Road to Cambewarra Road);
- Albatross Road (Cabbage Tree Lane to Flinders Road); and
- Bomaderry High School to Shoalhaven High School route.

Walkways and Equestrian Trails

Create linkages between the equestrian centres at Worrigee, the South Nowra horse racing centre, Berry and Kangaroo Valley.

7. URBAN INFRASTRUCTURE

Utility infrastructure represents the network of pipes, cables, wires and antennae that support urban development in the 21st Century. These services are often taken for granted by the community, until there is a failure in service delivery. Major capital intensive infrastructure such as sewerage plants and trunk sewers often pose threshold costs that have significant implications for the scale and direction of urban expansion. This chapter addresses the supply and demand for water, waste water, energy, solid waste and communications.

7.1 WATER

7.1.1 Current Situation

Water is supplied, as per the National Health and Medical Research Council 1996 Guidelines to the residences, businesses and public facilities in Nowra and Bomaderry. Water is sourced from the Shoalhaven River at the Burrier Pumping Station and pumped to two treatment plants, Bamarang and Flat Rock. The total water drawn from the Shoalhaven River in 2003/04 was 15,675 megalitres or 1.2% of the total river flow. This is marginally above the average for 1991 to 2000 of 15,060 megalitres. There are currently no health, colouration or taste issues associated with the water source.

The current Water Supply Network is shown in Map 7.1.

Bamarang Water Treatment Plant

The plant has a capacity of 75 megalitres per day and generally serves the urban areas north of the Shoalhaven River with the exception of the Bolong Road Industrial area. The plant also serves coastal villages from Nowra as far south as Lake Conjola.

Flat Rock Water Treatment Plant

The plant has a capacity of 28 megalitres per day and serves the Nowra urban area and the Bolong Road Industrial Area.

Untreated Water Supply

Untreated water is supplied to Australian Paper under a long term agreement. Australian Paper provides treatment to the water for their production purposes.

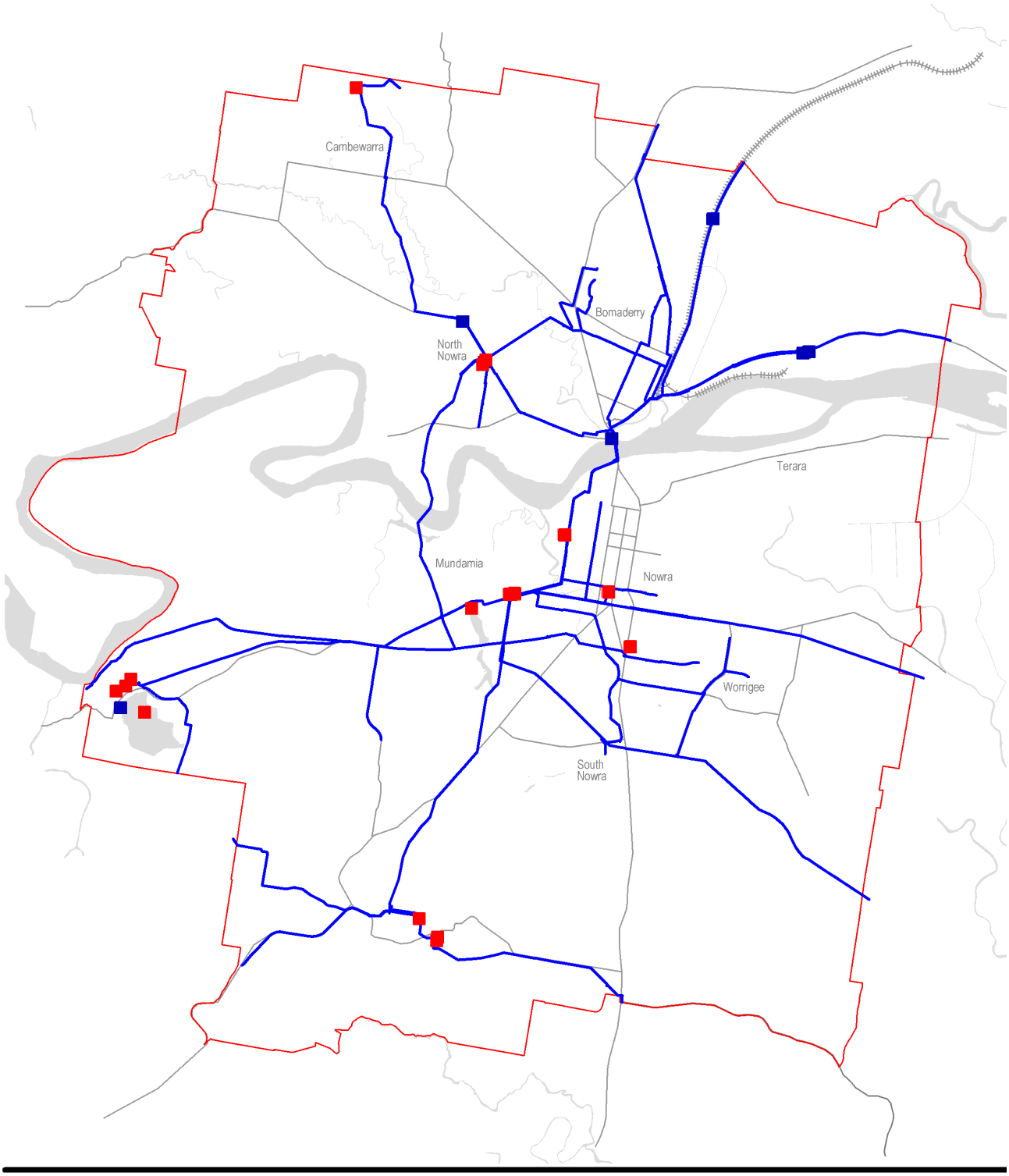
7.1.2 Current Demand

Approximately 57% of the demand of fresh water is attributable to residential customers. In total, industry accounts for 32% of which 19% is used by Australian Paper.

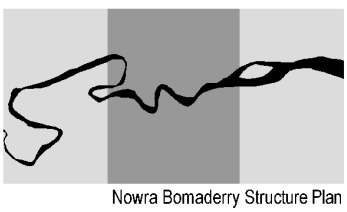
Table 7.1: **Current Water Demand in the Shoalhaven**

Source of Demand	1995/96	2003/04
Residential (including rural)	47%	57%
Industrial (excluding Australian Paper)	11%	13%
Australian Paper	24%	19%
Commercial	11%	10%
Institutional (including CSO's)	4%	1%

Source: Shoalhaven Water 2005



Water Supply Network



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Water Trunk Mains
- Water Reservoirs
- Water Pumping Stations

September 2005

0 1 2

Kilometres

Map 7.1

Long Term Supply

A strategy has been adopted for the long term water supply for anticipated growth in the city. The strategy is based on extractions from the Shoalhaven River for current licence conditions of a 90 megalitre per day environmental flow past the Burrier extraction point, and a water entitlement of 23,900 megalitres per year. The strategy is complimented by a rigorous Demand Management Program and Drought Management Plan.

7.1.3 Demand Management Program

A rigorous Demand Management Program has been in place since 1996 with a resultant reduction in average residential consumption from 300 kilolitres per year (1993) to 230 kilolitres per year (2004). There has also been a reduction in peak day demand that has reduced the design criteria by 50%. This reduction has a resultant increase in the amount of population that can be served with the current water resource and the capacity of infrastructure required to service the community. Demand Management is a planned program to reduce demand on water supply in ways that do not compromise lifestyle, and extend existing water resource capability. These programs including pricing and non pricing strategies.

Pricing strategies have seen the reduction of fixed charges and more reliance upon the majority of revenue from usage charges. This has meant that usage charges have increased with quarterly billing sending early signals to users regarding their water consumption. This allows customers to monitor their usage and adjust it if necessary to conserve water. Non pricing strategies includes promotion of water conservation, eduction of school children and retro-fit programs (i.e. water tanks and shower roses).

One significant influence will be the advent of BASIX (Building and Sustainable Index) introduced by State Government requiring all new houses to be set up to reduce water consumption by 40% compared to an average house. This essentially requires the fitting of water efficient fixtures and a rainwater tank plumbed to the toilet and washing machine and for external uses.

Drought Management Plan

A Drought Management Plan has been adopted that compliments the Demand Management Program and is based on a 90 megalitres per day environmental flow past Burrier. The plan is invoked by a trigger point based on a particular number of days demand in reserve and/or inflows into Tallowa Dam on to the Shoalhaven River. There are various trigger points to increase the severity of restrictions from Level 1 to Level 4. At Level 4 restrictions water can be purchased from the Sydney Catchment Authority, operators of Tallowa Dam.

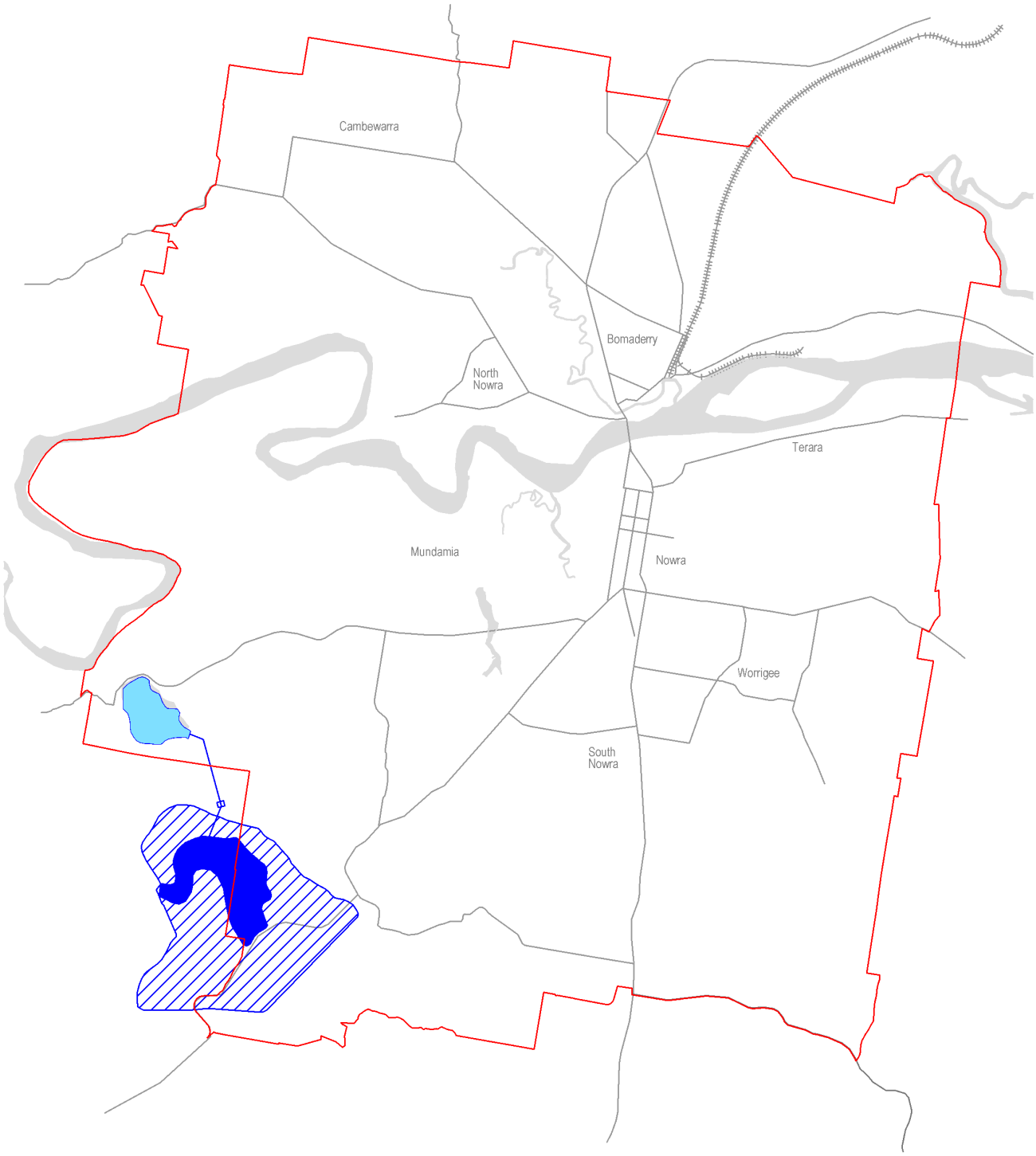
7.1.4 Current System Capacity

The present water supply system has the capacity to cater for some future growth, however with upgrading, it can cater for anticipated growth in the next 30 to 50 years without augmentation of major dams. Upgrades will be required for treatment plants, reservoirs and trunk mains to service growth areas.

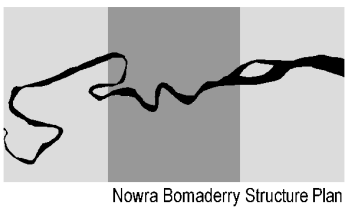
7.1.5 Structure Plan Issues

A 30 year plan for water supply infrastructure has been prepared based on growth predictions within existing, planned and investigation areas. This plan will be reviewed every five years or when significant changes are made in planning strategies. It is important that planning for infrastructure is well in advance of development to ensure the water supply systems are in place to service the development.

There are no major impediments for the provision of infrastructure for water supply for Nowra and Bomaderry. Major infrastructure includes upgrade of the Bamarang Water Treatment Plant (30 ML/d in 2012/14 and 30 ML/d in 2024/26). These upgrades will serve growth in both Nowra and Bomaderry plus development in other areas of the city.



Possible Option For Long Term Water Supply



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Potential Albatross Reservoir
- Potential Albatross Reservoir Catchment Boundary
- Bamarang Reservoir

Note:
Subject to decision by State Government on Sydney water sharing plan

September 2005

0 1 2

Kilometres

Map 7.2

Reservoirs will be required to meet peak day demand in Moss Vale Road North (5.5 ML 2015/17), Cambewarra (1 ML 2024/26) and Nowra (20 ML 2024/26). Trunk mains are also required from the Pitt Street Reservoir to the new Moss Vale Road North Reservoir, Bangalee, Bangalee West and Crams Road areas (2014/18). Trunk mains are also required to service new residential development in the Moss Vale Road investigation areas.

South of the Shoalhaven River trunk mains are required to feed investigation areas of Mundamia (2018), Cabbage Tree Lane (2017) and an expanded South Nowra Flinders Industrial Estate. Various other feeder mains are required from either the existing infrastructure or the proposed reservoirs, trunk mains to service proposed new growth areas.

The potential Long Term Water Supply System is shown in Map 7.2.

7.2 WASTE WATER

7.2.1 Current Situation

Sewage (Wastewater) from Nowra Bomaderry is treated at two Wastewater Treatment Plants, Nowra and Bomaderry.

Nowra Treatment Plant

The Nowra Treatment Plant treats all wastewater produced in North Nowra and the urban areas south of the Shoalhaven River. The plant has a 21,000 equivalent person capacity. The treated wastewater is retained in ponds for 10 days at average dry weather flow before discharging into a flood drain connected to the Shoalhaven River. Two local farmers and a golf course access the discharged reclaimed water from the maturation pond and are capable of utilising all dry weather flows from the plant.

Bomaderry Wastewater Treatment Plant

The Bomaderry Treatment Plant treats all wastewater produced north of the River (except North Nowra). The plant has a 12,500 equivalent person capacity. The treated wastewater is directed through 15 days detention ponds at average dry weather flow then to drain that discharges into the Shoalhaven River.The large industrial developments of Manildra, Dairy Farmers and Australian Paper manage their own wastewater and are not connected into the plant.

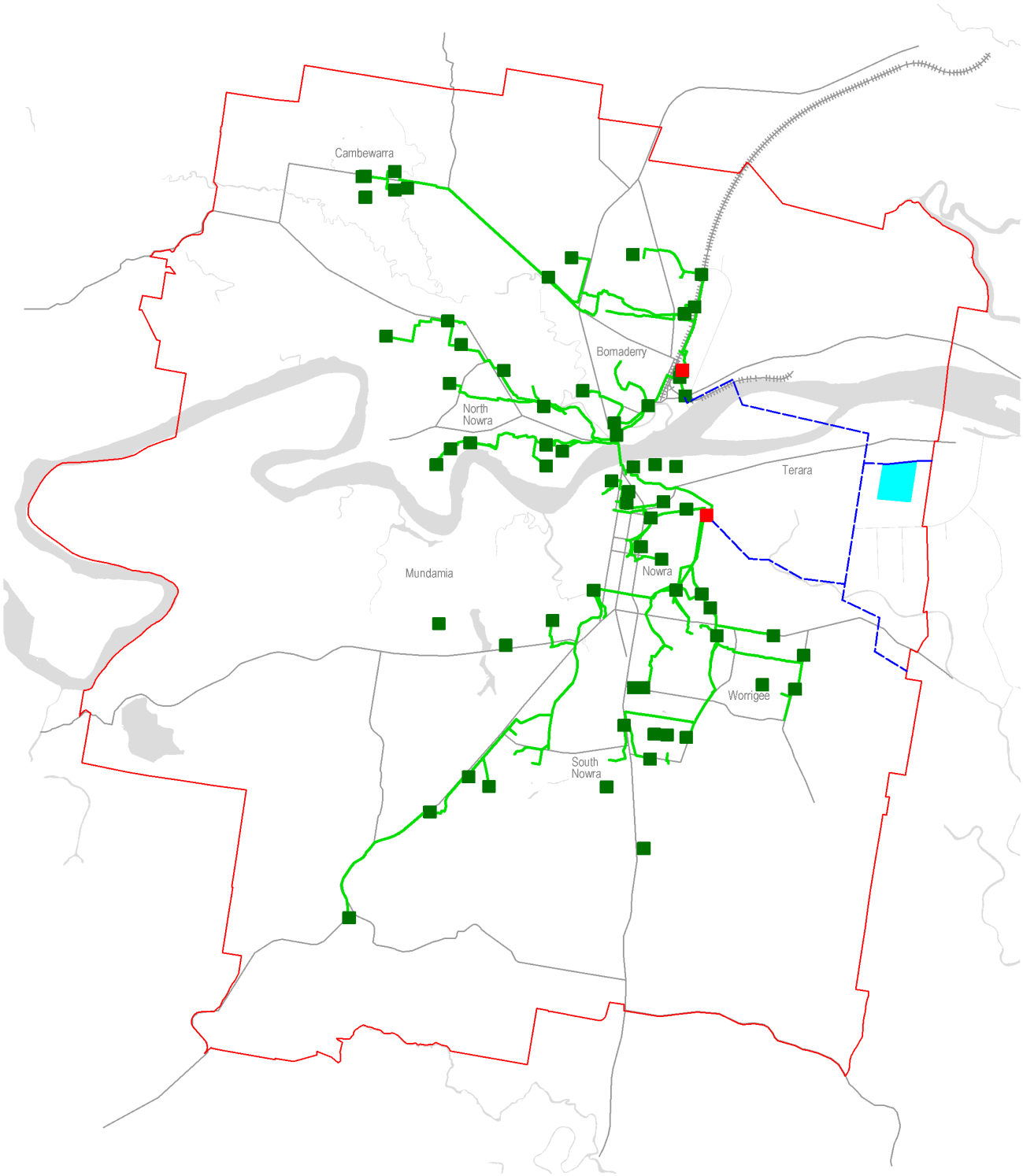
7.2.2 Reclaimed Water Management

Wastewater collected from the Nowra Bomaderry area is treated to a tertiary level and distributed to agricultural, horticulture and recreation users by agreement. The agreement is under the Reclaimed Water Management Scheme (REMS) and incorporates reclaimed water from six wastewater treatment plants for use by seventeen dairy farms, two golf courses, a number of sporting and recreation fields from Nowra Bomaderry across the Nowra flood plain down the coast to St Georges Basin. The REMS scheme is designed to reuse 80% of wastewater generated in an average year. There is currently more demand for reclaimed water than there is supply. In the future it is likely that industrial users may have access to this water resource, further taking pressure off natural water resources.

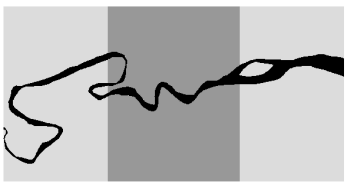
Current System Capacity

The wastewater system has the capacity to cater for some future growth, however with upgrading can cater for anticipated growth in the next 30 to 50 years. Upgrades will be required for treatment plants, trunk sewers and pumping stations to service growth areas.

The current wastewater network is shown in Map 7.3.



Waste Water Network
(including REMS)



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Waste Water Trunk Mains
- Waste Water Pumping Stations
- Sewage Treatment Works
- REMS Stage 1a
- REMS Stage 1b
- REMS Dairy Farm

September 2005

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Kilometres

Map 7.3

7.2.3 Structure Plan Issues

A 30 year plan for wastewater supply infrastructure has been prepared based on growth predictions within existing, planned and investigation areas. This plan will be reviewed every 5 years or when significant changes are made in planning strategies. It is important that planning for infrastructure is well in advance of development to ensure the wastewater systems are in place to service this demand.

Major headworks to service growth include upgrades of the Nowra Treatment Works in 2007/09, 2014/015 and 2028/29. There is an urgent reconfiguration of the Nowra surcharge main to service growth and manage inflows into the Nowra Treatment Plant (2009/10).The initial Nowra upgrade (2007/08) is part of the Reclaimed Water Management Scheme (REMS) Stage 1B development that will include Nowra and Bomaderry Treatment Plants into the scheme.

The planned growth of Nowra and Bomaderry (plus other areas to St Georges Basin) add more reclaimed water to REMS. Recent experience has seen far more demand for reclaimed water than there is available supply therefore the scheme will expand as the result of growth without impediment. The scheme may provide reclaimed water to other uses such as industrial sometime into the future. Any industrial use would be on a commercial basis and not impact on the Nowra Bomaderry Structure Plan.

There is a planned upgrade of the Bomaderry Treatment Plant by an inlet works upgrade to 24,500 EP in 2008/09 and a 12,000 EP aeration upgrade in 2013/14.

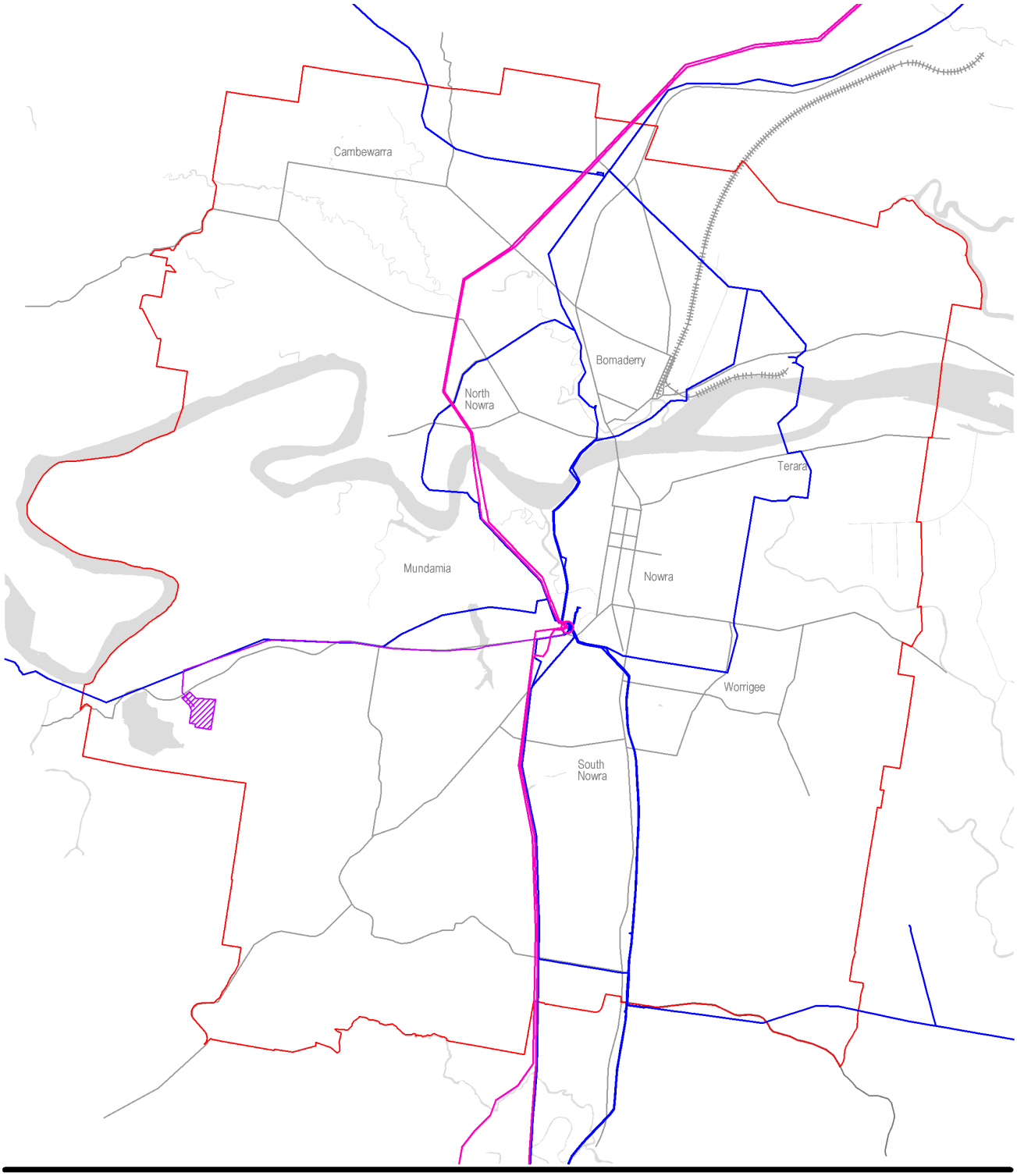
A major transportation system is required to service growth north of the river for Crams Road, Bangalee, Bangalee West and Moss Vale Road growth areas to transfer wastewater to the Bomaderry Treatment Plant. Wastewater from these areas will be transferred by several pumping stations and rising/gravity mains to a major pump station to be located near Bomaderry Creek. This pump station will transfer wastewater by a rising/gravity main along west Cambewarra Road to the Bomaderry Treatment Plant.

This is required because the existing North Nowra transportation system is at capacity and would require major upgrades through a significant number of private properties at substantial costs and inconvenience. These major works are programmed for 2014/15 together with works to service the Crams Road area. Infrastructure will be implemented from 2014 to 2024 to service the majority of the Crams Road, Bangalee, Bangalee West and Moss Vale Road growth areas.

Infill areas north of the river (other than Bangalee) will be served with current infrastructure, upgraded where necessary. For Nowra, infill development will be served by upgraded facilities where identified. Similarly new development will be served by new infrastructure where necessary, particularly the South Nowra area adjacent to Old Southern Road.

The Worrigee investigation area will be served by pumping to an existing facility in Worrigee Road where existing capacity is available. The Mundamia and Cabbage Tree Lane investigation areas will be served by pump stations, gravity and rising main discharging into a proposed trunk gravity main flowing into the existing St Anne's Street pumping station (programmed for 2015/17).

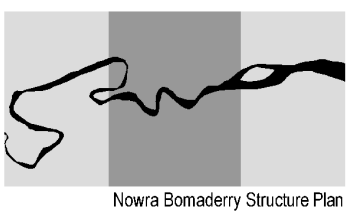
The extension of the South Nowra Industrial Estate (investigation area) will be served by a pumping station and rising main into an existing gravity sewer and is programmed for 2024/25.



Electricity Network

Legend

- Structure Plan Boundary
- 132kv Electricity Line
- 33kv Electricity Line



Nowra Bomaderry Structure Plan

September 2005

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Kilometres

Map 7.4

7.3 ENERGY

Energy sources and networks in Nowra Bomaderry comprise electricity, gas and solid fuel.

7.3.1 Electricity

Nowra Bomaderry is supplied with electricity by Integral Energy from Dapto BSP via the Mount Terry transmission substation (TS) each rated at 197 MVA. This is supplied to the district by two 132kV high tension transmission lines that traverse the lower slopes of the Cambewarra range and enter the area from the north west. The current electricity network is shown on Map 7.4.

The Shoalhaven TS 132 kV busbar, located in West Nowra downloads to ten 33kV feeder lines that provide power distribution to the whole of the northern Shoalhaven. The Shoalhaven TS subsequently supplies the Ulladulla system on feeders 98H and 98M together with Country Energy's BB and Moruya substations.

The Shoalhaven TS has 3 x 60 MVA 132/33 kV transformers giving it a firm rating of 120 MVA. See Table 7.2 for more detailed substation rating information.

Table 7.2: **Substation Rating**

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Shoalhaven TS	3 x 60 + 1 x 30	180.0	130
Bolong	1 x 12.5	12.5	12.5
Bomaderry	3 x 10	30.0	20.0
Nowra	2 x 15	30.0	17.0
South Nowra	1 x 12.5 + 1 x 10	22.5	11.0

Source: Integral Energy 2005

Local Supply Situation

The Nowra Bomaderry area is serviced by six zone substations: Bolong Road, Bomaderry, Manildra, Nowra South Nowra and a separate site at Australian Paper. These download the power supply from 33kV to the 11 kV distribution network. Substations on street poles, pads and within major buildings, download the 11 kV power supply to the 415 volt domestic supply network.

7.3.2 Current Demand

Generally demand in the Nowra Bomaderry area is 70% domestic and 30% commercial/industrial. Major demand spikes occur in the Shoalhaven at Easter and during the June long weekend. The Nowra zone substation (ZS) supplies the commercial centre at Nowra and surrounding residential and rural areas. This area has been experiencing moderate load growth due to residential development and some commercial expansion. The load profile is summer peaking driven mainly by air conditioning units on hot summer afternoons. The summer peak demand is about 1.5 MVA higher than the winter peak demand. The summer growth rate is about 0.5 MVA per annum. Nowra ZS has a firm rating of 15 MVA and a cyclic rating of 17MVA.

The South Nowra zone substation supplies the industrial area at South Nowra, HMAS Albatross and surrounding rural areas. This area has been experiencing moderate load growth due to industrial development. The load profile is summer peaking driven by air conditioning on hot summer afternoons. The summer growth rate is about 0.5 MVA per annum. South Nowra ZS has a firm rating of 10 MVA and a cyclic rating of 11 MVA.

Recent electricity demand is shown in Tables 7.3 and 7.4.

Table 7.3: **Current Demand: Summer** (MVA)

Location	1999	2000	2001	2002	2003	2004
APPM	16.6	17.2	14.7	17.7	14.5	14.6
Bamarang (new)				0.4	1.2	0.5
Bolong	2.1	2.8	2.4	3.9	4.7	4.3
Bomaderry	12.5	13.6	13.8	15.8	15.1	17.1
Manildra	10.3	12.7	12.8	14.2	15.0	16.6
Nowra	16.8	17.7	19.3	18.2	20.8	19.4
South Nowra	7.3	7.5	8.7	8.7	10.9	10.3
Shoalhaven TS	86.2	85.1	87.5	88.8	103.9	98.0

Source: Integral Energy 2005

Table 7.4: **Current Demand: Winter** (MVA)

Location	1998	1999	2000	2001	2002	2003
APPM	18.4	13.8	16.3	16.8	14.6	13.2
Bamarang				0.4	0.4	0.4
Bolong	2.2	2.1	2.5	2.9	3.2	4.7
Bomaderry	15.3	15.1	17.7	16.6	17.1	17.4
Manildra	10.0	11.2	13.1	13.9	14.2	13.7
Nowra	16.5	15.0	18.8	17.2	16.1	16.8
South Nowra	8.0	6.8	8.2	7.6	8.4	9.7
Shoalhaven TS	91.5	90.8	105.0	99.9	97.4	103.0

Source: Integral Energy 2005

7.3.3 Anticipated Demand

Demand at the zone substations is anticipated to gradually increase in the next ten years. The Nowra zone substation is forecast to sustain an increase in summer demand from 19.4 MVA in 2004 to 24.4 MVA by 2014. The Nowra zone substation's winter demand is forecast to increase from 16.8 MVA in 2003 to 18.1 MVA in 2013. The projected growth in demand at Nowra Bomaderry's other zone substations is summarised in Tables 7.5 and 7.6.

Table 7.5: **Forecast Demand: Summer** (MVA)

Location	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
APPM	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4
Bamarang	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Bolong	5.0	5.1	5.2	5.3	5.4	5.6	5.7	5.8	5.9	6.1
Bomaderry	16.3	16.6	16.9	17.2	17.5	17.9	18.2	18.5	18.8	19.1
Manildra	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Nowra	20.2	20.9	21.6	22.2	22.6	23.0	23.3	23.7	24.1	24.4
South Nowra	11.7	12.2	12.7	13.2	13.7	14.1	14.5	15.0	15.4	15.8
Shoalhaven TS	111.6	114.4	122.2	124.7	126.9	128.9	130.8	132.8	134.8	136.8

Source: Integral Energy 2005

Table 7.6: **Forecast Demand: Winter** (MVA)

Location	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
APPM	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4
Bamarang	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Bolong	4.7	4.8	4.8	4.8	4.8	4.8	4.8	4.9	4.9	4.9
Bomaderry	17.8	18.3	18.8	19.3	19.8	20.3	20.8	21.3	21.9	22.4
Manildra	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0	31.0
Nowra	16.2	16.4	16.6	16.8	17.0	17.3	17.5	17.7	17.9	18.1
South Nowra	10.2	10.4	10.7	10.9	11.2	11.5	11.7	12.0	12.2	12.5
Shoalhaven TS	114.5	119.1	122.3	125.3	128.1	130.7	133.3	136.0	138.6	141.2

Source: Integral Energy 2005

Capacity Constraints

The current capacities and forecast 2010 peak loads of the Shoalhaven TS, the up-line Mt Terry TS together with the key Nowra Bomaderry zone substations are summarised in Table 7.7. Both the Nowra and South Nowra zone substations have been identified as requiring possible augmentation to meet projected peak loads.

Table 7.7: **Electricity Supply Capacity Constraints**

Transmission/Zone Substation			Summer		Winter		Potential Remedial Action
		A	B	A-B	D	A-D	
	Total Capacity 2004	Current Firm/Cyclic Rating	Forecast Peak Load 2010	Spare Capacity 2010	Forecast Peak Load 2010	Spare Capacity 2010	
Mt Terry TS	240.0	130.0	125.3	4.7	135.0	(-5.0)	Under Review
Shoalhaven TS	180.0	130.0	128.9	1.1	133.3	(-3.3)	
Bolong ZS	12.5	12.5	5.6	6.9	4.8	7.7	
Bomaderry ZS	30.0	20.0	17.9	2.1	20.8	(-0.8)	
Nowra ZS	30.0	17.0	23.0	(-6.0)	17.5	(-0.5)	ZS Augmentation
South Nowra ZS	22.5	11.0	14.1	(-3.1)	11.7	(-0.7)	ZS Augmentation

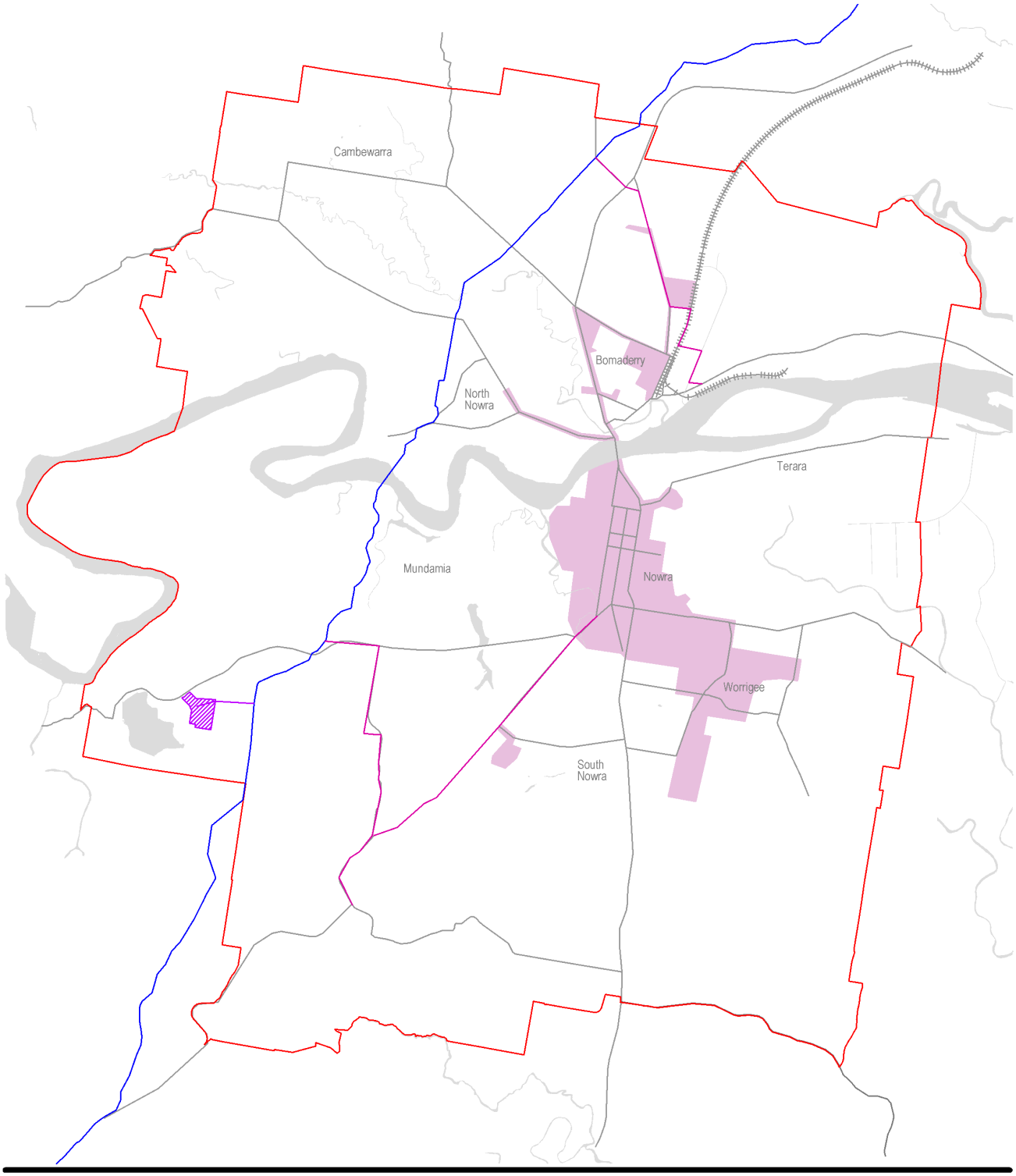
Source: Integral Energy 2005

7.3.4 Planning Implications

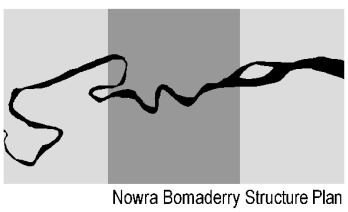
The following yardsticks can be applied to the planning of new urban release areas:

- Approximately 4-6 kVA per dwelling (depending on whether gas is available).
- As a supply/demand indicator 1 feeder line (from 33/11kV zone substation) would supply 4,000 dwellings in an urban context and 1,500-2,000 dwellings in a rural residential situation.
- Typically a 33/11kV zone substation supplies six feeder lines.

The planning lead-time for a new zone substation to be commissioned is approximately five years.



Gas Network



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Eastern Gas Pipeline
- Gas Mains
- Reticulated Gas Distribution Network
- Proposed Power Station Gas Supply
- Proposed Gas Turbine Power Station Bamarang

September 2005

0 1 2
Kilometres

Map 7.5

7.4 NATURAL GAS

The Eastern Gas Pipeline traverses the structure plan area well to the west of the urban area in a general north-south direction (Map 7.5). This transports gas from the Victorian border to the Sydney metropolitan area. Reticulated natural gas is supplied to the industries and households in a limited section of Nowra Bomaderry. Currently this is not sourced directly from the Eastern Gas Pipeline.

Proposed Gas Turbine Power Station

Delta Electricity proposes to develop and operate a gas turbine power station on a 20.2 hectare site at Bamarang, some 8 kilometres from Nowra. The power station will generate electricity from natural gas supplied by pipeline from the Eastern Gas Pipeline. The facility is proposed to be developed in two phases:

Phase1: Installation of gas turbines to provide a 'peaking' facility. This stage would use two open cycle gas turbines to meet peak electricity demands. It would only operate during periods when demand peaks.

Phase 2: Conversion to a combined cycle power base load facility to provide a constant supply of electricity. As local and regional electricity demands increase, steam generators would be added to increase the output of electricity. Additional steam turbines would create a need for cooling water, which would be sourced from existing waste water streams where available.

The electricity transmission line would connect the facility to the electricity distribution network via the existing zone substation located near the corner of Yalwal and Albatross Roads. Currently it is proposed to run the electricity transmission line above ground along the cleared transmission corridor through Bamarang Nature Reserve and then along Yalwal Road to Flat Rock Creek. From there it is proposed to run the transmission line underground through the urban area from the eastern side of Flat Rock Creek to the zone substation.

The location of the overhead supply and compatibility with future urban areas in the west Nowra sector is an issue for further detail consideration.

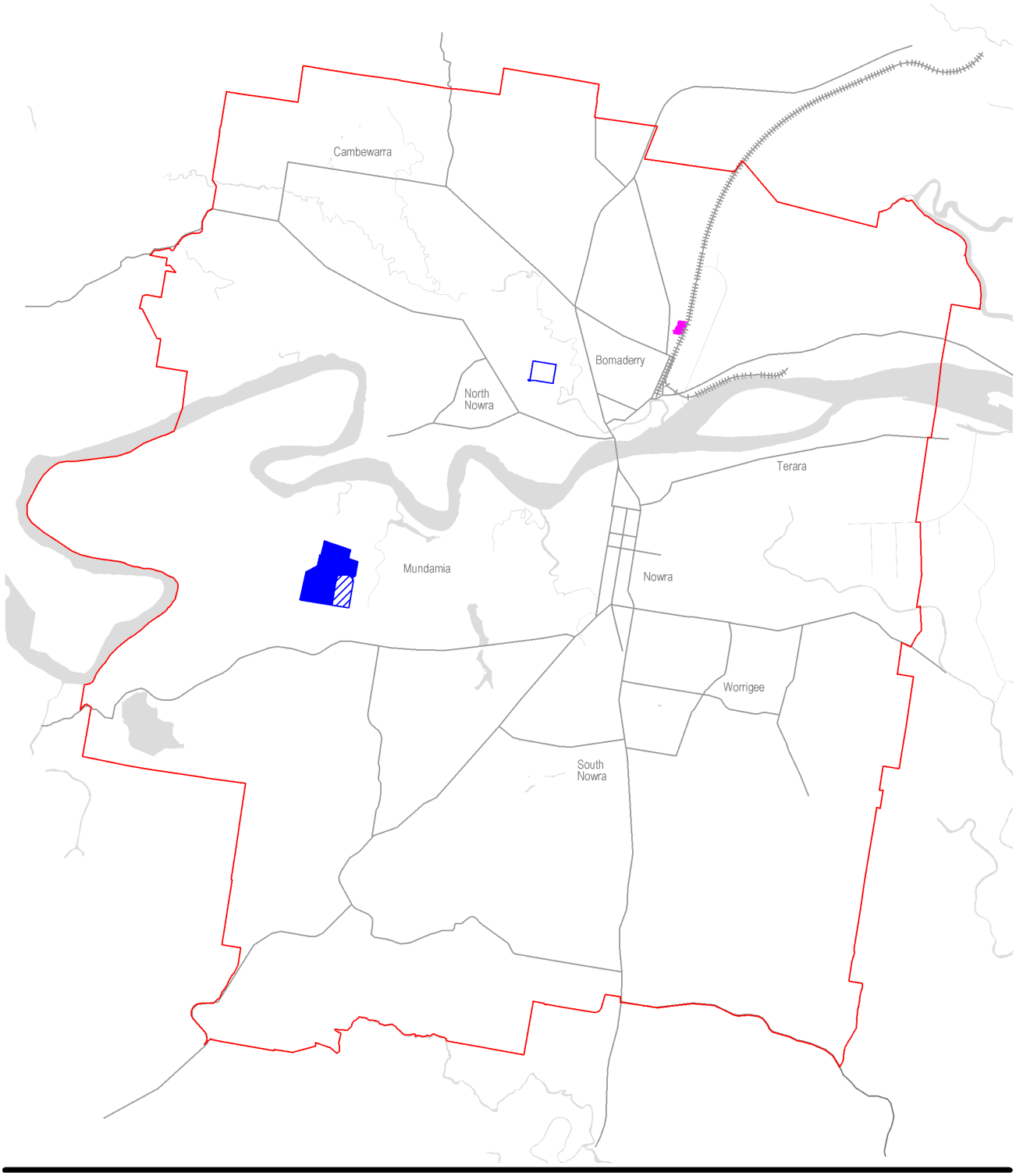
7.5 OTHER FUELS

Other fuels consumed by urban activities in Nowra Bomaderry include: oil, coke and coal, as well as wood.

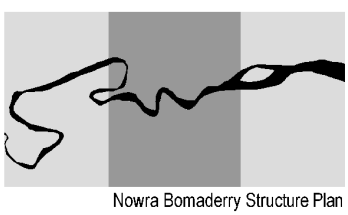
Oil: Oil for heating is supplied from a number of depots in Bomaderry.

Coke and Coal: Limited domestic use of this form of solid fuel.

Wood: Because of the mild winters, log fires are not a major feature of domestic heating in Nowra Bomaderry.



Other Urban Infrastructure



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Existing Waste Depot
- Potential Waste Depot
- Closed Waste Depot
- Council Works Depot

September 2005

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Kilometres

Map 7.6

7.6 SOLID WASTE

All domestic and commercial waste from Nowra Bomaderry is disposed of at the West Nowra Recycling and Waste Depot, located off Yawal Road. The depot does not accept industrial or hazardous waste. The site which extends over approximately 39 hectares has been operating since 1973.

Map 7.6 shows the location of the existing potential and closed waste depots.

7.6.1 Current Waste Collection

From 1990 to 1991 domestic waste has been collected by way of wheelie bins (general garbage) and 60 litre crates for recycling materials. In 1999, a system of two wheelie bins was put into operation: one bin for general garbage and one for recyclable materials.

Assessment

More sustainable management of resources is critical to ensure attainment of the best environmental and economic outcomes for all residents of the Shoalhaven.
Waste management indicators reveal that total waste to landfill has increased by 11.3% in the 2003/04 reporting period. Recycling has also increased by more than 16.5% in the 2003/04 reporting period. Issues include:

- Effect of waste minimisation activities causing an increase in unit cost for waste management services
- Unauthorised commercial and domestic use of the street and reserves litter bin service
- Dumped waste
- Roadside litter
- Contamination in kerbside recyclables stream
- Continuing high per capita waste generation rates

Commercial Pressures

- Declining markets for collected recycled products
- Competitiveness of Council's transfer depots for self haul waste as an alternative
- Dramatic increase in tourist population during holiday periods

Implications

The level of waste disposed to landfill over the past six years is of considerable concern for the whole of the Shoalhaven community.

Waste disposal to landfill represents the burial of potential resources, reduction in potential employment opportunities and subsequent erosion of potential economic activity through the Shoalhaven.

Current trends in waste disposal and management require highly technical skills in waste managers and waste management service providers and a rigorous approach to monitoring of a wide range of environmental impacts.

Increased disposal of waste to landfill leads to increased long-term costs in management, decreased community economic activity, social benefit and potentially greater long-term environmental impacts.
Conversely a well resourced and well planned approach to resource recovery, reprocessing and re-use can lead to significant overall benefit to the local/ regional economy and the environment, whilst also providing substantial local and district social enhancement.

7.6.2 Anticipated Demand

Waste is landfilled at the rate of 67,000 tonnes per annum (2003/04). This rate has remained relatively static for the past seven years. This has been the case despite the fact that the tips at Ulladulla and Sussex Inlet have been closed for active landfill, with the landfill material redirected to West Nowra.

7.6.3 Proposed Infrastructure

At the current rate of usage, the West Nowra Recycling and Waste Depot is anticipated to have a life of some 20 years. However, with the increasing emphasis on reducing household waste generation and the recycling of household and garden materials, the per capita demand for landfill should be reduced.

7.6.4 Towards a Waste Strategy

Working with these various opportunities, it is possible to create options which bring together certain elements of the above opportunities to form a coherent package of activities, logistics and infrastructure. These are discussed below as Options 1 through 7:

- Option 1 – Maintain current operations.
- Option 2 – Increased Recycling at Depots.
- Option 3 – Mixed Waste Processing at West Nowra.
- Option 4 – Mixed Waste Processing with Regional Pre-Treatment.
- Option 5 – Current Arrangements with Landfill Disposal at Woodlawn.
- Option 6 – Pre-Treatment and Export to Whytes Gully for Processing.
- Option 7 – Pre-Treatment and Export to Woodlawn for Processing.

Option 1 is based on the following assumptions:

- All Council collected waste is directly hauled to West Nowra from regional centres in kerbside collection vehicles.
- All waste is disposed to landfill at West Nowra.
- Current levels of kerbside recycling set-out, self-haul green waste and self-haul drop-off at transfer depots are maintained.
- Approximately 2,100 Council kerbside services are provided to small businesses across the region with this waste and recyclable material included with the residential data for each region.

7.7 COMMUNICATIONS

Communications include telephones (fixed and mobile), cables (copper and fibre optic), satellite and navigational aids.

7.7.1 Telephone

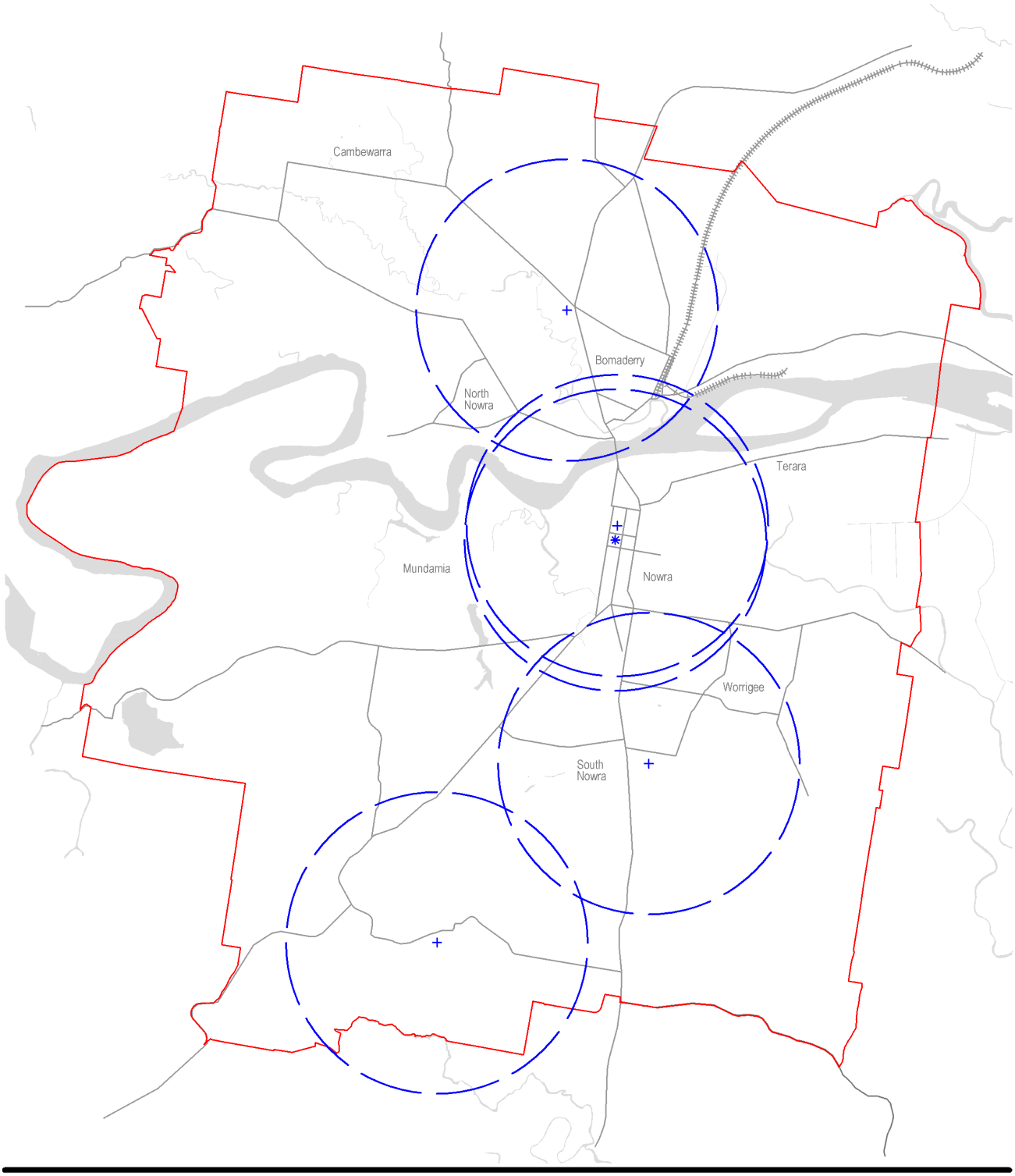
Since the deregulation of Australia's telephone system, there are now three major telephone carriers operating in the Shoalhaven: Telstra, Optus and Vodafone.

7.7.2 Mobile Phone

The mobile phone system in Nowra Bomaderry has been set up for digital transmission. Only Telstra offers both CDMA and GSM infrastructure, whilst Optus and Vodafone offer only a GSM service. The development of mobile phones and their supporting infrastructure is important for urban and environmental planning, in that they rely on a system of towers, often located in prominent positions.

The system operates on various UHF frequency bands for their transmission and reception based on a system of cells centred around a base station tower. GSM cells currently have a maximum radius of 35 kilometres whilst CDMA can operate to a greater distance. Adverse local conditions can result in a significantly smaller radius of operation. The framework of the system serving Nowra Bomaderry is centred on the following towers that link the cells by microwave signals.

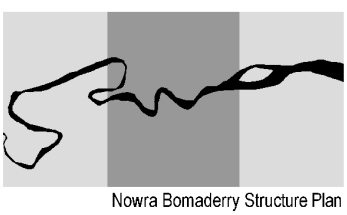
- ***Regional:***
  - Cambewarra Lookout (Optus and Vodafone).
  - Red Rocks (Telstra).



Telecommunications

Legend

- Structure Plan Boundary
- Mobile Phone Towers (wave circles 5km diameter)
- Police Communications Tower leased to mobile phone companies



Nowra Bomaderry Structure Plan

September 2005

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Kilometres

Map 7.7

- ***Nowra CBD:*** Telstra telephone exchange and Nowra Police Station (Optus and Vodafone).
- ***Bomaderry:*** Cnr of the Princes Highway and Moss Vale Road (Optus).
- ***South Nowra:*** Quinns Lane (Optus).
- ***Nowra Hill:*** Off BTU Road (Telstra).
- ***Other:***
  - Moeyan Hill near Berry (Telstra, Optus and Vodafone).
  - Coonemia Road (Optus).
  - Bewong near Tomerong (Telstra, Optus and Vodafone).
  - Comberton Grange near Falls Creek (Optus).

The Nowra Bomaderry area generally receives good mobile phone reception in most locations covered by a range of cells servicing the area of interest. Map 7.7 shows the main mobile phone tower locations.

The mobile telecommunications network in the Nowra Bomaderry area operates on radio energy, which forms part of the electromagnetic spectrum. All electronic equipment as well as broadcasting communications produce radio waves. The Australian Communications authority has adopted Interim Australian Standard 2772.1 as the applicable compliance standard governing the maximum exposure levels to radiofrequency fields. It sets the safe exposure level at 200 microwatts per square centimetre. This standard is one of the most stringent in the world, being five times more rigorous than current standards in the UK, USA and most of Europe.

7.7.3 Microwave

The prime users of microwave technology are the carriers, Internet Service Providers (ISP's) and Council.

Carriers would include telephone companies and television networks that are linking broadband signals between areas across the region. ISP's provide internet distribution to clients over a local area.

Council's use of microwave includes linking branch offices with telephone and data networks as well as short distance links for broadband applications.

7.7.4 Cable

Fibre optic cables are used by Telstra for distribution between town-centre exchanges and connection to medium to large organisations requiring high capacity phone and data connections. The predominant connection in use for domestic and small business is copper cable.

7.7.5 Satellite

Many of the clubs in Nowra Bomaderry are subscribers of Sky Channel and an increasing number of households are becoming subscribers to satellite television companies, such as Austar, Galaxy and Foxtel.

Satellite linked telephones are available to provide Australia wide coverage.

7.7.6 Navigational Aids

Principally these facilities are used by defence organisations.

7.7.7 Future Developments in Telecommunications

Telephone exchange based technologies such as ADSL is increasing use for telephone and broadband internet usage in business and domestic connections. The distance limitations of these technologies using copper cables is overcome through wireless connections using technologies offered through the GSM and particularly CDMA networks.

Internet Service providers are likely to expand local distribution through radio linking which will lead to additional infrastructure in towns and residential centres. This type of distribution has a relatively small radius of operation due to low power levels and as such additional localised facilities are required.

8. DEVELOPMENT CONSTRAINTS

The future development of Nowra Bomaderry is influenced by a set of factors that can be categorised under the headings of physical, biodiversity, cultural and operational constraints. They acknowledge functional limitations as well as the community values that underpin the maintenance of biodiversity and cultural diversity.

8.1 PHYSICAL CONSTRAINTS

The key physical constraints in the Nowra Bomaderry area are: landform, acid sulphate soils, flooding and riparian corridors.

8.1.1 Landform

Steep Slopes

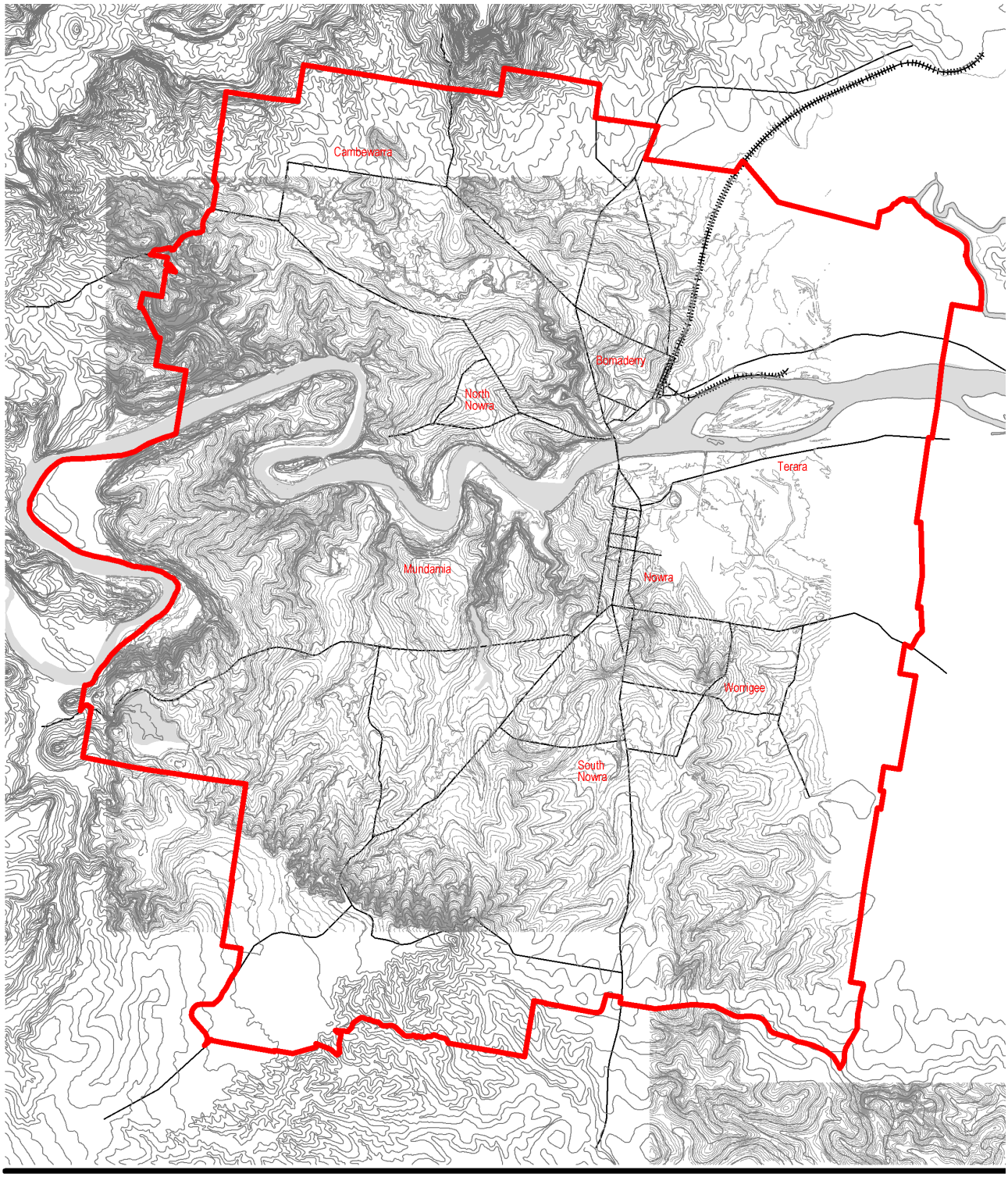
Steep slopes in the Nowra Bomaderry area are generally associated with the deeply incised riparian profiles of the Shoalhaven River drainage system. They are identified as being land with a gradient steeper than 18 degrees. Steep slopes are prone to erosion and mass movement and therefore the maintenance of vegetation coverage is important in such areas (Map 8.1).

High Water Tables and Salinity

A number of Shoalhaven lowland soils have naturally occurring permanent high water tables. Induced high water tables in the Shoalhaven tend to be rare due to the general lack of large scale irrigation schemes. Apart from general waterlogging making conditions unsuitable for plant growth, the main issue with rising water tables is salinity. Salinity problems arise when soluble salts increase within the soil profile. Salt affects plant growth and in extreme cases can be toxic to vegetation. Two forms of salinity occur in Nowra Bomaderry: irrigation salinity and induced salinity.

Irrigation Salinity: generally occurs through the application of waters to land. It occurs when trees are cleared and replaced with shallow rooted crops and pastures and exacerbated when irrigation water is applied at a rate which is greater than can be removed through evapo-transpiration. Water tables begin to rise and bring with them dissolved salts which have built up in the soil profile or are already present in the groundwater. As these groundwaters are removed from the soils by evapo-transpiration, the dissolved salts become concentrated in the root zone. These salts may eventually reach levels which are toxic to plants. The only large scale irrigation practice that occurs in the Shoalhaven is the application of starch wastewaters to several a large tract of land to the north of the Shoalhaven River, east of Bomaderry. Insufficient groundwater monitoring has been undertaken to determine if rising groundwaters are causing a potential salinity threat in this area.

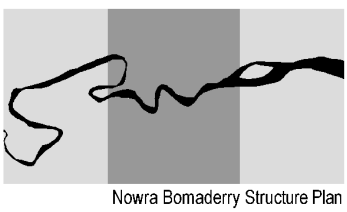
Induced Salinity: is caused by the addition of wastewaters high in salts to the land. These salts can be directly toxic to plant life and can cause long term soil structure decline by dispersion of soil particles. Studies at the Bomaderry irrigation scheme have identified large increases in salinity, particularly in levee bank soils, however, toxic affects on plants have not been recorded, presumably as a result of the high nutrient content of the wastewaters (Lawrie 1993). NSW Agriculture has been extensively involved in this irrigation scheme. However, further studies need to be undertaken to determine the future sustainability of this practice (Shoalhaven City Council 1997).



Topography

Legend

- Structure Plan Boundary
- 2 Metre Contours
- 10 Metre Contours (LIC)



Nowra Bomaderry Structure Plan

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0 1 2

Kilometres

Map 8.1

Acid Soils

Coastal areas with high rainfall have naturally occurring acidic soils. Other soils may become acidic by the:

- Use of acidifying nitrogen fertilisers.
- Use of legume dominated pastures.
- Nitrification of soil organic compounds.
- Removal of alkaline products and waste products from the soil.

This induced acidity will:

- Affect the chemistry of the soil.
- Reduce the availability of some plant nutrients.
- Release elements from the soil which may be toxic to plants (eg. aluminium and manganese).
- Lead to reduced pasture and crop growth.

Due to the natural acidity of local soils, the extent of induced acidity is, however, largely unknown.

8.1.2 Acid Sulphate Soils

Acid sulphate soils are extremely acidic soil horizons or layers resulting from the aeration of soil materials that are rich in iron sulphides, primarily pyrite (FeS_2) (van Breeman 1982). When drainage or excavation brings oxygen into these previously waterlogged soils, the pyrite is oxidised to sulphuric acid. Should the production of acid exceed the neutralising capacity of the soil, so that the pH falls to below 4, these soils are known as Actual Acid Sulphate Soils (AASS).

Potential Acid Sulphate Soils (PASS) are waterlogged soils rich in pyrite that have not been oxidised. Any disturbance which admits oxygen will lead to the development of Actual Acid Sulphate Soil layers. Potential Acid Sulphate Soils are completely innocuous to the environment if kept under water. Actual Acid Sulphate Soils overlay PASS in Australian coastal environments.

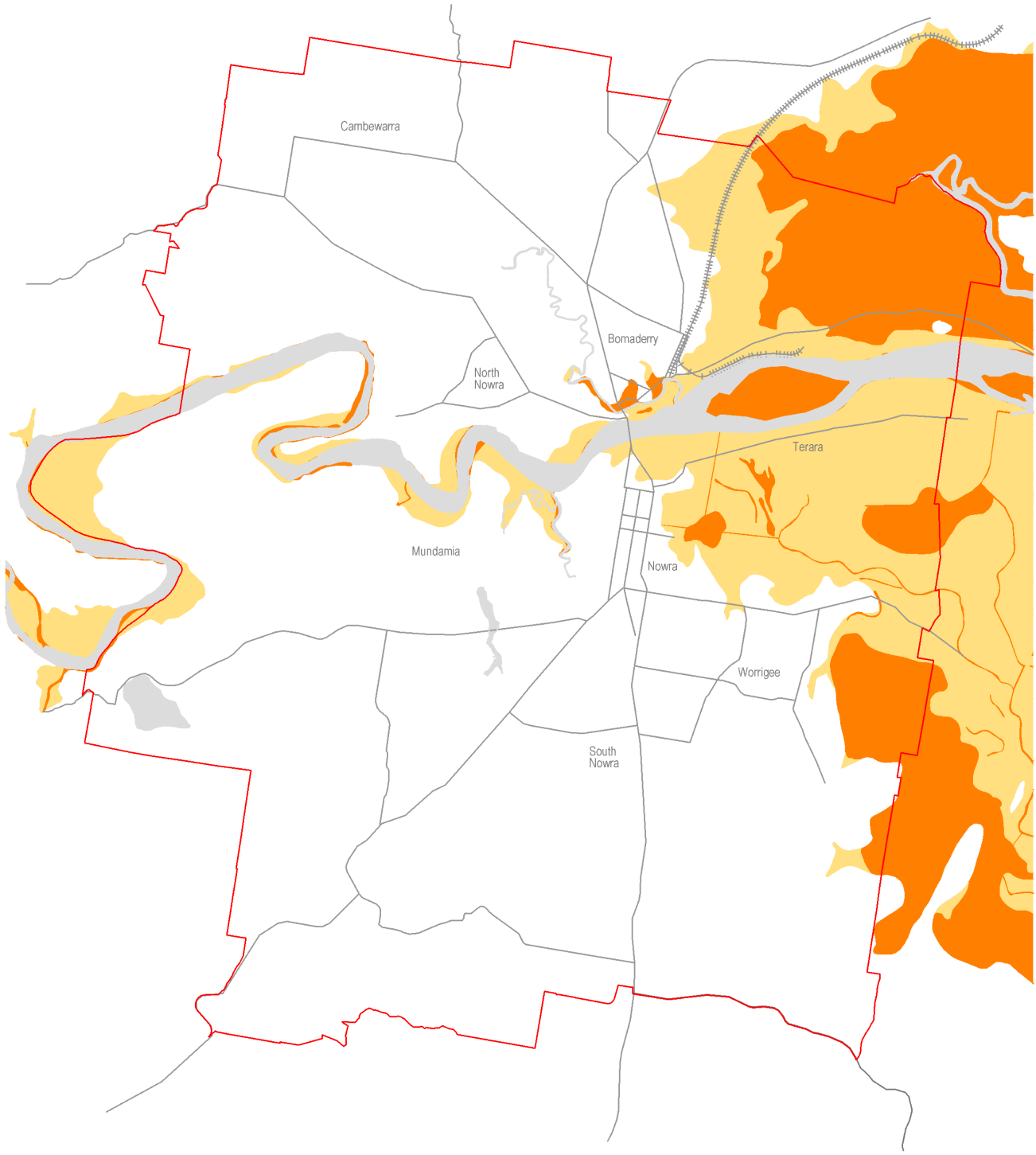
A series of Acid Sulphate Soil Risk Maps covering the entire NSW coastline has been prepared by the former Department of Land and Water Conservation. The mapping has been designed to provide information on acid sulphate soil distribution and indicate land uses which are likely to create an environmental risk by exposing ASS to air. The maps have been prepared for a wide range of users to assist with land management and the environmental planning of coastal landscapes in NSW. Actual acid sulphate soils were not mapped separately from potential acid sulphate soils. Unless specified as Actual or Potential, the use of the term 'acid sulphate soils' or ASS is a generic term used to imply both Actual and Potential Acid Sulphate Soils.

Disturbance of acid sulphate soils in NSW coastal areas has resulted in degradation of lowland environments and estuarine water quality. As a first step towards identification and future management of acid sulphate soils in these areas, a series of Acid Sulphate Soil Risk Maps was prepared by a team of soil surveyors.

The Acid Sulphate Soil Risk Maps predict the distribution of acid sulphate soils based on an assessment of the geomorphic environment. This assessment has involved aerial photo interpretation, extensive field work and laboratory analyses of soil samples. The maps have three primary map classes:

- High Probability of Occurrence of Acid Sulphate Soils.
- Low Probability of Occurrence of Acid Sulphate Soils.
- No Known Occurrence of Acid Sulphate Soils.

Where there is a probability of occurrence of acid sulphate soils (ASS), the depth to the ASS layer is provided. A guide is also given to land use activities which may create an environmental risk if carried out without acid sulphate soils investigation.



Acid Sulphate Soils

Legend

- Structure Plan Boundary
- High Probability
- Low Probability

Nowra Bomaderry Structure Plan

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0 1 2
Kilometres

Map 8.2

The mapping has been designed to provide information on acid sulphate soil distribution and indicate land uses which are likely to create an environmental risk by disturbing ASS. Map 8.2 shows, in summarised form, the high and low probability areas in the Nowra Bomaderry structure plan area. The incidence of ASS is highly correlated with the Nowra floodplain and upstream areas adjacent to the Shoalhaven River. All but one of the potential development areas is located outside the areas of risk.

Area 7, the Worrigee Road area, falls outside the risk area in the main. However, highly localised occurrences may be found where potential development areas abut areas of high probability. Initial consultation with the authors of the risk mapping has indicated that the mapping in that area has a good level of accuracy. Some future infrastructure development on the floodplain, such as active recreation and the proposed Eastern Nowra Sub Arterial Road (ENSA), will need to address this issue.

8.1.3 Flood Liability

In April 2005, the State Government released a new version of the 'Floodplain Development Manual'. The State Government's Flood Prone Land Policy is directed at providing solutions to existing flooding problems in developed areas and to ensuring that new development is compatible with the flood hazard and does not create additional flooding problems in other areas.

The Nowra Bomaderry structure plan area involves both. That is, there are flood issues relating to the historical development and definition of new investigation areas that minimises flood risks generally by avoiding flood prone lands.

Existing Urban Areas

In the first category, that is where there is existing development and/or development zoning there is a recommendation procedure consisting of four stages. This procedure enables Council to receive technical and financial support from State Government. The stages are:

1. **Flood Study -** determines the nature and extent of the flood problem.
2. **Floodplain Risk Management Study -** evaluates management options for the floodplain in respect of both existing and proposed development in consideration of social, ecological and economic factors relating to flood risk.
3. **Floodplain Risk Management Plan -** involves formal adoption of preferred risk management options for the floodplain after public exhibition by Council.
4. **Plan Implementation -** construction or implementation of floodplain risk management measures to protect existing development, use of Local Environmental Plans to ensure new development is compatible with the flood hazard.

The Local Environmental Plan for Nowra Bomaderry gazetted in 1985 generally followed these principles in that it identified the areas subject to flooding and avoided rezoning new land that was flood prone. Where the land was already zoned for development (1964) and was partially developed it incorporated special requirements in assessment of development applications. Since then however, better and more detailed information is becoming available. It is also now considered more desirable to set out the detailed development policies for the flood affected area rather than ad hoc consideration of flood issues with each development application.

New Urban Areas

For the second category, that is defining new development areas, it is only necessary to carry out a Stage 1 Flood Study, unless for very cogent reasons it is considered necessary to zone some land that is identified as flood prone land.

In Nowra Bomaderry there are also two types of flooding to consider. The first is the Shoalhaven River and its floodplain. The second is the flooding from the local tributaries including Nowra Creek, Browns Creek and Bomaderry Creek.

Lower Shoalhaven River Flood Plain

The Shoalhaven River rises approximately 50km inland of Moruya and follows a northerly direction for 170km before turning east for a further 90km to reach the Pacific Ocean at Crookhaven Heads. The Shoalhaven River has a length of around 332 kilometres from its headwaters to the mouth and a total catchment area at Nowra of some 7000 square kilometres. Downstream of Nowra, the Lower Shoalhaven River floodplain consists of approximately 120 square kilometres of primarily rural land. The Shoalhaven catchment can be described in terms of three broad regions:

- Upstream of Welcome Reef where the catchment comprises rolling plateau.
- Between Welcome Reef and Burrier, where the catchment contains steep forested gorge terrain;
- Between Burrier (38 kilometres upstream of Nowra) and the coast (Lower Shoalhaven) it is a typical alluvial floodplain.

It is the latter region that is the area of immediate concern to the structure plan but it is the flooding from the upstream regions that differentiate the Shoalhaven River flooding from that of the local streams in the Nowra Bomaderry area. In line with the process outlined in the previous section, Stage 1 Flood Study was completed in April 1990.

The study employed a computer based hydrologic model, termed the Watershed Bounded Network Model (WBNM), and established for the entire Shoalhaven River catchment. This model converts rainfall input data into estimates of streamflow for use in a hydraulic model (called the CELLS Model) to determine flood behaviour (flood levels, flow distribution and velocities). This hydraulic model covered the lower floodplain area from a point approximately 10 kilometres upstream of Nowra Bridge to the Tasman Sea, forming an arm of the Pacific Ocean, at both Shoalhaven Heads and Crookhaven Heads.

Both models were calibrated and verified to data recorded for the flood events of August 1974, June 1975, October 1976, March 1978 and April 1988. Design rainfall data were obtained from Australian Rainfall and Runoff (1987 edition) and input to the models to produce design flood information for the extreme, 1%, 2% and 5% AEP floods. The extreme flood provides an indication of the likely effects of a Probable Maximum Flood (PMF). The Flood Study also considered:

- Appropriate design ocean levels.
- Effect of the relative timing of the ocean peak and peak discharge.
- Effect of closure of the Shoalhaven Heads entrance and subsequent scouring during the flood.
- Variation in adopted width and friction values at the Shoalhaven Heads entrance.

The study concluded that for a 1% AEP flood, the peak level at Shoalhaven Heads would be 0.75 m higher if the entrance was closed rather than open at the beginning of the flood. This difference would reduce to 0.014 metres at Nowra Bridge.

The models used in the Flood Study were ‘state of the art’ at the time the investigation work was undertaken (1986 to 1988). Little has changed in hydrologic modelling since that time but a new generation of hydraulic models has appeared. These new models still rely on calibration against historical flood information to produce accurate simulation of flood events. Given the amount of historical data used to calibrate and verify the CELLS Model, it is considered that the application of an ‘up to date’ hydraulic model would not significantly alter the estimated design flood levels for locations where historical levels are available. The results from the Flood Study were therefore considered suitable for use in this process.

Design flood levels were established in the Flood Study for 1%, 2% and 5% AEP events and the extreme event. As part of the risk management study levels for the 0.2%, 0.5% and 10% AEP design floods were also established using the same models and procedures applied in the Flood Study. Table 8.1 indicates the peak levels of major flood and design flood levels for the Structure Plan area.

Table 8.1: **Peak Levels of Major Floods and Design Levels** (m AHD)

	Historical Events				Design Events				
	1860	1870	1974	1978	5%	2%	1%	0.5%	Extreme
Nowra Bridge	5.5	6.55	4.9*	5.3*	5.3	5.8	6.3	6.8	8.9
Shoalhaven River at Terara	4.8	5.7	4.4*	4.7*	4.8	5.1	5.5	5.8	7.4
Numbaa	U	U	U	3.7#	3.3	3.6	4.1	4.4	6
Estimated AEP at Nowra Bridge	3%	0.7%	8%	5%					
Estimated Average Recurrence Interval (ARI) at Nowra Bridge	30 years	150 years	12 years	20 years					

Notes:

* Recorded level taken from the Lower Shoalhaven River Flood History at Nowra Bridge 1860-1980.
E The levels for the 1860 and 1870 floods at Nowra Bridge and in the Shoalhaven River at Terara are estimated as no actual levels were recorded. The levels shown are based on other historical flood data taken from the Lower Shoalhaven River Flood History at Nowra Bridge 1860-1980.
U Unknown
\# Recorded level in Shoalhaven River Flood Study Compendium of Data

Map 8.3 shows the 1% and the extreme design events and varies marginally from previous mapping in that it is based on detailed terrain mapping of the floodplain recently completed. The following table shows the existing building potentially affected by these events. Table 8.2 is extracted from The Draft Floodplain Risk Management Study Report and is based on specific survey works of building floor levels.

Table 8.2: **Buildings Inundated** (1)

Area	Extreme	1% AEP	2% AEP	5% AEP	10% AEP
Nowra	104	34	12	5	3
Riverview Road Area	117	7	2	nil	nil
Terara Village	55	44	13	1	nil
Bomaderry	77	33	27	24	11
Total	**353**	**118**	**54**	**30**	**14**

Note: The above assessment is based on the assumed modelling scenario (Flood Study Design Conditions) where the entrance at Shoalhaven Heads is closed at the start of the flood event and allowed to scour out progressively with the passage of floodwaters (Reference 3) and surveyed floor level information gathered by Council in Jan/Feb 2001. The building is considered to be inundated if the design flood level is above the surveyed floor level for the property. Includes at least one level at each caravan park.

Source - Draft Lower Shoalhaven River Floodplain Risk Management Study Report.

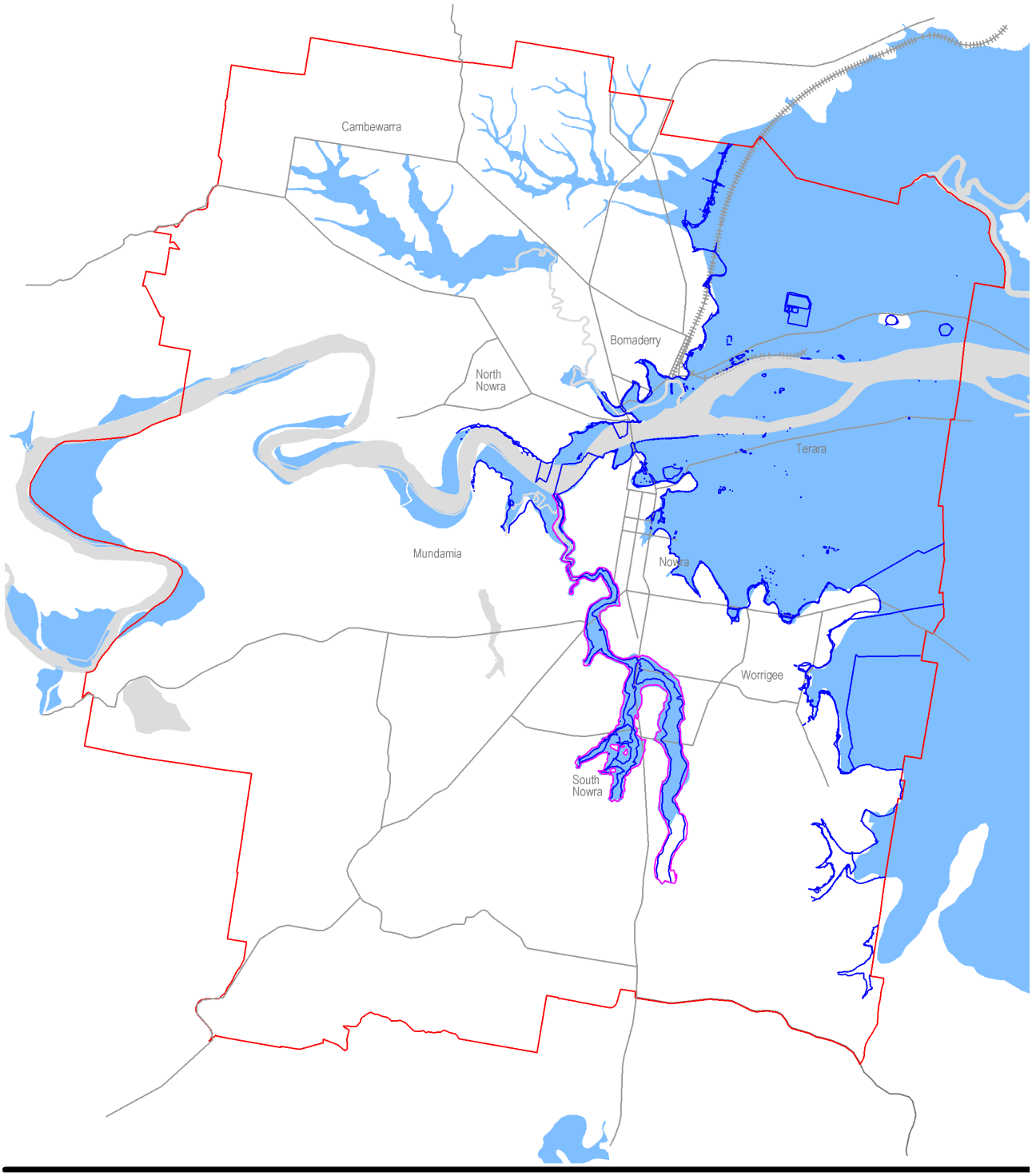
Table 8.3 provides an indication of the impact of tangible costs of existing development in the Structure plan area on flood prone land.

Table 8.3: **Location Apportionment of Average Annual Flood Damages**

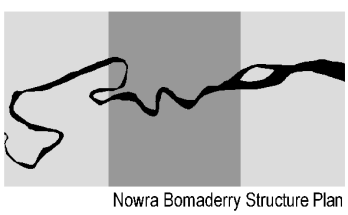
Area	Average Annual Damages	
	Entrance Condition at Start of Flood	
	Closed	Open
Nowra	$47,900	$41,000
Riverview Road	$70,000 (1)	$65,000
Terara Village	$25,000(2)	$23,000
Bomaderry	$543,700	$507,000
Total	$686,600	$636,000

Notes: (1) Entrance closed value calculated in Riverview Road Area Study (Reference 18) - refer to Section 1.3.
(2) Entrance closed value calculated in Terara Village Study (Reference 17) - refer to Section 1.3

Source: Draft Lower Shoalhaven River Floodplain Risk Management Study (Feb 2003)



Flooding



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Flood Prone Land (Concept Plan)
- PMF (Browns/Nowra Creek Flood Study)
- 1 in 100 year Flood Line (Browns/Nowra Creek Flood Study)
- 1 in 100 year Flood Line (North Shoalhaven River Flood Study)

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Kilometres

Map 8.3

At Bomaderry a major proportion of the damage is incurred in the 2% AEP and greater events due to the inundation of the industrial development particularly the large developments such as the Paper Mill, Manildra and the Dairy Farmers.

Floodplain Risk Management Plans for Riverview Road and Terara Village areas have been prepared and adopted by Council. Some changes in zoning to LEP 1985 have been made to take account of requirements of the Risk Management Plans. For the remainder of the Structure Plan area a draft Floodplain Risk Management Study has been prepared which also covers the major part of floodplain outside the Structure plan area. The Risk Management Plan is scheduled to be ready for public exhibition during mid 2005. In relation to the Lower Shoalhaven River Floodplain the Structure plan issues are:

- Industrial Development at Bomaderry.
- Highway River Crossings.
- Expansion of the Nowra CBD.
- Recreation Facilities and Areas Central Nowra.
- Road links between CBD and Greenwell Point Road.

These issues are to be addressed in detail taking into account the requirements of the Floodplain Management Manual. The above list of developments is of major strategic importance to Nowra Bomaderry and alternative locations or non flood prone land is not feasible.

Browns Creek - Nowra Creek

Other than the Shoalhaven River Floodplain the flooding in the Browns Creek-Nowra Creek system has the greatest interface with urban development in Nowra Bomaderry. Both of these creek systems rise in the Southern area just outside the study area. The main section of Brown Creek is on the eastern side of the highway and runs parallel, traversing industrial land, to the highway until it crosses the highway again to merge into Nowra Creek near Hillcrest Avenue.

Nowra Creek and its tributaries are to the west of the highway and run through the Finders industrial area and the industrial and bulky goods areas along the western side of the highway before joining Browns Creek and skirting around the residential areas of Nowra. North of Albatross Road, Nowra Creek becomes more deeply incised before entering the Shoalhaven River. Parts of this system have been subject to a number of ad hoc flood studies over the years.

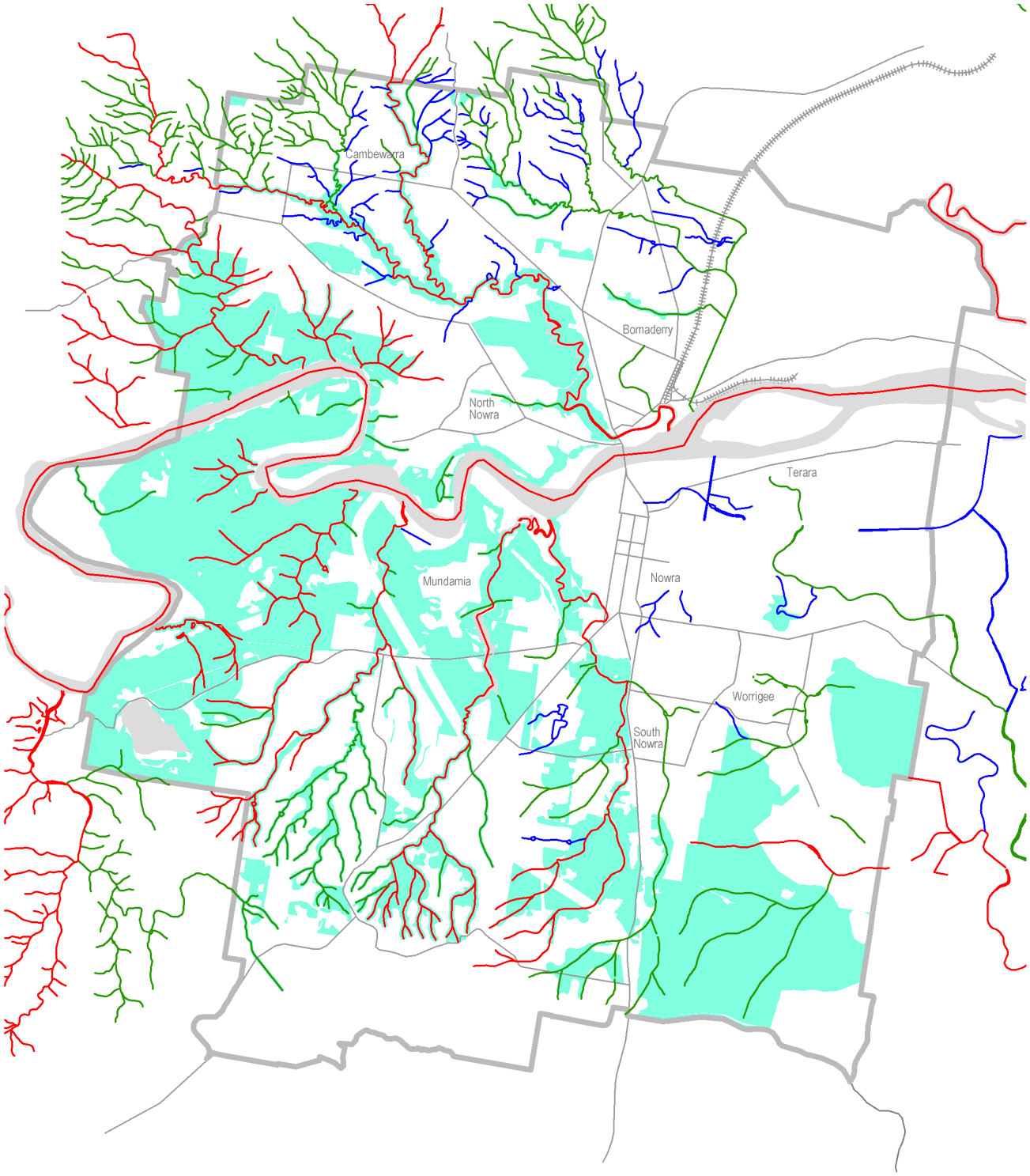
The Browns Creek Study dates back to the early 1970's and the 9(a) Natural Hazards Urban Flooding zone was based on the principle of a clearly constructed floodway to contain the then calculated 1% AEP flood. Policies as well as modelling analysis have changed considerably since that time. Other more recent studies have looked at sections of Nowra Creek where they have traversed zoned development areas.

A comprehensive flood study (Stage 1) of the floodplain management process has been undertaken and the extent of flooding under the 1% AEP and the PMF events are shown on Map 8.3. Because there are a number of locations where existing development areas are affected it will be necessary to wait for the Risk Management Study to be completed before any detailed policy can be incorporated into the Structure plan.

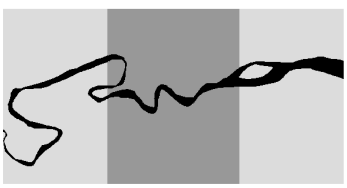
8.1.4 Riparian Corridors

Riparian corridors are linear tracts of land associated with the Shoalhaven River drainage system. They are important for maintaining biodiversity and river bank stability. They are a significant component of the Nowra Bomaderry conservation strategy and represent both constraints and opportunities to urban development.

The Department of Infrastructure, Planning and Natural Resources (DIPNR) has assisted Council with the provision of the study 'Riparian Corridor Objectives for Selected Streams in Nowra and Bomaderry' (2005). This Study categorised streams in the Nowra and Bomaderry study area and identified riparian objectives for each category to best protect each stream. There are three riparian corridor categories. Table 8.4 summarises the objectives and management requirements for each of the riparian categories and Map 8.4 indicates their location.



Riparian Corridors



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Conservation Areas
- Category 1 (Riparian Policy DIPNR)
- Category 2 (Riparian Policy DIPNR)
- Category 3 (Riparian Policy DIPNR)

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Kilometres

Map 8.4

Table 8.4: **Riparian Corridor Categories & Management Requirements**

Management Requirements & Minimum Environmental Objectives for Riparian Land	Category 1 Environmental Corridor (red)	Category 2 Terrestrial & Aquatic Habitat (green)	Category 3 Bank Stability & Water Quality (blue)
Delineate riparian zone on a map and zone appropriately for environmental protection.	Yes	Yes	If resources are available.
Provide a minimum Core Riparian Zone (CRZ) width.	40 m from top of bank	20 m from top of bank	Usually 10 m from the bank
Provide additional width to counter edge effects on the urban interface (i.e. Vegetated Buffer).	10 m	10 m	Generally not required
Provide continuity for movement of terrestrial and aquatic habitat.	yes/ (including piered crossings)	yes (with appropriate crossing design)	Where appropriate
Rehabilitate/re-establish local provenance native vegetation.	yes	yes	Where appropriate
Locate services outside the Core Riparian Zone wherever possible.	yes	yes	Merit consideration
Locate playing fields and recreational activities outside Core Riparian Zone.	yes	yes	Merit consideration
Treat stormwater runoff before discharge into the riparian zone or the watercourse.	yes (outside CRZ and buffer)	yes (outside CRZ and buffer)	Yes

Source: Department of Infrastructure, Planning and Natural Resources

Category 1: ***Environmental corridor*** The overarching objective is to provide biodiversity linkages by maintaining connectivity for the movement of aquatic and terrestrial species along the riparian corridor and between key destinations (eg between bottom and top of catchment, between wetlands and large nodes of vegetation). This Category builds upon Category 2 and 3.

Category 2: ***Terrestrial and aquatic habitat*** The overarching objective is to provide basic habitat and preserve or emulate as much as possible a naturally functioning stream (not necessarily linking key destinations). While accepting the width of the riparian corridor will not fully satisfy the requirements of a Category 1 – Environmental Corridor, the width must still be sufficient to provide long term robust habitat and refuge for native fauna. This Category builds upon Category 3.

Category 3: ***Bank stability and water quality*** As implied, the overarching objectives are to prevent accelerated rates of soil erosion and to enhance water quality. This Category may have limited habitat value but contributes to the overall basic health of a catchment. While an open water course emulating some natural stream function is the preferred option, it is recognised, for example, that the practicality and economics of developing urban land may make this difficult. It is this Category of watercourse where it may be possible to negotiate trade-offs.

These categories reflect their relative environmental significance, and potential function within the landscape and are hierarchical, with Category 1 being of the highest value, and being achieved by a larger group of management requirements, and Category 3 being of the lesser value and being achieved by a reduced suite of management requirements. Spatial requirements also differ in order to achieve the objective or function assigned to each Category. These spatial implications are important to plan and zone in a strategic sense in order to achieve the long term outcome (Table 8.4).

Overview of Study Area

The study area consists of the sub-catchments within which nine potential areas of future urban development are situated:

- Meroo Meadow
- Moss Vale Road North
- Moss Vale Road South
- Bangalee Road West
- Crams Road
- Mundamia
- Bamarang
- Cabbage Tree Lane
- Worrigee

General Description of Stream Types in the Study Area

The streams in the area varied from: (i) incised channels with perennial flow and distinct bed and banks to; (ii) broad flat channels, often without distinct bed and banks. It is important that the environmental principles of the settlement strategy and any subsequent Local Environmental Study/Local Environmental Plan process adequately address and protect all the geomorphic and environmental features of streams. The overall objective of the exercise is to protect the long term riparian function and provision of catchment health. The following sections provide details of each investigation area.

Meroo Meadow

The catchment is entirely cleared of vegetation, with the land being used for agricultural purposes. The potential for full rehabilitation of riparian vegetation for most of the streams in this area is minimal, however, two unnamed watercourses which flow through the site have the potential to provide some connectivity between Abernethy's Creek and the upper catchment and are worth preserving and rehabilitating. Such an outcome would also afford greater amenity, a sense of place and reduced localised flood risk should future settlement be considered here. The riparian objective classifications for streams in this area are:

- Central unnamed streams Category 2
- Other streams Category 3

Moss Vale Road North

The catchment is nearly entirely cleared for agricultural purposes. Abernethys Creek runs through the site and is severely degraded with extensive straightening and modification, particularly at the downstream end around Bomaderry. There is still opportunity to provide a robust and continuous riparian vegetation and habitat link between the Shoalhaven River and the top of this catchment, as there is plenty of space and few constraints to reinstate the streams with some riparian vegetation and habitat and incorporate this into any future subdivision design (integrating with open space networks). However, other nearby streams such as Tapitallee Creek and Good Dog Creek are more substantive streams and provide better opportunities for connectivity between the upper and lower catchments and because of this Abernethy's Creek has not been classified as a Category 1 stream. The riparian objective classifications for the streams in this location are:

- Abernethy's Creek Category 2
- Other streams Category 3

Moss Vale Road South

This catchment is also nearly entirely cleared for agricultural purposes. There are no substantial waterways within the immediate area of the proposed urban area. On the south west side of the site Good Dog Creek is a major watercourse that provides a good link between the Shoalhaven River and the upper catchment. This stream has been given a riparian objective classification of 1 and should be protected and rehabilitated to the fullest extent, particularly in view of the severe degradation of streams in the Moss Vale Road north area. Good Dog Creek runs into Bomaderry Creek which is near the southern boundary of the site.

Bomaderry Creek provides excellent connectivity between Good Dog Creek and the Shoalhaven River. This environmental corridor also links National parks in the upper catchment to the Bomaderry bushland and enables long term biodiversity functioning between key nodes of vegetation. The riparian objective classifications for streams in this location are:

- Bomaderry Creek Category 1
- Other streams Category 3

Bangalee Road West

This is a small area with existing urban development in the eastern portion and National Park along the western portion. About half of the area has been cleared, with the other half still fully vegetated.

There are two first order streams that drain into Bengalee Creek to the west of the site. These streams are still fully vegetated and may not be affected by proposed development. Because of this they have been given a riparian objective classification which may be reviewed once any proposed development is known or the conservation significance of vegetation understood. Bengalee Creek is an important stream, still heavily vegetated, connecting two sections of Tapitallee Nature Reserve with the Shoalhaven River. First order streams play two roles here:

(i) A longitudinal riparian corridor retaining extant vegetation.
(ii) A lateral connection in this node of biodiversity (ie from one side of the creek to the other).

The riparian objective classifications for streams in this area are:

- Bengalee Creek Category 1
- Other Streams Category 1

Crams Road

This is a heavily vegetated area with existing urban development along the eastern boundary and the Shoalhaven River near the western and southern boundary. There is only one stream of significance that traverses the northern part of the site. This stream is only 2 km long but is still heavily vegetated with significant habitat value worth retaining. The riparian vegetation also has considerable scenic value along the Shoalhaven River (the outside bend is a focal point). The riparian objective classifications for streams in this area are:

- All streams Category 1

Mundamia

About one third of this catchment is significantly disturbed with the other two thirds remaining vegetated. There are no substantial streams flowing through the site, however, the Shoalhaven River is along the northern boundary and streams linking the Shoalhaven River with National Parks and State Forests are along the eastern and western boundaries, being Flat Rock Creek and Cabbage Tree Creek respectively. There are also some minor watercourses within existing native vegetation that may be within the proposed urban area. The riparian objective classifications for streams in this area are:

- Shoalhaven River Category 1
- Flat Rock Creek Category 1
- Cabbage Tree Creek Category 1
- Other streams Category 2

Bamarang

This site is adjacent to the western side of the Cabbage Tree Lane site. The catchment is still fully vegetated. Sandy Creek is a significant stream that flows between this catchment and the Cabbage Tree Lane site to the east and forms a natural boundary between the two sites.

The area is still fully vegetated and the riparian objective classification of other streams is kept high due to their relationship with the nearby network of nature reserves. The classification may be reviewed once details of any proposed development and conservation significance are known and site investigation undertaken. The riparian objective classifications for streams in this area are:

- Sandy Creek Category 1
- Other streams Category 1

Cabbage Tree Lane

About two thirds of the catchment has been cleared, initially for agricultural use, and now for rural residential subdivisions. Two streams flow through the area and both still have significant amounts of riparian vegetation and connect to heavily vegetated areas. An unnamed stream is well formed and provides good connectivity between areas of remnant vegetation upstream and downstream of the site. Cabbage Tree Creek is also well worth preserving as it still has significant amounts of native riparian vegetation, but does not provide the same level of connectivity between the upper and lower catchment as the other stream. Just to the west of the site Sandy Creek flows through a fully vegetated area and this stream also forms a natural boundary between another investigation area called Bamarang. The riparian objective classifications for streams in this area are:

- Sandy Creek Category 1
- Unnamed streams Category 1
- Cabbage Tree Creek Category 2

Worrigee

This catchment is about 50% cleared and bounded by State Forest to the west and a National Park to the east. There are two streams that flow from the State Forest, through the site, into the National Park which contains Worrigee Swamp and from there into the Crookhaven River. The unnamed northern stream provides good connectivity between Worrigee Swamp and the State Forest. Rotten Creek flows through a golf course and it is unlikely the riparian corridor could be fully vegetated without significant disruption to the golf course. The riparian objective classifications for streams in this area are:

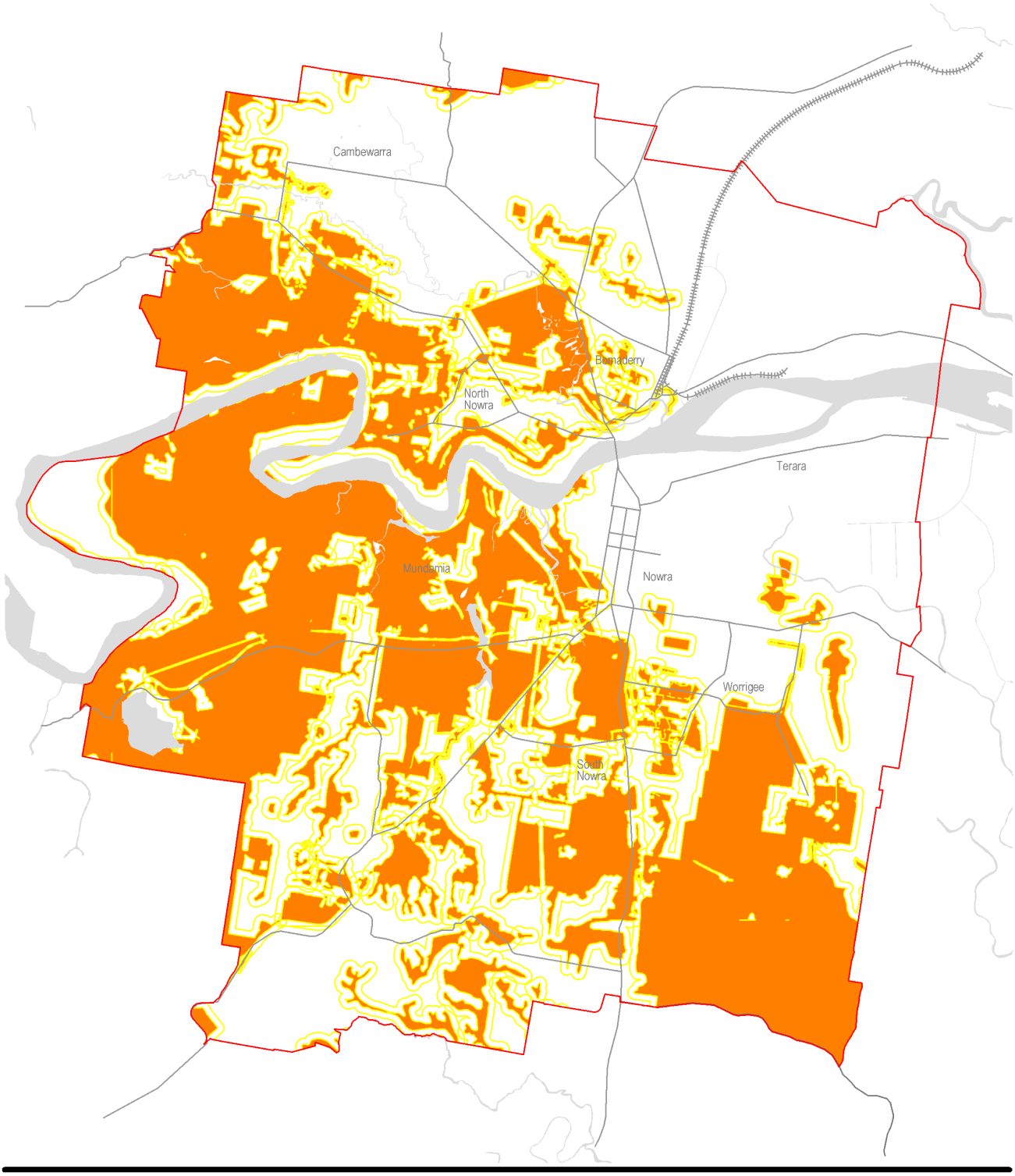
- Unnamed stream Category 1
- Rotten Creek Category 2

8.1.5 Bushfire

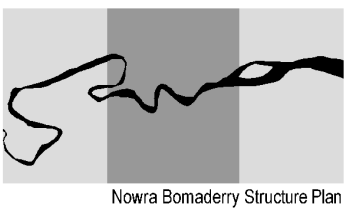
Recent amendments to legislation relating to bushfire management, introduction of Planning for Bushfire Protection Guidelines, the Bushfire Environmental Assessment Code and introduction of Bushfire Prone Land Maps have introduced a range of requirements and procedures that conflict with the conservation of biodiversity. As such, these considerations need to be considered early in the planning process to reduce areas of conflict between the conservation objectives and bushfire hazard reduction requirements.

Planning for Bushfire Protection Guidelines have introduced the need to have asset protection zones (APZs) around properties that are located on land considered to be 'Bushfire Prone' as identified on Council's Bushfire Prone Land Map (Map 8.5). These APZs consist of inner and outer protection zones, the distance and management of which are related to the perceived hazard associated with the relevant structure(s). Construction standards may also be enforced for buildings on 'Bushfire Prone Land', along with standards for access such as perimeter roads.

Requirements in Planning for Bushfire Protection Guidelines indicate that APZs should be within the boundaries of the property, however for existing developments, this may often be difficult. This is the situation where conflicts arise between existing protection of vegetation and provision of protection for life and property. The structure plan has tried to incorporate requirements from Planning for Bushfire Protection Guidelines into the planning process by modelling perceived threat of bushfire and needs for APZs and construction standards in all urban investigation (specifically Greenfield areas). This data has then been used to provide appropriate setbacks and buffers between future urban expansion areas and biodiversity conservation areas.



Bushfire Prone Land



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- Bushfire Prone Land
- Bushfire Prone Land Buffer

Source: NSW Rural Fire Service Certified June 2004

September 2005

0 1 2
Kilometres

Map 8.5

In many of these cases riparian corridors and bushfire APZs may be located adjacent to each other. Effect planning for the provision of APZs will minimise the probability of damage to outbuildings, fences and dwellings. In this regard it may be appropriate to consider an arrangement where an APZ is located between a riparian corridor and urban/residential area as this could ensure threat to property/life is minimised in the event of a bushfire.

8.2 BIODIVERSITY CONSTRAINTS

8.2.1 Rare or Threatened Plant Species

Nine nationally rare plant species were recorded in the Nowra study area by Dr Kevin Mills (Table 8.5). Six of these species have been listed on the register of nationally rare or threatened Australian plant species (ROTAP species) (Briggs and Leigh 1988); the other two species meet the criteria for listing as ROTAP species, so Dr Kevin Mills proposed to the CSIRO that they be included on the register. Six rare species recorded nearby have also been included in Table 8.6 because they could occur in the study area. The distribution of these ROTAP species in the Nowra study area is shown on the accompanying maps and the rare plant survey sheets are provided in the Appendices. Plant species that are threatened in New South Wales (Threatened Species Conservation Act 1995) are also identified in Table 8.7; three of these species occur in the Nowra study area, and two others occur nearby.

Table 8.5 **Rare or Threatened Plant Species in Nowra Bomaderry**

Species & Family	TSC[1]	Risk Code	Habit	Distribution
Acacia subtilinervis Faboideae	-	3RCa	Small shrub to 2m	Scattered on rock surfaces, North to West Nowra.
Dampiera scottiana Goodeniaceae	-	2RCi+	Small shrub	Scattered across the sand-stone country, in woodlands.
Eucalyptus langleyi Myrtaceae	V	2V	Mallee to 3m	Rare. Locations include Bomaderry Creek and near HMAS Albatross.
Leptospermum Epacridoideum Myrtaceae	-	2RC-	Erect shrub to 1.5m	Uncommon. On rock surfaces throughout the sandstone country.
Leptospermum sejunctum Myrtaceae	-	2K	Shrub to 3m	Common on rock surfaces throughout the sandstone country.
Platysace sp. *nov.* Apiaceae	-	2RC+	Small shrub	Moderately common on rock surfaces in the sandstone country.
Rulingia hermanniifolia Sterculiaceae	-	3RCa	Low to prostrate shrub	Occasionally recorded in the Parma Creek area, also at Bomaderry Creek.
Triplarina nowraensis Myrtaceae	E	2V+	Shrub to 3m	Uncommon. On poorly drained sites, mainly at West Nowra.
Zieria 'baeuerlenii' Rutaceae	E	2E	Small shrub	Very localised at a small number of sites at Bomaderry Creek.

1. Threatened Species Conservation Act 1995: V = vulnerable, E = endangered
+ Risk codes recommended by Kevin Mills and Associates.

Other Rare Species in the Region

In addition to plant species that are nationally rare or threatened, some species have state or regional significance. These species may be generally rare in New South Wales, may be rare on the South Coast or may represent outlying populations of species with a predominantly more northern or southern distribution. These species are listed in (Table 8.7).

Table 8.6: **Rare or Threatened Plant Species in Area Adjacent to Nowra Bomaderry**

Species & Family	TSC1	Risk Code	Habit	Distribution
Acacia bynoeana Fabaceae	V	3VC-	Low shrub	Found once on the Toorooroo Plateau.
Eucalyptus sturgissiana Myrtaceae	V	2VC-	Mallee to 4m	Found once in the Parma Creek area.
Grevillea barklyana Proteaceae	-	3RCa	Large shrub to 3m	Occurs south-west of HMAS Albatross.
Pultenaea villifera Fabaceae	-	3RC-	Low-growing shrub	Occurs on the Toorooroo Plateau, Yalwal Road.
Dodonaea rhombifolia Sapindaceae	-	3RCa	Shrub to 2m	Recorded along the Shoalhaven River below Tallawa Dam.
Typhonium eliosurum Araceae	-	3EC-	Herb	Along the Shoalhaven River, at Parma and Currambene Cks.

1. Threatened Species Conservation Act 1995: V = vulnerable, E = endangered
+ Risk codes recommended by Kevin Mills and Associates.

Table 8.7: **Significant Plant Species other than ROTAP Species at Nowra**

Species Name	Habit	Notes
Abrophyllum ornans	Shrub	Rainforest; rare south of the Cambewarra Range
Acacia hispida	Shrub	Southern limit of its range is in Nowra Bomaderry
Bulbophyllum shepherdii	Orchid	An uncommon epiphytic orchid
Callitris rhomboidea	Tree	Uncommon to rare in region, found in far west of area
Daviesia alata	Shrub	Rare south of the Shoalhaven River
Eucalyptus capitellata	Tree	Southern limit of its range is in Nowra – Bomaderry
Eucalyptus eximia	small tree	Southern limit of its range is to the west of Nowra
Eucalyptus moluccana	Tree	Southern limit of its range is at south Nowra
Ficus superba	Tree	Rare south of the Shoalhaven River
Leucopogon amplexicaulis	small shrub	Rare on the South Coast
Melaleuca styphelioides	Tree	Near southern limit of its range in Nowra – Bomaderry
Melicope micrococca	Tree	Rare on the South Coast
Peperomia leptostachya	Herb	Southern limit of its range is in Nowra –Bomaderry
Planchonella australis	Tree	Southern limit of its range is in Nowra – Bomaderry
Psilotum nudum	fern ally	Bomaderry Creek
Sarcochilus hillii	Orchid	An uncommon epiphtyic orchid
Tetratheca decora	small shrub	Rare on the South Coast

Important Vegetation Communities

Spotted Gum Communities

Most of the Spotted Gum *Eucalyptus maculata* communities that originally occurred on private land around Nowra have been cleared; substantial stands survive only in state forests. These communities are inadequately represented in the region's system of conservation reserves and they are not reserved at all in Nowra Bomaderry.

Sandstone Gully Complex

Several vegetation communities are associated with the large gullies on the sandstone, such as at Flat Rock Creek. The communities exhibit the following conservation values:

- They are biodiversity 'hot spots', because of their floristic diversity.
- Most of the rare or threatened plant species in Nowra Bomaderry occur in these communities.

- Grey Gum Eucalyptus punctata is a common tree in the sandstone communities and is the main food tree of the threatened Yellow-bellied Glider Petaurus australis in Nowra Bomaderry.
- The rocky outcrops, creeks, forests and other habitats associated with the Nowra Sandstone support many fauna species not found in the surrounding woodlands or on the clayey soils.

Estuarine Vegetation

There are small areas of mangrove, saltmarsh and seagrass on the Shoalhaven River and its main tributaries in Nowra Bomaderry. These vegetation types have been almost totally cleared from this district, although there are still large areas near the coast. This wetland vegetation is of interest because it is now so uncommon and because it is located so far inland, which is unusual.

Sedgeland (Swampland)

Small areas of sedgeland occur in the far western part of the study area, near Bamarang. These are the low altitude equivalent of the more extensive 'upland swamps' at Sassafras, further west. At Bamarang they are at their lowest altitude and although they cover only a small area, they are of botanical interest as they are different from the more extensive sedgelands at higher altitude.

Floodplain Vegetation

There is little natural vegetation remaining on the Shoalhaven River floodplain; some remnants of the floodplain vegetation occur on the eastern edge of the Nowra study area. These include the Swamp Mahogany *Eucalyptus robusta* - Paperbark *Melaleuca linariifolia* forest, the Woollybutt *Eucalyptus longifolia* - Spotted Gum *Eucalyptus maculata* forest and the Swamp Oak *Casuarina glauca* forest; the latter was not mapped in Nowra Bomaderry because the occurrences are too small. North and south of Nowra, the floodplains of the larger streams have been cleared and support only remnant forest communities. These include the Blue Gum *Eucalyptus saligna/E. botryoides* forest, the Prickly-leaved Paperbark *Melaleuca styphelioides* forest and the River Oak *Casuarina cunninghamiana* forest. Floodplain vegetation is not reserved in the region.

8.2.2 Fauna Habitat Types

A fauna survey of Nowra Bomaderry was carried out by consultant Paul Bircher in 1998. Bircher described fauna habitat types, profiled endangered fauna in the area and mapped areas of fauna diversity / richness. The different types of fauna habitat occurring in Nowra Bomaderry are discussed below. Habitat type is largely a result of vegetation structure and floristics. Thus the habitat types are generally broad groupings of the vegetation communities described by Mills (1995).

8.2.3 Key Planning Issues

The key planning issues below have been derived from reports on the landform, biodiversity and aquatic environments of Nowra Bomaderry. Decisions made in the planning process will impact upon the natural environment. The following issues and associated recommendations have been put forward to ensure due regard is given to the principles of ESD, as ESD is the context within which the planning process for Nowra Bomaderry is operating.

Ecologically sustainable development (ESD) requires the effective integration of economic, environmental and social considerations in the decision-making processes. ESD can be achieved through the implementation of the following principles and programs:

[a] Precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:
  - careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment
  - an assessment of the risk-weighted consequences of various options;

[b] inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;

[c] conservation of biological diversity and ecological integrity- namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration

[d] improved valuation, pricing and incentive mechanisms - namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays - that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by established incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

8.3 CULTURAL CONSTRAINTS

Cultural constraints include Aboriginal heritage and contemporary land claims, together with European settlement heritage considerations.

8.3.1 Aboriginal Heritage

The consistent Aboriginal presence in Shoalhaven is identified as a heritage theme of importance. This has been recognised by the Department of Environment and Conservation who in conjunction with Council have commenced a Regional Aboriginal Heritage Study for the Shoalhaven Local Government Area.

This study aims to develop a better understanding of Aboriginal Heritage in the Shoalhaven, including heritage values of traditional, historic and cotemporary importance to Aboriginal communities. It also aims to identify sites and areas of significance to Aboriginal people and for these sites and areas to be incorporated into the planning system so that they can be better managed .In addition, the Aboriginal Heritage Study will provide an agreed basis from which land use planning decisions can be made by all stakeholders.

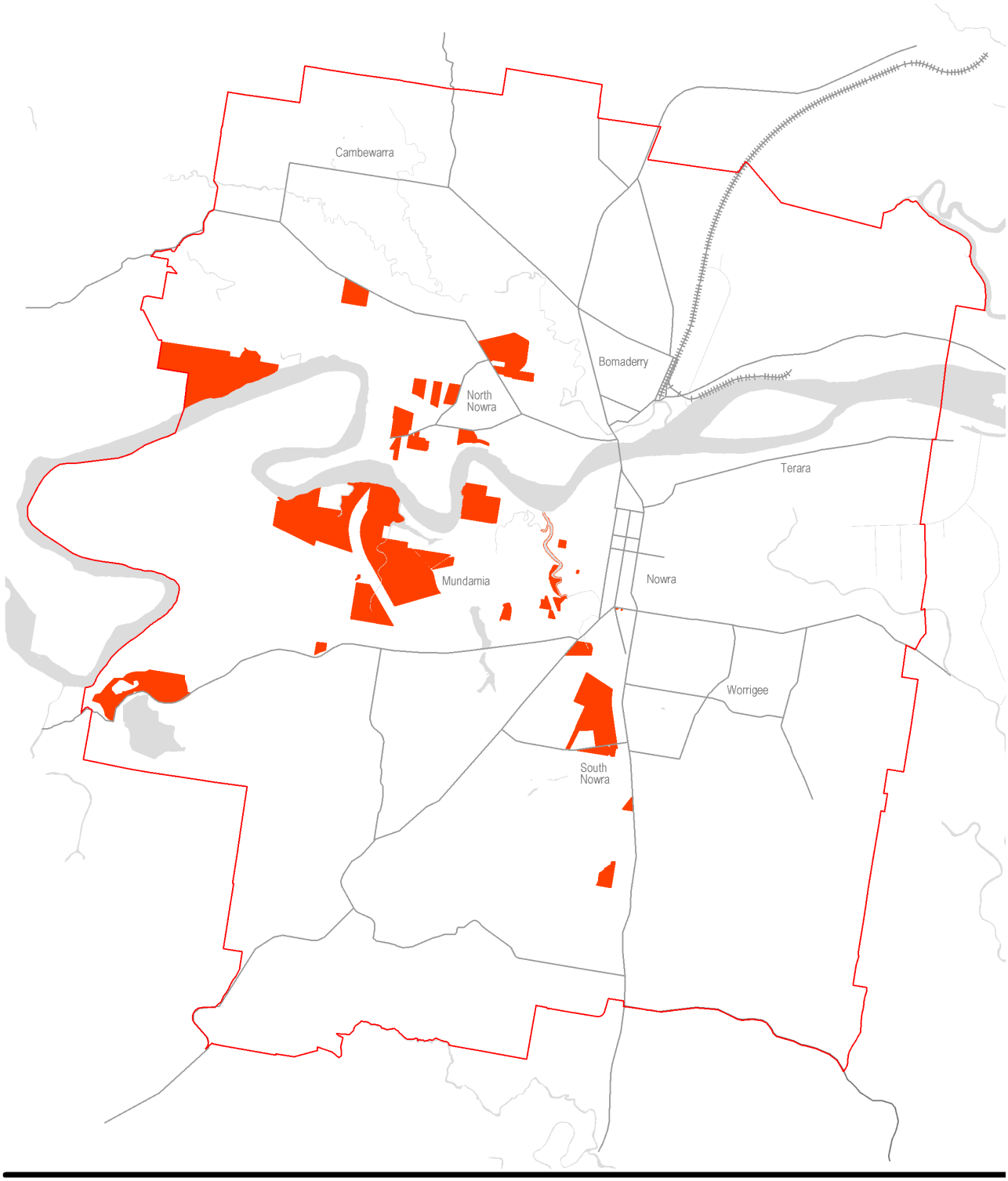
Aboriginal Land Claims

A total of 639.31 hectares remain subject to Aboriginal Land Claims. Of this 104.11 hectares has been granted and a further 217.24 hectares has been part granted. The vast majority of this is located south of the Shoalhaven River. An additional 55.56 hectares is supported by Council; 222.61 hectares is not supported by Council and 39.79 hectares is pending an outcome (Table 8.8). The Aboriginal Land Claims which have been granted or are pending are shown in Map 8.6.

Table 8.8: **Extent of Aboriginal Land Claims**

Claim Status	North of River Hectares	South of River hectares	Total Nowra Bomaderry hectares
Claim Granted	12.56	91.55	104.11
Claim Part Granted	-	217.24	217.24
Claim Supported by Council	45.09	10.47	55.56
Claim Not Supported by Council	108.77	113.84	222.61
Claim Pending	39.79	-	39.79
Total Extant Claims	**206.21**	**433.1**	**639.31**

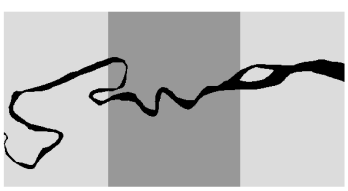
Source: Shoalhaven City Council's Aboriginal Claims Records 2005



Aboriginal Land Claims

Legend

- Structure Plan Boundary
- Granted or Pending Aboriginal Land Claims



Nowra Bomaderry Structure Plan

September 2005

0 1 2

Kilometres

Map 8.6

8.3.2 Pastoral Landscape

The pastoral landscape to the north and east of Nowra Bomaderry represents a highly significant component of the rural economy as well as a valuable scenic resource. The underpinning land capability classification (Map 8.7) and the associated areas of prime crop and pasture (Map 8.8) provide the fundamentals for the management of this landscape. The pastoral landscape contains a number of significant heritage places (Map 8.9).

Areas of high quality agricultural land (prime crop and pasture) need to be preserved for agricultural use. Land classed as 1, 2 and 3 constitutes 'prime crop and pasture land'. All practicable measures should be taken to avoid taking this land away from sustainable, viable agricultural use. The development of this land should be regarded as a 'last resort'.

8.4 OPERATIONAL CONSTRAINTS

The key operational constraint limiting development in the Nowra Bomaderry area is the level of aircraft noise associated with the take-off and landing flight paths associated with the HMAS Albatross defence base to the south west of Nowra.

HMAS Albatross Aircraft Noise Exposure Forecasts

Map 8.10 shows the Australian Noise Exposure Forecast (ANEF) Maps produced in relation to HMAS Albatross, which is located in the south-western portion of the Structure Plan area. These forecasts show a decrease from 2006 to 2014 in the areas affected by aircraft noise exposure, however the noise exposure remains a constraint in those areas in close proximity to HMAS Albatross. The types of land use considered appropriate within these ANEF contours are summarised in Table 8.9.

Table 8.9: **ANEF Zones & Landuse Acceptability**

Building Type	ANEF Zone of Site		
	Acceptable	Conditionally Acceptable	Unacceptable
Houses, Home Unit, Flat, Caravan Park	Less than 20 ANEF (Note 1)	20n to 25 ANEF (Note 2)	Greater than 25 ANEF
Hotel, Motel, Hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, University	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hospital, Nursing Home	Less than 20 ANEF (Note 1)	20 to 25 ANEF	Greater than 25 ANEF
Public Building	Less than 20 ANEF (Note 1)	20 to 30 ANEF	Greater than 30 ANEF
Commercial Building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light Industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other Industrial	Acceptable in all ANEF zones		

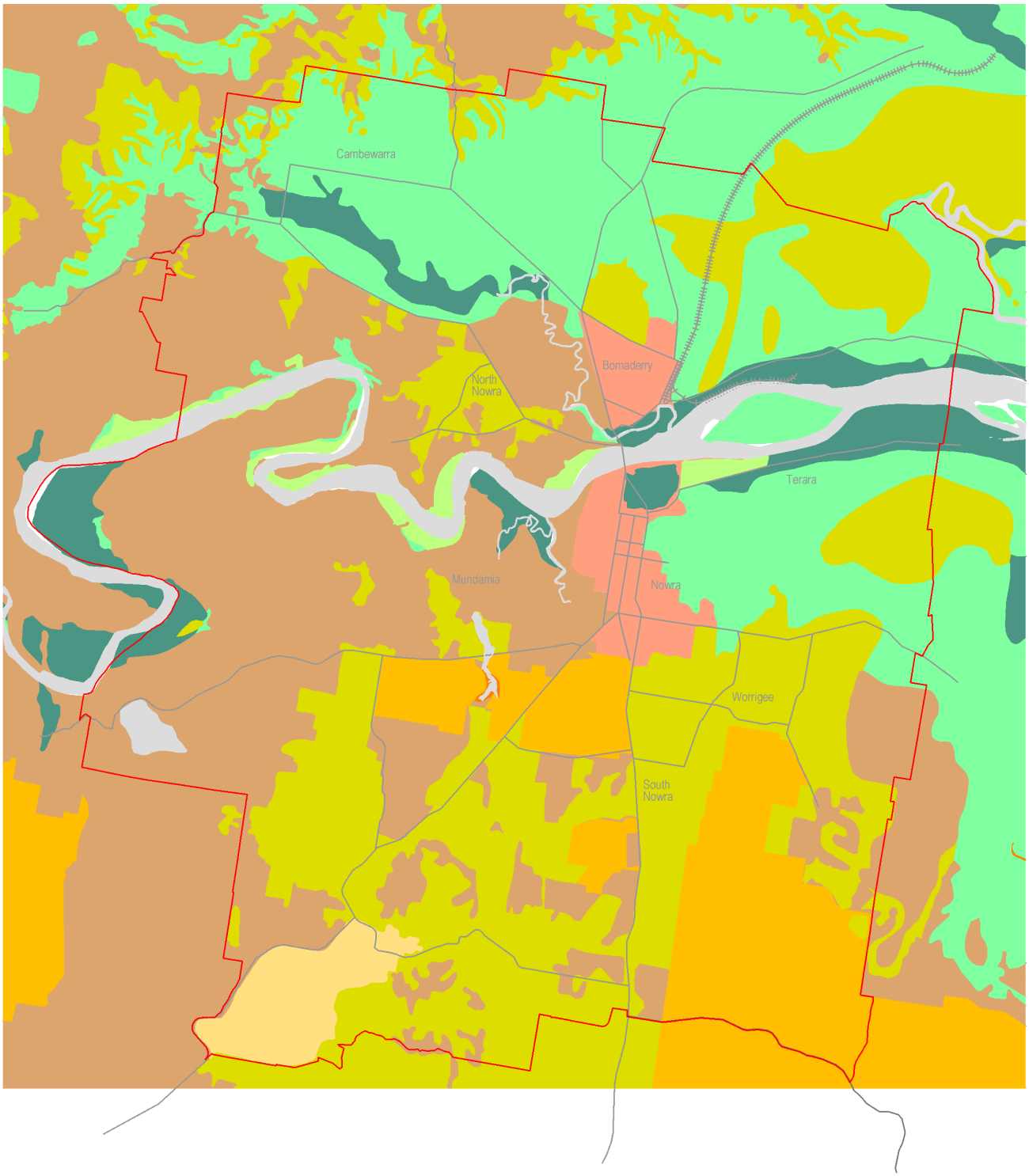
Note 1: The actual location of the 20 ANEF contour is difficult to define accurately, mainly because of variations in aircraft flight paths.
Note 2: Within the 20 ANEF to 25 ANEF, some people may find that the land is not compatible with residential or educational uses.
ANEF: Australian Noise Exposure Forecast

Source: AS 2021-2000

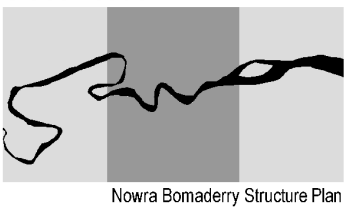
ANEF Measurement

The Noise Exposure forecast (NEF) system is a scientific measure of the aircraft noise levels around airports and airfields. It is the only endorsed measure that is used for land use planning and can also be used to give an indication of assessing average community response to aircraft noise.

The Australian Noise Exposure Forecast (ANEF) is a variation of the US NEF system, noise exposure levels are calculated in ANEF units, which take into account the following factors of aircraft noise:



Agricultural Land Classification



Nowra Bomaderry Structure Plan

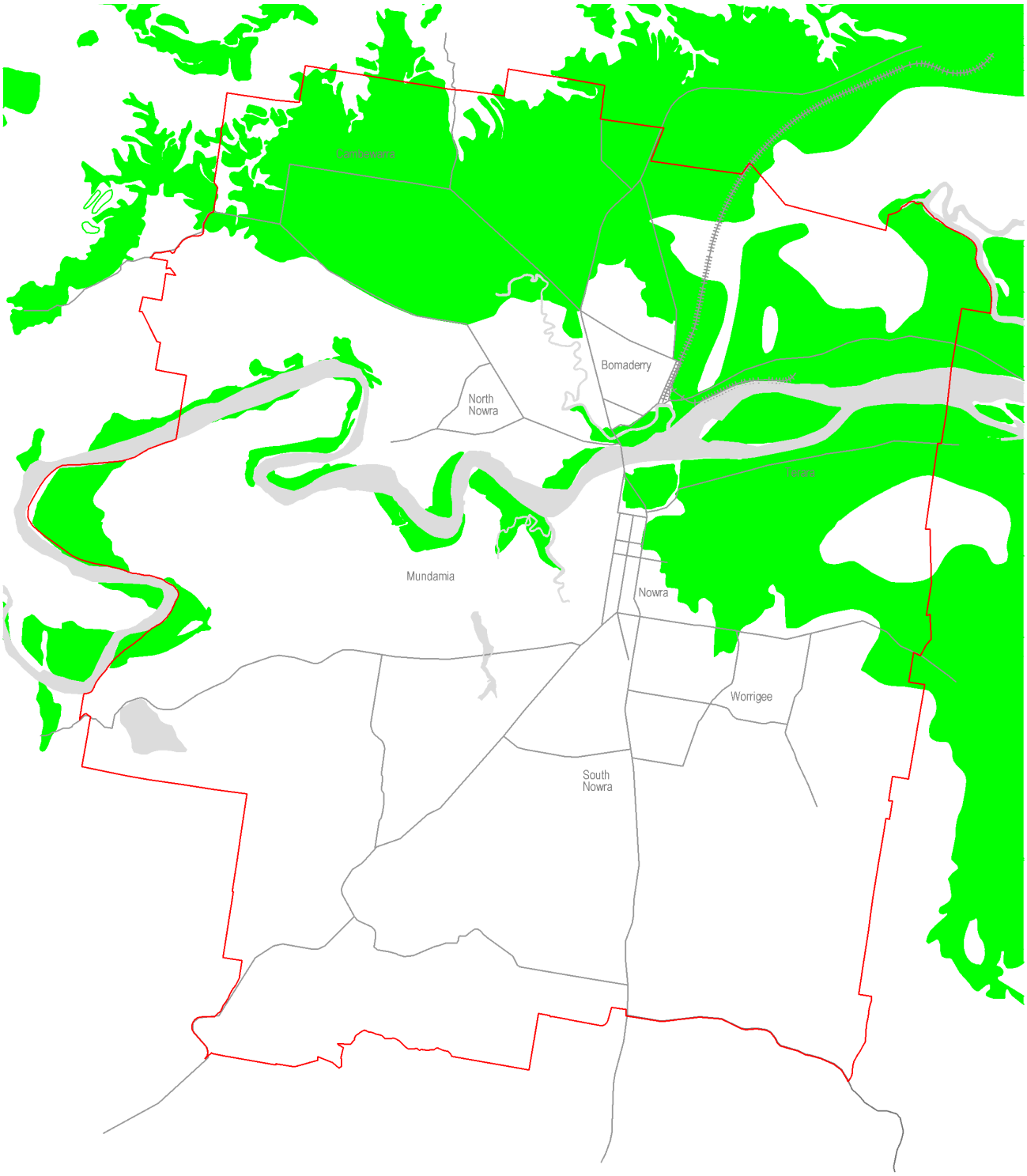
September 2005

0 1 2
Kilometres

Legend

- Structure Plan Boundary
- Land Classification 1
- Land Classification 2
- Land Classification 3
- Land Classification 4
- Land Classification 5
- Land Classification 7
- Land Classification 8
- Land Classification 9
- Land Classifcation 14

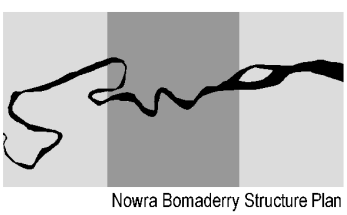
Map 8.7



Prime Crop & Pasture

Legend

- Structure Plan Boundary
- Prime Crop & Pasture Land



Nowra Bomaderry Structure Plan

September 2005

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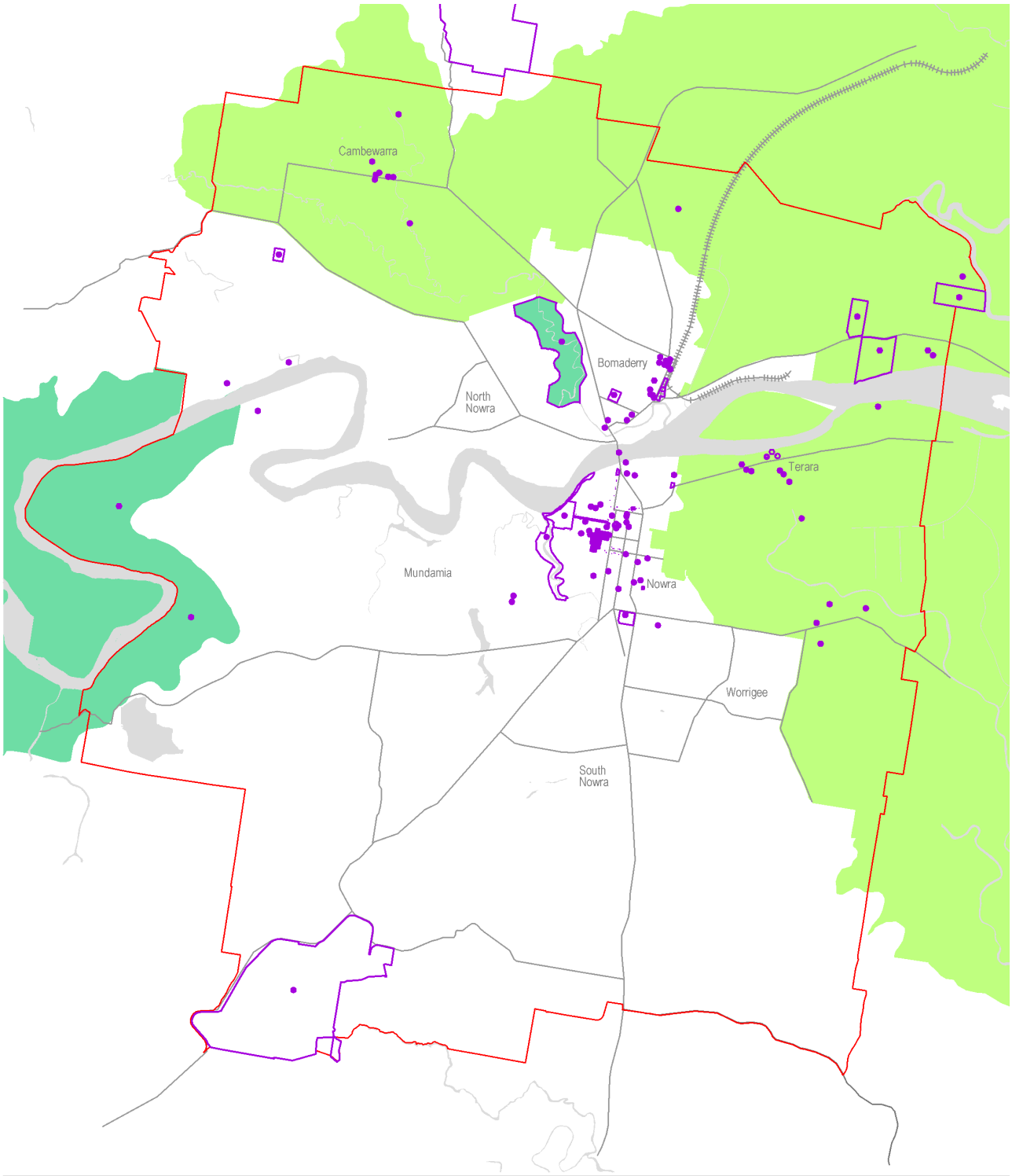
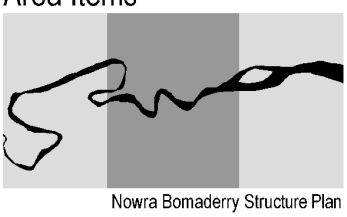
Kilometres

Map 8.8



Heritage Conservation Area Items



Nowra Bomaderry Structure Plan

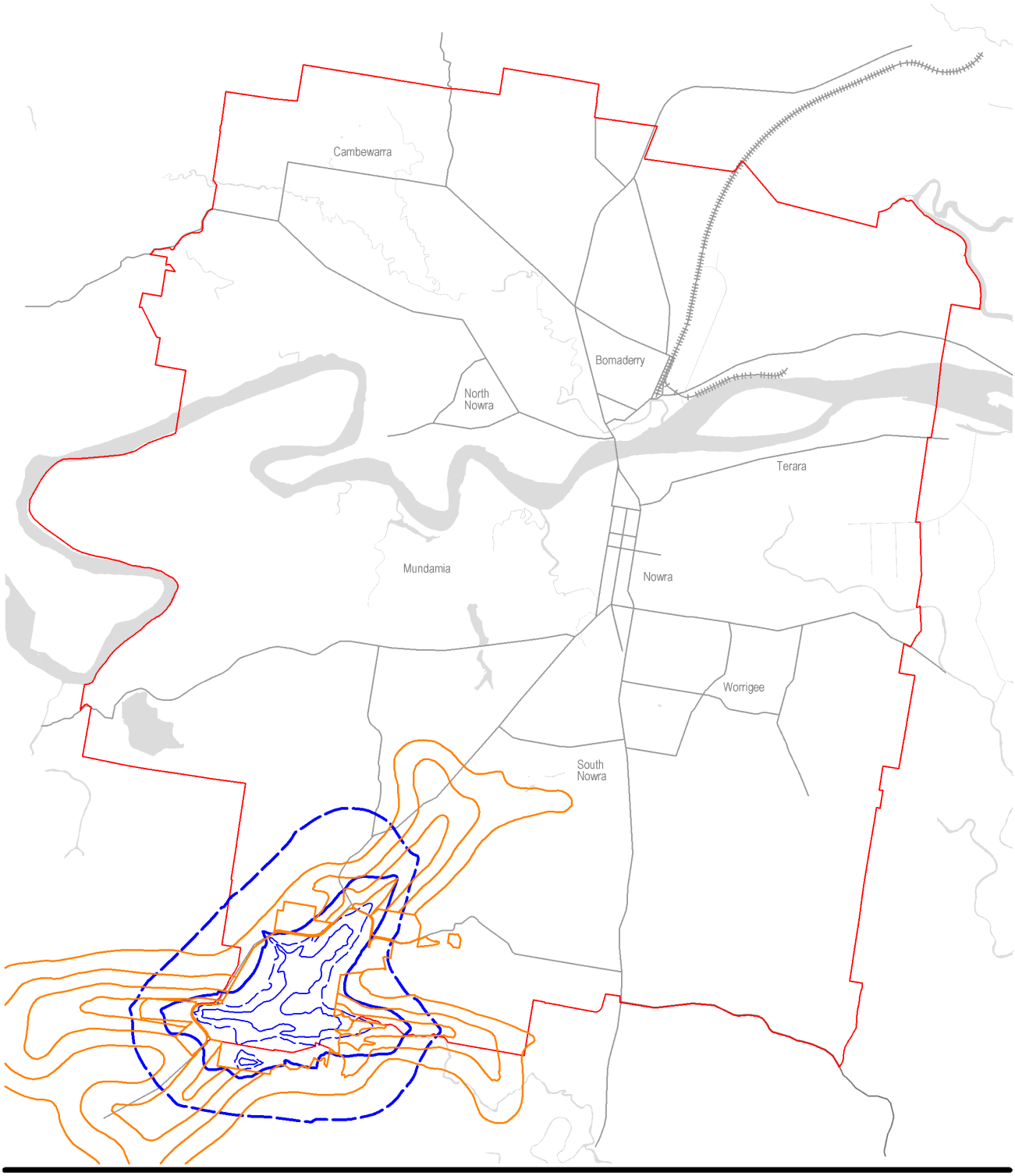
Legend

- Structure Plan Boundary
- Existing Pastoral Landscape
- Existing Natural Landscape
- Heritage Conservation Area
- Heritage Item

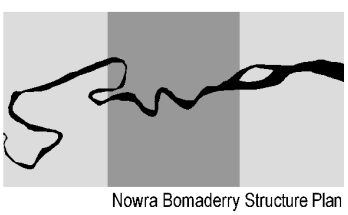
September 2005

0 1 2
Kilometres

Map 8.9



ANEF 2006 & 2014



Nowra Bomaderry Structure Plan

Legend

- Structure Plan Boundary
- 2014 ANEF contour 20
- 2014 ANEF contour 25
- 2014 ANEF contour 30
- 2014 ANEF contour 35

The 2014 ANEF contour plan of HMAS Albatross was supplied from:
HMAS ALBATROSS, NOWRA NSW 2014 ANEF SUMMARY REPORT September 2004 by Department of Defence

- 2006 ANEF contours

September 2005

0 1 2
Kilometres

Map 8.10

- Intensity, duration, tonal content and spectrum of audible frequencies of the noise of aircraft take offs, approaches to landing, flyover and reverse thrust after landing.
- Forecast frequency of aircraft types and movements on various flight path, including flight paths used for circuit training.
- Average daily distribution of aircraft arrivals and departures in both day-time and night-time (day-time defined as between 07:00am and 07:00pm and night-time defined as between 07:00pm and 07:00am).

8.5 SUMMARY OF CONSTRAINTS AND MANAGEMENT ISSUES

The foregoing analysis of constraints can be summarised under the physical, biodiversity, cultural and operational constraint categories, as follows:

Physical Constraints

- Need to assess the special challenges and risks due to slopes, terrain and soils in areas primarily associated with incised creek systems, erosion-prone soils, limited access and increased servicing costs.
- Need to minimise risks associated with the disturbance of acid sulphate soils.
- Need to avoid flood prone land associated with the lower Shoalhaven flood plain.
- Need to maintain stream flow and water quality in Nowra Bomaderry's riparian corridors.
- Need to evaluate bushfire risk associated with certain vegetation communities, aspect and terrain.

Biodiversity Constraints

- Need to conserve significant vegetation and fauna habitats.
- Need to protect remnant vegetation in extensively cleared areas.
- Need to protect rare vegetation communities (rainforest, mangrove, salt marsh and Grey Gum-Blackbutt forests).
- Need to protect remnant vegetation in extensively cleared areas, subjected to degrading landuses.

Cultural Constraints

- Need to acknowledge extant and approved Aboriginal land claims.
- Need to respect Aboriginal and European heritage sites and precincts.
- Need to protect pastoral landscapes for their agricultural and scenic attributes.

Operational Constraints

- Need to maintain the operational viability of HMAS Albatross.

Constraints in Context

Certain constraints need to be considered as more or less absolute, such as highly flood prone land and areas of severe bushfire risk. Other 'no-go' areas may include those with value-based constraints such as rare and threatened species habitats. However, with careful planning and management, other constraints are capable of being converted to opportunities. They can be managed to trial highly self-contained development and to implement best practice in areas such as water cycle management, energy efficient subdivision and housing design, electronic communications and reduced dependency on private transport. In the case of ANEF contours associated with HMAS Albatross, there may be opportunities to develop noise exposure tolerant activities such as light and general industry.

The identified constraints are summarised and potential management issues are identified in Tables 8.10 to 8.13. To assist analysis and decision making, these constraints can be further grouped under the overarching categories of functional and value-based constraints. The functional constraint grouping includes all the physical constraints, with the exception of bushfire, which correlates closely with the district's native vegetation and tends to be ubiquitous in its extent. The district wide mapping (Map 8.5) serves to indicate the general location of the potential bushfire threat. In terms of planning for new living areas, the issue can be more accurately addressed at the neighbourhood design stage. The value-based grouping includes biodiversity and cultural constraints.

Table 8.10: **Summary of Physical Constraints & Management Issues**

Constraint	Management Issues	
1: Landform	Areas with a high risk of erosion, sedimentation, mass movement and steep slopes are to be protected where practicable. Certain areas (eg. land >18° slope) are mapped and protected by the protected land provisions of the Native Vegetation Conservation Act (1998). Where areas of high erosion and sedimentation risk are targeted for development an engineering plan must be prepared by the developer addressing issues such as soil and water management during development. For areas subject to mass movement, limitation of development on the lands and engineering approaches to improve stability are to be used as forms of development control.	
2: Acid Sulphate Soils	Areas of high and low probability acid sulphate soil risk are to be tested before development can proceed. Acid sulphate soils pose significant environmental risks - both ecological to waterways, flora and fauna and economical to agricultural viability. Appropriate measures need to be taken before development can proceed on or near areas of acid sulphate soil risk.	
3: Flood Liability	**Lower Shoalhaven Flood Plain:** 100 Year ARI Event Risk Areas >	Bomaderry industrial area Nowra CBD eastward expansion Princess Highway river crossings Recreational facilities east of Nowra CBD Greenwell Point Road
	Browns & Nowra Creeks: 100 Year ARI Event Risk Areas >	South Nowra Part of Flinders Industrial Estate Inner West Nowra
4: Riparian Corridors Riparian corridors provide the ESD backbone to the Nowra Bomaderry structure plan, maintaining stream water quality and biodiversity connectivity.	**Category 1: Environmental Corridor** Functions as the key a key biodiversity link maintaining connectivity for the movement of aquatic and terrestrial species between significant ecological nodes: • Minimum CRZ width: 40m from top of bank + 10m buffer. • Locate utility services outside CRZ where possible. • Locate active recreation outside CRZ. • Treat stormwater runoff before discharge into CRZ and buffer	
	Category 2: Terrestrial & Aquatic Habitat Functions as a more localised riparian link providing terrestrial and aquatic habitat: • Minimum CRZ width: 20m from top of bank + 10m buffer • Locate utility services outside CRZ where possible • Locate active recreation outside CRZ • Treat stormwater runoff before discharge into CRZ and buffer	
	Category 3: Bank Stability & Water Quality Serves to limit accelerated soil erosion and enhance water quality locally: • Minimum CRZ width: 10m from top of bank (no buffer) • May locate utility services inside CRZ (merit consideration) • May locate active recreation inside CRZ (merit consideration) • Treat stormwater runoff before discharge into CRZ	
5: Bushfire Risk	New urban development to take account of 'Planning for Bushfire Protection Guidelines' and the 'Bushfire Environmental Assessment Code'. Need to consult Bushfire Prone Land Mapping for Nowra Bomaderry structure plan area (Map 8.5). Identification of asset protection zones (APZs) in all New Living Areas. In many cases riparian corridors and APZs may be located adjacent to each other.	

Table 8.11: **Summary of Biodiversity Constraints**

Constraint	Management Issues
Rare Plant Species & Threatened Species Habitat	Rocky gullies dominated by Grey Gum - Stringybark Woodland/Open Woodland (PUN-AGG) and Kunzea Shrubland (KUN-CAL), contain most of the rare plant species in the area. These communities must be protected and appropriately managed, because of their botanical importance. These areas are also important because they provide habitat for the endangered Yellow-bellied Glider Petaurus australis.
Remnant Vegetation in Extensively Cleared Areas	Most of the tall forests on the floodplains around Nowra, characterised by Blue Gum Eucalyptus saligna-E. botryoides, Forest Red Gum Eucalyptus tereticornis, Rough-barked Apple Angophora floribunda and Prickly-leaved Paperbark Melaleuca styphelioides, have been cleared. Stands of this forest and the associated River Oak Casuarina cunninghamiana should be protected. In the long term, this riparian vegetation should be restored along cleared sections of the main streams. Spotted Gum Eucalyptus maculata forests have been extensively cleared from the shale soils in the Nowra district; the conservation reserves in the region contain virtually none of this forest type. Substantial stands should be reserved in the Nowra area, preferably containing all 4 communities dominated by Spotted Gum.
Rare Rainforest Communities	All areas of rainforest in Nowra Bomaderry are important, since they are restricted to small sites and contain a significant proportion of the area's native flora. Most of the rainforest occurs along the Shoalhaven River, where cliff lines give protection from fire. Full protection should be given to these sites.
Rare Mangrove & Salt Marsh Communities	The small areas of mangrove and saltmarsh along the Shoalhaven River, for example at Depot Farm, are of botanical interest. These communities are uncommon in the Shoalhaven region and inland occurrences at Nowra are very uncommon. Full protection should be given to these sites; most of these are currently being impacted by grazing and other activities.
Rare Grey Gum - Blackbutt Forest Communities	The Grey Gum - Blackbutt forest (PUN-PIL) is quite extensive west of Nowra (Map 3.2), but it has not been recorded in such large stands elsewhere in the region. This community does not appear to be reserved in the region, so consideration should be given to reserving a large area. This community provides habitat for the threatened species, the Yellow-bellied Glider Petaurus australis and the Glossy Black-Cockatoo Calyptorhynchus lathami.
Remnant Vegetation in Cleared & Degrading Landuse Areas	East and West of Nowra, the original forests have been extensively cleared from the Shoalhaven River floodplain. In some locations, there are areas of freshwater swamp and saltmarsh vegetation surrounded by cleared land mainly used for grazing. These wetlands should be fenced to protect their botanical and wildlife habitat values since they are being severely affected by stock grazing. Landholders should be encouraged to erect protective fencing.

Table 8.12: **Summary of Cultural Constraints**

Constraint	Management Issues
Aboriginal Cultural Heritage	Unresolved Aboriginal land claims continue to restrict the potential for urban development. Resolved Aboriginal land claims offer potential for urban development either where granted or not granted, providing land is unaffected by other constraints. Potential significant Aboriginal cultural heritage sites will either restrict urban development or call for special management measures. Urban development to respect and where appropriate integrate items of Aboriginal cultural heritage value.
European Cultural Heritage	Urban development to respect and integrate items of European cultural heritage value. These characteristics to be enhanced by the continuing evolution of the cultural identity of the existing and future communities of Nowra Bomaderry.
Pastoral Landscape	Areas of high quality agricultural land need to be preserved for agricultural use. Land classed 1, 2 and 3 constitutes 'prime crop and pasture' land. All practicable measures must be implemented to avoid removing this land from sustainable, viable agricultural use. The visual integrity of the significant areas of scenic value need to be maintained.

Table 8.13: **Summary of Operational Constraints**

Constraint	Management Issues
Albatross ANEF Contours	Maintain the operational viability of HMAS Albatross as a significant driver of the Nowra economy. Adopt the precautionary principle in preventing urban development expanding in the vicinity of HMAS Albatross. There are opportunities to explore the potential to site noise exposure tolerant industrial and warehousing landuses within the designated ANEF contour zone.

9. DEVELOPMENT OPPORTUNITIES

The foregoing assessment of the dynamics for change in Chapter 2 and development constraints in Chapter 8 set the parameters for the future development of Nowra Bomaderry as a sustainable regional centre. These trends and constraints provide a mix of limitations and opportunities. Also, whilst the Nowra Bomaderry area is an established regional urban centre and has, as its primary focus urban-based activities, there is nonetheless a need to maintain an acceptable level of bio-diversity within that designated area.

9.1 GROWTH CONTEXT

Nowra Bomaderry has a number of positive attributes in terms of strengths and opportunities that have the potential to assist the sustainable growth of the district. However, it also has a number of negatives in the form of weaknesses and future threats that may retard development. These are summarised in Table 9.1.

Table 9.1: **Strengths Weaknesses Opportunities & Threats**

Strengths	***Opportunities***
• Attractive environmental setting • Shoalhaven's retail & tourism service hub • Export-oriented manufacturing sector • HMAS Albatross • Transport hub • Affordable development land • University/TAFE campus • Wide range of school facilities	• Sea change phenomenon • Small scale manufacturing • Expansion of aviation business park • Corporate hotel & convention centre • Expansion of education sector • Main Road 92 • Greater focus on the Shoalhaven River waterfront • Boutique agricultural enterprises
Weaknesses	***Threats***
• Declining 'base' employment • Increasing dependent population • Current shortage of residential land • Transport linkages to markets • Poor urban design quality	• Increased traffic on Princes Highway • Loss of major manufacturers • Defence commitment to HMAS Albatross • Future shortage of industrial land • Future water shortage

9.1.1 Strengths and Opportunities

Nowra Bomaderry's strengths are founded on its attractive landscape setting, astride the Shoalhaven River. It functions as the commercial and community service hub for a growing number of Shoalhaven residents and holiday visitors. Key economic anchors are HMAS Albatross, and the manufacturing sectors in Bomaderry and South Nowra. It offers a choice of affordable residential, commercial and industrial land and it now has a university/TAFE campus and a wide range of public and private school facilities. Key opportunities include: the expansion of the aviation business park, the construction of Main Road 92; the development of a corporate hotel-convention centre and a multi-cultural centre; and an enhanced interface between the town and the Shoalhaven River.

9.1.2 Weaknesses and Threats

Nowra Bomaderry's weaknesses include: a declining 'base' employment; increasing dependent population; a perceived shortage of residential land; extended transport linkages to markets; and a mediocre quality of urban design in the Nowra CBD. Potential threats include: increasing levels of traffic on Princess Highway and the issue of the river crossing; the future Commonwealth Government commitment to HMAS Albatross; potential future shortage of industrial land; and uncertainties regarding adequate future water supply.

9.2 URBAN GROWTH OPTIONS

The challenge is to provide for the growth of Shoalhaven's population from 87,650 in 2001 to 141,990 in 2036, an increase of 54,340 or 62%. In line with this projection, the Nowra Bomaderry area is anticipated to grow from 30,168 in 2001 to 53,709 in 2036, an expansion of 23,540 or 78%. This will represent a paradigm shift in the scale and nature of Nowra Bomaderry as a regional centre. It would put it on par with other NSW regional centres such as Maitland and Tweed Heads. With a population in excess of 50,000 within a 30 years period, Nowra Bomaderry will be in the position to support a higher threshold of facilities and services.

To accommodate this level of demand for urban growth, consideration has been given to the following set of growth options:

- No growth.
- A new urban centre.
- Urban expansion.
- Urban consolidation.

9.2.1 No Growth Scenario

Nowra Bomaderry has evolved to be the service and production centre of the Shoalhaven. It is also the area where most employment has been created. Council has continuously attempted to channel employment growth to the other major settlements in the Shoalhaven. Experience has demonstrated the difficulty of this strategy. The arbitrary limitation of Nowra Bomaderry's growth, even if it could be achieved, would have a major effect on employment creation and it highly likely that existing employment levels would decline. This course of action would have major social implications, such as the continued outflow of young people and reduced housing affordability.

9.2.2 New Urban Centre

The option of starting a new town is problematic and is accompanied by a number of issues. This option greatly increases infrastructure and has start-up costs which even State governments would be reluctant to meet. It is almost impossible to have a range of services which would make a new town viable as an integrated urban area. For many years the new area would be a dormitory area with increased travel costs for employment and services.

The expansion of one of the Shoalhaven's existing urban areas other than Nowra Bomaderry would significantly impact on the integrity of its existing values as a small to mid-size settlement. In addition, integrating major new residential areas and substantially increased urban infrastructure and services would be problematic. Normally, this scale of expansion is most easily absorbed by larger urban areas.

In overview, it should be noted that, the significant development of any of the towns and villages of the Shoalhaven would also encounter a range of environmental issues, at least on par with that currently evident in Nowra Bomaderry.

9.2.3 Expansion or Consolidation

To cater for the anticipated level of demand for urban infrastructure, the remaining options are urban expansion or urban consolidation. However, before the pros and cons of these options are discussed, it is important to articulate the goals and objectives that would under-pin the future development of Nowra Bomaderry as an urban system. These are identified and developed in the following section.

9.3 STRUCTURE PLANNING PRINCIPLES

9.3.1 Planning Goals and Principles

Three prime goals have been identified as the basis for the development-conservation of the Nowra Bomaderry structure plan footprint. These are:

- Sustainable living.
- Economic vitality.
- Community wellbeing.

The process of achieving milestones towards these goals will create a 'place' that is viable authentic, sustainable, and above all, liveable.

9.3.2 Sustainable Living

The concept of sustainable development embraces development which performs a delicate balancing of economic, environmental and social objectives. However, a key feature of sustainability approaches is the shift away from standard trend projection and conflict-driven conservation to a more pro-active planning philosophy which harnesses resources for long-term benefits. The concept also needs to be viewed in a holistic sense embracing the complete urban-rural continuum as outlined in Table 9.2. The term sustainability has many definitions. A succinct and appropriate definition in this context expresses it in these terms:

'….sustainability is about how we meet the needs of people today without compromising the ability of future generations to meet their needs. It is an approach to decision making that recognises that social, economic and environmental issues are interconnected and decisions must incorporate each of these aspects if they are to be good decisions in the longer term.' (ACT PALM 2002).

There appears to be a growing appreciation and acceptance of the ways in which cities and towns can become more sustainable. Urban growth and continuing car dependency lead to rising levels of traffic congestion, air and noise pollution and consumption of fossil fuels and greenhouse gas emissions. Transport, accessibility, density and urban form are key factors which influence the sustainability of an urban area. Metropolitan development policies (Table 9.3), as advocated by AMCORD, espouse the need to provide more transit supportive and sustainable urban form where there is an ability to maximise 'exchange' (connectivity of home, workplace, recreation and social activities) whilst minimising the necessary travel.

This has developed as a fundamental need in metropolitan areas and major regional centres such as Wollongong, where extended daily travel patterns are the norm. However, in smaller regional centres such as Nowra Bomaderry there has not, until now, been the necessity to adopt this paradigm shift in urban development philosophy. With the anticipated crossing of the urban size threshold, coupled with significant changes in society, the workplace as well as the climatic environment, there is a need to begin to consider different models of urban development. Five planning principles have been identified to guide the development of Nowra Bomaderry towards a 'sustainable living' goal.

(1) Facilitate the delivery of environmental benefits

The pattern of urban development will be designed with nature (McHarg 1969). It will acknowledge land capacity constraints resulting from the topography, solis, geotechnical factors, drainage, natural hazards, micro-climate as well as vegetation and fauna habitats. Living and employment areas will be designed to minimise the use of non-renewable resources. Their design will support an integrated and flexible pedestrian, cycling and public transport system. They will generally be walkable, compact and densities will support, as far as possible an accessible and frequent energy efficient public transport system. Living areas will be designed to minimise the consumption of water and encourage the use of technologies which re-use and recycle within the home and neighbourhood. In addition, the use of passive and active solar systems and energy efficient building design will be encouraged.

(2) Respond to local features

To a large extent, effective and sustainable planning design is founded on respecting and accentuating local characteristics. The shape and structure of the new living areas will have a variety of characters derived to a large extent from the natural and cultural features of the location.

(3) Respect the past and present when creating the future

Places become memorable and valuable when they embody qualities that are associated with present and past events that have meaning to the community. The development of the new living areas will seek to respect and integrate items of Aboriginal and European cultural heritage value. These characteristics would, in turn, be enhanced by the continuing evolution of the cultural identity of the existing and future Nowra Bomaderry community.

(4) Engender continuing adaptation and change

Places that are considered to be attractive and are imbued with character have generally evolved slowly over time (Alexander et al 1977). Thus the Nowra Bomaderry structure plan needs to be flexible in order to accommodate change in the future. Nevertheless it must also be robust. Fixed and flexible elements will need to be clearly defined. It is the intent of this structure plan that Nowra Bomaderry be diverse in character with mixed and multiple use areas to be encouraged at all levels of the urban structure.

(5) Facilitate the achievement of high quality design

Living areas will display a high quality of urban design and will provide an urban structure that is simple, legible and flexible. Suburban layouts will be permeable and identifiable and have a high degree of connectivity. Public spaces such as streets, centres, squares and parks shall be of high quality to provide a strong underlying structure to urban areas. A series of connected residential areas will be provided around a series of landscaped areas, schools, community facilities and mixed use retail centres.

Table 9.2: **Multiple Goals of Sustainability as Applied to Human Settlements**

Meeting the needs of the present: ....
• ***Economic needs:*** includes access to an adequate livelihood or productive assets; also economic security when unemployed, ill, disabled or otherwise unable to secure a livelihood.
• ***Social, cultural, environmental & health needs:*** includes shelter which is healthy, safe, affordable and secure within a neighbourhood with provision for piped water, sanitation, drainage, transport, health care, education and child development. Also a home, workplace and living environment protected form natural hazards, including chemical pollution. Also important are needs related to people's choice and control – including homes and neighbourhoods which they value and where their social and cultural priorities are met. Shelters and services must meet the specific needs of children and of adults responsible for child-rearing (usually women).
• ***Political needs:*** includes freedom to participate in national and local politics and in decisions regarding management and development of one's home and neighbourhood, within a broad framework which ensures respect for civil and political rights and the implementation of environmental legislation.
.....without compromising the ability of future generations to meet their own needs:
• ***Minimising use or waste of renewable resources:*** includes minimising the consumption of fossil fuels in housing, commerce, industry and transport plus substituting renewable sources where feasible. Also, minimising waste of scarce mineral resources (reduce use, reuse, recycle, reclaim). There are also cultural, historical and natural assets within cities that are irreplaceable and thus not-renewable, for instance, historic precincts, parks and natural landscapes which provide space for play, recreation and access to nature.
• ***Sustainable use of finite renewable resources:*** cities drawing on freshwater resources at levels which can be susutained (with recycling and reuse). Keeping to sustainable ecological footprint in terms of land area on which city-based producers and consumers draw for agricultural and forest products and biomass fuels.
• ***Biodegradable wastes not overtaxing capacities of renewable sinks:*** for instance, the capacity of a river to break down biodegradable wastes without ecological degradation.
• ***Non-biodegradable wastes/emissions not overtaxing (finite) capacity of local and global sinks***: to absorb or dilute them without adverse effects, for instance, persistent pesticides, greenhouse gases and stratospheric ozone –depleting chemicals.

Source: Developed from Satterthwaite 1997

Table 9.3: **New Urbanism Policies**

Specific policies advocated are:
• Creation of more compact cities and towns with higher density nodes (urban villages) along transit corridors
• Arranging cities in a linear or radial pattern developed along transit corridors
• Designing the urban fabric to support transit and facilitate personal choice to use transit
• Facilitating mixed use development within higher density nodes to enable people to live and work at these nodes
• Increasing cycling for transport and recreation to enhance community wellbeing (The National Bicycle Strategy)
Such policies seek to produce a built environment which:
• Is diverse in use and population
• Is scaled to the pedestrian
• Is capable of accommodating the car and transit
• Has a well defined public realm which is responsive to site features and ecology
• Has an architecture reflecting the climate and culture of the region
• Has fine grained and mixed use town, neighbourhood and local centres
• Has higher residential and employment densities than conventional suburban development
• Has a higher interconnected street system for traffic efficiency with traffic management to protect safety and amenity of residential and town centre areas

Source: Developed from AMCORD (Practice Note PND 3) Commonwealth Department of Housing & Regional Development 1995.

9.3.3 Economic Vitality

A key aim of the structure plan is to facilitate the diversification and expansion of Nowra Bomaderry's economy by building on the town's expanding human resources, skills base and high quality environmental context; whilst strengthening regional linkages, providing efficient support networks, fostering innovation and rewarding enterprise. Three planning principles have been identified to guide the development towards the goal of 'economic vitality'.

(1) Plan for the 'post industrial economy'

Traditionally cities and towns have been based on patterns of long distance commuting to relatively high paid full-time male jobs. This is no longer the pattern of employment growth. Generally the main areas of employment growth are taking place in the service sector, especially in female and part-time employment. These changes in employment, work and society appear to be sustainable long term trends. Potentially these changes are a symptom of a change to a 'post-industrial society'. In combination these socio-economic forces are likely to have a fundamental impact on Australian cities and regional centres like Nowra Bomaderry. The growth in part-time, lower paid and service sector jobs means the typical spatially separated land uses are no longer economically or socially sustainable. There is a growing need to provide jobs close to the residential workforce.

This is becoming increasingly possible, given the growing importance of service sector employment and the fact that approximately 75% of jobs are suitable for locating in residential areas (Kemp 1995). The past segregation of land uses that characterised urban planning for the 'industrial economy' is no longer so relevant in the 'post industrial economy' with the predominance of employment and new businesses in the service sector. The growth in part-time employment has been accompanied by a growth in multiple employment. The increase in part-time and 'out of hours' employment, tends to place greater emphasis on finding a job close to home.

This is the economic cornerstone of 'mixed use development', which is based on strong connectivity between home, workplace, recreation and social activities. A feasible development model for Nowra Bomaderry would be the development of local enterprise hubs associated with neighbourhood commercial and community facility centres which have a nexus with higher density residential development.

(2) Provide for the traditional 'industrial economy'

One component of the traditional 'industrial economy' has seen a significant growth-mutation in recent years. This is the industrial-logistic-bulky goods sector, which is developing as a major growth segment in the Nowra Bomaderry economy. Since this sector is highly reliant on heavy freight transport, by necessity it needs to be close to major transport links (road/rail/air) and to a certain extent separated from residential areas. In this sector the primary synergy is inter-enterprise linkages rather than home to enterprise linkages.

(3) Development in a cost effective manner

The development of Nowra Bomaderry will be undertaken in an economically efficient and sustainable manner. The development of new living areas will be phased in order to capitalise on the pattern and form of existing urban fabric to avoid crossing infrastructure cost thresholds prematurely. It will take account of the significant travel impediment of the Shoalhaven River crossing by localising, as far as possible, the connectivity between home and workplace. The regeneration of existing living areas will build on the significant capital investment in existing community and physical infrastructure and seek to minimise any negative economic externalities.

9.3.4 Community Wellbeing

Provide living areas in Nowra Bomaderry, which maximise lifestyle quality and choice by engendering a healthy, caring and harmonious society where both individual and collective rights are respected and there is fair and reasonable access to facilities and services. Three planning principles have been identified to guide the development towards a 'community wellbeing' goal.

(1) Endeavour to distribute benefits widely to the population

The planning of the new living areas will ensure that residential precincts, facilities and services are safe, accessible and well connected to Nowra Bomaderry's existing living areas. It will adopt community safety principles by designing residential area, public places, movement systems, community facilities and centres in a way that provides opportunities for passive surveillance and that engenders a sense of community ownership. Facilities and services will be provided in locations that maximise accessibility for all users. Their location will maintain and if possible increase the independence of residents with special needs and will preserve their dignity. Residential areas will be designed to provide for appropriate housing to suit a range of needs and income capacities.

(2) Respond to community needs

The provision of community facilities will reflect the diverse needs of the residents as well as lifestyle choices. Public spaces will be provided to cater for a broad range of formal and informal uses. A wide range of housing types will be provided to meet the changing needs of residents at different stages of their lifecycle and according to different requirements.

(3) Engage the interests of the community

The ongoing planning of the Nowra Bomaderry will be undertaken in collaboration with the community. By working consultatively with communities and developing the existing and new living areas sensitively, Council can provide the residents of Nowra Bomaderry with the opportunity to shape their own environments. Residents will have the opportunity to provide input into the planning and management of facilities and services.

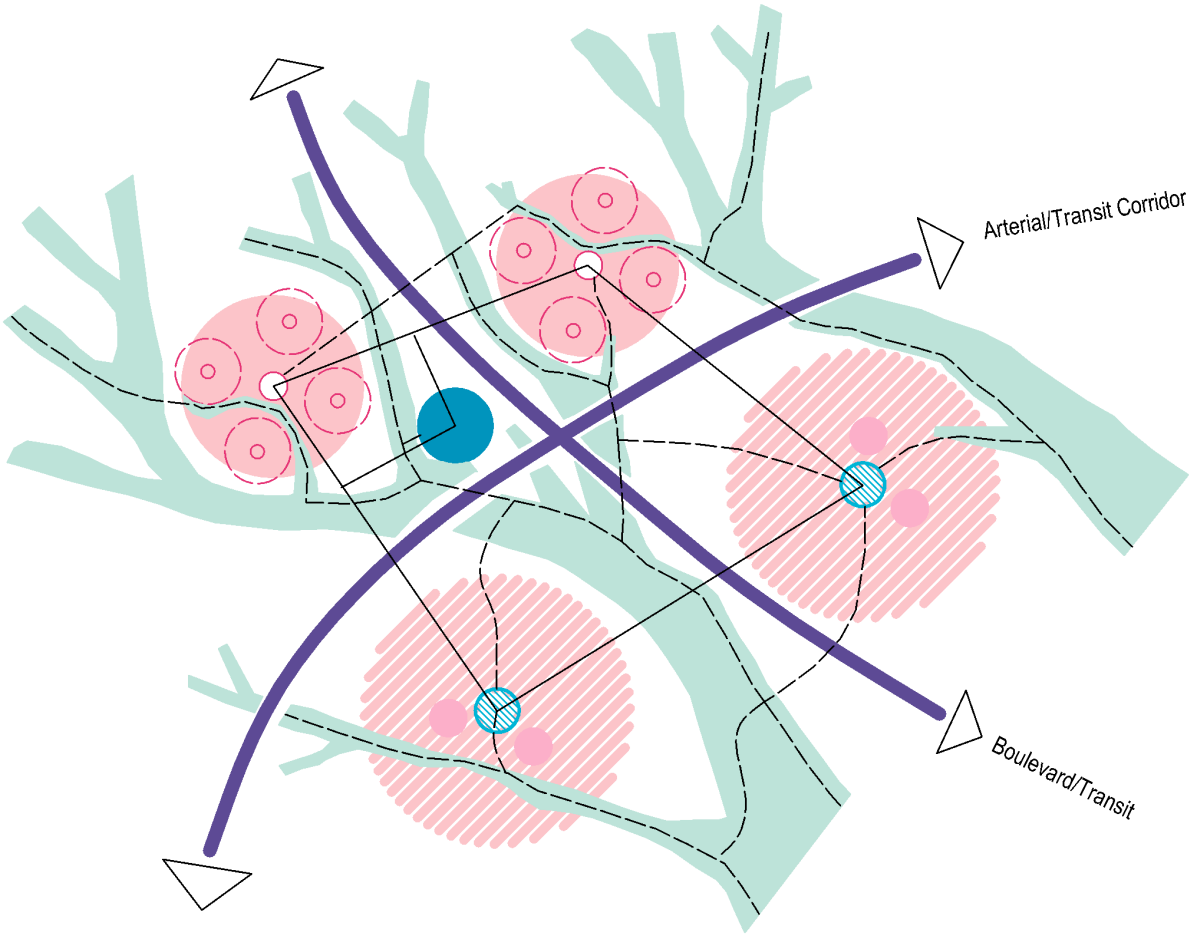
These structure planning principles are graphically depicted in Figures 9.1 and 9.2.

9.3.5 Urban Structure Principles

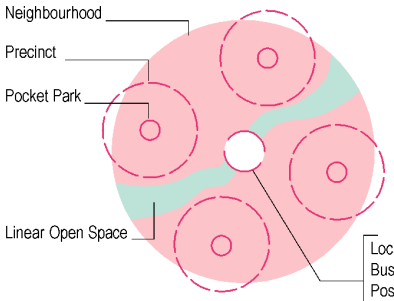
The development of the proposed new living areas is founded on a model hierarchical structure, which incorporates a blend of spatial and social elements. This can be envisaged as building blocks of increasing size and complexity, as follows:

Street: a public spatial unit which connects each dwelling to the rest of the town.

Precinct: an urban spatial unit focused on a pocket park with a notional walking distance of 200m.



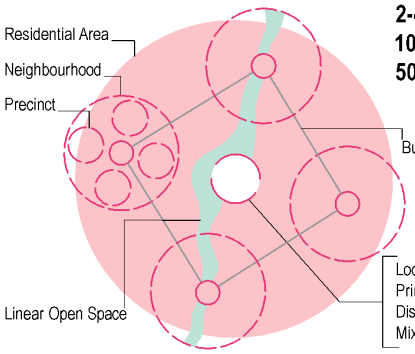
New Living Areas
Model Community Structure



Neighbourhood & Precincts

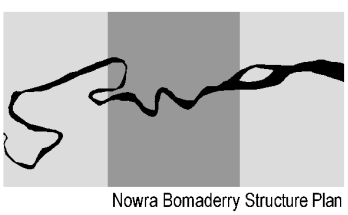
Precinct
12-15 hectares
120-150 dwellings
Pocket Park (0.25ha)
within 200m of dwellings

Neighbourhood
50-60 hectares
500-600 dwellings



Suburb
2-4 neighbourhoods
100-200 hectares
500-600 dwellings

Urban Structure Principles



Nowra Bomaderry Structure Plan

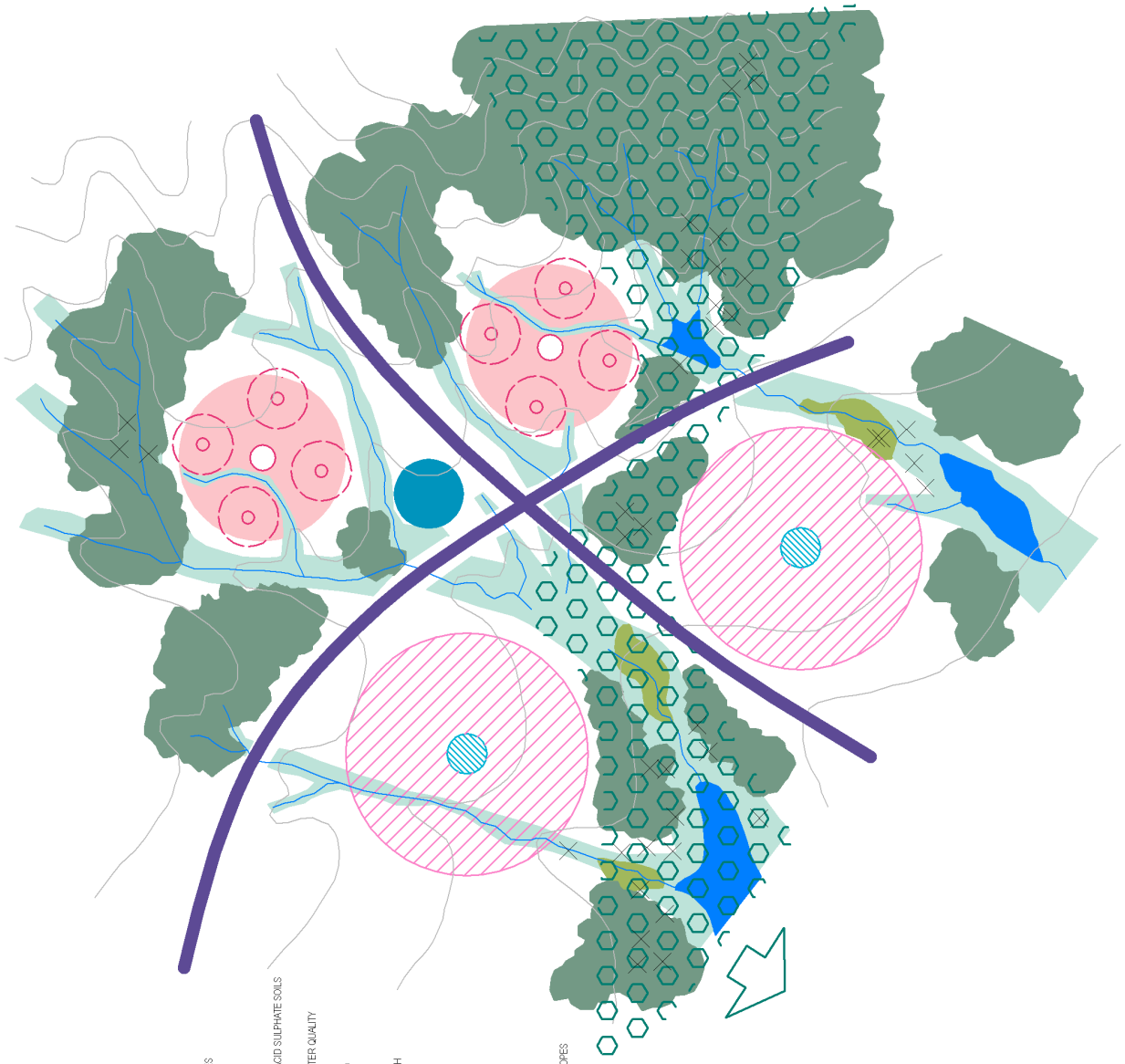
Legend

- Existing Suburb
- Existing Neighbourhood Centre
- Urban Consolidation Area
- New Suburb
- Neighbourhood
- New Neighbourhood Centre, High School,Neighbourhood Playing Fields
- Riparian Corridor
- Cycleway/Footpaths

September 2005

Not To Scale

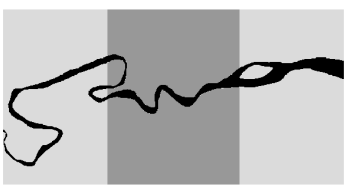
Figure 9.1



TYPICAL RIPARIAN CORRIDOR SECTION

Note:
Riparian Corridor Category 1 width:-
Core Riparian Zone 40m from top of bank
Riparian Zone Buffer 10m

Nature Conservation Principles



Nowra Bomaderry Structure Plan

Legend

- Contours
- Creeks
- Wetlands
- Woodland
- Acid Sulphate Soils
- Wildlife Habitat Corridor
- Threatened Species
- Riparian Corridor

September 2005

Not To Scale

Figure 9.2

Neighbourhood: a higher order urban spatial unit focused on a local park, bus stop, community facility and possibly a 'corner store'. This is based on a notional walking radius of 400m.

Suburb: focussed on a local centre and situated at the intersection of a boulevard and/or collector. This may have a primary school a district park and mixed use and medium density residential development associated with the centre.

This model community structure and its contextual relationship with the riparian corridor network and existing suburbs is illustrated in Figure 9.1. This model is by necessity modified to take account of constraining factors and opportunities evident in each locality.

9.4 URBAN EXPANSION POTENTIAL

Over a period of some 10 years the urban expansion potential of Nowra Bomaderry has been monitored, reviewed and evaluated. As a consequence, a detailed investigation of a number of candidate urban expansion areas has been undertaken as part of the structure planning process. As a consequence of Nowra Bomaderry's physical setting: straddling the Shoalhaven River; at the western edge of the coastal plain: and set amidst a natural and pastoral landscape that has significant inherent biodiversity and scenic values, the scope for urban expansion is highly constrained.

9.4.1 Development Options

A number of development options were assessed according to four key variables:

- Extent of developable land and the conservation of woodland and pastoral landscapes;
- Shoalhaven river crossing.
- Road network: connectivity between new and existing living areas.
- Distribution of schools and other community facilities.

Assessment of Options

In broad terms, the determination of viable and sustainable potential new living areas, has been a process of identifying locations that minimise ecological and cultural footprint impacts, within the economic reach of urban infrastructure, within a reasonable travel distance for work, social and recreational purposes. More specifically, a detailed appraisal of the options was undertaken and their performance evaluated against the following set of criteria:

- Conservation of sites of natural and cultural heritage significance.
- Maintenance of water quality and biodiversity via the riparian corridor network.
- Protection of pastoral landscapes and areas of high scenic value.
- Avoidance of land with significant physical constraints.
- Transport connectivity with the existing Nowra Bomaderry transport network.
- Ability to maximise exchange and to minimise necessary travel.
- Accessibility to Nowra CBD, other commercial centres, schools and other community facilities.
- Compatibility of the road network with topographical constraints.
- Efficiency of infrastructure provision and ability to accommodate alternative development sequences.

9.4.2 Response to Constraints

This has been followed by a process of trading off a range of physical, biodiversity, cultural and operational constraints. Going beyond basic physical and operational issues, it has in large part been a process of trading-off potential impacts on biodiversity values predominantly to the south of the existing urban area with impacts on agricultural and pastoral landscapes principally to the north.

This process has highlighted a dilemma increasingly faced by planners and urban designers. This is the developing imbalance between 'push' and 'pull' factors in the decision-making process. The constraints in relation to the water environment, wildlife habitats and landscape protection are backed by influential state and national agencies, whose positions have been significantly bolstered by the new sustainability agenda. On the other hand, there are few equivalent lobbies for sustainable development potential. Issues such as ease of access to facilities, jobs, transport, pedestrian and cycling networks are easily sidelined (Guise et al. 1994). This also applies to issues such as the economies of scale in the provision of urban infrastructure and energy efficiency. The imbalance is even more pronounced when considering the socio-cultural benefits derived from the overall form of an urban system with qualities such as a coherent urban assembly, image and legibility.

There is a need for trade-offs or 'transferable constraints' as part of the development process where natural resources, such as a particular habitat could be effectively relocated in the form of off-sets. The objective of responsible urban planning is to 'engineer' a changed environment that maintains a diversity of native flora and fauna and that contributes to the satisfaction of urban requirements for both energy efficiency and a good quality of life for inhabitants.

9.4.3 Potential New Living Areas

Initially nine candidate areas were identified and evaluated for their potential as new living areas. Following a preliminary evaluation this number was reduced to seven. The potential residential yields of these seven potential new living areas is summarised in Table 9.4. Their locations are shown in Map 9.1 and a summary of new living area settlement factors is illustrated in Maps 9.2 and 9.3. A significant feature of the majority of these areas is a significant component of medium density housing.

Table 9.4: **New Living Areas: Potential Residential Capacities**

Potential New Living Area	Area ha	Density Dwelling/ha	Dwellings
Area 1: Moss Vale Road North	108.0	12/ha & 15/ha	1360
Area 2: Moss Vale road South	99.3	12/ha & 15/ha	1250
Area 3: Bangalee Road West	16.3	12/ha	200
Area 4: Crams Road	89.9	12/ha & 15/ha	1140
Area 5: Mundamia	53.0	12/ha & 15/ha	720
Area 6: Cabbage Tree Lane	182.4	12/ha & 15/ha	2480
Area 7: Worrigee	32.6	12/ha	390
Total Areas	**581.5**		**7540**

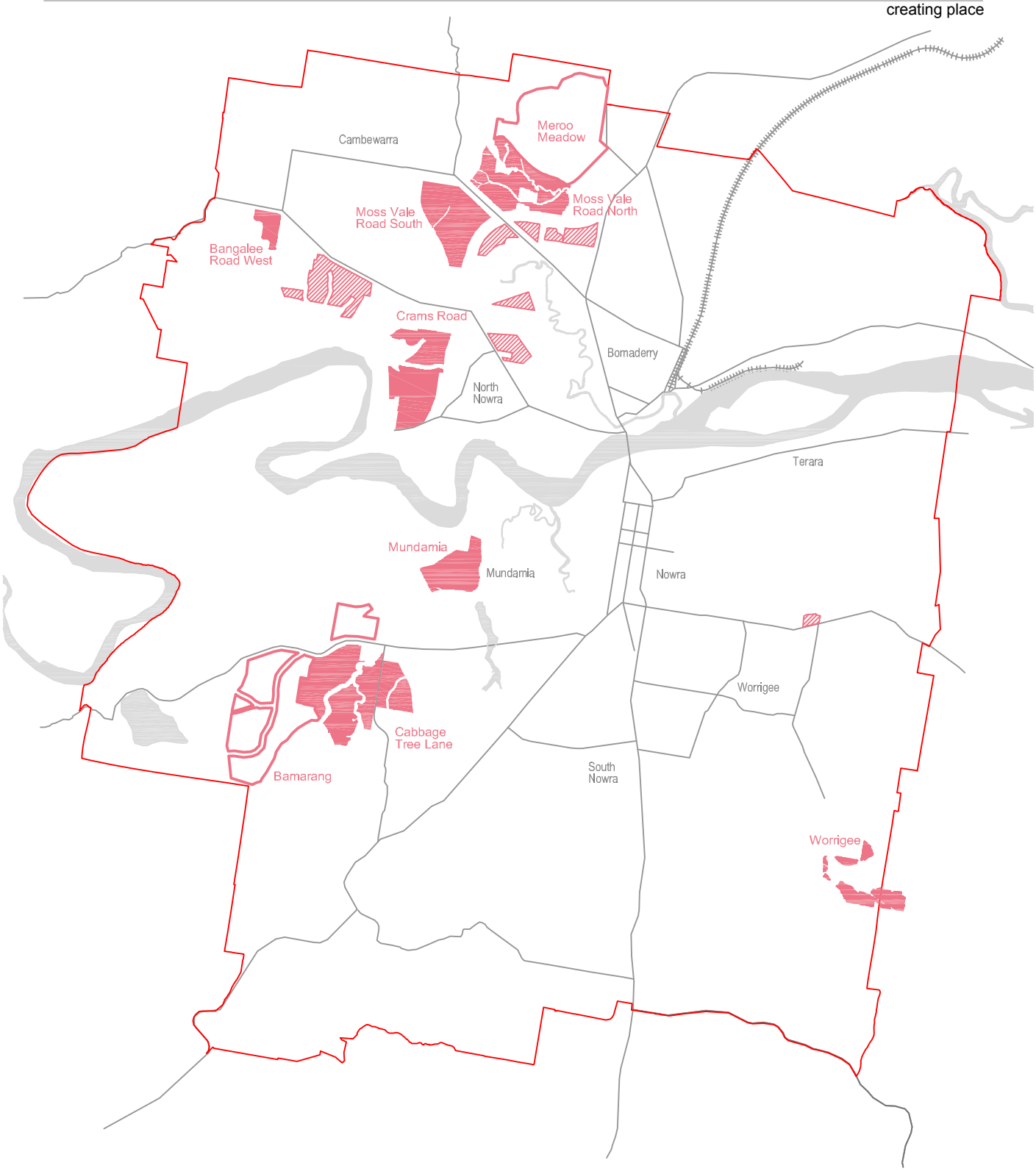
In addition to these areas there is potential for further urban expansion beyond two of the identified new living areas. The potential residential yield of these areas is provided in Table 9.5

Table 9.5: **New Living Areas: Potential Residential Capacities**

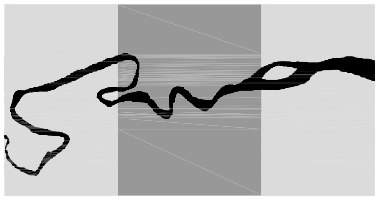
Potential New Living Area	Area ha	Density Dwelling/ha	Dwellings
Area 1a Meroo Meadow	185.0	12/ha	2220
Area 6a Bamarang	186.0	12/ha	2230
Total Areas	**271.0**		**4450**

9.5 URBAN CONSOLIDATION POTENTIAL

The implementation of urban consolidation is generally considered to be a laudable objective, but one that has a number of associated issues. Feasibility studies have indicated that in Nowra Bomaderry it is not currently economically viable to demolish existing dwellings to replace them with medium density housing in most areas. While there has been a small increase in medium density housing, the market still generally resists medium density housing and smaller lot sizes. However, as demonstrated in Chapter 4, there has in recent years been a marked shift in household formation where various forms of medium density would be more appropriate.



New Living Areas



Nowra Bomaderry Structure Plan

Legend

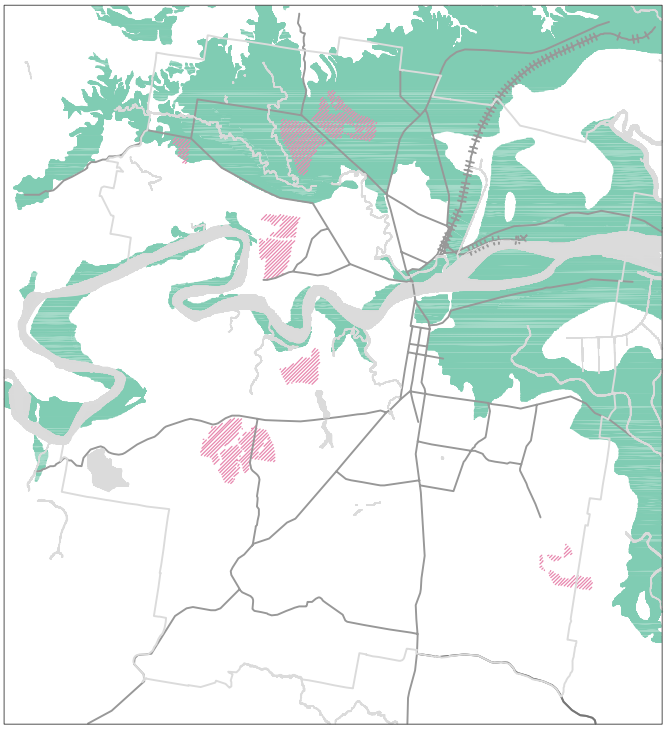
- Structure Plan Boundary
- Future Living Areas
- Future Long Term Living Areas
- Potential Additional Living Areas

October 2006

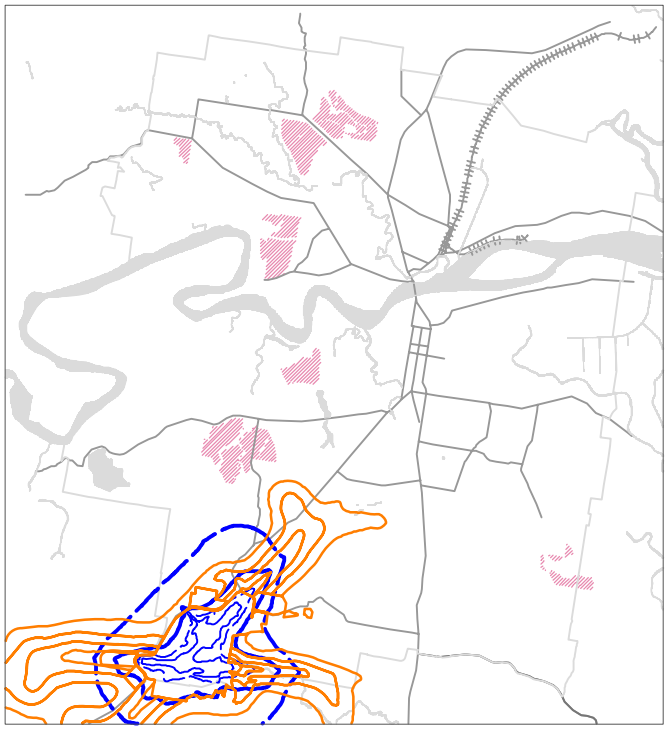
0 1 2

Kilometres

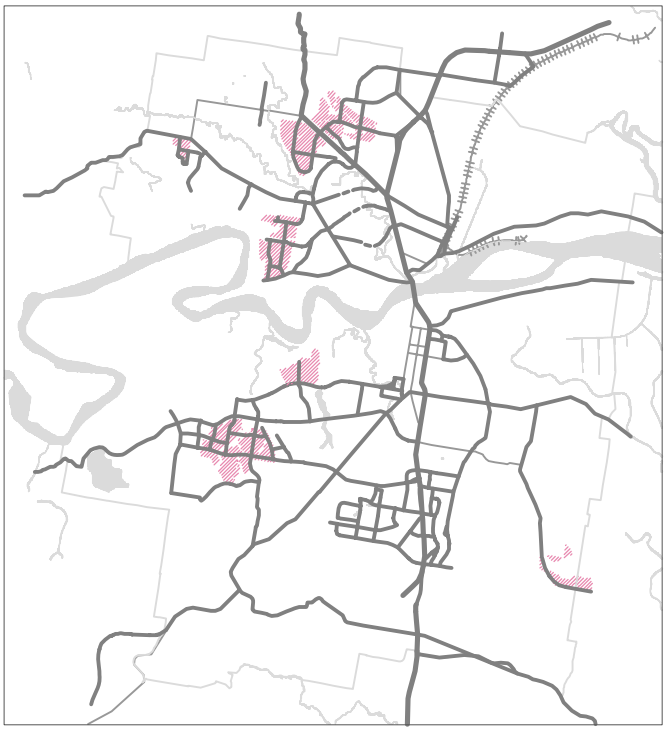
Map 9.1



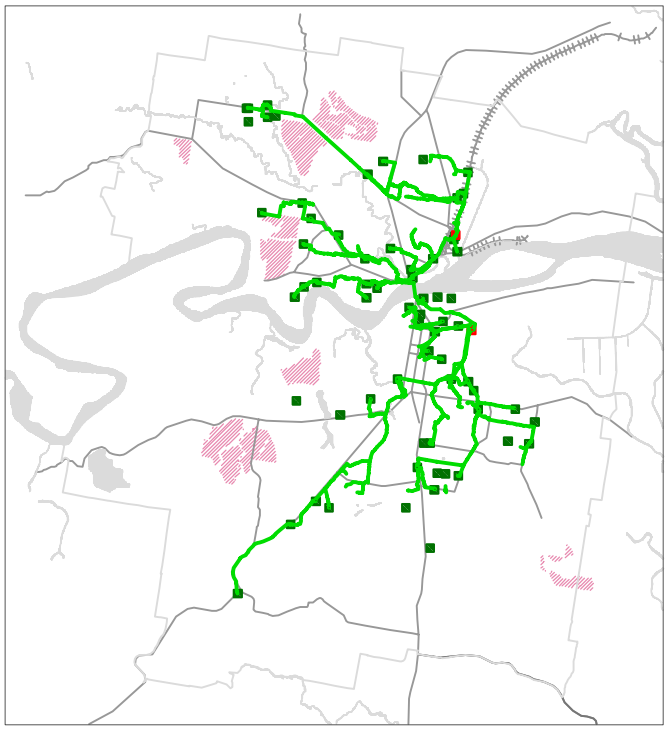
New Living Areas &
Prime Crop & Pasture Land



New Living Areas &
HMAS Albatross Flight Path

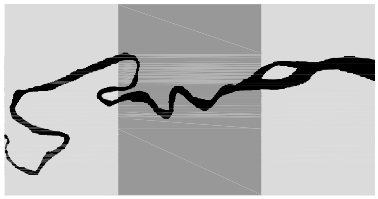


New Living Areas &
Road Network



New Living Areas &
Waste Water Network

New Living Areas: Settlement Factors

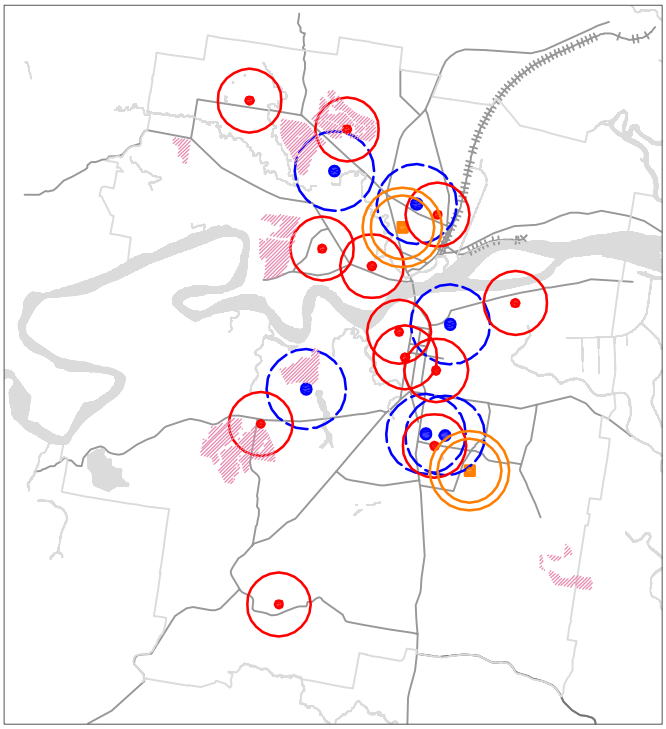


Nowra Bomaderry Structure Plan

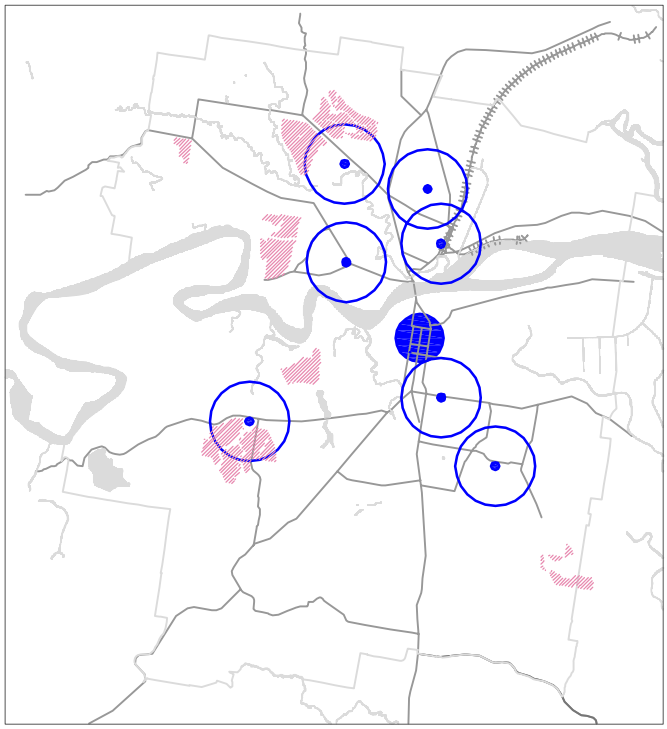
October 2006

Not To Scale

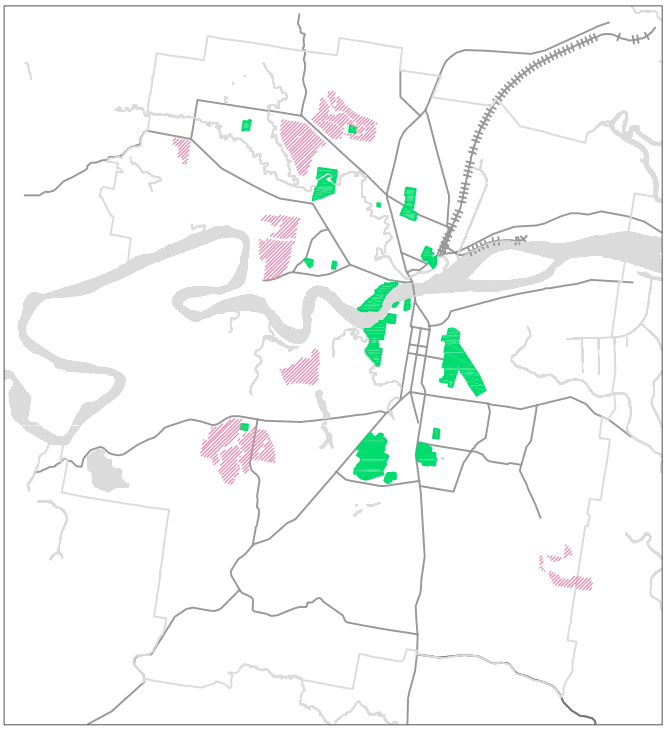
Map 9.2



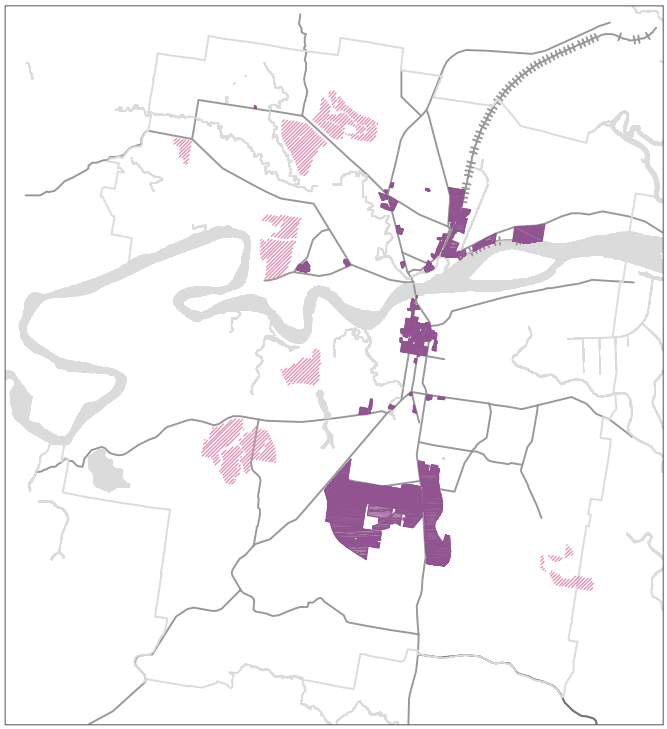
New Living Areas &
Schools



New Living Areas &
Shopping Centres

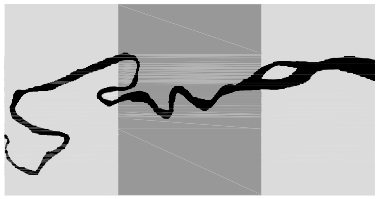


New Living Areas &
Active Recreation



New Living Areas &
Employment Areas

New Living Areas:
Settlement Factors



Nowra Bomaderry Structure Plan

October 2006

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Map 9.3

Advantages and Disadvantages of Urban Consolidation

Over the years there have been a number of studies of the feasibility and benefits of urban consolidation. These issues have been identified in the Illawarra as far back as the early 1980s, when urban consolidation was becoming an issue in urban NSW (Department of Environment and Planning 1984). A significant study of the limitations of urban consolidation was undertaken more recently by Glen Searle (2003) as part of the Urban Frontiers Program. His study found that there are significant limits on the extent to which urban consolidation can solve the range of growth problems now expected of it by State and Local Government.

He also found that market support is critical, a condition highlighted by the rise of 'generation X' demand for inner city apartment living. Unfortunately the long term strength of such demand cannot be taken for granted. There are also serious potential limitations on the supply side.

The scale and density of residential redevelopment have arguable social limits and there are constraints on the capacity of the urban fabric to accommodate ever-increasing densities. Searle stresses the need to measure and factor in these parameters at a fine-grained spatial level when assessing urban consolidation potential.

Much of the justification for urban consolidation has been in the context of large city central areas. However, much of the impetus for this form of inner city regeneration is not applicable to a regional centre such as Nowra Bomaderry. Drawing on the experience of these and other studies, the advantages and disadvantages of urban consolidation are depicted starkly in Table 9.6.

Table 9.6: **Urban Consolidation: Advantages & Disadvantages**

Advantages	Disadvantages
• Greater housing choice • More affordable housing • More efficient utilisation of physical infrastructure • More efficient use of community infrastructure • Reduced travel to work distances • Reduced size of the urban/ecological footprint	• Treated with suspicion by existing residents • Over-estimation of urban land area savings • May not reduce housing prices substantially • Higher traffic volumes • Impact on urban conservation values

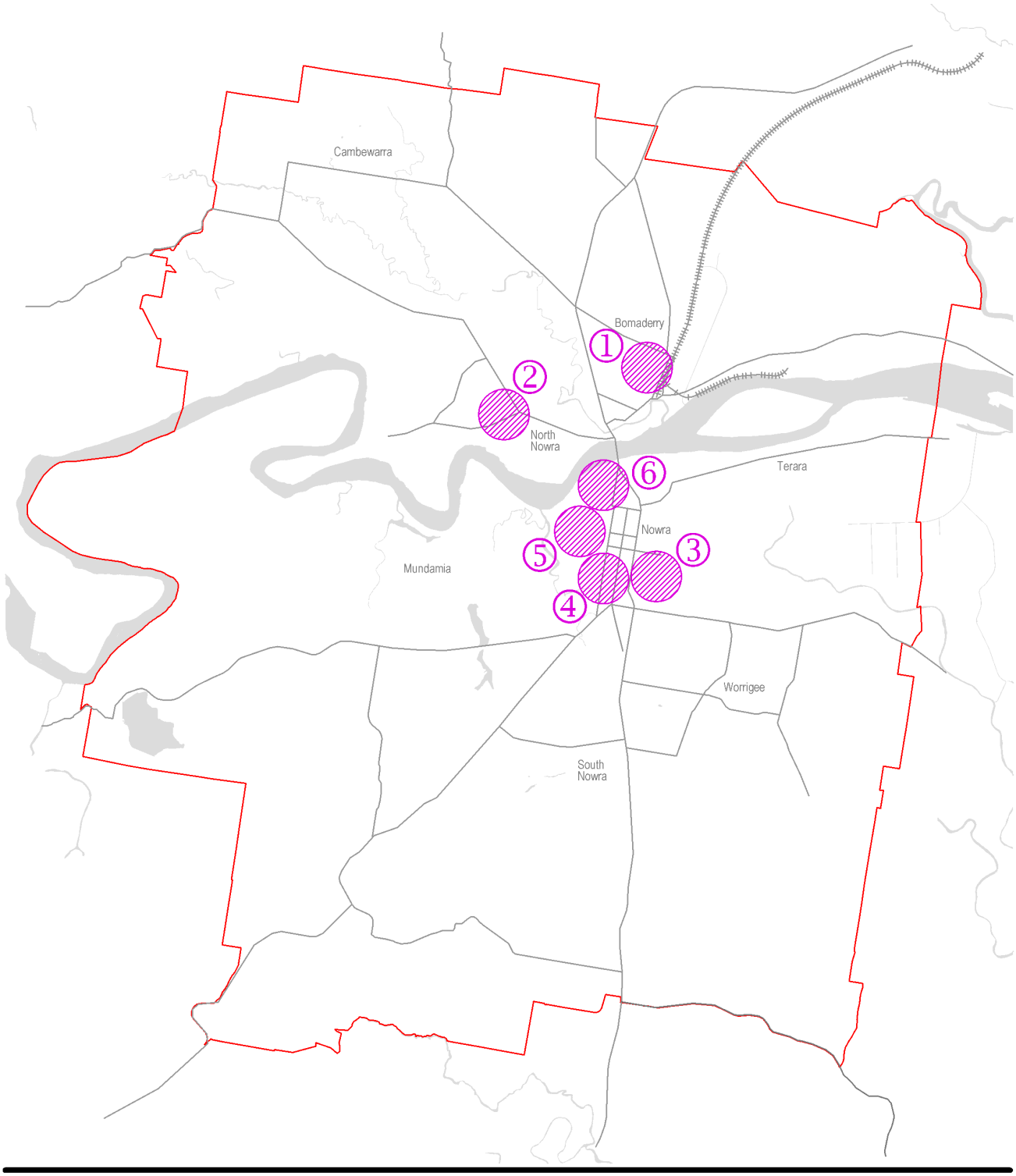
Urban Consolidation in the Mix

It is acknowledged that urban consolidation has its limitations and is certainly not a panacea offering the potential to satisfy the bulk of the future demand for Nowra Bomaderry's housing. However, there are compelling reasons why a degree of urban consolidation, in association with an element of mixed use development, would be appropriate for Nowra Bomaderry. In broad terms these reasons correspond with the positive attributes summarised in Table 9.6. In addition the adoption of an urban consolidation strategy responds to recent societal and workplace trends outlined earlier.

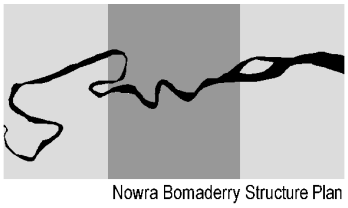
Thus Council should, wherever possible, take opportunities to increase densities where it is compatible with housing affordability and heritage considerations. However, to be realistic, dwelling yields from urban consolidation may fall short of expectations and take some time to implement. Council's recently adopted Housing Strategy has identified a need to provide more accommodation for special needs groups close to areas with a range of services. However, this demand for urban centre living is relatively limited. A total of six areas within the existing urban fabric have been assessed (Map 9.4) regarding their potential for urban consolidation. These areas are:

- Bomaderry
- North Nowra
- CBD East
- CBD South
- CBD West
- CBD North

The findings of this assessment are summarised in Tables 9.7 to 9.10.



Existing Living Areas: Potential Urban Consolidation



Nowra Bomaderry Structure Plan

Legend (Options For Further Investigation)

- ① Bomaderry
- ② North Nowra
- ③ CBD East
- ④ CBD South
- ⑤ CBD West
- ⑥ CBD North

September 2005

0 1 2
Kilometres

Map 9.4

Table 9.7 **Urban Consolidation Areas: Dwelling Type**

Dwelling Type	Bomaderry %	North Nowra %	CBD East %	CBD South %	CBD West %	CBD North %
Single Storey Detached	85.4	86.5	93.0	89.0	88.7	92.3
Two Storey Detached	7.6	3.3	2.4	0.0	3.1	3.2
Dual Occupancy	1.3	0.7	0.2	0.7	0.3	3.8
Single Storey Units/Flats	2.6	6.8	1.4	4.3	1.7	0.0
Two Storey Units/Flats	1.3	0.5	0.2	1.7	1.7	0.0
Vacant	1.7	2.3	2.8	4.3	4.5	0.6
Total	**(302)**	**(429)**	**(497)**	**(420)**	**(292)**	**(156)**

Note: Data based on residential lots
Source: Shoalhaven City Council 2005

Table 9.8: **Urban Consolidation Areas: Dwelling Age**

Dwelling Type	Bomaderry %	North Nowra %	CBD East %	CBD South %	CBD West %	CBD North %
<1940	4.3	0.5	6.4	9.8	15.1	19.2
1940-1960	67.9	4.4	43.9	67.4	59.9	44.9
1960-1990	23.5	79.0	44.9	15.5	18.8	28.2
1990+	2.6	13.8	2.0	3.1	1.7	7.1
Vacant	1.7	2.3	2.8	4.3	4.5	0.6
Total	**(302)**	**(429)**	**(497)**	**(420)**	**(292)**	**(156)**

Note: Data based on residential lots
Source: Shoalhaven City Council 2005

Table 9.9: **Urban Consolidation Areas: Dwelling Materials**

Dwelling Type	Bomaderry %	North Nowra %	CBD East %	CBD South %	CBD West %	CBD North %
Stone	0.7	0.0	0.0	0.2	0.0	0.0
Brick	29.1	75.8	20.9	19.3	26.0	34.0
Weatherboard	20.5	5.6	23.3	27.9	33.6	19.9
Cladding	16.6	7.5	5.2	13.3	11.6	7.1
Fibro-Cement	31.5	8.9	47.7	34.5	24.3	34.0
Other	0.0	0.0	0.0	0.5	0.0	4.5
Vacant	1.7	2.3	2.8	4.3	4.5	0.6
Total	**(302)**	**(429)**	**(497)**	**(420)**	**(292)**	**(156)**

Note: Data based on residential lots
Source: Shoalhaven City Council 2005

Table 9.10: **Urban Consolidation Areas: Dwelling Condition**

Dwelling Condition	Bomaderry %	North Nowra %	CBD East %	CBD South %	CBD West %	CBD North %
Good	20.5	75.8	20.1	23.3	46.2	26.3
Fair	48.7	19.6	67.0	65.2	44.2	72.4
Poor	29.1	2.3	10.1	7.1	5.1	0.6
Vacant	1.7	2.3	2.8	4.3	4.5	0.6
Total	**(302)**	**(429)**	**(497)**	**(420)**	**(292)**	**(156)**

Note: Data based on residential lots
Source: Shoalhaven City Council 2005

Urban Consolidation Yield

A preliminary assessment of the residential yield from urban consolidation indicates a crude net increase of 6670 dwellings within the six areas (Table 9.10).

Table 9.11: **Urban Consolidation Areas: Dwelling Yield**

Location	Area ha	Existing Dwellings	Additional Dwellings	Dwelling Net Increase
Bomaderry	30.14	399	1821	1482
North Nowra	35.64	518	2323	1805
CBD East	39.73	479	2094	1615
CBD South	31.95	423	1738	1315
CBD West	7.71	108	370	262
CBD North	5.80	87	278	191
Total	**150.97**	**1954**	**8624**	**6670**

Total Residential Yield

In aggregate, the seven new living areas, the expansion areas and the urban consolidation areas would have a potential residential yield of some 18,660 dwellings (Table 9.11).

Table 9.12: **Potential New Living & Urban Consolidation Area Dwelling Yield**

Location	Description	Dwelling Yield	%
New Living Areas	Areas 1-7	7540	40.4%
Expansion Areas	Areas 1a & 6a	4450	23.9%
Urban Consolidation Areas	UC Areas 1-6	6670	35.7%
Total		**18660**	**100.0%**

9.6 CONSERVATION FRAMEWORK

A key element of the structure plan is maintaining an acceptable level of biodiversity. In many ways, the transition from rural to urban in the new living areas is as revolutionary in its implications as was the introduction of burning techniques by the Aboriginal peoples, or of stock grazing by the early European settlers. The measure of a sustainable relationship with the natural environment is therefore relative to prevailing community values. Given that the task is to conserve and enhance biodiversity, the challenge is to find the ways and means of making the maximum feasible gains.

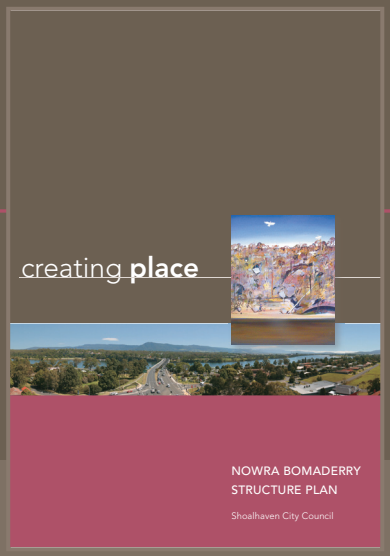
The best way to achieve this is not only to conserve remnant habitats for both vegetation and fauna, but to also enhance the overall spectrum and variety of habitats by interlinking relatively large elements of restored open space. It is considered that a 'web' of inter-linked riparian corridors and ridge lines should provide the best framework for maximising biodiversity in association with meeting urban development needs.

In an attempt to protect conservation values, whilst facilitating urban expansion, a range of conservation-related parameters have been taken into consideration. Conservation of biodiversity is a primary goal of the structure plan, however biodiversity values are sometimes difficult to quantify. In lieu of extensive detailed studies, occurrence of threatened species, plant communities and areas with identified high biodiversity values have been used to document which areas within the structure plan have conservation value.

The parameters that have been studied for the structure plan that identify which areas have biodiversity value are therefore the diversity of vegetation communities, areas of identified high biodiversity value and the presence of and habitat for threatened and rotap species. Riparian corridors have also been incorporated into the planning process because protection of riparian habitat buffers not only assists in maintaining water quality and preventing soil erosion, but these areas provide useful habitat linkages that facilitate movement of animals and genetic exchange. The relationship between the riparian corridor, other biodiversity issues and potential new living areas, is illustrated in Figure 9.2. Further habitat linkages have also been identified where a need exists for linking patches that do not have a riparian corridor. The protection of all examples of the different vegetation communities is a surrogate to conserving the full examples of biodiversity that occur in the structure plan area. Because threatened species often have specific habitat requirements, their presence can indicate habitat that has had little disturbance and remains in good condition. In addition there are a number of threatened and rotap plants that are endemic to the Nowra Bomaderry region, which therefore need to be conserved in-situ as they occur nowhere else in the world. Because Council was concerned with conserving biodiversity in the structure plan area, they commissioned work that would identify ecological communities that had specifically identified biodiversity value. Protection of these areas has also been incorporated into the structure planning process.

9.7 CONCLUSION

This concludes the Background Report to the structure plan, providing the rationale and technical support to the Strategic Direction.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Appendices

Appendix A

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Relevant Legislation

Environmental Planning and Assessment Act 1979
Local Government Act 1993
Threatened Species Conservation Act 1995
Catchment Management Act 1989
Disability Discrimination Act 1992
Protection of the Environment Operations Act 1997
Environment Protection and Biodiversity Conservation Act 1999
Native Vegetation Act 2003
Native Vegetation Conservation Act 1997
Water Management Act 2000
Roads Act 1993
Rural Fires Act 1997
Rivers and Foreshores Improvement Act 1948

Glossary of Terms

Biodiversity/Biological diversity

The variety of living organisms considered at all levels of organisation, including: the genetic, species and higher taxonomic levels; the variety of habitats and ecosystems; as well as processes occurring therein.

Building Code of Australia (BCA)

The document of that name published on behalf of the Australia Building Codes Board in October 1996, together with: (a) such amendment made by the Board, and (b) such variations approved by the Board in relation to NSW, as prescribed by the regulations.

Conservation

The processes of looking after a place to retain its natural and cultural significance.

Cultural heritage

All the evidence we have in terms of past human occupation.

Cultural significance

Imbued with aesthetic, historic, scientific, social or spiritual value for past, present or future generations. Cultural significance is embodied in the place itself, its fabric, setting, use, association, meanings, records, related places and related objects. Places may have a range of values for different individuals or groups. The term cultural significance is synonymous with heritage significance and cultural heritage values.

Ecological footprint

Defined as the total area of land required by a human settlement to fully sustain itself. It is based on the total area of land whose production the inhabitants of a city depends for food, other renewable resources and the absorption of carbon to compensate for the carbon dioxide emitted from fossil fuel use. For example, the city of Vancouver (Canada) has been estimated to require an ecological footprint approximately 20 times its actual land area (Rees 1992).

Ecologically sustainable development (ESD)

Requires the effective integration of economic and environmental considerations in decision-making processes. ESD recognises that development which improves the total quality of life, both now and in the future, requires the maintenance of essential ecological processes. ESD can be achieved through the implementation of the following:

(a) the precautionary principle

(b) inter-generational equity

(c) conservation of biological diversity

(d) improved valuation, pricing and incentive mechanisms.

Habitat

The structural environments where an organism lives for all or part of its life.

Heritage significance

In relation to a place, building, work, relic, moveable object or precinct, means significance to an area in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.

Infrastructure capacity

The physical, functional capacity of municipal and associated utilities and facilities.

Medium Density Housing

Row, townhouse and unit residential development generally at net densities between 20 and 30 dwellings per hectare (net).

Mixed Use Development

Mixed use development is about bringing together and properly integrating a wide range of landuses and activities. It is not achieved by simply placing one large area of single use development in close proximity to another. Mixed use involves different uses being designed to co-exist in close and compatible relationship to one another either horizontally on adjacent parcels of land, or vertically within the same building. By fostering an appropriate range of uses in this way, vibrant local centres can be created that are safe, attractive, sustainable and more convenient for people (UDAS 2000).

Riparian Corridor

Linear tracts of land associated with the rivers and creeks of a region's drainage system. They are important for maintaining biodiversity and river bank stability. In the Nowra Bomaderry context, there are three functional categories: Category 1: Environmental corridor; Category 2: Terrestrial and aquatic habitat; Category 3: Bank stability and water quality.

Sea Change

A phenomenon whereby people relocate from metropolitan centres to coastal locations for lifestyle reasons.

Urban Consolidation

The process by which low density housing in central urban locations is replaced with housing of a higher density, to maximise the utilisation of existing urban facilities and services.

Values

Those beliefs which have significance for a cultural group, often including, but not limited to, political, religious, spiritual and moral beliefs.

Water Sensitive Urban Design (WSUD)

The interactions between the urban built form (including urban landscapes) and the urban water cycle as defined by the three urban water streams of potable water, wastewater and stormwater (Landcom 2004). The guiding principles of WSUD are centred on achieving integrated water cycle management solutions for new urban release areas and urban renewal developments aimed at:

- Reducing potable water demand through water efficient appliances, rainwater and greywater reuse.
- Minimising wastewater generation and treatment of wastewater to a standard suitable for effluent reuse opportunities and/or release to receiving waters.
- Treating urban stormwater to meet water quality objectives for reuse and/or discharge to receiving waters.
- Using stormwater in the urban landscape to maximise the visual and recreational amenity of developments.

Appendix B

POPULATION PROJECTIONS

1. Projection Method

The population projections for both the Shoalhaven and Nowra Bomaderry have been prepared using a 'cohort component model' (DEMOGRAPH), which estimates future population on the basis of three components:

- Birth Rate: children expected to be born in the area over the next 5 years;
- Survival Rate: Numbers of people who are expected to survive in the area for the next 5 years;
- Net Migration: the net result of inflows and outflows of people into the area.

Birth Rates

Council has obtained local information from the Australian Bureau of Statistics on birth rates, that is, the number of children born to women in the area over the last few years according to age of the mother. This allows an estimate of the number of infants born to local women to be made each year of the projection period, based on the number of local women in each relevant age group, rather than adopt rates for the State.

Survival Rates

Council also obtained and used survival rate data from the ABS for Shoalhaven LGA rather than State wide averages. This gives the probability of death amongst men and women according to their age. From this it is possible to estimate the number of people in each age group who may be expected to survive a further 5 years. For younger age groups this is clearly the vast majority of the population, but for those of 75 and more years of age, the probability of death over this same 5 year period rises substantially.

Natural Increase

The net result of births over deaths represents 'natural increase'. Constant survival rates and birth rates have been assumed throughout the projection period. There has been a trend of increasing survival rates (people living longer) and declining birth rates (fewer births per female) over the last 50 years, however the estimation of future rate variation was not considered necessary for two reasons:

- Firstly, in outcome, increasing survival rates tend to balance declining birth rates; fewer births are balanced by fewer deaths each year. The result is a slightly older population than would otherwise occur, but population numbers are not greatly affected by the changes, compared with the uncertainties which apply to net migration.
- Over the last few years the rates of change for both survival and birth rates are slowing considerably, probably reflecting factors such as diminishing returns to improved health care.

Net Migration

Net migration is the end result of inflows and outflows of people to the area. The quantum is calculated between 1996 and 2001 after subtracting anticipated births plus anticipated deaths amongst the local population in each age group at 1996, to predict the 2001 population through natural increase. Then the difference between the predicted population and the actual census count represents net migration.

For most areas of the city, net migration has been assumed to be constant throughout the projection period. This is a level of migration which can be anticipated with a high level of confidence based on past experience. However, net migration within Nowra Bomaderry has been adjusted upwards to reflect the anticipated impact of the university sub-campus now established there, and continuing growth in numbers of people arriving from centres such as Sydney and Wollongong.

Once these three components of population growth have been established, namely: survivors, births and net migration, they are added to the 2001 population to estimate the 2006 population by age group. This process is then repeated to estimate the population in subsequent years.

To produce the best possible projections, usual residence data has been used in the 2001 year except for Nowra/Bomaderry. This data has only recently become available for small areas and reflects where people responding to the Census indicated was their 'home' (usual residence). Hence, the projections estimate the number of usual residents in each required area according to age.

2. Shoalhaven Birth Rate Trends

Shoalhaven, in common with most other areas, is following the general trend of declining birth rates. Table B1 shows the trends in the Shoalhaven LGA. There was a significant decrease in the rates for young mothers (15-19 years) between 1996 and 2001 and a marginal increase in the 30-39 age group for the same period. Some mothers having babies later has further increased the drop in birth rates for the younger age groups. Since 2001 the rates have remained relatively constant. As can be observed from Table B2, there are differences between Nowra Bomaderry and the rest of Shoalhaven although this gap may be narrowing.

Table B1: **Age Specific Fertility Rates (per 1000 in the age group): Shoalhaven LGA**

Age Of Mother	1996	2001	2002	2003
	ASFR	ASFR	ASFR	ASFR
15-19	30.6	20.3	20.8	20.9
20-24	116.4	92.6	89.4	92.0
25-29	153.6	131.0	125.3	124.9
30-34	90.8	87.0	105.8	93.4
35-39	37.0	37.0	42.6	41.4
40-44(b)	8.8	7.0	11.0	4.8
Total fertility rate		**1.875**	**1.974**	**1.887**

Note: (b) Includes births to women aged 45 years and over.

Table B2: **Age Specific Fertility Rates (per 1000 in the age group): Nowra Bomaderry & Shoalhaven (2002 & 2003)**

Age	A: Nowra Bomaderry	B: Shoalhaven Balance	C: Shoalhaven LGA
2002			
15-19 years (a)	29.9	14.6	20.8
20-24 years	121.3	61.7	89.4
25-29 years	143.0	111.4	125.3
30-34 years	113.4	100.4	105.8
35-39 years	40.2	43.8	42.6
40-44 years (b)	11.2	10.8	11.0
Total Fertility Rate	**2.295**	**1.714**	**1.974**
2003			
15-19 years (a)	32.1	13.5	20.9
20-24 years	101.7	83.2	92.0
25-29 years	128.6	121.9	124.9
30-34 years	82.8	101.0	93.4
35-39 years	47.6	37.9	41.4
40-44 years (b)	5.0	4.6	4.8
Total Fertility Rate	**1.989**	**1.810**	**1.887**

Shoalhaven rates remain above the State rate in NSW of 1.8 (2003) and Australia 1.76 (2003).
(a) Includes births to women aged under 15 years.
(b) Includes births to women aged 45 years and over.
Source Australian Bureau of Statistics

3. Shoalhaven Natural Increase Trends

In general, for Australia, death rates have declined. In the past 20 years the risk of dying has declined for people of all ages. The largest declines in male age-specific death rates occurred in the 10-14 years age group (down 60%), followed by those aged 5-9 years (down 56%), 50-54 years (down 53%) and 55-59 and 1-4 years (each down 52%). Female age-specific death rates declined most substantially for infants (down 50%), followed by those aged 1-4, 5-9 and 50-54 years (each down 47%).

In 2003, as in previous years, Malignant neoplasms (cancer) were the leading cause of death, accounting for 37,600 deaths or 28% of all deaths. This was followed by all heart diseases with 33,100 deaths or 25% of all deaths. Of all heart diseases, Ischaemic heart disease was the largest contributor, accounting for 77% of all deaths by heart disease. Cerebrovascular diseases (stroke) accounted for 9% of all deaths (or 12,200 deaths). Chronic lower respiratory disease accounted for 5% of all deaths (6,000 deaths) and accidents accounted for 4% of all death (or 4,900 deaths).

On average for persons born in the last few years, males have a life expectancy of 77.8 years and females 82.8 years although there is considerable regional variation in these figures. In comparison the life expectancy of the Indigenous population (which represents 5.6% of the Nowra Bomaderry population) is estimated at 59.5 years for males and 64.8 years for females. Table B3 shows the age specific survival rates for the general Shoalhaven population.

Table B3: **Age Specific Survival Rates: Shoalhaven**

Age Group	1994 – 1996		1999 - 2001	
	Males	Females	Males	Females
Newborn	0.98275	0.98399	0.99341	0.99302
0-4	0.99267	0.99393	0.99854	0.99925
5-9	0.99941	0.99946	0.99926	0.99895
10-14	0.99935	0.99944	0.99635	0.99805
15-19	0.99736	0.99889	0.99394	0.99686
20-24	0.99515	0.99861	0.99027	0.99643
25-29	0.99494	0.99853	0.99016	0.99772
30-34	0.99435	0.99812	0.99282	0.99766
35-39	0.99370	0.99735	0.98879	0.99526
40-44	0.99238	0.99599	0.98468	0.99395
45-49	0.98928	0.99349	0.98073	0.99101
50-54	0.98317	0.98931	0.97030	0.98317
55-59	0.97175	0.98289	0.95559	0.97412
60-64	0.95113	0.97308	0.92775	0.95891
65-69	0.91771	0.95600	0.88652	0.93622
70-74	0.86891	0.92711	0.82300	0.88978
75+	0.50893	0.66418	0.58637	0.63499

These two factors influence natural increase in an area, but in terms of population growth it has to be borne in mind that these rates have to be applied to an ever increasing population. When total live births and deaths are considered (Table B4) it can be seen that natural increase has gone from making a considerable contribution to Shoalhaven's growth between 1986 and 1996 to a negative impact in the 2001-2002 period.

Table B4: **Natural Increase: Shoalhaven**

Year	Live Births	Deaths	Natural Increase
1986-87	964	510	454
1987-88	934	607	327
1988-89	1009	618	391
1989-90	1058	570	488
1990-91	1125	654	471
Five Year Period Total	**5090**	**2959**	**2131**
1991-92	1133	622	511
1992-93	1124	678	446
1993-94	1142	687	455
1994-95	1071	685	386
1995-96	944	698	246
Five Year Period Total	**5414**	**3370**	**2044**
1996-97	943	720	223
1997-98	933	722	211
1998-99	943	768	175
1999-00	884	753	131
2000-01	820	770	50
Five Year Period Total	**4523**	**3733**	**790**
2001-02	892	919	(27)

4. Migration Tends: Shoalhaven and Nowra Bomaderry

Migration is the most difficult aspect to assess and predict, particularly since the Nowra Bomaderry population tends to be highly mobile. Table B5 illustrates the comparative extent of this mobility for NSW and selected defined Census areas. This figure includes persons who have moved within the area as well as those that have moved into the area. Table B6 shows the persons that have moved into the Shoalhaven in the period and were still living in the area at the time of the five yearly Census.

Table B5: **Different Address Prior to the 2001 Census**

Location	% at Different Address 1 Year Ago	% at Different Address 5 Years Ago
NSW	17.2	41.9
Sydney	16.8	42.1
Illawarra	16.0	40.1
Shoalhaven	17.8	44.4
Nowra Bomaderry	19.9	47.0

Table B6: **Shoalhaven In-Migration by Age Group**

Age Group	1986-1991	1991-1996	1996-2001
5-9	1879	1801	1642
10-14	1312	1253	1280
15-19	896	771	832
20-24	1233	999	900
25-29	1872	1542	1429
30-34	2101	1754	1571
35-39	1644	1562	1536
40-44	1137	1129	1313
45-49	804	978	1022
50-54	993	956	1180
55-59	2250	1244	1547
60-64	1619	1195	1637
65-69	1097	997	1113
70-74	540	423	655
75-79	271	279	405
80-84	136	137	222
85+	108	137	179
Total	**19892**	**17157**	**18463**

It is evident from Table B6 that the total in-migration remains relatively constant and within a range of 2,735, whereas the net growth for the same periods shows variations of up to 4,219. Out-migration plays a significant factor and appears to be marginally increasing from over 9,000 in the 1986-1991 period to over 10,500 in the 1996-2001 period. Table B7 shows the net migration for Nowra Bomaderry between 1996 and 2001 by age group. The important issue to emerge from this analysis is the net out-migration in most age groups below 40 years. Loss of population in these age groups accelerates the decrease in natural growth and the aging of the population.

Table B7: **Net Migration 1996-2001 Nowra Bomaderry**

Age	Male	Female	Total
0-4	311	210	521
5-9	-8	-59	-67
10-14	9	-39	-30
15-19	-78	-72	-150
20-24	-118	-137	-255
25-29	-15	-41	-56
30-34	-39	-36	-75
35-39	-54	-25	-79
40-44	6	68	74
45-49	38	25	63
50-54	-24	42	18
55-59	46	57	103
60-64	55	82	137
65-69	97	109	206
70-74	46	36	82
75+	104	135	239
Total	**375**	**356**	**731**

5. Population Projections

The previous projections that formed the basis of the Concept Plan report were based on 1996 Census data and other unpublished ABS data up to the year 2001. All data used in these projections is based on the 2001 Census and the latest non Census material.

In late 2004, the Department of Infrastructure Planning and Natural Resources, Transport and Population Data Centre issued NSW Statistical Local Area population projections to 2031. The ABS also produced population projections for each LGA in 2004. The exact methodology and assumptions that underpin these projections is unknown. When these projections are compared to work carried out by Council it appears the methodology is similar to Council's but the assumptions vary. Table B8 shows the DIPNR and ABS projections and two projections prepared by Council.

Table B8: **Nowra Bomaderry Structure Plan Area**

Projection	Year								
	1996	2001	2006	2011	2016	2021	2026	2031	2036
1: DIPNR		30170	32020	33560	35030	36510	37990	39400	
2: ABS	28707	30168	32371	33989	35440	36719			
3: Council (a)	28707	30168	31680	34310	37870	41510	45740	49770	53710
4: Council (b)	28707	30168	32050	34690	38260	41920	46170	50220	54180

Assumptions

Projections 1&2-DIPNR and ABS: Council is unaware of the assumptions used in these projections. It seems likely that the survival and fertility rates are State figures, with some trends factored in because trends are more reliable at that level. It would be likely that migration assumptions are based on past trends and aggregated to conform to overall State assumptions. Some adjustments may have been made to factor in planned developments in Sydney and regionally, for instance West Dapto. However the sum total of all the SLA projections would have to conform to the State migration assumptions.

Projection 3-Council (a): The fertility rates and survival rates assumptions are based on the local rates discussed in the previous section. These rates have been kept constant throughout the period. It has been assumed that any decrease in fertility rates would to some extent be offset against increases in survival rates. As natural growth now does not contribute to any great extent to Shoalhaven Growth, minor variation of rates over time will make little impact on the total growth figures.

The assumptions on migration are much more important. The basic underlying assumption in projection 3 is that the age specific net migration pattern between 1996 and 2001 will remain constant. When this model is run it gives a relatively similar projection to the DIPNR projection 1. Projection 3, however, has two further assumptions built into the model:

(1) An attempt to factor in the effect that the recently constructed tertiary education complex at Mundamia would have on population growth. There is abundant research from around the world that indicates that a new university in regional areas has a positive impact on population changes. From 2011 the model has factored in a progressive retention in the younger age groups. The retention is skewed to females in that they are dominant in both University enrolments and the numbers leaving the area.

(2) An acknowledgement of the fact that the coastal land supply is diminishing and prices in coastal areas are rapidly increasing. Given State Government Policies in relation to coastal urban expansion and the recent Jervis Bay Settlement Strategy, land, particularly land availability in the Bay and Basin area, will progressively decrease after 2011 and even with some possible rezoning will be exhausted in the period 2020-30. This factor, together with increasing transport costs, has led to the assumption that some of the incoming workforce will be diverted to live in Nowra Bomaderry where they will be closer to their employment. This diversion is only a percentage and is phased in over time. No other Jervis Bay or Coastal growth has been diverted to Nowra Bomaderry although it would be reasonable to conclude that this would happen to some extent.

Projection 4-Council (b): The fourth projection is basically the same as projection 3 but the starting basis has been adjusted to take into account a higher growth rate since 2001 discussed in the previous sections. Whilst this gives higher growth in the period up until 2011 it is considered for a number of reasons that 2001-2006 will be a higher growth spike common to the 1986-91surge. Actual growth is characterised by a series of ups and downs whereas projection models give a smoother trend-line.

Projected Population Characteristics

Projection 3 has been chosen as the basis for the major economic and transport analysis however as it is considered that in the intermediate term it would be the most realistic. Table B9 shows the broad age categories for projection 3. The age group with the biggest growth is the 75+ year category with a 180% increase. The 65-74 category also shows major growth of over 100%. The 20-29 years category also shows over 100% growth. All other categories, with the exception of the 60-69 growth, show a below average growth (78%). The lowest category is the 5-14 age group with only a 40% growth over 35 years.

Table B9: **Nowra Bomaderry Projection 3: Age Groups**

Age	2001	2006	2011	2016	2021	2026	2031	2036	Growth 2001-36
0-4	2269	2247	2491	2892	3227	3438	3565	3752	65.4
5-9	2519	2200	2218	2482	2903	3258	3469	3595	42.7
10-14	2505	2486	2209	2248	2531	2973	3328	3538	41.3
15-19	2250	2418	2702	2594	2619	2989	3430	3783	68.1
20-24	1678	2135	2472	2915	2817	2852	3220	3659	118.0
25-29	1753	1742	2351	2858	3308	3236	3270	3636	107.4
30-34	1898	1668	1686	2307	2821	3289	3216	3250	71.2
35-39	2089	1811	1624	1664	2291	2836	3302	3230	54.6
40-44	2322	2146	1942	1792	1808	2529	3070	3531	52.1
45-49	2039	2360	2270	2114	1943	2065	2780	3315	62.6
50-54	1848	2029	2431	2387	2204	2150	2271	2976	61.1
55-59	1442	1907	2120	2535	2484	2350	2297	2414	67.4
60-64	1244	1530	2011	2234	2645	2619	2490	2438	96.0
65-69	1224	1380	1672	2136	2345	2758	2733	2613	113.4
70-74	1162	1200	1344	1614	2035	2232	2609	2585	122.5
75+	1927	2424	2764	3095	3531	4162	4723	5394	179.9
Total	**30168**	**31681**	**34307**	**37866**	**41513**	**45736**	**49771**	**53710**	**78.0**

Source: Shoalhaven City Council 2005

Appendix C

HOUSING SUPPLY FACTORS

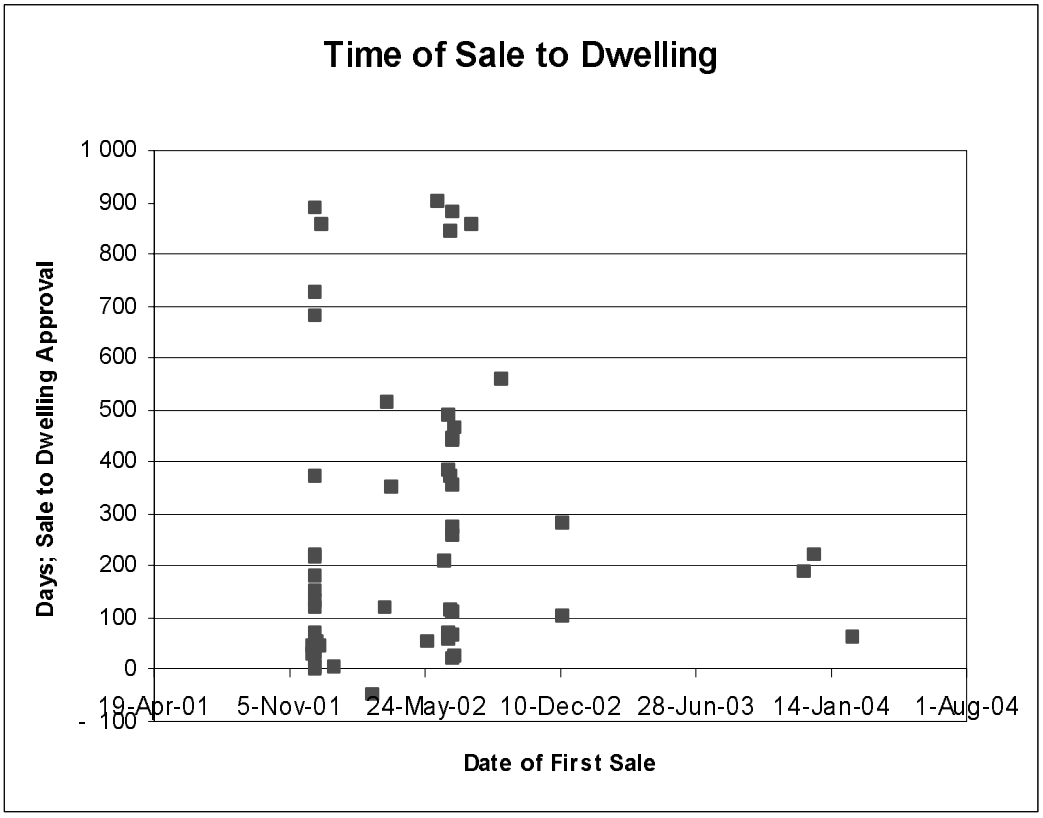
A key factor influencing the supply of housing stock in Nowra Bomaderry is the time lapse between the purchase of a residential lot and the approval and construction of a dwelling. To gain a better understanding of this phenomenon, Council undertook a study of the time lapse between the sale of a residential lot and subsequent dwelling approval. The study looked at three areas to the north of the Shoalhaven River (Tables C1-C3) and four areas to the south (Tables C4-C7). The findings of the study are documented below.

NORTH OF RIVER

Area 1

Time from sale to dwelling approval (against date of sale) provides evidence of a decline in the period for which developed land is held prior to dwelling approval, although the number of lots involved has contracted markedly over the 3 year period (Table C1).

Table C1: **Time of Sale to Dwelling**

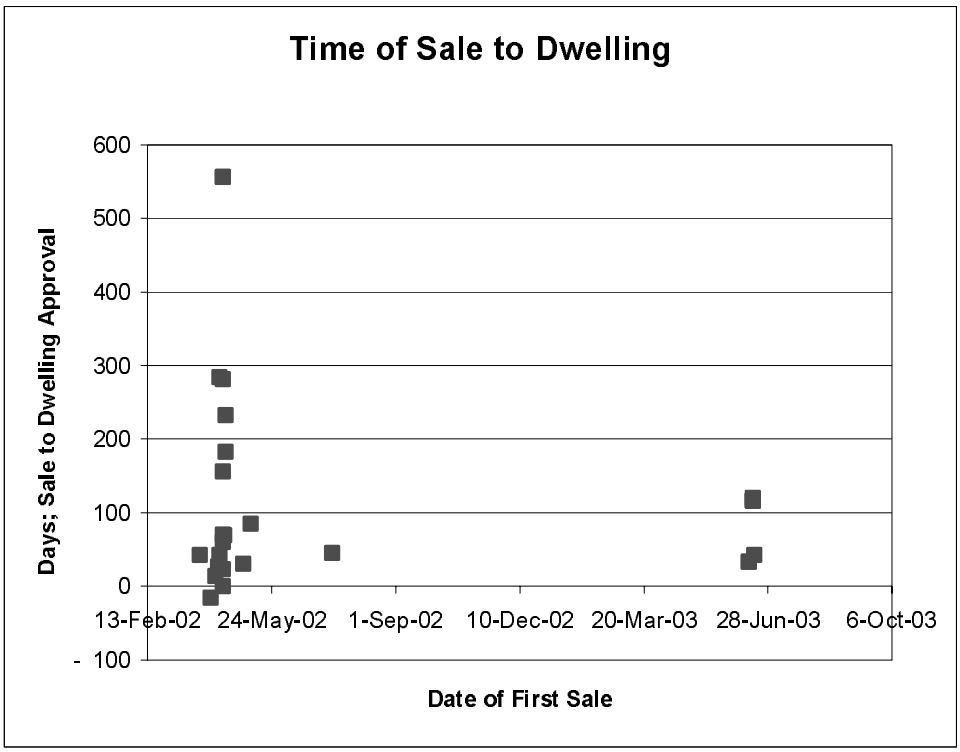


In November 2001 approximately 20% of lots were held for more than 2 years, where as in January 2004 no lot was held for more than one year.

Area 2

Time from sale to dwelling approval (against date of sale) indicates that there was a cluster of dwelling approvals in May 2002, with very little following until Jun 2003. The time period between sale and dwelling approval during this cluster varies greatly, with some properties gaining approval before purchase while others were held for up to 2 years. Later sales (June 2003 and subsequent) involved a maximum holding time of a mere 4 months. Hence a marked contraction in holding period is apparent (Table C2).

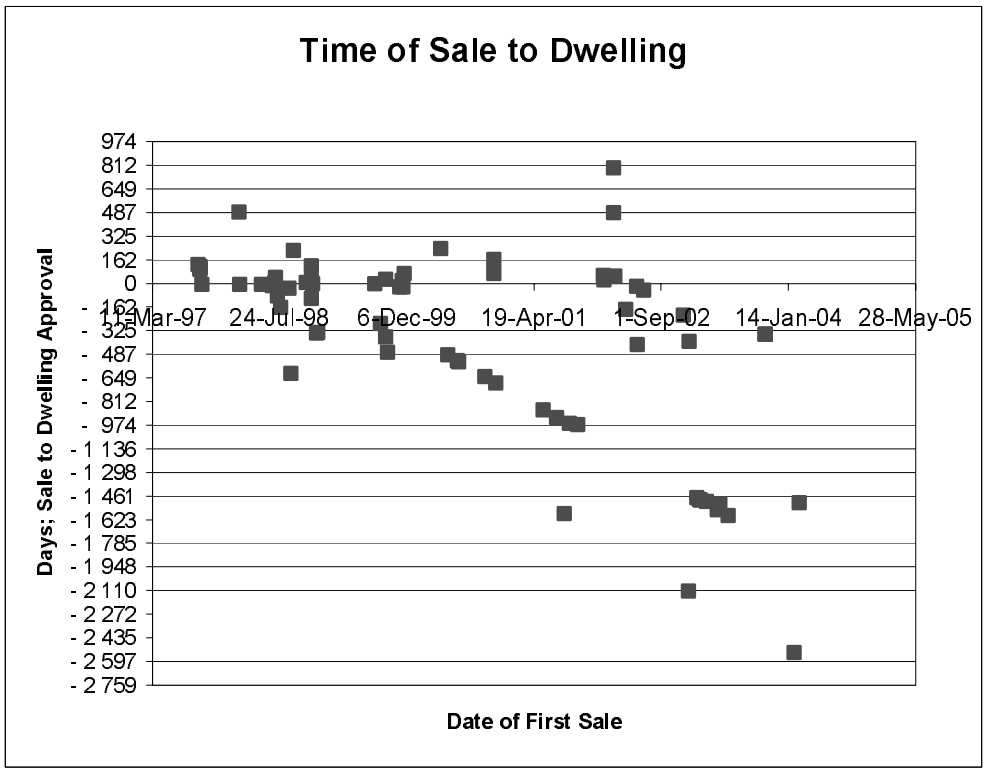
Table C2: **Time of Sale to Dwelling**



Area 3

Time from sale to dwelling approval (against date of sale) shows a significant increase in the number of dwelling proposals (BAs) approved before the sale of the lot. Further, the time period between approval of the dwelling and the subsequent sale steadily increases from December 1998 to January 2004. Hence, dwelling approvals are being obtained an increasing period before sale of the lot. For those cases where the (vacant) lot was sold prior to dwelling approval, there is an increase in the time between sale and dwelling approval. The number of lots involved, particularly after 2001, is very small however and could easily reflect exceptional circumstances (Table C3).

Table C3: **Time of Sale to Dwelling**

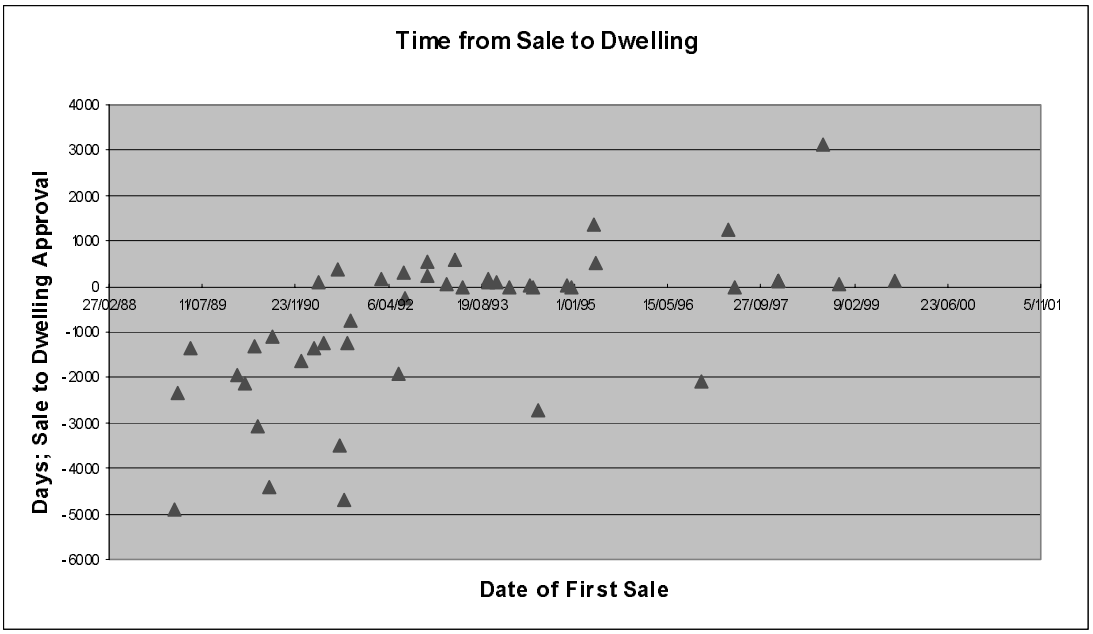


SOUTH OF RIVER

Area 1

Time from sale to dwelling approval (against date of sale) indicates an increasing trend of obtaining dwelling approval after sale until April 2001 (end of the data). For instance, in 1988 all approvals occurred before sale whereas in 1999 all approvals occurred after sale. For those properties where dwelling approval has been obtained after first sale, the period of time between sale and approval is remaining essentially static, with just one outlier (Table C4).

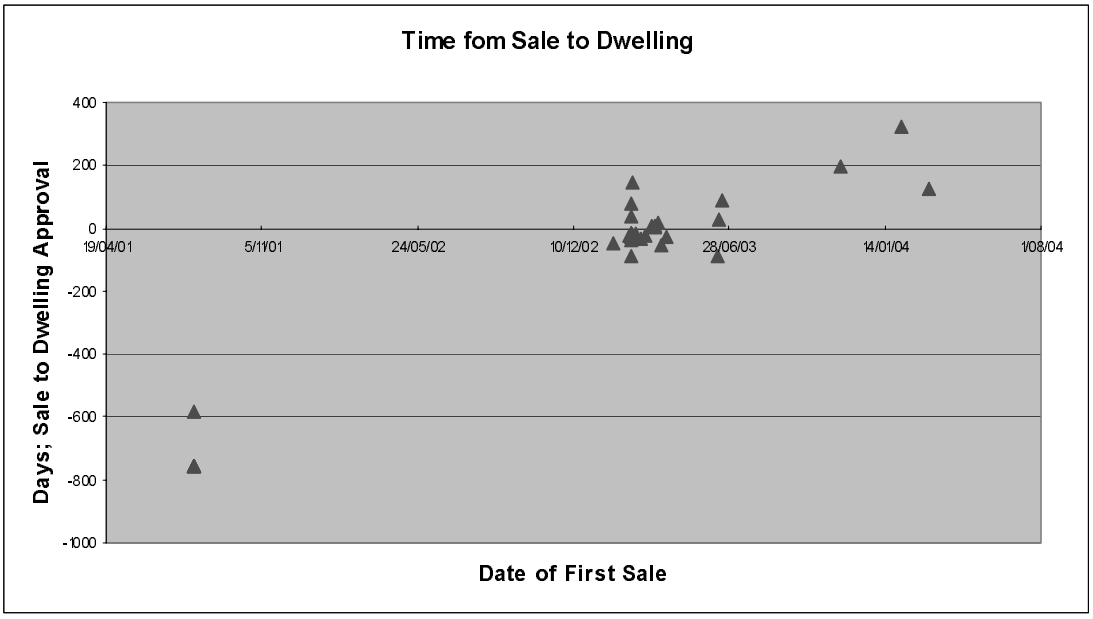
Table C4: **Time from Sale to Dwelling**



Area 2

Time from sale to dwelling approval (against date of sale) Data is too concentrated in time (just over one year) to make any firm conclusions. Certainly, in 2001 the majority of dwelling approvals occurred before sale, whereas in 2002/2003 the majority occurred after sale – with no activity in the intervening period. The time periods between sale and approval, for sales after January 2002, may be increasing (Table C5).

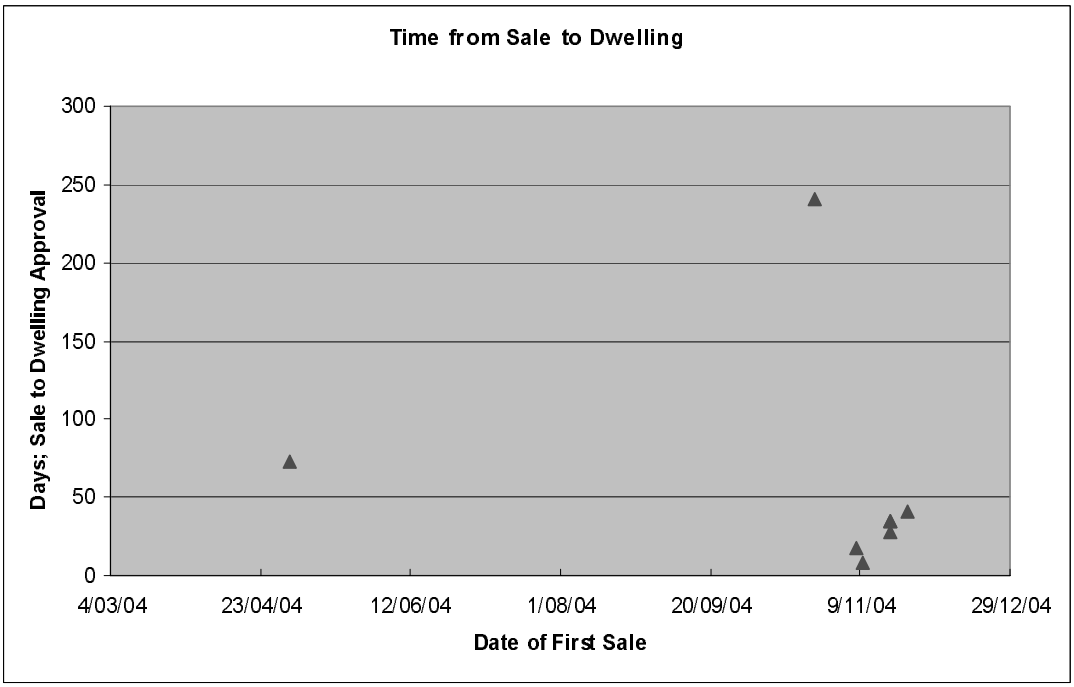
Table C5: **Time from Sale to Dwelling**



Area 3

Time from sale to dwelling approval (against date of sale) Data is too sparse to make any firm conclusions; it only covers the year 2004. No trend would be expected within a single year (Table C6).

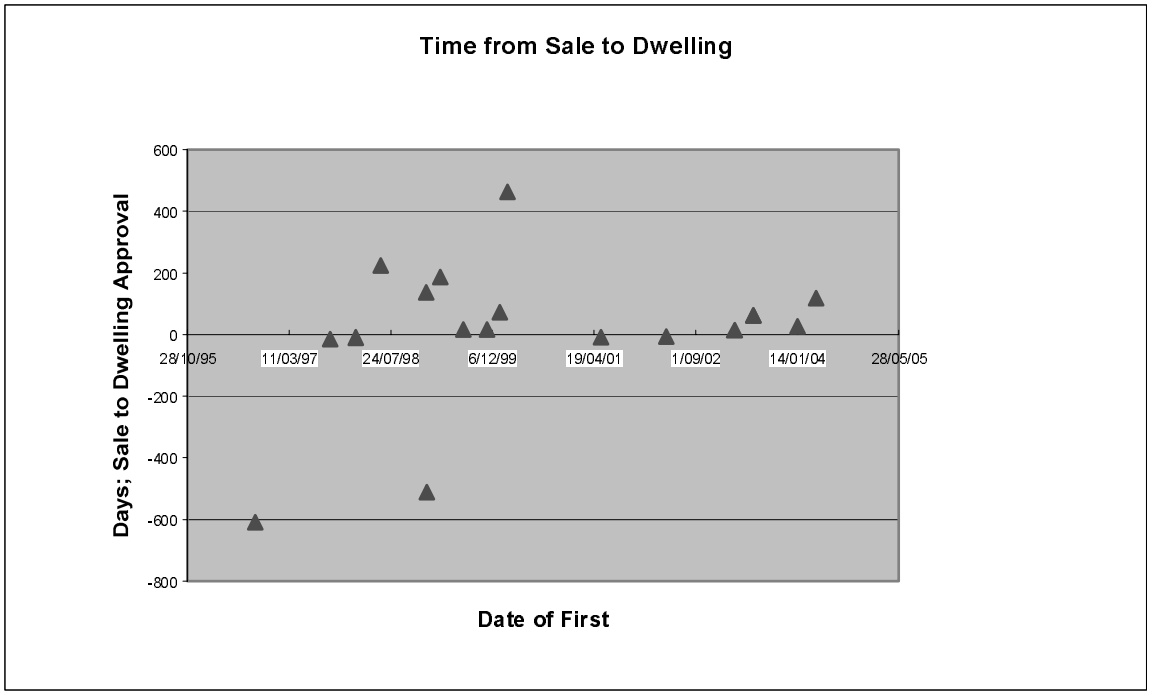
Table C6: **Time from Sale to Dwelling**



Area 4

Time from sale to dwelling approval (against date of sale) shows that the time period between sale and dwelling approval declined substantially in the long term (1997-2004). However between mid 2002 and mid 2004 there has been an increase in time elapsed, from virtually 0 to 100 days (Table C7).

Table C7: **Time from Sale to Dwelling**



Conclusions: North of the River

Analysis of northern areas provides some evidence that the typical time from sale of a vacant lot to approval of a dwelling has declined over the last 3 years (the period for which data is available). The trend is not as clear as that in Mollymook, but the period is far shorter, so a weaker trend is to be expected.

In Area 3 most land is sold with a dwelling already constructed, so dwelling approval has occurred before first sale, in some cases a year before first sale. However, for those few properties where the dwelling was approved after sale of the vacant lot, the time between sale and approval of a dwelling has perhaps increased slightly.

Conclusions: South of the River

The areas south provide evidence that the typical period of time between sale and dwelling approval has remained essentially static for the last 13 years. Certainly there are a number of properties that took considerably longer than the average period from sale to dwelling approval, but there are not many of these cases and that number is slowly decreasing.

Table B8: **Nowra Bomaderry Structure Plan Area Dwelling Approvals**

Locality	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Bangalee														2	1	1	2	1	1	7
Illaroo	0	0	0	0	34	44	37	39	30	21	20	10	14							249
Bomaderry	47	44	130	116	104	66	94	96	116	61	56	51	65	41	26	50	32	18	15	1286
Cambewarra	7	11	7	17	33	33	24	23	15	7	7	11	6	13	3	1	25	23	9	284
Cambewarra Rural	0	0	0	0	8	3	7	6	5	10	12	8	16	5	0	1	1	1	0	83
North Nowra	81	74	124	162	71	84	87	90	67	31	34	11	25	25	17	26	45	16	12	1189
Meroo Meadow														1	5	3	4	7	33	45
Total North	**135**	**129**	**261**	**295**	**250**	**230**	**249**	**254**	**233**	**130**	**129**	**91**	**126**	**87**	**52**	**82**	**109**	**66**	**69**	**3143**
Mundamia														0	1	1	3	1	5	10
Nowra	45	34	62	55	8	10	21	23	17	12	5	4	1	5	7	7	26	116	56	562
Nowra Rural	0	0	0	0	4	4	4	6	10	6	9	9	19						0	71
Nowra Hill														11	20	42	28	25	15	137
East Nowra	0	0	0	0	3	12													0	15
Worrigee														58	36	84	181	132	127	586
West Nowra														15	13	10	13	23	13	84
Terara														1	1	0	0	0	1	3
SouthNowra														3	7	2	0	0	0	12
Numbaa	0	0	0	0	6	7	13	14	8	12	12	5	6						0	83
Total South	**45**	**34**	**62**	**55**	**21**	**33**	**38**	**43**	**35**	**30**	**26**	**18**	**26**	**93**	**85**	**146**	**251**	**297**	**217**	**1563**
Total	**180**	**163**	**323**	**350**	**271**	**263**	**287**	**297**	**268**	**160**	**155**	**109**	**152**	**180**	**137**	**228**	**360**	**363**	**287**	**4706**

Appendix D

NATURAL ENVIRONMENT

Water Quality

Shoalhaven City Council continuously monitors water quality in the river and creek systems of the Nowra Bomaderry district. Specific sampling was undertaken at sites on streams that may be impacted by potential urban development. The location of these sites is shown on Map 3.2. Most of the sites had not been sampled by Council's Environmental Services in the past and therefore this is the only rigorous data available for these sites. Sampling was conducted on two days: 24/01/05 and 01/02/05. There was a small amount of rain before and on 24/01/05, which had caused some of the sampled creeks to start flowing. They are usually intermittent water courses with a chain of permanent ponds. Bomaderry Creek is possibly the only creek sampled that would maintain a continuous flow in dry periods. The results of the sampling are summarized in Table D1. Very poor performances against key water quality indicators are indicted in bold.

Table D1: **Nowra Bomaderry Creeks: Water Quality Analysis**

Site	Stream	FC	TN	TP	SS	Chla	Temp	DOxy	pH	Tu
1	Flat Rock Creek	**656**	<0.02	0.006	8	<0.1	25.1	54	7.05	1.2
2	Cabbage Tree Creek	-	-	-	-	-	21.4	**24.6**	7.27	195.9
3	Cabbage Tree Creek	**270**	0.51	0.018	3	-	20.9	**29.7**	6.98	20.4
4	Mundamia Creek	**1200**	0.56	0.037	52	-	19.7	**27.7**	6.26	332.7
5	Cabbage Tree Creek	116	<0.02	0.004	5	3.7	24.2	64.8	6.95	3.7
6	Flat Rock Creek	120	0.64	0.017	<1	-	24.1	75.3	7.65	0.2
7	Bengallee Creek	**>2400**	1.1	0.094	49	-	20.7	77.6	7.26	129.7
8	Bengallee Creek	**1520**	0.52	0.025	<1	-	19.5	**37.4**	6.56	4.1
9	Bengallee Creek	**632**	<0.02	<0.002	5	0.2	24.4	**39.2**	6.77	1.8
10	Unnamed Creek 1	**>2100**	0.04	0.011	7	<0.1	23.17	**25.0**	6.61	34.2
11	Unnamed Creek 2	**1600**	<0.02	0.028	7	<0.1	23.6	**21.0**	6.69	120.0
12	Unnamed Creek 2	12	<0.02	<0.002	4	9.6	25.3	37.0	7.11	0.6
13	Bomaderry Creek	100	0.32	0.081	2	-	23.9	77.5	7.25	2.5
14	Abernethy's Creek	160	0.17	0.054	18	-	22.8	**12.6**	6.70	5.7
15	Unnamed Creek 3	10	0.78	0.057	28	-	21.8	**11.1**	6.36	600.0
16	Unnamed Creek 4	**550**	0.47	<0.006	21	-	27.56	164.2	8.69	-4.5

Source: Shoalhaven City Council Environmental Services 2005

Key Water Quality Indicators

Water Quality Indicator		Measurement	Performance Measure	Performance Guide
FC:	Faecal Coliforms	Coliform units/100 milliltres	Public Health	Swimming: 150; Secondary contact: 1000
TN:	Total Nitrogen	Milligrams/litre	Nutrients	0.5
TP:	Total Phosporous	Milligrams/litre	Nutrients	0.05
SS:	Suspended Solids	Units/litre	Sedimentation	<10% Seasonal Change
Chla:	Chlorophyll a	Micrograms/litre	System Health	1-10
Temp:	Temperature	Degrees Celsius	System Health	Ambient Temperature
DOxy	Dissolved Oxygen	% oxygen in water	System Health	>80%
pH	Acidity-Alkalinity	Scale: 0-14	System Health	6.5-8.5
Tu	Turbidity	NTU – turbidity units	Sedimentation	<10% Seasonal Change

Conservation of Native Vegetation Communities

As data on the distribution of individual species is unavailable for Nowra Bomaderry, specific vegetation communities will be targeted to ensure that the majority of plants and animals are conserved in the region. One of the targets of the conservation strategy will be to conserve all vegetation communities that currently exist in the Nowra Bomaderry Area.

Areas which have conservation significance will be identified separately within the 14 Nowra Bomaderry sub-catchments in order to ensure that conservation planning is strategic. Of them, nine have very little remaining native Vegetation.

Areas that Warrant Environmental Protection

The areas that warrant protection are discussed in the following sections, generally in the catchments within which they are located.

1. Bangalee Creek Catchment

Area to be protected: 674.38 ha
Threatened Plants in area: None Known
Indicator Species known from area: Powerful Owl (1), Yellow-bellied Glider (7), Square Tailed Kite (1), Brush-tailed Rock-Wallaby (1, 1979), Glossy- Black-Cockatoo (2)
Suitable Habitat for: Sooty Owl, Masked Owl, Greater Broad-nosed Bat, Broad- headed Snake, Great Barred Frog, *Dampieria scottiana*

Table D2: **Proposed Protection of Bangalee Creek Catchment Vegetation Communities**

Vegetation Code	Description	Area	% Protected in this reserve
SAL-SYN	Blue Gum Tall Forest	367.32	50.6
MAC-PAN	Spotted Gum – Grey Ironbark Forest	258.13	12.6
SCL-GUM	Scribbly Gum-Bloodwood Woodland/Open Woodland	25.84	2.1
MAC-PIL	Spotted Gum – Blackbutt Forest	9.64	1
CER-WRF/BAC-WRF	Warm Temperate Rainforest	10.89	59.5
ACM-WRF	Lily Pilly Warm Temperate Rainforest	2.56	100

Significance: Although widespread the Spotted Gum–Grey Ironbark community, has been extensively cleared, particularly north of North Nowra and Bomaderry and in the vicinity of Currambene Creek (Mills 1996). There is potential to establish a connectivity zone between this area and Morton National Park and Red Rocks Nature Reserve.

2. Bomaderry Creek

Area to be protected: 111.26 ha
Threatened Plants in Area: *Zieria bauerlenii, Eucalyptus langelyi*
Indicator Species Known From Area: Yellow-bellied Glider (1), Large-footed Myotis
Suitable Habitat For: Giant Burrowing Frog, Glossy Black-Cockatoo, Powerful Owl, Australasian Bittern, Black Bittern, *Rulingia hermanniifolia, Acacia subtilinervis, Leptospermum sejunctum, Platysace* sp. nov., *Leptospermum epacridoideum*

Table D3: **Conservation of Bomaderry Creek Catchment Vegetation Communities**

Vegetation Code	Description	Area	% Protected in this reserve
KUN-SHR	Kunzea Shrubland	7.43	41
PUN-AGG	Grey Gum-Stringybark Woodland/Open Woodland	65.59	11
SST-SDG	Sedgeland/Shrubland	1.62	21
MAC-PIL	Spotted Gum – Blackbutt Forest	29.60	4
CER-WRF/BAC-WRF	Warm Temperate Rainforest	7.02	38

Significance: The Bomaderry Creek Catchment has been mostly cleared of native Vegetation. The area of native Vegetation around Bomaderry Creek is thought to be significant because of the species found there including the only known population of the endangered plant *Zieria bauerlenii*. There are also two records of *E. langleyi* in the area. The proposed protection zone would run along the creek line and aim to protect a linear strip of the remaining Vegetation. Maintaining a 100 m buffer along the Bomaderry Creek line and Good Dog Creek would also provide a connectivity zone to Red Rocks Nature Reserve.

3. Brundee Swamp Catchment - Currambene State Forest

Area to be protected: 541.25 ha
Threatened Plants in Area: *Pterostylis gibbosa*
Indicator Species Known From Area: Yellow-bellied Glider (1)
Suitable Habitat For: Squirrel Glider, Powerful Owl, Masked Owl, White-footed Dunnart, Great Pipistrelle, Green and Golden Bell Frog, Glossy Black-Cockatoo *Dampieria scottiana, Leptospermum epacridoideum.*

Table D4: **Conservation of Brundee Swamp Catchment Vegetation Communities**

Vegetation Code	Description	Area	% Reserved in this reserve
CAS-GLA	Swamp Oak Forest	39.76	100
MAC-LON	Spotted Gum – Woollybutt Forest	107.73	25
MAC-PAN	Spotted Gum – Grey Ironbark 3	450.47	19
SCL-GUM	Scribbly Gum-Bloodwood Woodland/Open Woodland	177.82	13
PIL-GUM	Blackbutt – Bloodwood Forest	139.70	98
SCL-CAS	Scribbly Gum – Casuarina Forest	259.46	43
TER-ANG	Red Gum - Angophora Forest	3.62	17
ROB-MEL	Swamp Mahogany Paperbark Forest	11.68	85
MAC-PIL	Spotted Gum – Blackbutt Forest	8.94	1
MEL-ERI	Paperbark Shrubland	202.15	90

Other Significance: Within the Brundee Swamp Catchment, Currambene State Forest supports the only known populations of *Pterostylis gibbosa* for the region and also has records of Yellow-bellied gliders from the forest. The Swamp Mahogany (*Eucalyptus robusta*) stand within the area is considered to represent a significant food resource for the Regent Honeyeater and Squirrel Glider.

4. Nowra Creek Catchment

Area to be protected: 532.5 ha
Threatened Plants in Area: *Triplarina nowraensis* (2)
Indicator Species Known From Area: None
Suitable Habitat For: Powerful Owl
Vegetation Communities Conserved:

Table D5: **Conservation of Nowra Creek Sub-Catchment Vegetation Communities**

Vegetation Code	Description	Area	% Protected in this reserve
MAC-PAN	Spotted Gum – Grey Ironbark Forest	459.42	19.0
MAC-PIL	Spotted Gum – Blackbutt Forest	182.58	23.0
MAC-SYN	Spotted Gum Tall Forest	21.10	100.0
PIL-PUN	Grey- Gum, Blackbutt Forest	14.72	2.9
SCL-CAS	Scribbly Gum – Casuarina Forest	13.61	2.3
MEL–FOR	Paperbark Forest	4.2	6.0
PUN-AGG	Grey-Gum Stringybark Woodland/Open Woodland	33.36	5.5

Significance: Incorporates part of the Nowra Creek buffer zone.

5. Mundamia Creek Catchment

Area to be protected: 1734.67
Threatened Plants in Area: *Triplarina nowraensis*
Indicator Species Known From Area: Yellow-bellied Glider (1), Glossy-Black- Cockatoo (1)
Suitable Habitat For: Pink Robin, *Dampieria scottiana, Leptospermum epacridoideum*

Table D6: **Conservation of Mundamia Creek Sub-Catchment Vegetation Communities**

Vegetation Code	Description	Area	% Reserved in this reserve
MAC-PAN	Spotted Gum – Grey Ironbark	71.77	3.0
MAC-LON	Spotted Gum - Woollybutt Forest	29.74	6.9
MAC-PIL	Spotted Gum - Blackbutt Forest	407.83	52.0
PUN-AGG	Grey Gum Stringybark woodland /open woodland	235.50	38.6
PIL-PUN	Blackbutt Forest - Grey Gum	314.98	62.6
MEL-FOR	Paperbark Forest	8.15	11.6
SCL-GUM	Scribbly Gum - Bloodwood woodland/open woodland	711.24	51.8
JUN-FRH/ELE-SDG	Freshwater wetlands	7.92	19.8
SST-SDG	Sedgeland/Shrubland	4.24	54.8

Significance: Grey Blackbutt-Gum Forest is considered significant from a conservation perspective as this Vegetation community is not recorded elsewhere in the Shoalhaven region (Mills 1996) and requires conservation protection. The reserved patch could be linked to the Mundamia Creek corridor to form a connectivity zone with the Shoalhaven River. In addition this community provides habitat for the threatened Yellow-bellied Glider and Glossy Black-Cockatoo.

6. Shoalhaven River Corridor

Area to be protected: 418.21 ha
Threatened Plants in Area: None Known
Indicator Species Known From Area: Powerful Owl (1), Masked Owl (1), Yellow-bellied Glider (2), Square-tailed Kite (1), Brush-tailed Rock-Wallaby (1, 1967), Glossy Black-Cockatoo (2), Long nosed Potoroo (1, 1980)
Suitable Habitat For: Large-footed Myotis

Table D7: **Conservation of Shoalhaven River Sub-Catchment Vegetation Communities**

Vegetation Code	Description	Area	% Reserved in this reserve
JUN-FRH/ELE-SDG	Freshwater Wetlands	4.13	54
MAC-PIL	Spotted Gum – Blackbutt Forest	316.15	44
PIL-PUN	Grey Gum – Blackbutt Forest	1.96	<1
PUN-AGG	Grey Gum Stringybark Woodland/Open Woodland	27.19	45
PUN-AGG/SCL-CAS	Sandstone Forest	21.92	100
SAL-SYN	Blue Gum Tall Forest	1.54	<1
SCL-CAS	Scribbly Gum – Casuarina Forest	45.32	34

Other Significance: Provides significant movement potential along corridor; scenic amenity, protection of water quality.

7. Cabbage Tree and Flat Rock Creek Catchments

Area to be protected: 567.58 ha
Threatened Plants in Area: *Eucalyptus langleyi, Triplarina nowraensis*
Indicator Species Known From Area: Black Bittern
Suitable Habitat For: Glossy Black Cockatoo, *Acacia subtilinervis, Leptospermum epacridoideum*

Table D8: **Conservation of Cabbage Tree & Flat Rock Creek Sub-Catchment Vegetation**

Vegetation Code	Description	Area	% Reserved in this reserve
MAC-LON	Spotted Gum – Woollybutt Forest	146.11	33.7
MAC-PAN	Spotted Gum – Grey Ironbark Forest	162.59	6.8
PUN-AGG	Grey Gum Stringybark Woodland /Open Woodland	207.29	34.0
SAL-SYN	Blue Gum Tall Forest	17.19	2.1
JUN-FRH/ELE-SDG	Freshwater Wetlands	5.40	13.5
SCL-CAS	Scribbly Gum – Casuarina Forest	40.37	6.7
MEL-FOR	Paperbark Forest	14.63	20.9

Significance: There is potential to join the Shoalhaven State Forest to the Flat Rock Creek, thus preserving a significant corridor of native Vegetation. Flat Rock, Mundamia and Cabbage Tree Creek support populations of the endangered Nowra Heath Myrtle. In order to protect populations of this species vegetation corridors need to be conserved bordering the creek system. The conservation zone needs to be 800 m wide at Flat Rock Creek and Mundamia Creeks and 850 wide around Cabbage Tree Creek. There is potential to link these reserves to the Shoalhaven River, thereby providing the potential for the exchange of genetic material.

8. Brundee Swamp (Crookhaven Creek Catchment)

Area to be protected: 16 ha
Threatened Plants in Area: None known
Indicator Species Known From Area: Australasian Bittern, Black Bittern
Suitable Habitat For: Turquoise Parrot, Green and Golden Bell Frog
Vegetation Communities Conserved: JUN-FRH/ELE-SDG (Freshwater Wetlands) 16 ha

Significance: Freshwater wetland community that provides habitat for a number of rare species.
Secondary Habitat

Area to be conserved: 811.23 ha
Significance: Areas of secondary habitat include habitat patches that do not form part of large continuous areas of native Vegetation but are still significant for the community they support or threatened species habitat they provide.

Table D9: **Conservation of Vegetation Communities as Secondary Habitat**

Vegetation Code	Description	Area	% Reserved in this reserve
MAC-LON	Spotted Gum – Woollybutt Forest	33.87	7.81
MAC-PAN	Spotted Gum – Grey Ironbark Forest	539.13	22.7
SAL-SYN	Blue Gum Tall Forest	74.54	9.3
SCL-GUM	Scribbly Gum – Bloodwood Woodland/ Open Woodland	5.87	0.4
TER-ANG	Red Gum-Angophora Forest	7.29	34.46
MST-SRF	Moist Subtropical Rainforest	14.71	77.7
SCL-CAS	Scribbly Gum – Casuarina Forest	45.85	7.6
MEL-ERI	Paperbark Shrubland	23.4	10.4
MEL-FOR	Paperbark Forest	15.58	22.24
PIL-GUM	Blackbutt – Bloodwood Forest	1.79	1.3
PIL-PUN	Grey Gum – Blackbutt Forest	7.16	1.4
TER-ANG	Red Gum Angophora Forest	4.21	19.9
MST-SRF	Moist Sub-tropical Rainforest	18.93	100.0

9. Good Dog Creek River Buffer

Significance: Potential to provide link of *Casuarina* riparian forest (10.75 ha) and Red Gum Angophora Forest (8.56 ha) to Red Rocks Nature Reserve and habitat for the Tiger Quoll.

10. Buffer for Triplarina nowraensis

Significance: Provides a buffer around populations of the threatened species, *Triplarina nowraensis*. Buffer consists of 977.54 ha of SCL-GUM, Scribbly Gum – Bloodwood Woodland/Open woodland.

Appendix E

NOWRA BOMADERRY HERITAGE ITEMS

Item	Description	Property Address
Bamarang		
Bamarang Homestead	Cemeteries and "Bamarang" Victorian Stone Homestead	72 Bamarang Road Lot 20 DP 746233
Bangalee		
"Weir" - Family Graves	Family Graves	Scout Camp Road Lot 48 DP 751273
Bolong		
Cottage	Berry Estate Vertical Timber Slab Cottage and Outbuildings	459 Bolong Road Lot 10 DP 1052770
"Beuna Vista"	Dairy Farm Complex, including Berry Estate Vertical Timber Slab Barn	490 Bolong Road Lot 1 DP 655442 Lot 1 DP 1034357
Former Bolong Public school Union Church	Including Shelter Shed, Relocated Bolong Carpenter Gothic style	8 Jennings Lane Lot 2 DP 550908 8 Jennings Lane Lot 2 DP 550908
"Iolanthe"	Dairy Farm Complex	100 Jennings Lane Lots 16,17,19 DP 4266
Berry Estate Timber Stud Framed Flood Boatshed		Jennings Lane Lot 1 DP 872745
Bomaderry		
Bomaderry Primary School	Former Bomaderry Primary School & Trees	5 Birriley Street Lot 2 DP 568955
Green Leaves	Federation Queen Anne style Residence and Grounds	59 Bolong Road Lot 5 DP 2886 Sec 32
Residence	Federation Brick and Asbestos Tile Residence	67 Bolong Road Part Lot 2 DP 324484
Bomaderry Milk Factory	Milk Factory (former)	Bolong Road Lot 1 DP 189450
Former United Aboriginal Mission	Group of Detached Batten Fibro Buildings	Brinawarr Street Lot 4 DP 2886 Sec 27 Lot 5 DP 2886 Sec 28 Lot 6 DP 2886 Sec 29
Residence	Federation Weatherboard Residence	10 Coomea Street Lot 16 DP 2886 Sec 9
Residence	Federation Weatherboard Residence	14 Coomea Street Lot 14 DP 2886 Sec 9
Residence	Inter-war Weatherboard Californian Bungalow	21 Coomea Street Lot 5 DP 2886 Sec 24
Residence	Victorian Weatherboard Residence	37 Coomea Street Lot 1 DP 613536
"Lynburn"	Timber Federation Residence and garden	Mattes Way Lot 23 DP 793122 Bomaderry
Presbyterian Church		7 Meroo Street Lot 6 DP 2886 Sec 9

Item	Description	Property Address
Residence	Brick & Asbestos Tile Federation Bungalow	13 Meroo Street Lot 9 DP 2886 Sec 9
Railwaymen's Barracks		16 Meroo Street Lot 1 DP 845131
Weatherboard Cottage	Formerly Mrs Pallett's Residence	77 Meroo Street Lot 1 DP 506705
Bomaderry Railway Station and Yard Group	Including Nowra Bomaderry Railway Station and "original bar holder", Bomaderry Station master's House.	Meroo Street Lot 3 DP 802440
Bomaderry Railway Siding Group	Including Turntable, Weighbridge, Goods Crane, Water Pump.	Meroo Street Lot 3 DP 802440
"Illowra"	Federation Timber Berry Estate Residence and Garden	472 Princes Highway Lot 2 DP 792770
Cottage	Federation Georgian style Worker's Cottage	9 Tarawara Street Lot 15 DP 2886 sec 7
Residence	Victorian Weatherboard Residence	6 Tanang Street Lot 3 DP 775937
Residence	Victorian Weatherboard Residence	8 Tarawara Street Lot 1 DP 552899
Cambewarra		
Cottage	Cambewarra Colonial Vertical Timber Slab Cottage	94 Barnfield Road Lot 1 DP 573197
Cambewarra Rainforest Reserve		Cambewarra Look Out Road Reserve No 57023
Evison's Dairy Farm Complex		49 Hockeys Lane Lot 2 DP 621553
Cambewarra Village		
"Llanthony Lodge"	Two storey Victorian Weatherboard Residence	1 Kalinga Street Lot 101 DP 788323
Corrugated Iron Community Hall		75 Main Road Lot 1 DP 725937
Residence	Federation Georgian style Residence (former Post Office)	77 Main Road Lot 2 DP 240571
Union Church	Weatherboard Gothic Carpenter Style Union Church	80 Main Road Part Lot 170 DP 751273
Former Weatherboard School		Main Road Lot 2 DP 839145
Residence	Former Schoolmaster's Brick Residence and garden	Tannery Road Lot 1 DP 850699
Longreach		
"Longreach Farm"	Former Dairy Farm Complex	501B Longreach Road Lot 102 DP 710389
"Wogamia"	Two storey Colonial Sandstone Homestead and Outbuildings	10 Wogamia Road Lot 3 DP 865094
Meroo Medow		
Union Church	Meroo Meadow Union Church	8 Boxsells Lane Lot 4 DP 249776
Farmhouse	Federation Georgian Style Farmhouse	55 Fletchers Lane Lot 8 DP 1007274
"Pomona"	Dairy Farm Complex	C360 Princes Highway Lot 2 DP 620160

Item	Description	Property Address
Former Meroo Meadow School and Schoolmaster's Residence		C385 Princes Highway Lot 1 DP 716569
Nowra Hill		
RANS Albatross	Military Defence Complex and Aviation Museum	489A Albatross Road Lot 102 DP 842713 Lot 2 DP 1002996
Nowra		
Plunkett Street Heritage Conservation Area		Plunkett Street
Industrial Building	Pressed Metal Clad Industrial Building (former Barnes Garage)	1 Berry Street Lot 111 DP 997750
"The Peoples Emporium"	Two Storey Victorian Shop and Residence	26 Berry Street Part Lot 1 DP 81072
"Roxy"	Inter - war Art Deco style Cinema & Footpath	41 Berry Street Lot 51 DP 625969
Residence	Former Victorian Weatherboard Residence	76 Berry Street Part DP 938363
"Hampden Villa"	Victorian Weatherboard Residence, including Stables, Garden	110 Berry Street Part Lot 1 DP 758794 Sec 34
Mechanics Institute and School of Arts		Berry Street Lot 20 DP 801794
"Kilsyth"	Federation Weatherboard Residence	33 Bridge Road Lot 1 DP 152217
"Uuna"	Late Victorian Weatherboard Cottage and garden	35 Bridge Road Lot A DP 161648
Residence	Victorian Brick Residence	45 Bridge Road Lot 10 DP601874
Cottage	Late Victorian Weatherboard Cottage	49 Bridge Road Lot 8 DP 549249
Residence	Inter-war Weatherboard Californian Bungalow	63 Bridge Road Lot 2 DP 203275
"Rodway's Cottage"	Inter-war Federation Style Residence and Garden	86 Bridge Road Lot 1 DP 737840
"The Bridge"	Two storey Victorian Masonry Hotel	87 Bridge Road Lot 2 DP 843396
Flood Boat & Memorial	Former Numbaa Red Cedar Flood Boat and	Bridge Road Lot 5 DP 262460 Part Lot 96 DP 755952
"Batt's Folly"	Sandstone Landscape Monument	Intersection of Bridge Road and North Street Road Reserve between Lot 2 DP 843396 & Lot 1 DP 737840
The Pines	Late Victorian Weatherboard Residence and Trees	76 East Street Lot 1 DP 115881
"Cudgerie"	Federation Weatherboard Residence	108 East Street Lot 11 DP 2607
"Moss"	Cottage forme Moss Central Hotel	1 Ferry Lane Part Lot 5 DP 755952
Cottage	Victorian Georgian style Timber Slab Cottage	19 Ferry Lane Lot 1 DP 193881

Item	Description	Property Address
Residence	Victorian Italianate Residence and Garden	22 Jervis Street Lot 11 DP 2624
"Trelawney"	Victorian Georgian Weatherboard Residence	69 Jervis Street Lot 1 DP 998589
"Roseville"	Federation Weatherboard Residence and fig tree	49-51 Journal Street Lots 1 & 2 DP2607
Residence	Federation Weatherboard Residence and trees	1 Junction Street Lot 1 DP21682
Residence	Federation Weatherboard Residence	2 Junction Street Lot W DP 405938
Hoop Pine	Araucaria cunninghamii	12 Junction Street Lot 4 DP 237126
Hoop Pine	Araucaria cunninghamii	14 Junction Street Lot 3 DP 237126
Convent	Two storey Federation Timber Convent (former Sisters of the Good Samaritan Convert) including Fence, Grounds	22 Junction Street Lot 9 DP 237126
"The White House"	Two storey Timber Inter-war Guesthouse	30 Junction Street Lot 13 DP 654893
"Hillcrest"	Two storey Timber Federation Residence	53 Junction Street Lot 1 DP 580440
Former Nowra Fire Station		55 Junction Street Lot 1 DP 81794
Mafeking Boer War Memorial		60 Junction Street Lot 3 DP 363266
Nowra Post Office (former)		72 Junction Street Lot 1 DP 884212
Two storey Victorian Commercial Building		76 Junction Street Lot 1 DP 512886
Commercial Building	Inter-war Art Deco commercial building	80 Junction Street Lot 1 DP 321055
"P.Walsh & Sons"	Two storey Victorian Commercial Building	90 Junction Street Lot 1 DP 732296
Junction Street Heritage Streetscape		Junction Street Between Berry & West Streets
Nowra General Cemetery		Kalandar Street Lot 1 DP 724120 Part Lot 336 DP 755952 Lots 1-6 Sec CEM Lots 8-10 Sec CEM Closed Road
Manse	Closed road Two storey Victorian Gothic style Manse	3 Kinghorne Street Lot 11 DP 130904
Presbyterian Church and Federation Gothic Style Rendered Brick Hall	St Andrews Presbyterian Church and Federation Gothic Style Rendered Brick Hall (former Church)	5 Kinghorne Street Lot 2 DP 567876
"Roslyn Court"	Inter-war Art Deco style rendered Shops and Offices	21 Kinghorne Street Lot 1 DP 225562
Victorian Commercial Bank Stables (former)		56 Kinghorne Street Lot 1 DP 817564
Residence	Victorian Weatherboard Residence	192 Kinghorne Street Lot B DP 157265

Item	Description	Property Address
Police Residence & Lock up	Federation Police Residence and Lock up (former)	Kinghorne Street Part Lot 11 DP 758794 Sec 26
Nowra Courthouse		Kinghorne Street Lot 701 DP 1024854
Graham Family Cemetery		Lyrebird Drive Lot 3 DP 328915
Residence	Two storey Victorian Masonry Terrace House	1 Moss Street Lot 38 DP 1607 Sec 1
Cottage	Inter-war Weatherboard Cottage and Trees	2 Moss Street Lot B DP 335109
Store	Victorian Weatherboard Store (former iron store)	3 Moss Street Lot 37 DP 1607 Sec 1
"Hazelmere"	Victorian Georgian Masonry Residence	7-11 Moss Street Lot C DP410954 Lot 34 DP 1607 Sec 3 Lot 35 DP 1607 Sec 4
Residence	Federation Weatherboard Residence	13-15 Moss Street Lots 31 & 32 DP1607 Sec 1
Residence	Late Victorian Weatherboard Residence	21 Moss Street Lot 1 DP 862764
Residence	Late Victorian Weatherboard Residence	29 Moss Street Lot 24 DP 1607 Sec 1
Cottage	Late Victorian Weatherboard Cottage	31 Moss Street Lot 23 DP 963328
Presbytery	Two Storey Victorian Presbytery and grounds	20 North Street Lot 14 DP 758794 Sec 3
Shop & Residence	Two Storey Victorian Shop and Residence (former Armstrong's Saddlery)	83 North Street Lot B DP 386390
St Michael's Church	St Michael's Catholic Church	North Street Lot 13 DP 758794 Sec 3
St Michael's Roman Catholic Cemetery		North Street Lot 1 DP 1047729
Uniting Church	Former Methodist Church	54 Osborne Street Lot 13 DP 714910
Wesley Centre	Former Wesleyan Parsonage	54 Osborne Street Lot 1 DP 714910
Residence	Victorian Georgian Rendered Masonry Residence	91 Osborne Street Lot 91 DP 847151
Residence	Mid-Victorian Timber Residence, including Detached Kitchen, Well, Red Cedar Tree	93 Osborne Street Lot 8 DP 758794 Sed 17
Residence	Two storey mid-Victorian Weatherboard Residence	95 Osborne Street Lot 3 DP 601332
Residence	Victorian Neo - classical Style Rendered Masonry Residence	97 Osborne Street Lot 4 DP 601332
Residence	Late Victorian Weatherboard Residence	105 Osborne Street Lot 1 DP 986393
Residence	Victorian Neo - Classical Style Timber Residence	109 Osborne Street Lot 11 DP 545053

Item	Description	Property Address
Graham Lodge	Former Greenhills Estate Homestead and Grounds	10 Pleasant Way Lot 1 DP 1010062
Retractory	Victorian Brick Anglican Retractory	66 Plunkett Street Lot 1 DP 1047926
Anglican Church Church Hall	All Saints Anglican Church, including Memorial Lychgate, Trees Victorian Gothic style Hall (former St John's Church)	70 Plunkett Street Lot 2 DP 1047926 70 Plunkett Street Lot 2 DP 863880
Nowra Public School	Victorian Rendered Brick School and grounds	74 Plunkett Street Lot 2 DP 863880
Residence	Victorian Weatherboards Residence	75 Plunkett Street Lot 3 DP 213471
Residence	Victorian Georgian Weatherboard Residence	77 Plunkett Street Lot 4 DP 213471
Residence	Victorian Rendered Brick Residence (former Schoolmaster's Residence)	82 Plunkett Street Lot 1 DP 863880
Police Residence	Police Sergeant's Residence and grounds (former Nowra Courthouse)	84 Plunkett Street Lot 429 DP 823259
"Karinga"	Inter-war Weatherboard Residence	85 Plunkett Street Lot 2 DP 10492
Residence	Brick Californian Bungalow (former Policeman's quarters)	87 Plunkett Street Lot 3 DP 10492
Residence	Federation Weatherboard Residence	89 Plunkett Street Lot A DP 401567
"Wernick Cottage"	Georgian style Weatherboard Cottage	102 Plunkett Street Lot 3 DP 329271
"Myambah"	Federation Weatherboard Bungalow and garden	134 Plunkett Street Lot 1 DP 124486
"Shoalhaven River Bridge	Victorian Wrought Iron Bridge	Princes Highway Road reserve
"Nowra Park"	Early Victorian Masonry Residence and garden	Wallace Street Lot 4 DP 542656
"Meroogal"	Victorian Timber Residence, including Outbuildings, Garden	35 West Street Part Lot F DP 403286
Nowra Showground	Nowra Showground and Sportsground Complex, including Federation Brick Pavilion, Victorian Masonry. Gate, Toilet, Hanging Rock Lookout, Inter-war Castellated Sandstone Memorial Gateway, Sculpture. "Monaghan's" Victorian Memorial Cast Iron Fountain	West Street Lot 374 DP 755952 Lot 702 DP 1024852 Crown reserve D580011
Crown Reserve D 580011 Ben's Walk	Including Suspension Bridge, Aboriginal Art Sites West and Worrigee Streets	Lots 701, 703 and 704 DP 1024852 R70802 R67547 Part Lot 7018, DP 1024840 Lot 7036 DP 1068935 Lot 7005 DP 1023875 Lot 3 DP 585626 Part Lots 94 and 95 DP 755952
	Inter-war Weatherboard Building and Timber Wharf	Wharf Road Lot 7012 DP 1002643
Residence	Federation Weatherboard Residence	26 Worrigee Street Part Lot 2 DP 156142
Residence	Inter-war Californian Bungalow	31 Worrigee Street Lot 1 DP 62072
Residence	Inter-war Federation Style Residence	42 Worrigee Street Lot 1 DP 912561

Item	Description	Property Address
Residence	Inter-war Weatherboard Bungalow	47 Worrigee Street Part Lot 1 DP 152694
Residence	Federation Weatherboard Residence	49 Worrigee Street Lot 1 DP 199922
Residence	Victorian Weatherboard Residence	54 Worrigee Street Lot 14 DP 976539
Residence	Victorian Weatherboard Residence	56 Worrigee Street Lot 13 DP 976539
Residence	Victorian Georgian Weatherboard Residence	57 Worrigee Street Lot 1 DP780982
Residence	Victorian Weatherboard Residence	58 Worrigee Street Lot 12 DP 976539
Residence	Victorian Weatherboard Residence	59 Worrigee Street Lot 1 DP 710860
Residence	Victorian Weatherboard Residence	63 Worrigee Street Lot 2 DP 736763
Tapitallee		
Good Dog Cemetery		Bangalee Road Lots 7006 and 7007 DP 1001534
Terara		
"The Old House"	Weatherboard Residence and Well	3-7 Fox Street Lots 1-5 DP 1035937
"Terara Lodge"	Former Wesleyan Parsonage	6 Holme Street Lot 28 DP 779285
Terara Public School	Victorian Sandstone School and attached Residence, including Terara Schoolgrounds, Trees	20 Millbank Road Lot 1 DP 725988
"Dower House"	Former Coachman's House to Millbank	27A Millbank Road Lot 2 DP 313528
"Millbank Cottage"	Cottage, outbuildings and trees	31 Millbank Road Lot 1 DP 32426
"Terara House" Tree-lined drive	Including Chapel, Grounds	77 Millbank Road Lot 1 DP 579451 77 Millbank Road Lot 1 DP 579451
"Rose Cottage"	Formerly Pooley's Store	157 South Street Lot 1 DP 735264
"Ayrton House"	Former CBC Bank	175 South Street Lot 11 DP 52910
Cottage	Timber Vertical Slab Worker's Cottage	119 Terara Road Lot 102 DP 817248
"Woodlawn"	Victorian Weatherboard Cottage and trees	124 Terara Road Lot 3 DP 602305
"Citrus Grove"	Victorian Residence and trees	126 Terara Road Lot 2 DP 79001
"Solway House"	Late Victorian Brick Residence and Store	10 West Berry Street Lot 1 DP 742238
Worrigee		
Rubbleston School	Former Worrigee Schoolhouse	20 Booligal Road Lot 15 DP 755953

Item	Description	Property Address
"Congla"	Former Mackenzie Estate Manager's Residence	315 Greenwell Point Road Lot 9 DP 791226
Dome Wells	Cement Rendered Colonial (Dome) Wells (2)	361 Greenwell Point Road Lot 3 DP 843027
Worrigee Cemetery		Greenwell Point Road Lot 8 DP 791226
West Nowra		
Building and Dam	Inter-war Reinforced Concrete Building and Storage Dam (former Nowra water supply and filtration plant)	Filter and Yalwal Roads Lots 6 and 12 DP 805611

Appendix F

Historical Perspective

1. OVERVIEW

The settlement of Nowra Bomaderry has developed on the western edge of the Shoalhaven flood plain at the lowest bridging point of the Shoalhaven River. This historical perspective comprises a historical overview of Nowra Bomaderry, followed by a thematic history of Nowra and development histories of the other settlements in the district.

1.1 Aboriginal Habitation

Pre-Contact

The Nowra Bomaderry district was occupied by the Wodi-Wodi people, speaking Tharuwal, (also spelt Dharawal) north of the Shoalhaven River and by the Wandandian people, speaking Dhurga, to the south. The Wodi-Wodi people extended northwards to Botany Bay whereas the Wandandian people exerted an influence as far south as Wallaga Lake. The coastal lands from Seven Mile Beach south to Durras were consistently but not densely populated in the eighteenth century. Each tribal group was divided into local groups of closely related families, forming highly independent hunter-gathering clans with their own territory, name and sacred sites.

Post-Contact

The local Aboriginal people were first seen by Europeans in 1770 when James Cook and Joseph Banks saw fire on the Murramarang shore. After settlement, Aboriginal and their canoes were first sighted by the crew of a whaling boat in 1791. By 1801, when Barralier aboard the Lady Nelson landed at Jervis Bay, smallpox was already rife on the South Coast and the indigenous population already reduced in numbers. Over the following two decades the Aboriginal camps in the Shoalhaven were significantly impacted by European appropriation of land. Nevertheless the Aboriginal people remained very visible through the 1830s with some assisting the Europeans explore and find suitable pasture and arable land. Many Aboriginals found sporadic employment on the increasing number of European Estates, particularly at Coolangatta. Small camps were scattered around the Shoalhaven, with concentrations only at Coolangatta, Greenwell Point and Jervis Bay. Table F1 indicates the changing Aboriginal population groupings in the Nowra Bomaderry district during the period from 1834 to 1840.

Table F1: **Aboriginal People Living In Structure Plan Area: 1834-40**

Location	1834	1836	1837	1838	1840
1: Numbaa	33	28	28	23	20
2: Shoalhaven	53	47	44	104	45
3: Worrigee	30	39	41	73	45
Total	**116**	**114**	**113**	**200**	**110**

Note: Total number of Aboriginal people listed in various official returns: 1834-1840.
Source: Organ Michael, A Documentary History of the Illawarra and South Coast Aborigines, 1770-1850, Wollongong, 1990

By 1900 two Aboriginal centres occupied marginal locations in the Shoalhaven area: Roseby Park at the mouth of the Crookhaven River and Jervis Bay near Huskisson. About 15 years later a self-oriented Aboriginal settlement was established at Wreck Bay. The settlement at Huskisson was slowly abandoned until the only reserves in the area were at Roseby Park and Wreck Bay. An increasing number of Aboriginal children were 'rescued' by missionaries and accommodated in the United Aboriginal Mission home in Bomaderry. The home opened in 1908 and closed in the 1980s. At one point the home held over 30 children, either orphaned or deemed to come from dysfunctional home environments. Today there is a significant Aboriginal community in Nowra Bomaderry.

1.2 Township Development

The first grant in the district was 'Cooloomagatta' of 10,000 acres to Messrs Alexander Berry and Edward Wollstonecroft in 1822 with a further 2,000 acre grant on the south side at 'Numbaa'. Berry expanded his landholding with additional grants of two 4,000 acre lots, one lot north of the first grant and one west of Broughton Creek. Downstream on the south side of the Shoalhaven River, Berry secured a 2,000 acre grant on either side of the Numbaa grant and other ground in the vicinity of the Crookhaven. Along the river to the west of Terara, Prosper de Mestre was granted 1,300 acres and 640 acres was promised to John Layton. William Elyard was granted Brundee (2,516 acres), whilst 2,000 acres promised to Hamilton Hume in 1825 was granted to Berry in 1842.

Coolangatta became the focus of the Berry Estate with early agriculture and dairying south of the Shoalhaven River at Jindiandy. Private townships were established at Numbaa and Broughton Creek (Berry) on the Berry Estate with Terara established by the de Mestre family and Greenhills by the Graham family. Greenwell Point became the crucial link with ocean going vessels plying the route to Sydney.

From 1852 to 1858 the Shoalhaven Court of Petty Sessions met in the Numbaa courthouse. By 1866 Numbaa had nearly 200 residents, a store, a busy wharf and a windmill to grind the corn of the Berry Estate tenants. In 1868 Numbaa became a municipality and ten years later Terara became the headquarters of the new municipality of Central Shoalhaven. Nowra was established as a government-planned village, becoming the centre for administration and governance.

1.3 Ascendancy of Nowra

Both Numbaa and Terara were sited on the floodplains adjacent to the Shoalhaven River. The two major floods of 1860 and 1870 significantly damaged both towns. After the floods the decision was made to establish the main settlement of the district on higher ground at Nowra. Land was designated and the 'Village of Nowra' was laid out by surveyor Thomas Mann in 1852, initially taking the form of a 200 x 200 metre square. Its positioning was further enhanced by the construction of the Shoalhaven River Bridge in 1881 and the construction of the railway to Bomaderry in 1893.

The dramatic rise in population which took place after the 1860s peaked in the 1890s and early 1900s. This resulted in the development of Nowra as a fully fledged township with private residences; school buildings; river wharfs; a post office; a school of arts; hotels and inns; churches; banks; commercial and industrial enterprises; roads; and cemeteries.

1.4 Post War Development

Following World War II, Nowra's role and character was transformed dramatically. During the war it had become a military town: defence service personnel became part of the population and considerable expansion in industry and tourism changed the social and economic character of the town. The Royal Australian Naval Air Station HMAS Albatross was established as a base for the fleet air arm. The English paper manufacturing firm of Wiggins Teape and Nash decided to establish a paper mill at Bomaderry. John Bull, the English rubber manufacturing firm also established a factory at Bomaderry, whilst Horlick's (Manildra) extended its milk processing facility.

In spite of redevelopment during the 1970s and 1980s, Nowra retains considerable evidence of the periods of prosperity during the late 19th Century and early 20th Century by way of buildings which define and articulate the character of the town's commercial and administrative centre within the original town plan. The construction of a second bridge across the Shoalhaven River and the long planned highway, known as the East Street deviation was opened in the early 1980s. The Nowra Fair retail centre, built on part of the Worrigee Swamp east of the Nowra CBD opened soon after in 1983.

Nowra has since developed as the commercial, administrative and community facility hub of the Shoalhaven. A summary of Nowra Bomaderry's historical development is provided in Table F2.

Table F2: **Nowra Bomaderry Historical Perspective: Summary**

Aboriginal Culture:	• District to the north of the Shoalhaven River inhabited by the Wodi-Wodi people. • District to the south of the Shoalhaven River inhabited by the Wandandian people. • First visual contact with Europeans in 1770 (James Cook & Joseph Banks). • Bomaderry Aboriginal Mission established in 1908 *('Stolen Generations').*
European Settlement:	• The Berrys establish Coolangatta estate in 1822. • Establishment of a settlement at Greenhills in the 1840s • Establishment of a settlement at Terrara in the 1840s. • Establishment of a settlement at Numbaa in the 1850s. • Nowra approved as a government town in 1852. • First Nowra land sales in 1855. • Berry laid out township of "Bumaderry" in December 1859 • Relocation of Terrara's population to Nowra following devastating flood of 1870. • Shoalhaven River road bridge completed in 1881. • Extension of Sydney South Coast Railway to Bomaderry in 1893. • Gas lighting installed in Nowra in 1902. • Electricity supplied to Nowra in 1927. • HMAS Albatross commissioned in 1948. • Second Shoalhaven River bridge opened in 1980. • Nowra Fair opened in 1983.
Development of Industry:	• Cooperative Dairy Company factory established in 1902. • Horlicks factory opened in 1937. • Dairy Cooperative Factory in 1939. • John Bull Rubber Factory established in 1951. • Wiggins Teape paper mill opened in 1956.

2. THEMATIC PERSPECTIVE

2.1 Commercial Development

The Nowra township, supporting a population of 601, underwent a rapid population increase in 1871, spurred by the discovery of gold at Yalwal in 1872. From being a weak municipality (proclaimed in 1871) Nowra became a main political economic and demographic power with well developed links with the South Road which connected Broughton Creek (Berry) with Milton Ulladulla. The bridge over the Shoalhaven River and the arrival of the railway in 1893 at Bomaderry, further sustained this initial period of development. The Nowra Public wharf was operational by the 189Os but its use was restricted until rocks at the mouth of Bomaderry creek were removed. It is ironic that the wharf was even constructed, since much of the produce that normally was shipped by river was now being transported by road and rail. Three banks opened between 1879 and 1883; Terara money moved into Nowra's business area; large hotels such as the Albion in the 1870's and The Prince of Wales in 1883 (both now demolished) and the Bridge Hotel (1887) struck a late Victorian note of solidity. Although Jeremiah Green was the towns first storekeeper (1861) it was not long before the town was the principle business centre for the area.

The pinnacle of business achievement was reflected in John McArthurs peoples Emporium (1891)-a two storied department store with cast iron lace verandahs on all four walls located next to the Post Office (1879) in Berry Street. Other businesses included Mark Walkers plumbing business later to become Walkers Retravision in Kinghorne Street and P J Walsh and Son who moved his business up from Terara to Junction Street (1890) into a building designed by Cyril Blackett. Service businesses operated around Junction and Kinghorne streets. The farriers and blacksmiths were gradually superceded by the likes of George Harrison's car-taxi and garage service. George operated the mail service to Moruya and opened a garage to service the ever increasing number of motor vehicles and sell Austin, Hudson and Willys- knight cars. Others to do likewise were Fraser's (Alex and Albert) Garage in Kinghorne Street who sold Ford, Oldsmobile, Fiat and Nash cars (Former Nowra Fruit and designed by Cyril Blackett) and Arthur Barns pressed metal (Wunderlich) garage on the corner of Berry and North streets sold Buick, Chevrolet cars and Vulcan lorries.

Apart from George Harrison's garage, these early garages together with Bill Conrad's Garage on the corner of Kinghorne Street and Smith Lane are still standing today. The Harrison family home in Kinghorne Street was only recently destroyed by fire pending its sale to Shoalhaven City Council for a car park.

By the outbreak of World War I (1914-1918) Nowra was a township principally reliant on the spending power of dairy farmers from the surrounding districts, an industry which in itself was in a state of transition. With the introduction of the 40 hour working week and ensuing increase in the amount of leisure time many of the outlying coastal villages became destination points for Sydney residents and the commercial facilities for these areas were derived from Nowra. Change entered the commercial sector of the township with the arrival of major retailing and the cash and carry businesses. By the 1960's the face of the old business centre had changed dramatically. Of the two principle business streets, only Walsh's Hardware store, the former Red Rose Café, the two Art Deco shops of Aroney's and the former Mavromattes New York Café and a section of the Prince of Wales hotel remain standing in Junction Street. In Kinghorne Street apart from the Presbyterian Church and Manse, only the former Government Savings Bank, former Frances and Conrad's Garages and Roslyn Chambers (the Art Deco building on the corner of Egan's lane and Kinghorne Street) remain. All other notable buildings have been demolished - many through the construction of the Coles and Woolworths supermarkets, the Commonwealth and WestPac Banks and Best and Less retail store. The motor vehicle also contributed to the demise of many of the town's early buildings particularly residential properties near the town centre. The construction of large car parks or road construction removed many fine buildings including Dr Mathew's two storey timber residence next to the School of Arts and the RTA demolished Kenilworth, Dr Brereton's imposing two storey Victorian residence to make way for the relocation of the Princes Highway in the early 1980s.

The next major change for the business sector came about when Shoalhaven City Council sold an area of the Worrigee swamp for the erection of a major shopping centre including a Venture Department Store, K Mart and Franklins Supermarket. Despite the furore from the local business community who objected to its location on the eastern side of the Princes Highway and the large number of specialty shops and objections from the Department of Main Roads (DMR) who had just finished constructing the Princes Highway deviation around the town centre, the complex was eventually approved by the State Govt following a commission of enquiry. The approval was subject to one important condition which required the developer to construct the Jane Street overpass. This resolved much of the DMR's objections and the complex was completed in 1983 at a cost of 12 million dollars. Following purchase of the centre by the Stockland group the name of the centre was converted to Stockland Nowra and is scheduled for further major expansion to include Big W and further specialty shops. Woolworths increased their profile in the town with the purchase of the Franklins store in Nowra Fair and replaced it with their own Supermarket.

2.2 Infrastructure and Services

Thus by 1890, Nowra had reached a stage of development where a permanent water supply was being mooted, street lighting was being provided on a limited basis, kerb and guttering was progressing and there was sufficient development to support a proposal to extend the township boundaries. Despite these municipal developments, however Nowra continued to reflect its position as the centre of an agricultural region: straying stock were still being declared a public nuisance in the streets of the town in 1896. Between 1881 and 1891 the population had almost doubled to 1705. By 1901 the population was 1910. The streets were now lit with gaslight. The first of these was installed in 1902 (acetylene) and changed over to coal gas in 1905 with the opening of the coal gas works in Bridge Road. The old gas undertakings are now redundant for natural gas supplied by Victoria through a major pipeline to Sydney was introduced to the area in 2000. The introduction of natural gas saw the end of an era with Shoalhaven City Council selling its assets to Integral Energy.

Nowra's drinking water supply was initially sourced from natural springs in the area. The first reticulated supply commenced after the completion of the Flatrock Creek dam and water treatment plant in 1933. The Dam and filtration plant was decommissioned in 1984 in favour of a much larger scheme fed from water stored in the Danjera Dam. The old dam now acts as an emergency source of water for the town.

Sewerage continues to be administered by Shoalhaven Water and was first provided through a night soil removal service with effluent being dumped basically untreated at the night soil depot on the BTU Road. Reticulated sewerage was not provided until 1970 with major treatment plants being provided on the flood plain east of the town. Today with the community being more water conscious Shoalhaven City Council has embarked on significant water reuse schemes with plantations of tea trees being grown for production of soap and other sustainable products.

A reticulated supply of electricity was provided to the township in 1928. In the early 1990s the electricity undertakings that had been up to this time administered by Shoalhaven City Council was sold to Integral Energy.

The collection of solid waste was first disposed of at a tip in North Nowra and later at a waste disposal facility in West Nowra.

2.3 Social

The Shoalhaven was represented in NSW's premier event of 1879, the International Exhibition held at the Garden Palace in Sydney. Nowra's regional status was such that it even received a visit from the All England cricket team in 1885. By 1926 the residents were said to be admirably provided for with all forms of recreation including tennis, bowling, surfing clubs, the skating rink at the Dance Palais (1935) cricket and football, billiards in the School of Arts and the annual show. John Sands Commercial Directory also confirmed the prescence of accommodation houses (the White House and former Culburra Guesthouse, relocated from Culburra to the banks of the Shoalhaven River and now part of the Riverhaven Motel) which is evidence of Nowra's growing popularity as a tourist resort. Other sports which gained popularity in the area included rowing, croquet, swimming and horse racing. In 1935, 81 building applications had been approved including the erection of one picture theatre and shop (The Roxy – designed by theatre architects Guy Crick and Bruce Furse 1935) and 27 cottages. At this time Nowra boasted two cinemas – the other being Wests located on the corner of Junction and Berry Streets.

2.4 Residential

By 1938 Nowra had grown to 3,000 persons occupying 750 houses and eighteen months later 421 of these houses had been connected to the sewer. By 1986 the number of dwellings in Nowra alone had increased to 3,807 and at the Census in 2001 dwellings totalled 5,093.

In spite of redevelopment pressures within its CBD, Nowra retains considerable evidence of its expansion during the late 19th and early 20th century through its Victorian, Federation, Californian Bungalow and other Interwar housing styles. The use of fibro-cement products also created distinctive Postwar housing styles and given Nowra's association with the Defence forces this material was popularised by government housing authorities to provide low cost and subsidised housing. By the 1980's Nowra had the second highest number of Housing Commission dwellings outside the Sydney Metropolitan Area – Wagga Wagga with its RAAF base had the highest. Many private dwellings were influenced by the more noteable architects designs in the area including John Horbury Hunt, Walter Liberty Vernon, Howard Joslund and Cyril Blackett (son of renowned architect Edmund Blackett). The most intact areas which best demonstrate these styles are the precinct of Nowra west of Berry Street and the area around the Bomaderry shopping centre.

2.5 Industry

Industries that were prominent in Nowra included brick making, first established at the end of Plunkett Street and then at South Nowra in 1948. The distinctive dry pressed red bricks made an important local contribution to building design and character. Brick making was initially propelled by horse powered facilities and whilst a major expansion program was initiated to make extruded bricks due to the proposal by Armco Steel to develop a major industrial plant and city on the shores of Jervis Bay, nothing eventuated apart from the appearance of a large steel chimney stack and unclad steel frame shed. In 2004 the brickworks were sold to John Druce who set about demolishing much of these works as well as the plant to the extent that only the brick chimney and some of the early kilns survive today. Sandstone quarrying occurred in Paringa Park which later supported a flourishing boat building industry during World War II.

Jacob Schlick, a German emigrant, started manufacturing concrete blocks at his site at South Nowra which also included monuments and other stone products. Other industries included ice making and broom handle making at Crams East Street site, cordial manufacture on the corner of East and Plunkett Streets and the Nowra Dairy Company which initially was located on the banks of the Shoalhaven River prior to relocating to Bomaderry. Saw mills were also located in the vicinity of the Nowra swimming pool and at South Nowra where evidence of its former structures is located on the Bunnings site. More recently Shoalhaven City Council through encouragement from the Department of Decentralization established Flinders Estate. Here land was sold at cost in an endeavour to encourage employment and growth to the area.

3. SETTLEMENT PERSPECTIVE

3.1 Bomaderry

Bomaderry is located between the foothills of Cambewarra (Good Dog) Mountain, Bomaderry Creek and the Shoalhaven River Flats of Bolong. Bomaderry is an Aboriginal word meaning Running water. The township commenced in the early 1860's when the settlement became the focus of an improved packhorse and bridle track from Kangaroo Valley to the ferry crossing at the mouth of Bomaderry Creek. Its counterpoint landing area to the south was at Ferry Lane Nowra. Just upstream from the ferry crossing in Bomaderry creek was a produce store and wharf where produce (butter and pigs) was loaded onto river droghers for the journey down to Greenwell Point. Coastal steamers then transported it to Sydney. At this time the settlement which was located east of Railway Street, comprised the ferryman's house and shop, Mr Miller's Bomaderry Store (1865), the Bomaderry Ferry school (1867) plus several residences.

In 1881 the bridge across the Shoalhaven was completed and the following rapid growth in Nowra was somewhat at the expense of the smaller villages. In 1893 the railway was extended from Kiama to Bomaderry. Transportation from the station to Nowra was by horse drawn coach until 1917 when a motor coach service was introduced. The accessibility to Sydney markets, as a result of this improvement, resulted in a mini land boom particularly as this event also coincided with the death of David Berry and the re-subdivision and sale of his Bomaderry estate. Postal services were introduced in 1893 and the next ten years also saw the advent of a concentrated milk factory, a bacon factory, a flour mill, a saw mill and several stores. In March 1903 the Bomaderry Hotel was well under way. The Nowra Dairy Co-op originally located on the south side of the river constructed new premises near the railhead in 1939. Bomaderry further enhanced its industrial base when the English paper manufacturer Wiggins Teape and Nash established a paper mill in 1956 with an initial investment of 12 million pounds and employment for over 500 workers. A further 7 million pounds was invested in 1964 to complete the project. Previous to this decision John Bull a rubber manufacturing company had constructed a factory in north Bomaderry. Other industries to be established in Bomaderry included the Pelaco Factory in 1969 (employing 80 staff); Moorhouse established a Dairy machinery factory and Horlicks expanded its milk concentrated plant.

The United Aborigines Mission established in 1908 originally cared for approximately 30 Aboriginal children in a bushland setting. The site is now owned by the Aboriginal land council and is a grim testament to its past as 'the birthplace of the Stolen Generations'. Sewerage was completed in 1970; Bomaderry high school was officially opened on the 30th May 1970 and the Ambulance service relocated their station from Nowra to Bomaderry in 1973. In 1976 the Census recorded a permanent population north of the river of 7,613 people. Industry continued to expand with Dairy Farmers abandoning their site near the railway for modern premises on the private rail line to the paper mill further to the east: Horlicks was purchased by the Manildra group and have embarked on major expansionary works due to their production of ethanol and Nowra TAFE college relocated its entire operation from its central Nowra location to its trades campus on the Princes Highway just north of the Shoalhaven River bridge.

Bomaderry now owes much of its growth to the expanding role of Nowra as a service hub to the growing coastal villages. The expansion of the residential area rather than expanding the existing town centre has seen neighbourhood centres at Lyndhurst and North Nowra develop into viable centres in their own right. Growth saw an additional crossing over the Shoalhaven River provide for an additional three lanes of traffic in 1980s. In the late 1980s Bomaderry tried in vain to effectively compete with the Nowra CBD with an ambitious shopping development on the site of the Bomaderry Hotel.

The centre proved to be unsuccessful with the majority of the shop units remaining vacant. Its failure to attract a major discount store for its second stage meant that it was unable to compete with Nowra Fair south of the river which initially contained K Mart, Venture and a Franklins supermarket.

3.2 North Nowra

North Nowra is a relatively new residential component of the Nowra Bomaderry urban area. The area had an early association with farming with the best land being located on the river frontages and other land being either undeveloped crown land or bushland blocks of little agricultural value. The two river front farms were Thomas Daley's which he acquired in the early 1900's now the site of the Nowra Golf Club (purchased from the Daley's in 1953 by Shoalhaven Shire Council - the cottage being for some time the clubhouse for the members). The site also contained a caravan and camping ground up until the 1990s but was removed following severe flooding of the area. The subdivision which bears the farmers name, Daley Crescent was approved in 1948. The other was Captain J Wilson's land referred to as the 'Grotto' and later acquired by John Hanson. The Hanson's grew crops, grapes and fruit for sale in their shop opposite the Roxy theatre in Nowra. A number of caves on the property were used to store produce and later became work sheds for subsequent owners who continued market gardening and the orchard. The land was eventually sold to Shoalhaven Shire council in 1964 and is now used for recreation. The remaining part of the Hanson's estate was developed for residential purposes in 1960s and 1970s and the naming of Hanson's Road within this estate is testimony to its early owners.

3.3 Cambewarra

The village of Cambewarra is located at the foot of Cambewarra Mountain on the northern side of the Shoalhaven River and west of Bomaderry. The name is derived from the Aboriginal words meaning high place. The first European settler Zaccheus Bice started faming the land with his wife in 1851. The settlement that formed was the result of the basic needs of the community and included; a cemetery (1870), school (1859) and the School of Arts was constructed in 1879. The village also had a store (1864) and an unofficial post office in 1866. Other buildings during this period included several hotels, a blacksmith, bakery and other general stores. Industries included three tanneries and the Cambewarra Dairy Company.

Although church services were held from an early stage it was not until circa 1900 that a simple wooden structure (the Union Church) was built to cater for all denominations. Cambewarra Shire Council was proclaimed in 1906 and functioned until 1948 when Shoalhaven Shire was formed through the amalgamation of a number of these small councils. Although the village today is considerably larger than in the 1800s, growth has been primarily driven by residential development attracted by the village's scenic pastoral setting (the Evison's dairy farm complex ha been continually occupied since 1853) and its village character. A new primary school was constructed in the 1990s. In 2001 the village had a permanent population of just over 1,000 persons. The church and School of Arts continue to provide valuable venues for the community and the former post office and primary school continue life, albeit as private residences and community function centres. The town has a general store complete with the original fig and palm tree that graced the rear garden of the post office. Although one of the timber bridges providing access to the town has been replaced, the one over Tapitallee Creek survives as a legacy of the days when abundant timber provided affordable and durable construction materials.

3.4 Terara

Terara is a small village on the banks of the Shoalhaven River east of Nowra. The name Terara was originally given to the 1300 acre property by its original owner Prosper De Mestre, a French émigré, after the family descendents property Terar on the island of Martinique in the French West Indies. It is also suggested that it is derived from the aboriginal meaning 'thick scrub.' When Prosper died in 1844 his widow and large family were left to develop the Estate and in time they turned it into a flourishing township. Their homestead 'Millbank' survives today. The first place of public worship was St John's Church of England 1856 now demolished although it is believed that the grave of Prosper De Mestre still survives in the former Church grounds. In the following year, a small Methodist Church was established although all that now survives is its manse. School was initially conducted in St John's Sunday school until a substantial sandstone building was constructed in 1878 – the school is still in use today.

Postal facilities were provided from 1865 in saddler James Armstrong's building and a branch of the commercial bank and first newspaper, The Shoalhaven News was established in 1867. During these early times, Terara had several hotels (only one remains, now a residence), a variety of shops and professional services and a depot for the Illawarra Steam Ship Company. The Chinese influence is present in Terara where immigrants provided produce to the goldminers. Solway's cottage and shop is evidence of this and still includes the shop where produce was sold and the land that was used for market gardening. The great flood of 1870 had a devastating effect on the area with some lives lost and a significant portion of the town washed away. The partly built town hall was never finished and any chance of Terara becoming an important administrative centre was abandoned in favour of the adjoining government town of Nowra. The Municipality of Shoalhaven was formed in 1879 but was short lived being amalgamated with the South Shoalhaven Council in 1895.

Terara is the location of one of the Shoalhaven's grandest houses - Terara House, built for Hugh Mckenzie in 1904. The impact of flooding has retained the village in almost its original form and its location in the Crookhaven/Numbaa pastoral landscape, as with Cambewarra, makes it a desirable residential enclave for persons working in Nowra.

3.5 Rural Hinterland

Nowra Bomaderry is located on the western edge of the Shoalhaven River floodplain, with the Cambewarra escarpment and foothills to the north and poorer sandstone country to the west and south. Cedar getting was soon followed by the pastoralists who took up grants on the better soil. The development of this industry was problematic and was dependent on farmers getting their produce to the Sydney market. Until Berry extended the road from Gerringong to Bomaderry in 1858 at his own expense, transport was either by ship through Greenwell Point or by bullock teams and packhorses over primitive bush tracks. Following these improvements the real beginnings of the dairy industry developed in the Shoalhaven after the 1860s. Water was crucial to the success of dairy farms and storage of high quality water was imperative for their success. The invention of corrugated iron and its use in making tanks was a big step forward although wealthier properties still continued to use in ground brick cisterns of beehive shape as these kept the water cool.

The invention of refrigeration by Thomas Mort in 1858 was an important technological innovation and the construction of the railway to Bomaderry changed the emphasis from butter and cheese production to milk, particularly since Shoalhaven was well located to supply the rapidly expanding Sydney milk market. Dairying has provided the Nowra Bomaderry with a lasting legacy in terms of its important contribution to the district's economy and the surviving pastoral landscapes around Bolong, Cambewarra, Numbaa and Worrigee. These scenic pastoral landscapes are primary character contributors to Nowra Bomaderry's sense of place and important assets for tourism. The dairy farm complexes consisting of homesteads, dairies, silos, slab timber barns, post and rail fencing, cisterns and wells along with vegetation markers such as the coral trees, figs, araucarias camphor laurels and poplars are all important elements of these landscapes. Similarly the irrigation channels, timber bridges, narrow grass verged roads and lone grave markers represent important components of the broader landscape of the district. The flood zoning has played an instrumental role in maintaining farming activities and the character of these landscapes, whereas other areas are under threat from small lot rural subdivisions and urban expansion.

3.6 HMAS Albatross

The airbase, now known as the Naval Air Station HMAS Albatross, first came into being as RAAF Base Nowra. The airfield was being developed as a municipal airport when World War II commenced in September 1939. The airfield had been an air transport facility since the late 1920s, with joy flights commencing in the early 1930s. Following the declaration of war, it was taken over and developed for the RAAF. On 7 May 1942, the RAAF commenced operating at the base, coincidentally while the battle of the Coral Sea was at its height. Squadrons of the United States Army Corp and the Royal Netherlands and East Indies Air Force, at different times, spent time at RAAF Base Nowra for bombing and torpedo training. The change to a naval role came in late 1944 when RAAF Base Nowra was transferred to the Royal Navy as one of the seven Royal Naval Air Stations in Australia. They provided training and support for air squadrons of the British Pacific Fleet.

The Royal Navy's Fleet Air Arm began operations at Nowra in late October 1944 and the base was commissioned as HMS Nabbington, later becoming HMS Nabswick from 15th November 1945 until 18th March 1948. After this the base was returned to the RAAF.

HMAS Albatross was commissioned on the 31st August 1948. The following May, the 20th Carrier Group, consisting of Sea Fury and Firefly aircraft, was brought from Britain on board HMAS Sydney. In 1953, the first helicopters arrived. In 1956 the Sea Venom Jet Fighters and Gannet Anti-Submarine Aircraft replaced the Sea Fury and Firefly. Their arrival meant that avionics workshop and test facilities had to be upgraded. More aircraft in the skies over Nowra demanded stricter standards of aircraft control and a new control tower was built in 1958. In 1963, the introduction of Wessex Helicopters into service with their dunking sonar, to find submarines, also caused a further increase in technical skills. 1968 saw the introduction of the Grumman Tracker and the Macdonald Douglas A4 Skyhawk come into service. These aircraft replaced the Fairey Gannets and Sea Venoms. The Tracker and Skyhawk squadrons were finally disbanded on the 30th June 1982. With them the fixed wing component of the RAN'S Fleet Air Arm came to an end, with the exception in the electronic warfare training role. The Skyhawks were sold to the Royal New Zealand Air Force. The area surrounding the base is dotted with World War II artefacts ranging from bomb shelters to command posts. Some trees in the area still have the guy wires used to secure the camouflage netting that covered aircraft during the war.

Emblematic Association

The Royal Australian Navy has developed an emblematic association with Nowra, its only shore air facility. In addition to the frequent over flight of its aircraft, the personnel of HMAS Albatross have been given the 'freedom of the city', with the right to enter Nowra 'on all ceremonial occasions with swords drawn, bayonets fixed, drums beating, bands playing and colours flying'.

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