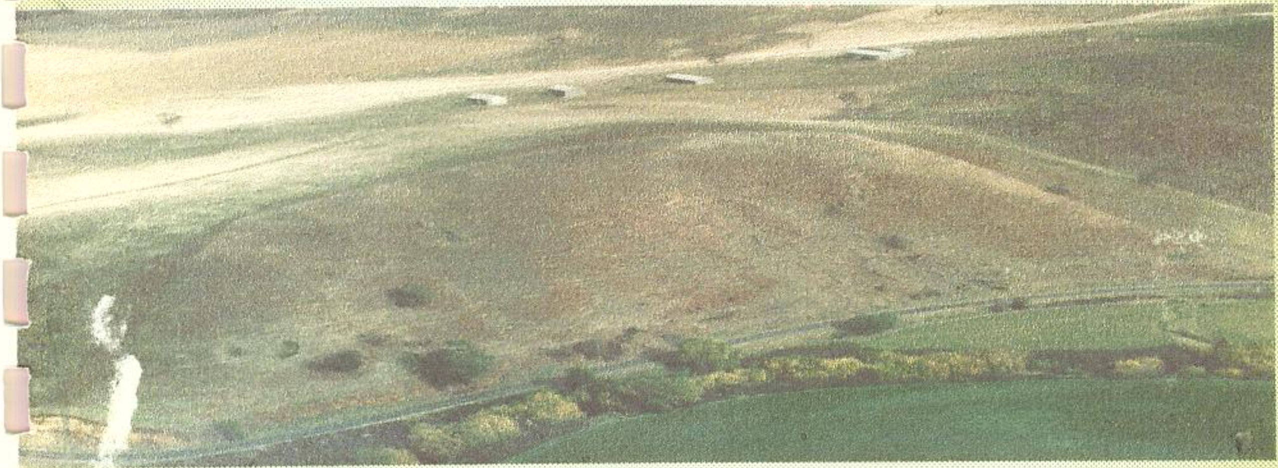
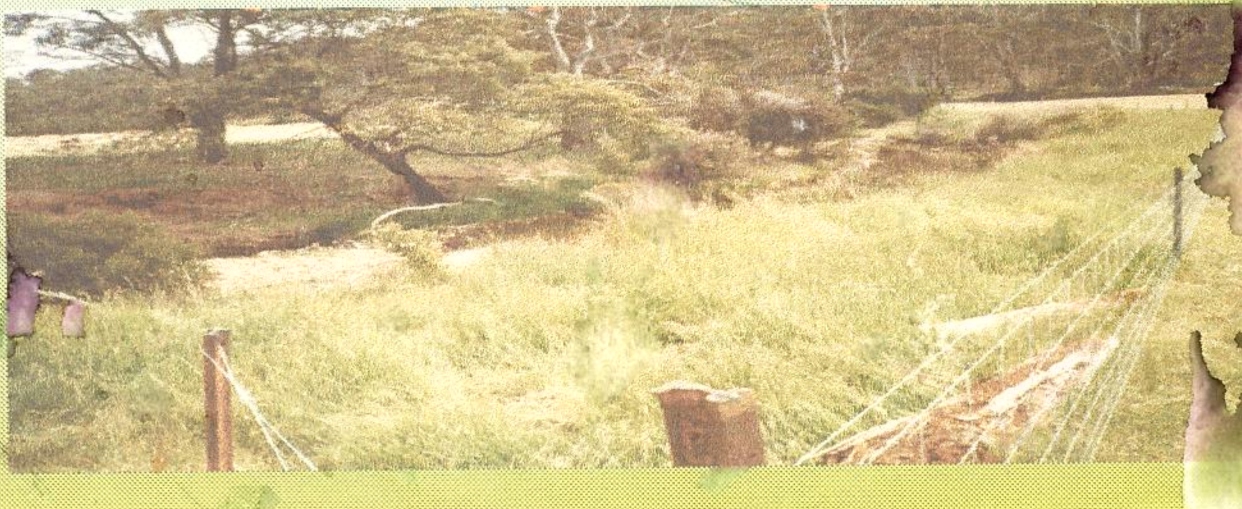
COAL RIVER CATCHMENT NATURAL RESOURCE ASSESSMENT





Nevelle Mendham

COAL RIVER CATCHMENT

NATURAL RESOURCE ASSESSMENT

July 1997

A summary of available natural resources information for the Coal River Catchment undertaken as part of the development of a Catchment Management Strategy for the valley.

This community process is being driven by the Coal River Catchment Committee with the support of the Natural Heritage Trust, the Clarence City Council, Sorell Council and the Southern Midlands Council.

Thanks must go to those who provided resource information for this report, particularly the Department of Environment and Land Management and the Department of Primary Industry & Fisheries. Clarence City Council is also thanked for data input and assistance in development of a GIS for the project.

Any conclusions drawn in this report are those of the author, not the contributing agency.

Steve Gallagher

Project Officer

WHAT IS NATURAL RESOURCE ASSESSMENT?

Natural resources such as water, soil and climate play a major role in where and how we live. Every catchment is unique in that it is the result of interaction between a range of natural characteristics or resources specific to that area. While most of us would be able to give a rough description of our valley, our knowledge is probably limited to those areas where we live, work or play.

This report aims to provide a comprehensive description of the natural resources of the Coal River Catchment. It is both a summary of existing resource data for the valley and a guide to other publications and databases where more extensive information may be available. Its aim is to capture the detail of those natural resources which combine to characterise the valley and present them in a concise and easily accessible manner.

WHY THE COAL RIVER CATCHMENT?

The Coal River catchment covers over 600 square kilometres of south-eastern Tasmania. Located on the eastern fringes of Hobart, the catchment contains a diversity of land uses including pasture, forest, recreation, irrigated cropland and rural residential development. Pitt Water Estuary, at the bottom of the catchment, is a Ramsar wetland site of international significance.

There is a recognised need for a co-ordinated approach to land and water management to balance the diversity of interests across the whole catchment.

Community involvement is seen to be the key to the development of a Catchment Management Plan for the integrated and sustainable management of natural and cultural resources. The process is driven and owned by the community, hosted by Local Government and undertaken in co-operation with State and Commonwealth agencies.

A key component of this process is to encourage sustainable catchment management through the provision of appropriate resource information required by planners and land and water managers. While this report aims to fulfill this role, it hopefully provides information which is of value and interest to the wider community.


COAL RIVER CATCHMENT
COLEBROOK
CAMPANIA
RICHMOND
HOBART
N
0 1 2 3 4 5 6
Kilometres


COAL RIVER
CATCHMENT
HOBART
N
0 1 2 3 4 5
Kilometres

WHAT IS A CATCHMENT?

Water is the common thread which ties a catchment together. Runoff from rainfall flows down creeks and streams into the larger rivers leading to the coast. Hills separating one river system from the next mark the catchment boundary and the land (and water) areas within these boundaries are called a 'catchment'.

Using maps recombined or reshaped in terms of catchment boundaries allows a shift in the frame of reference from man-made boundaries to the physical boundaries imposed by landscape and drainage lines. The notion of the catchment as a discrete unit is a useful starting point for management purposes but is subject to qualification.

While landscape features allow simple boundary definition, they are not always indicative of water movement within catchments. Sub-surface flow or inter-catchment transfer of water (water supply, power generation, sewage, etc.) can affect water quality and quantity yet are seldom factored in to catchment management plans due to the lack of available data.

The impact of wind-borne soil particles, industrial pollutants and marine aerosols may be significant across catchment boundaries. Flora and fauna also have some capacity to move across these physical boundaries. When considering catchment 'sustainability' in more general terms, the continual movement of outputs (farm products, labour, timber) and inputs (population, fertilisers, fuel, commodities) between catchments should be acknowledged.

Thus catchment boundaries, while superior to administrative boundaries for defining resource management issues, should not be viewed as barriers that isolate catchments from larger-scale regional concerns.

CATCHMENT MANAGEMENT

Land and water resource issues (salinity, vegetation clearance, water quality and quantity, etc.) should not be viewed in isolation when developing management strategies. Activities in one area of the catchment can have a range of flow-on effects elsewhere in the catchment. Vegetation clearance may degrade downstream water quality or weed infestation may cross property boundaries and reduce faunal habitat.

Catchment based management recognises the 'web' of inter-relationships which exist between land, water and biological resources at catchment and sub-catchment level. Whether described as 'integrated', 'total' or 'whole' catchment management, it applies a co-ordinated approach to the management of local resource issues.

As catchments are dynamic systems undergoing continual change due to natural cycles and human activity, the management process needs to be flexible and on-going. Responsiveness to change requires a co-ordinated strategy based upon best available resource information.

The central objective of catchment management strategies is to provide a balance between economic development and the conservation of natural resources. This balance is commonly referred to as 'sustainable development'.

Comparison of two different images of the Coal River Catchment (previous two pages) illustrates the magnitude of the task involved in developing a catchment management plan. Landsat satellite imagery depicts a simplified catchment - land or water, forested or cleared - requiring straight forward recommendations on best management practices to achieve a desired result. Add roads, towns and property boundaries, however, and the diversity of community interests which need to be reconciled before acceptance of any management plan is made graphically clear.

LAND RESOURCES

Area

The Coal River rises in the hills east of Tunnack at an altitude of over 520 metres and wends its way nearly 70 km to sea level at Pitt Water. The catchment runs from north to south and stretches 50 km and 20 km at its longest and widest points. Total catchment area is approximately 630 square km. For the purposes of the management plan, streams draining into Pitt Water to the west of Midway Point are included as part of the catchment.

Landform

The Coal River Valley is the dominant landscape feature and is defined by roughly parallel north-south ridges with heights of up to 900 metres. The eastern drainage divide extends south from Mt. Seymour township, to Mount Ponsonby (797 m), Brown Mountain (792 m), Black Charlies Sugarloaf (382 m) and Mount Lord (278 m) which overlooks Pitt Water. The western drainage divide runs from Flat Top Tier (699 m), to Quoin Mountain (900 m), Gunns Sugarloaf (375 m), Grasstree Hill (534 m) and Canopus Hill near Cambridge. Lesser ridges up to 300 metres delineate sub-catchment boundaries for the major tributaries - Wallaby Rivulet, White Kangaroo Rivulet and Native Hut Rivulet - and for Duck Hole Creek and Barilla Rivulet which discharge into Pitt Water.

From the gently sloping, higher altitude areas around Tunnack and Stonor, the Coal River passes through a deeply incised gorge (up to 180 metres deep) in the upper catchment before crossing the broader plains of the lower valley. Wetlands characterise the low relief areas which fringe the Pitt Water estuarine zone.

Geology

Jurassic dolerite intrusives form the high ridges and rounded hills (weathered igneous plugs) which cover approximately thirty percent of the catchment. Triassic fluvio-lacustrine sequences of quartz sandstone with varying proportions of shale and mudstone comprise nearly forty percent of the total area, primarily in the upper regions of the Coal River valley floor. Siliceous siltstone outcrops of Permian age cover ten percent of the catchment in the Tunnack-Baden region and around Cambridge. Tertiary sedimentary deposits (basalt silts and fine sand) are found along the Coal River Estuary and Pitt Water, while basalt extends between Campania and Richmond on the Coal River plain. Quaternary alluvial deposits are restricted to stream valleys throughout the catchment (Leaman 1971).

Soil Types

The major agricultural soils of the Coal River Valley are outlined in Davey & Maynard (1992c) as derived from Holtz (1987). Davies (1988) provides an assessment of soil types as part of a regional Land Systems study. The major soil types are..

- aeolian or wind-blown sands which are good for intensive agriculture but susceptible to wind erosion
- floodplain/terrace soils which require dry weather irrigation and may have moderate to high subsoil salinity
- alluvial plain soils which are good for most crops but require irrigation and drainage
- pediment and high terrace soils characterised by poor workability and drainage
- tertiary sediment prone to drainage problems, high sub-soil salinity and breakdown of soil structure
- tertiary basalts subject to cracking in dry seasons but capable of producing good crops
- friable dolerite soils prevalent on hill tops
- soft plastic clays underlie dispersible clays and fine sand or silt soils on the western shores of Pitt Water. Steane (1983) suggests erosion is a problem where the foreshore is cleared, cultivated or subject to heavy grazing pressure.

LAND SYSTEMS ANALYSIS

The Department of Primary Industry and Fisheries have undertaken natural resource assessment in the Coal River catchment. Davies (1988) surveyed land and soil resources in relation to regional rainfall, topography and vegetation in order to group similar land types or 'land systems'. These classifications are available in map format (Figure 1) and can be used for management purposes. The Coal River catchment is characterised by eleven such Land System types. Table 1 outlines the erosion susceptibility of these regions and typical land use.

Recent work by Grice (1995) looked in more detail at soil and land degradation on private freehold land. The report includes maps on areas prone to gully erosion, tree decline, mass movement, tunnel erosion, salinity, wind erosion, sheet and rill erosion hazard, and soil structure decline hazard. Several of these maps are reproduced in this report (Figures 2-5).

With map interpretation only appropriate at 1:500,000 scale, it is intended to provide a regional guide rather than local detail.

Table 1: Land Systems erosion risk

Land System	Code	Erosion Risk				Land Use
		Crests	Upper Slopes	Lower Slopes	Flats	
Government Hills	264141	sheet & rill	sheet & rill	gully, streambank & flooding	gully, streambank & flooding	grazing, nature conservation & sub-division
Whitefoord	264232	sheet & rill	sheet & rill	sheet & rill gully & tunnel	gully & tunnel flooding & waterlogging	grazing
Stony Hills	272141				flooding & waterlogging	grazing
Isis Hills	272242				gully, flooding & waterlogging	grazing
St Peters Pass	272251				flooding & waterlogging	forestry & grazing
Heathy Hills	273141			rill, gully & streambank	rill, gully & streambank flooding & waterlogging	grazing, cropping & forestry
Huntington Tier	278141	sheet & rill	sheet & rill	sheet & rill gully, tunnel & streambank	gully, tunnel & streambank	grazing & cropping
Coal River Flats	288123				rill, gully & streambank * flooding & waterlogging	cropping & grazing
Eastern Tiers	372241	sheet & rill			flooding & waterlogging **	forestry, nature conservation, grazing, water catchment & recreation
Mt. Hobbs	372245					forestry & grazing
Levendale	378232	sheet & rill	sheet & rill gully & tunnel	sheet & rill gully & tunnel	gully & tunnel flooding & waterlogging	grazing, forestry & nature conservation

*terraces **marshes and swamps

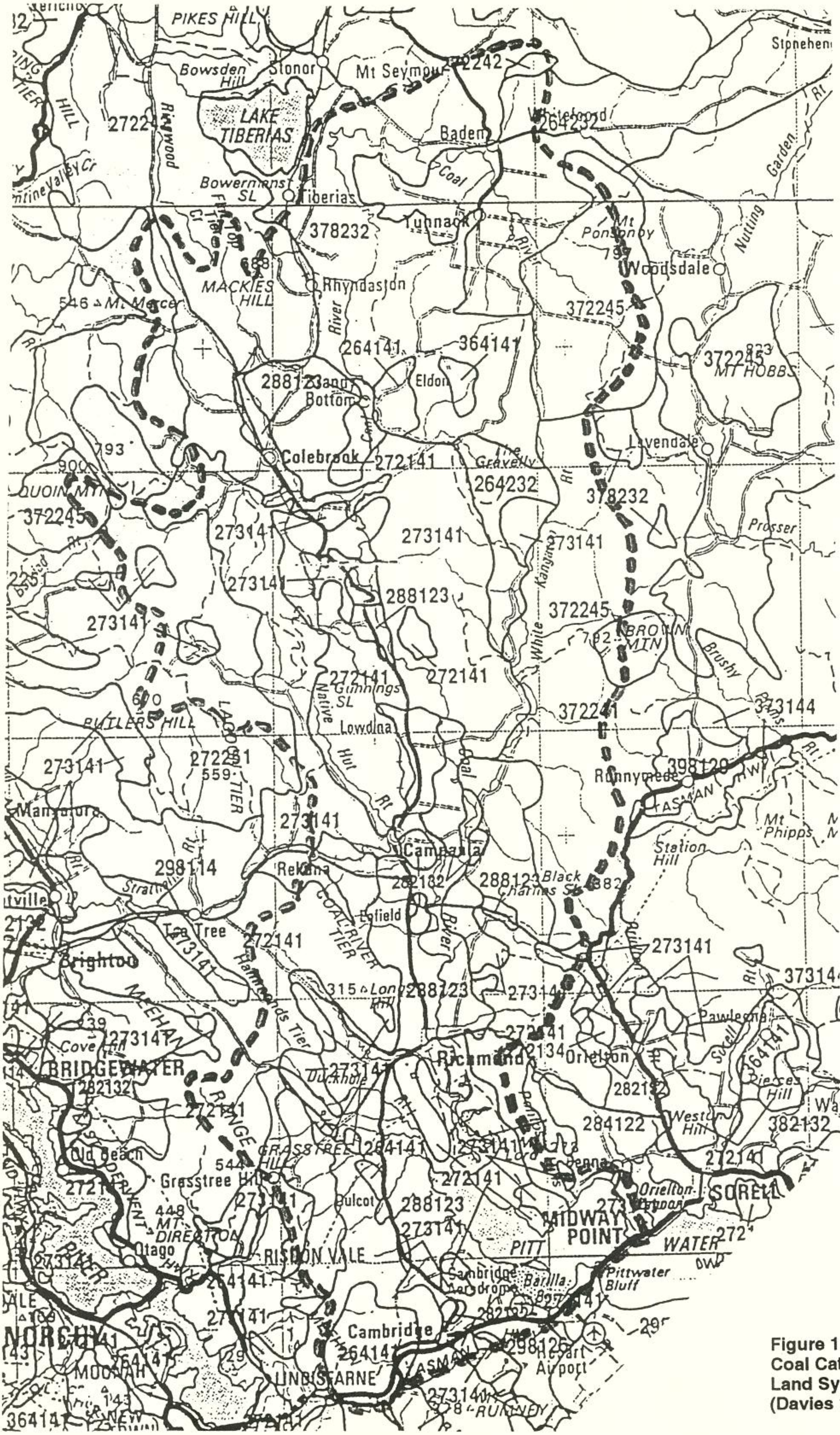


Figure 1:
Coal Catchment Land Systems
(Davies 1988)

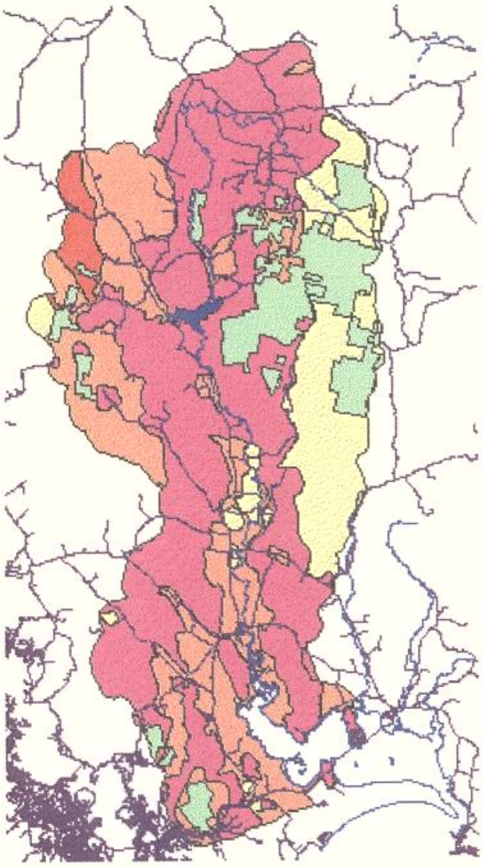


**Figure 2: GULLY EROSION
(Grice 1995)**

Channels caused by periodic water flow (in this case including riverbank slumping) have been assessed by ground survey and aerial photography. Each land system component was assessed on the total length of gully erosion present in a typical 100 hectare zone.

Hence

- No appreciable gully erosion means less than 10 metres of gullying per 100 hectares
- Minor gully erosion 10 – 100 metre per 100 hectares
- Moderate gully erosion 100 – 1000 metre per 100 hectares
- Severe gully erosion greater than 1 kilometre per 100 hectares

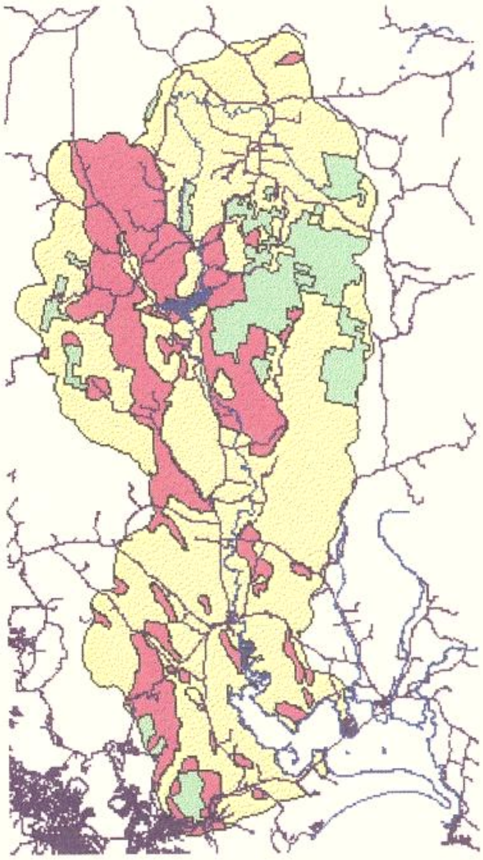
349 Crown Land
351 No Appreciable Gully
352 Minor Gully
353 Moderate Gully
354 Severe Gully

**Figure 3: MASS MOVEMENT
(Grice 1995)**

Downhill slumping of soil and rock is related to structural soil weakness generally associated with steep slopes and vegetation removal. While it may be evident as slumps or landslides, the formation of terracettes (a series of paths or minor slumps on steep slopes caused by livestock passage) is a less dramatic form of mass movement. Assessment was by ground and air survey.

Hence

- No mass movement detected.
- Mass movement is with or without terracettes.



330 Crown Land
331 No Mass Movements
332 Mass Movements

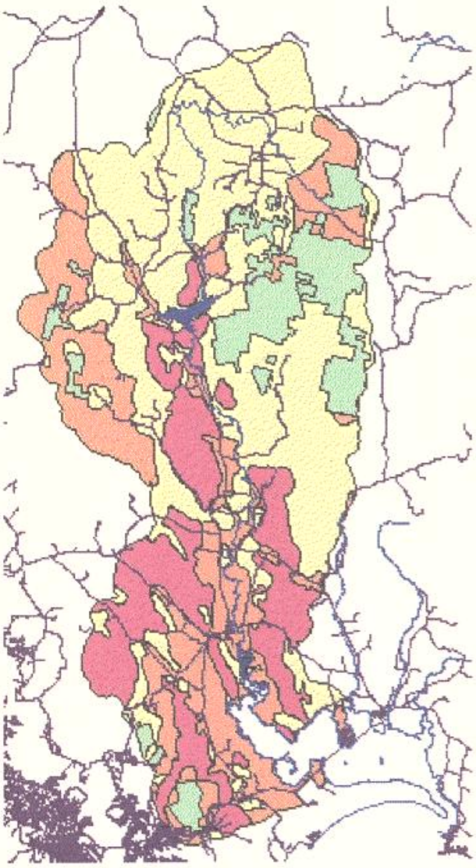


Figure 4: SHEET & RILL EROSION HAZARD ON PRIVATE FREEHOLD LAND (Grice 1995)

Sheet & rill erosion is the removal of a fairly uniform layer of soil by raindrop splash and runoff. Erosion hazard was predicted using rainfall erosivity, soil erodibility, slope length and gradient, vegetation cover and land management practices.

Hence

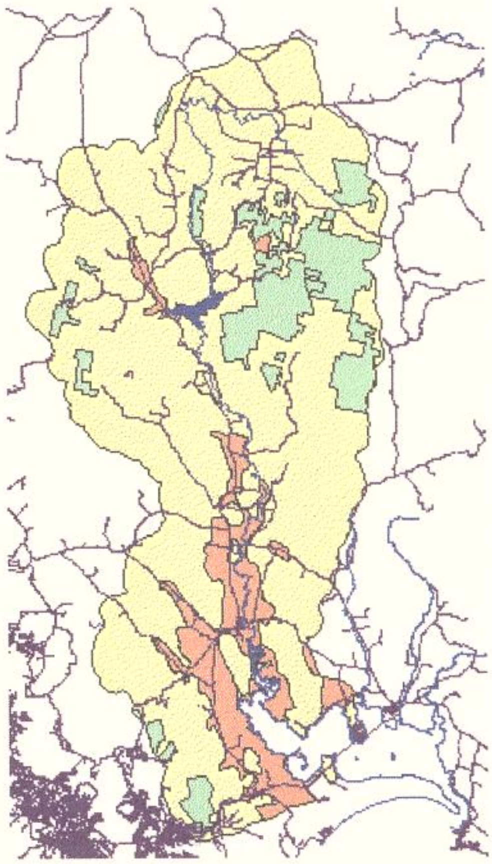
- Nil to Minor hazard refers to areas of pasture with good vegetative cover or forestry and cropping areas on flat to very gently sloping land.
- Moderate hazard refers to poor or steep pastures or cropping and forestry undertaken on gently sloping land.
- Very severe hazard refers to cropping or forestry on very steep land, poor pastures or vegetable production on very steep land.

Figure 5: SOIL STRUCTURE DECLINE HAZARD ASSESSMENT (Grice 1995)

Soil structural decline is the change in inherent structure in the soil as a result of land use practices. This structural change is evident in aspects of soil drainage, air movement, erosion susceptibility and soil biological activity. Land use, such as intensive cropping, is the principal factor used for assessment.

Hence

- Nil to Minor hazard refers to soils under pasture with light grazing which have the same structural characteristics as equivalent undisturbed soils.
- Moderate hazard refers to soils used for forestry plantations or selective logging and loam and clay soils used for frequent cropping



CLIMATE

The Coal River catchment is located in a relatively dry area of Tasmania with an average annual rainfall increasing from 520 mm at Hobart Airport to 630 mm further inland at Colebrook. High ridges ringing the catchment (Central Highlands to the west and Brown Mountain to the east) place much of the valley within a rainshadow. While east coast low pressure systems tend to produce more rain from October to December, Table 2 shows that monthly rainfall figures are relatively uniform in the 40 - 60 mm range (Davey & Maynard 1992b, Bureau of Meteorology 1977).

River flow records indicate that only ten to fifteen percent of rainfall in the catchment is evident as run-off (SDAC 1996). Low run-off can be the result of high net evaporation rates and increased ground permeability.

Mean maximum daily temperatures (Hobart Airport) range from 22 °C in January and February to 12 °C in June and July. July has the mean minimum daily temperature of 3.9 °C. On average, frosts occur nine times per year with the frequency increasing further inland.

Winds generally blow down the valley from the north-west, with the lower catchment receiving cooler south-easterly sea breezes in the summer.

Table 2: Average rainfall Coal River catchment

Rainfall Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mt Seymour	50	44	47	55	49	60	48	48	46	63	51	70	631
Colebrook	44	46	46	59	51	53	53	50	50	66	56	67	641
Campania	48	45	44	52	50	53	44	38	40	60	47	64	585
Richmond	44	44	39	45	42	42	40	39	36	53	44	56	524
Cambridge	44	40	44	50	45	50	39	37	38	57	43	53	540

VEGETATION

Vegetation coverage reflects the impact of clearing and agriculture, landform, local geology and soil, bushfire frequency and soil erosion and deposition. A large proportion of the catchment has been cleared for agriculture. An estimated 235 square kilometres or 38% of the catchment has forest cover. The Landsat satellite image gives a good visual indication of forest cover as of 1994.

Typical vegetation communities for the Coal Valley are outlined in Figure 6. The more frequently fired higher dolerite slopes are characterised by open forest (dominants *Eucalyptus globulus, E. pulchella, E. viminalis, E. amygdalina, E. ovata,* and *E. obliqua*). Open scrub and *E. tenuramis* forest are found at Mt. Bains, Springhill Bottom, Hodgsons Sugarloaf, Gunnings Sugarloaf, Coal River Tier and Grass Tree Hill. Areas of *E. delegatensis* tall open forest are found at Flat Top Tier, Brown Mountain and Quoin Mountain and *E. ovata* forest and scrub around Levendale, White Kangaroo Rvt. and Runneymede (Hepper *et al.* 1988).

While differences in vegetation between rock type are not obvious, tussocky grass is common on dolerite and ferns are more common on sandy Triassic soils (Leaman 1971).

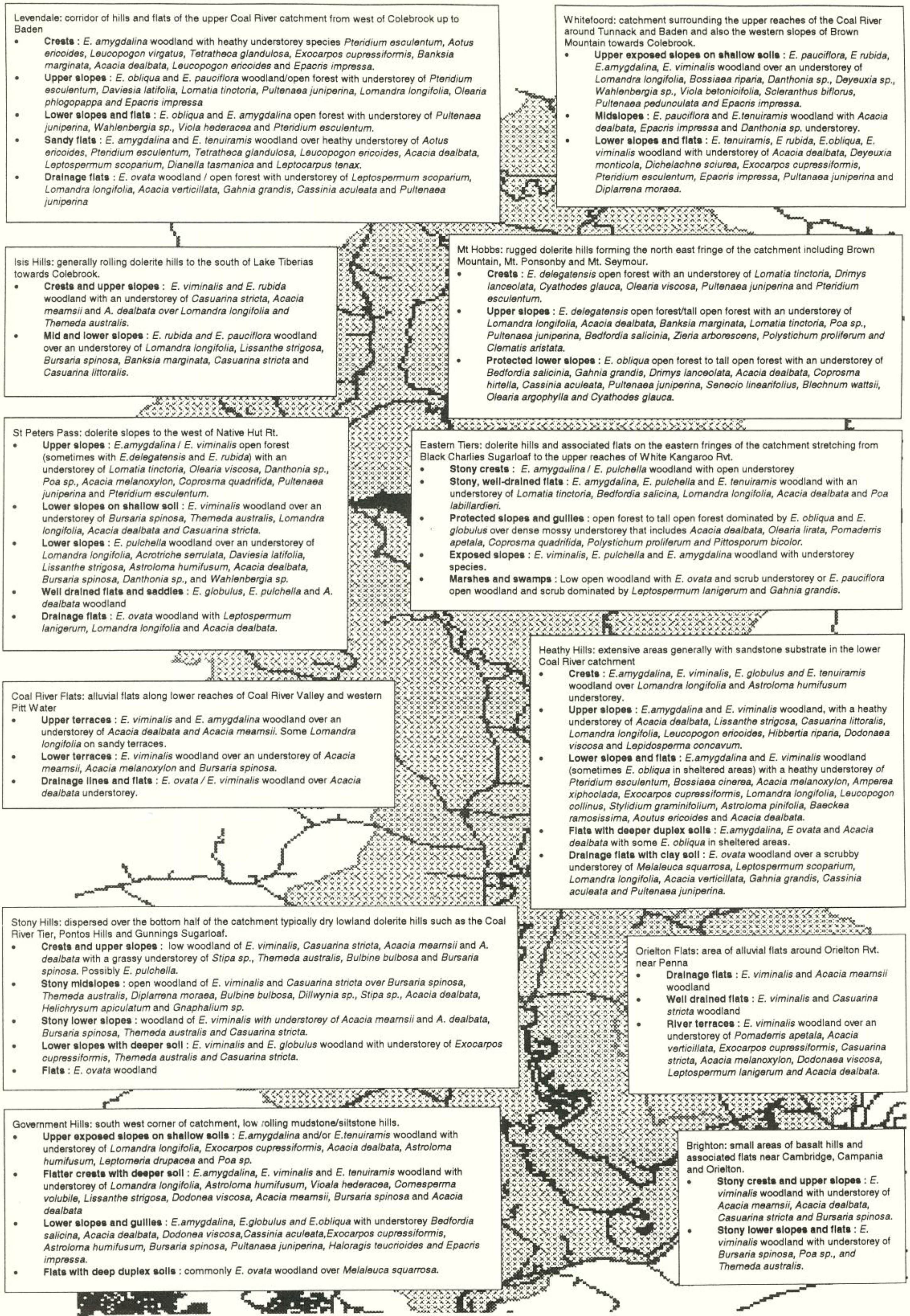
Riparian vegetation assemblages on the upper reaches of the Coal River have been studied and mapped by Askey-Doran (1993).

Some areas of Crown Land within the catchment have been nominated as 'recommended areas for protection' as dry sclerophyll forest communities enhancing the existing state reserve system.

To the south of Tunnack, one of the few areas within the state dominated by *Eucalyptus perriniana* has been set aside as the Spinning Gum Forest Reserve. It has been suggested that the small size of the reserve in relation to adjoining farmland will make site management difficult (Kirkpatrick *et al.* 1995). West of this reserve is the Coal River Gorge Nature Reserve. Johnson and Kirkpatrick (1996) catalogued its vegetation and flora and pointed to the significance of its stands of heathy *Eucalyptus tenuiramis* forest, once widespread in the southern Midlands and Derwent Valley.

Salt marsh composition in estuarine areas of the lower Coal Valley and Pitt Water have been mapped by Kirkpatrick and Glasby (1981) and are considered to be areas of international significance (Ramsar Convention).

A 'natural assets inventory' undertaken for the City of Clarence (de Gryse 1995) surveyed and mapped vascular plant communities within the old municipal boundaries. Currently this is being updated to include newly amalgamated areas around Richmond.



Levendale: corridor of hills and flats of the upper Coal River catchment from west of Colebrook up to Baden

- **Crests** : *E. amygdalina* woodland with heathy understorey species *Pteridium esculentum, Aotus ericoides, Leucopogon virgatus, Tetratheca glandulosa, Exocarpos cupressiformis, Banksia marginata, Acacia dealbata, Leucopogon ericoides* and *Epacris impressa.*
- **Upper slopes** : *E. obliqua* and *E. pauciflora* woodland/open forest with understorey of *Pteridium esculentum, Daviesia latifolia, Lomatia tinctoria, Pultenaea juniperina, Lomandra longifolia, Olearia phlogopappa and Epacris impressa*
- **Lower slopes and flats** : *E. obliqua* and *E. amygdalina* open forest with understorey of *Pultenaea juniperina, Wahlenbergia sp., Viola hederacea* and *Pteridium esculentum.*
- **Sandy flats** : *E. amygdalina* and *E. tenuiramis* woodland over heathy understorey of *Aotus ericoides, Pteridium esculentum, Tetratheca glandulosa, Leucopogon ericoides, Acacia dealbata, Leptospermum scoparium, Dianella tasmanica* and *Leptocarpus tenax.*
- **Drainage flats** : *E. ovata* woodland / open forest with understorey of *Leptospermum scoparium, Lomandra longifolia, Acacia verticillata, Gahnia grandis, Cassinia aculeata* and *Pultenaea juniperina*

Whitefoord: catchment surrounding the upper reaches of the Coal River around Tunnack and Baden and also the western slopes of Brown Mountain towards Colebrook.

- **Upper exposed slopes on shallow soils** : *E. pauciflora, E rubida, E.amygdalina, E. viminalis* woodland over an understorey of *Lomandra longifolia, Bossiaea riparia, Danthonia sp., Deyeuxia sp., Wahlenbergia sp., Viola betonicifolia, Scleranthus biflorus, Pultenaea pedunculata and Epacris impressa.*
- **Midslopes** : *E. pauciflora* and *E.tenuiramis* woodland with *Acacia dealbata, Epacris impressa* and *Danthonia sp.* understorey.
- **Lower slopes and flats** : *E. tenuiramis, E rubida, E.obliqua, E. viminalis* woodland with understorey of *Acacia dealbata, Deyeuxia monticola, Dichelachne sciurea, Exocarpos cupressiformis, Pteridium esculentum, Epacris impressa, Pultanaea juniperina* and *Diplarrena moraea.*

Isis Hills: generally rolling dolerite hills to the south of Lake Tiberias towards Colebrook.

- **Crests and upper slopes** : *E. viminalis and E. rubida* woodland with an understorey of *Casuarina stricta, Acacia mearnsii* and *A. dealbata over Lomandra longifolia and Themeda australis.*
- **Mid and lower slopes** : *E. rubida and E. pauciflora* woodland over an understorey of *Lomandra longifolia, Lissanthe strigosa, Bursaria spinosa, Banksia marginata, Casuarina stricta* and *Casuarina littoralis.*

Mt Hobbs: rugged dolerite hills forming the north east fringe of the catchment including Brown Mountain, Mt. Ponsonby and Mt. Seymour.

- **Crests** : *E. delegatensis* open forest with an understorey of *Lomatia tinctoria, Drimys lanceolata, Cyathodes glauca, Olearia viscosa, Pultenaea juniperina* and *Pteridium esculentum.*
- **Upper slopes** : *E. delegatensis* open forest/tall open forest with an understorey of *Lomandra longifolia, Acacia dealbata, Banksia marginata, Lomatia tinctoria, Poa sp., Pultenaea juniperina, Bedfordia salicinia, Zieria arborescens, Polystichum proliferum and Clematis aristata.*
- **Protected lower slopes** : *E. obliqua* open forest to tall open forest with an understorey of *Bedfordia salicinia, Gahnia grandis, Drimys lanceolata, Acacia dealbata, Coprosma hirtella, Cassinia aculeata, Pultenaea juniperina, Senecio linearifolius, Blechnum wattsii, Olearia argophylla and Cyathodes glauca.*

St Peters Pass: dolerite slopes to the west of Native Hut Rt.

- **Upper slopes** : *E.amygdalina / E. viminalis* open forest (sometimes with *E.delegatensis* and *E. rubida*) with an understorey of *Lomatia tinctoria, Olearia viscosa, Danthonia sp., Poa sp., Acacia melanoxylon, Coprosma quadrifida, Pultenaea juniperina* and *Pteridium esculentum.*
- **Lower slopes on shallow soil** : *E. viminalis* woodland over an understorey of *Bursaria spinosa, Themeda australis, Lomandra longifolia, Acacia dealbata and Casuarina stricta.*
- **Lower slopes** : *E. pulchella* woodland over an understorey of *Lomandra longifolia, Acrotriche serrulata, Daviesia latifolia, Lissanthe strigosa, Astroloma humifusum, Acacia dealbata, Bursaria spinosa, Danthonia sp.*, and *Wahlenbergia sp.*
- **Well drained flats and saddles** : *E. globulus, E. pulchella* and *A. dealbata* woodland
- **Drainage flats** : *E. ovata* woodland with *Leptospermum lanigerum, Lomandra longifolia* and *Acacia dealbata.*

Eastern Tiers: dolerite hills and associated flats on the eastern fringes of the catchment stretching from Black Charlies Sugarloaf to the upper reaches of White Kangaroo Rvt.

- **Stony crests** : *E. amygdalina / E. pulchella* woodland with open understorey
- **Stony, well-drained flats** : *E. amygdalina, E. pulchella* and *E. tenuiramis* woodland with an understorey of *Lomatia tinctoria, Bedfordia salicinia, Lomandra longifolia, Acacia dealbata* and *Poa labillardieri.*
- **Protected slopes and gullies** : open forest to tall open forest dominated by *E. obliqua* and *E. globulus* over dense mossy understorey that includes *Acacia dealbata, Olearia lirata, Pomaderris apetala, Coprosma quadrifida, Polystichum proliferum and Pittosporum bicolor.*
- **Exposed slopes** : *E. viminalis, E. pulchella* and *E. amygdalina* woodland with understorey species.
- **Marshes and swamps** : Low open woodland with *E. ovata* and scrub understorey or *E. pauciflora* open woodland and scrub dominated by *Leptospermum lanigerum* and *Gahnia grandis.*

Heathy Hills: extensive areas generally with sandstone substrate in the lower Coal River catchment

- **Crests** : *E.amygdalina, E. viminalis, E. globulus and E. tenuiramis* woodland over *Lomandra longifolia* and *Astroloma humifusum* understorey.
- **Upper slopes** : *E.amygdalina* and *E. viminalis* woodland, with a heathy understorey of *Acacia dealbata, Lissanthe strigosa, Casuarina littoralis, Lomandra longifolia, Leucopogon ericoides, Hibbertia riparia, Dodonaea viscosa* and *Lepidosperma concavum.*
- **Lower slopes and flats** : *E.amygdalina* and *E. viminalis* woodland (sometimes *E. obliqua* in sheltered areas) with a heathy understorey of *Pteridium esculentum, Bossiaea cinerea, Acacia melanoxylon, Amperea xiphoclada, Exocarpos cupressiformis, Lomandra longifolia, Leucopogon collinus, Stylidium graminifolium, Astroloma pinifolia, Baeckea ramosissima, Aoutus ericoides* and *Acacia dealbata.*
- **Flats with deeper duplex soils** : *E.amygdalina, E ovata* and *Acacia dealbata* with some *E. obliqua* in sheltered areas.
- **Drainage flats with clay soil** : *E. ovata* woodland over a scrubby understorey of *Melaleuca squarrosa, Leptospermum scoparium, Lomandra longifolia, Acacia verticillata, Gahnia grandis, Cassinia aculeata and Pultenaea juniperina.*

Coal River Flats: alluvial flats along lower reaches of Coal River Valley and western Pitt Water

- **Upper terraces** : *E. viminalis* and *E. amygdalina* woodland over an understorey of *Acacia dealbata and Acacia mearnsii.* Some *Lomandra longifolia* on sandy terraces.
- **Lower terraces** : *E. viminalis* woodland over an understorey of *Acacia mearnsii, Acacia melanoxylon* and *Bursaria spinosa.*
- **Drainage lines and flats** : *E. ovata / E. viminalis* woodland over *Acacia dealbata* understorey.

Stony Hills: dispersed over the bottom half of the catchment typically dry lowland dolerite hills such as the Coal River Tier, Pontos Hills and Gunnings Sugarloaf.

- **Crests and upper slopes** : low woodland of *E. viminalis, Casuarina stricta, Acacia mearnsii* and *A. dealbata* with a grassy understorey of *Stipa sp., Themeda australis, Bulbine bulbosa* and *Bursaria spinosa.* Possibly *E. pulchella.*
- **Stony midslopes** : open woodland of *E. viminalis* and *Casuarina stricta over Bursaria spinosa, Themeda australis, Diplarrena moraea, Bulbine bulbosa, Dillwynia sp., Stipa sp., Acacia dealbata, Helichrysum apiculatum* and *Gnaphalium sp.*
- **Stony lower slopes** : woodland of *E. viminalis with understorey of Acacia mearnsii* and *A. dealbata, Bursaria spinosa, Themeda australis and Casuarina stricta.*
- **Lower slopes with deeper soil** : *E. viminalis* and *E. globulus* woodland with understorey of *Exocarpos cupressiformis, Themeda australis and Casuarina stricta.*
- **Flats** : *E. ovata* woodland

Orielton Flats: area of alluvial flats around Orielton Rvt. near Penna

- **Drainage flats** : *E. viminalis* and *Acacia mearnsii* woodland
- **Well drained flats** : *E. viminalis* and *Casuarina stricta* woodland
- **River terraces** : *E. viminalis* woodland over an understorey of *Pomaderris apetala, Acacia verticillata, Exocarpos cupressiformis, Casuarina stricta, Acacia melanoxylon, Dodonaea viscosa, Leptospermum lanigerum and Acacia dealbata.*

Government Hills: south west corner of catchment, low rolling mudstone/siltstone hills.

- **Upper exposed slopes on shallow soils** : *E.amygdalina* and/or *E.tenuiramis* woodland with understorey of *Lomandra longifolia, Exocarpos cupressiformis, Acacia dealbata, Astroloma humifusum, Leptomeria drupacea* and *Poa sp.*
- **Flatter crests with deeper soil** : *E.amygdalina, E. viminalis* and *E. tenuiramis* woodland with understorey of *Lomandra longifolia, Astroloma humifusum, Vioala hederacea, Comesperma volubile, Lissanthe strigosa, Dodonea viscosa, Acacia mearnsii, Bursaria spinosa* and *Acacia dealbata*
- **Lower slopes and gullies** : *E.amygdalina, E.globulus and E.obliqua* with understorey *Bedfordia salicina, Acacia dealbata, Dodonea viscosa,Cassinia aculeata,Exocarpos cupressiformis, Astroloma humifusum, Bursaria spinosa, Pultanaea juniperina, Haloragis teucrioides and Epacris impressa.*
- **Flats with deep duplex soils** : commonly *E. ovata* woodland over *Melaleuca squarrosa.*

Brighton: small areas of basalt hills and associated flats near Cambridge, Campania and Orielton.

- **Stony crests and upper slopes** : *E. viminalis* woodland with understorey of *Acacia mearnsii, Acacia dealbata, Casuarina stricta and Bursaria spinosa.*
- **Stony lower slopes and flats** : *E. viminalis* woodland with understorey of *Bursaria spinosa, Poa sp.*, and *Themeda australis.*

Figure 6: Typical vegetation communities – Coal River Catchment (Davies 1988)

WILDLIFE

Regional fauna sightings recorded on the Tasmanian Parks & Wildlife Service TASPAWS database (see Table 3) provide some information on wildlife present in the Coal River Catchment.

Spotlight survey results by the Department of Parks, Wildlife and Heritage dating back to 1975 include results from the Coal River Valley as part of the state south-east region (Driessen & Hocking 1992). Applying the results of this larger region, populations of the larger fauna - Tasmanian pademelon, brushtail possum, wombat, Tasmanian devil and eastern quoll - appear to have increased in abundance since 1975. This is attributed to favorable patterns of land clearance and plantation development and, for possums, a decline in hunting pressure. A population decrease was noted for both the Bennetts wallaby and the European rabbit. However, with reductions in hunting pressure since 1985 the Bennetts wallaby appears to be increasing in numbers.

There is little information on the current status of the Forester Kangaroo (*Macropus giganteus tasmaniensis*) in the valley. Due to loss of its preferred habitat - grassy woodland and marshy bottoms - its coverage on a statewide basis is down to ten percent of its past distribution (which included the Coal River Catchment). Relocation has recently been undertaken to the Buckland Military Area and the Kempton area. Successful reintroduction into farming areas must come to terms with the potential for conflict arising from crop and fence damage.

Distribution of the Tasmanian Bettong (*Bettongia gaimardi*) in the catchment has also been assessed as part of the Southern Midlands region (Driessen *et al.* 1990). Conservation status of the bettong is considered to be "potentially vulnerable". While moderately abundant with a wide distribution, reductions in its preferred habitat - open dry sclerophyll forest - suggest a need for future monitoring and protection.

Table 3 : Species list from Tasmanian Parks & Wildlife Service (*TASPAWS 1996*). Sightings were recorded within the Coal River Catchment or from the western divide near Tea Tree.

Tasmanian devil	*Sarcophilus harrisii*
Tasmanian pademelon	*Thylogale billardierii*
Bennetts wallaby	*Macropus rufogriseus rufogriseus*
brushtail possum	*Trichosurus vulpecula fuliginosus*
eastern barred bandicoot	*Perameles gunnii*
southern brown bandicoot	*Isoodon obesulus affinis*
brown hare	*Lepus capensis*
cat	*Felis catus*
rabbit	*Oryctolagus cuniculus cuniculus*
Goulds wattled bat	*Chalinolobus gouldii*
Australian magpie	*Gymnorhina tibicen hypoleuca*
banded lapwing	*Vanellus tricolor*
brown falcon (Tasmanian)	*Falco berigora tasmanica*
common bronzewing	*Phaps chalcoptera*
common skylark	*Alauda arvensis*
eastern rosella	*Platycercus eximius diemenensis*
European goldfinch	*Carduelis carduelis*
flame robin	*Petroica phoenicea*
forest raven	*Corvus tasmanicus tasmanicus*
grey goshawk	*Accipiter novaehollandiae*
noisy miner	*Manorina melanocephala*
swift parrot	*Lathamus discolor*
yellow-rumped thornbill	*Acanthiza chrysorrhoa*
spotted marsh frog	*Limnodynastes tasmaniensis*
brown froglet	*Crinia signifera*
metallic skink	*Niveoscincus metallicus*
blotched blue-tongue lizard	*Tiliqua nigrolutea*
southern grass skink	*Pseudemoia entrecasteauxii*
three-lined skink	*Bassiana duperryi*
Whites skink	*Egernia whitei*
arthropod	*Austropsocus sinuosus*
arthropod	*Ectopsocus briggsi*
arthropod	*Ectopsocus californicus*
arthropod	*Propsocus pollipes*
seastar	*Patiriella vivipara*
seastar	*Patiriella regularis*

WATER RESOURCES

Hydrology

Non-regulated stream flow within the Coal River catchment is typical of the flow regime found in drier mainland regions where great variation in monthly and annual flows operates within an overall framework of low mean annual runoff (Hughes 1988). There are few perennial streams and springs in the region with ponds in stream beds or dams being the major supply in the driest summer periods (Leaman 1971). Flow levels are shown in Table 4.

As part of the Richmond floodplain study, sub-catchment areas have been calculated and run-off event models have been developed for twenty sub-catchments totaling 503 square kilometres upstream of Richmond (HEC 1995).

The Craigbourne Dam impounds the Coal River south-east of Colebrook to supply the South East Irrigation Scheme. This represents an upstream catchment area of 247 square kilometres or nearly half of the Coal River catchment. White Kangaroo Rivulet is the major tributary with a catchment area of 103 square kilometres. This enters the Coal River below Craigbourne Dam near Campania.

The effect of river impoundment is illustrated in Figure 7 with post-dam flows (1989) increasing over the drier months and decreasing over the wetter months. While there is a natural annual variation in flow with rainfall, average flow figures are consistently lower following dam construction (Fitzpatrick 1995).

Table 4: Rated flow for regional gauge sites (Fitzpatrick 1995)

Site location * post dam only	Maxima (m^3/s)	Minima (m^3/s)	Mean (m^3/s)
Coal River @ Baden	46.8	0.00	0.22
Coal River @ Craigbourne Rd	155.4	0.00	0.56
Coal River d/s Craigbourne Dam*	8.69	0.001	0.22
Coal River u/s White Kangaroo Rvt.	223.6	0.00	0.71
Coal River @ Richmond*	21.41	0.00	0.24
White Kangaroo Rvt.	29.47	0.00	0.07

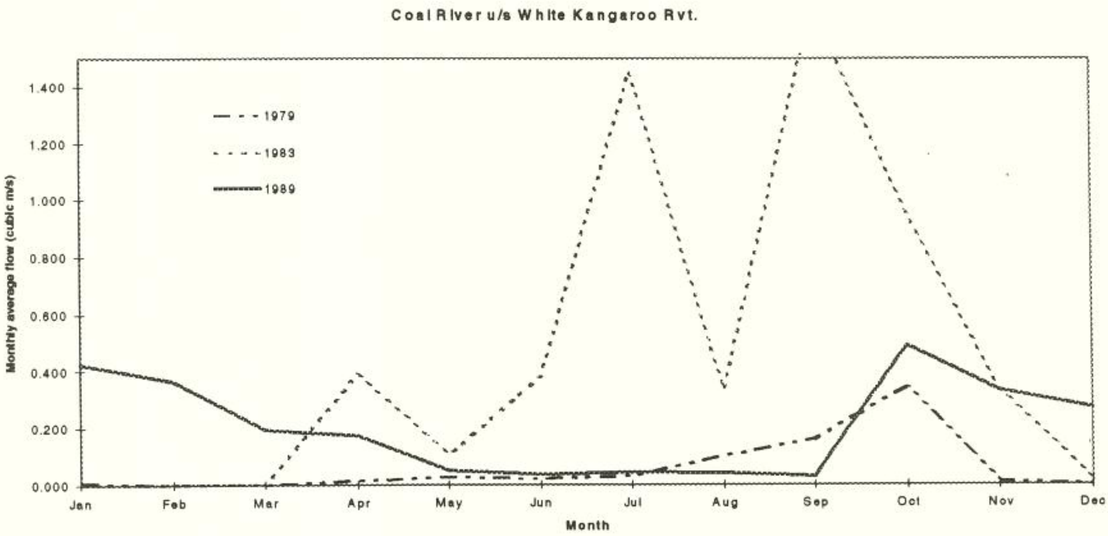


Figure 7: Monthly average flows Coal River upstream of White Kangaroo Rvt.

WATER RESOURCES

Groundwater

Despite the relative lack of perennial streams or springs, the Coal River Catchment is noteworthy for having a considerable volume of groundwater (Table 5). Leaman (1971) estimated the groundwater reserves for the Coal River Basin as 8,200,000 ML. Generally these reserves were located within regions of Permian mudstone and Triassic sandstone.

There is little artesian water with most groundwater being rainfall derived and present as a continuous and unconfined watertable. A minimum of twenty percent of rainfall is assumed to enter the groundwater reserve with very little runoff.

Although groundwater quality (high salinity) prevents its use for domestic purposes and places some restrictions regarding irrigation use, most bore water is suitable for stock watering.

Flood Plains

Flood maps of Richmond township show the extent and height of flooding due to floods in the Coal River with annual exceedance probabilities of 1:20, 1:50 and 1:100 (HEC 1995). Results identify flood-prone areas for the use of Council planners in guiding development.

Table 5: Estimated groundwater recharge and usage within Coal Catchment regions (Leaman 1971).

REGION	ESTIMATED MINIMUM ANNUAL RECHARGE (MEGALITRES)	ESTIMATED VOLUME OF USABLE STORAGE WATER (MEGALITRES)	ESTIMATED PRESENT USAGE OF GROUNDWATER FROM BORES, WELLS OR SPRINGS (MEGALITRES)
Tunnack-Baden	7182	378000	212
Stonor	4536	378000	106
Colebrook	13986	2268000	57
White Kangaroo Rvt	9450	756000	nil
Native Hut Rvt	4158	378000	nil
Campania-Richmond	13608	1512000	11
Duckhole Creek	6048	756000	76
Cambridge – Seven Mile Beach	5292	264600	53
Penna	1134	113400	8

SALINITY

Origins

Increasing concentrations of salts in soil and water can adversely affect the growth of non-tolerant plants and animals. While increases in salinity may be a natural process, the occurrence and distribution of naturally occurring salt stores can be significantly influenced by land management factors (vegetation clearance, over-irrigation or inadequate drainage).

Vegetation removal increases groundwater recharge through greater rainfall infiltration and reduction in water uptake by plants. Over time this causes a rise in the watertable with increasing concentrations of soluble salts. Over-irrigation, while flushing salts from surface soils, adds to the rate of groundwater recharge and watertable rise. When the watertable is within two to three metres of the surface, increased salinity may substantially affect farm production. Depending upon the severity, effects will range from crop productivity losses to complete vegetation loss and salt crusting (see Table 6).

Table 6 : Soil salinity classes and vegetation response (Finnigan 1995).

Presence of Water Buttons (Cotula) Bare soil patches - damp in winter, crusting in summer	**Severe** > 2000 µS/cm
Salt tolerant indicator species: Sea Barley Grass - Coastal Sand Spurrey - Buck's Horn Plantain - Annual Beard Grass - Australian Salt Grass	**High** 1500 - 2000 µS/cm
Reductions in crop vigour/density Yellowing of foliage Tree decline in shelterbelts	**Moderate** 1000 - 1500 µS/cm
No visible change	**Low** < 1000 µS/cm

Groundwater Salinity

Leaman (1971) detected the most saline waters in Tertiary deposits in the south of the catchment. Further detailed survey and mapping work by the Department of Primary Industry and Fisheries in the Coal River Valley (Finnigan 1995) found groundwater quality to be poor with electrical conductivity levels in near surface waters of between 3500 µS/cm and 16000 µS/cm (see Figure 8). Piezometer measurement of groundwater levels identified near surface watertables frequently at or above ground-level with a lowest depth reading of 5.5 metres. Some seasonal variation in groundwater level was evident with lower levels over the drier summer months.

Soil Salinity

Finnigan (1995) identified 1641 ha or nearly fourteen percent of the South-East Irrigation Scheme area as saline land, approximately two thirds being classified low to moderately saline (Table 7, see Figure 9).

Table 7 : Soil salinity in Coal Valley S.E. Irrigation Area (from Finnigan 1995).

Salinity class	Area (ha)
Severe	148
High	362
Low to Moderate	1132
Suspect	462
Not Saline	988

The distribution of salt affected soils increases from north (below Craigbourne Dam) to south in the catchment. Sixty percent of these soils are within Stage 2 of the SEIS with severe salting evident over 100 hectares.

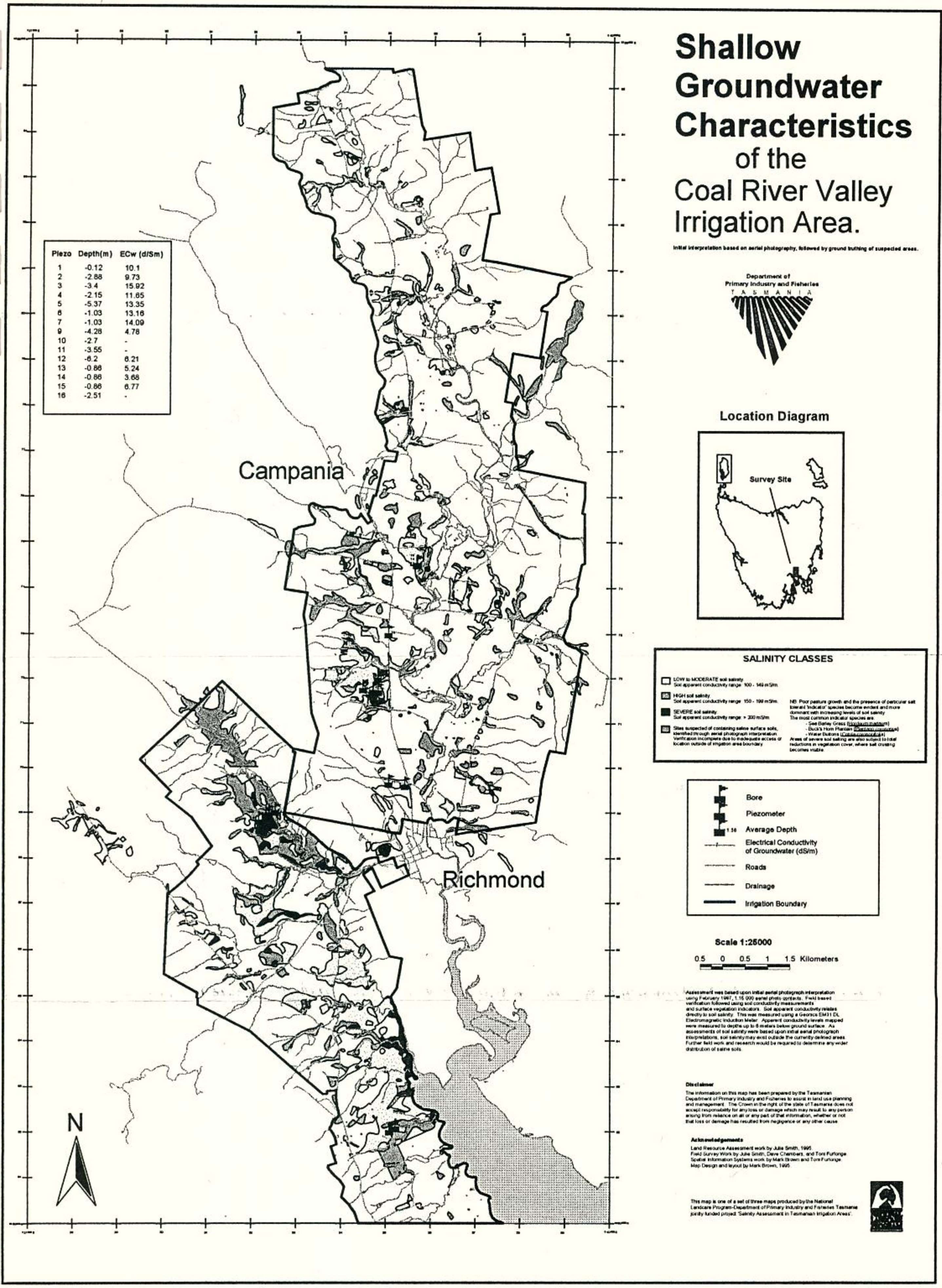


Figure 8: Goundwater Salinity Coal River Valley (Finnigan 1995)

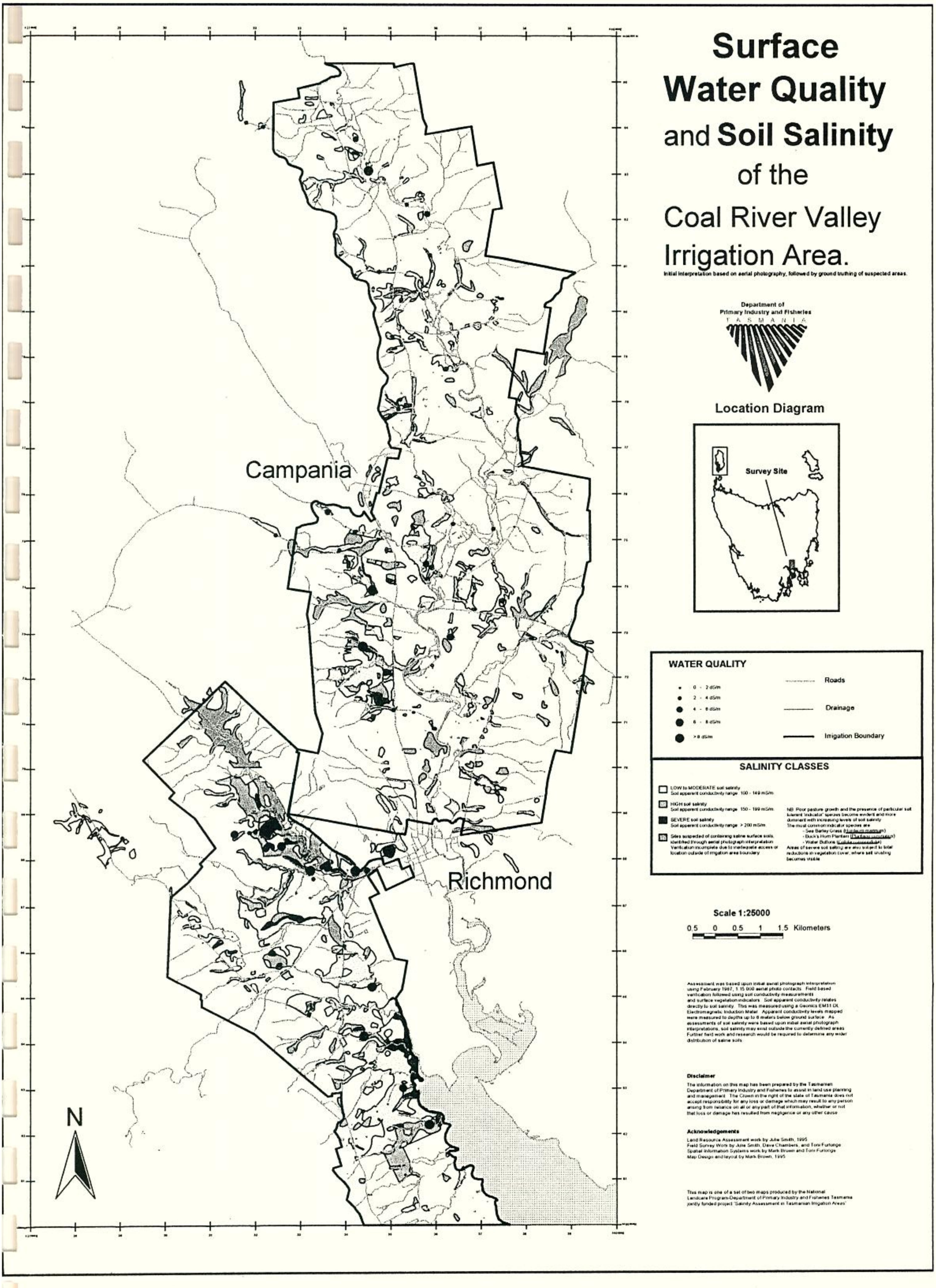


Figure 9: Surface Water & Soil Salinity Coal River Valley (Finnigan 1995)

SALINITY

Surface Water Salinity

The Coal River has relatively high electrical conductivity with laboratory results between 460 and 770 µS/cm range and field measurements from 300 to 700 µS/cm. All mean results are below the freshwater ecosystem guideline of 1500 µS/cm but place restrictions on irrigation use. Peaks values are evident from August to September.

Conductivity increases as water moves from high in the catchment at Baden to the lower reaches. The lower conductivity waters of the White Kangaroo Rvt. (550 µS/cm) appear to have a diluting effect upon the waters of the Coal River with lower levels evident below their confluence. The maximum individual result was 1750 µS/cm for the Coal River site at White Kangaroo Rvt.

Finnigan (1995) also assessed the conductivity of surface waters for farm dams and creeks in the Coal River Catchment (Figure 8).

High conductivity results from farm dams (eighteen percent at 2000 - 4000 µS/cm and fifteen percent greater than 4000 µS/cm) probably reflect summer evaporation and capture of saline seepage. Naturally saline water flows from the upper western slopes during high rainfall months producing saline drainage lines.

PITT WATER ESTUARY

Pitt Water Estuary receives drainage from the Coal River and its tributaries and run-off from smaller streams fringing the estuary itself. A coastal barrier fronted by Seven Mile Beach protects the estuary from the oceanic influence of Frederick Henry Bay with a small opening at the eastern end of the beach providing a tidal channel.

The western expanses of the estuary - Coal River Estuary, Midway Bay and Barilla Bay - extend over 16 square kilometres or nearly forty percent of the total Pitt Water Estuary. It is a modified estuarine system in that tidal flow is restricted to a 500 metre bridged section of the 1.5 kilometre long Sorell Causeway. The average tidal prism (water volume flowing in and out) for the upper Pitt Water is 11 million tonnes with an average flushing time of around two days (DPIF 1996).

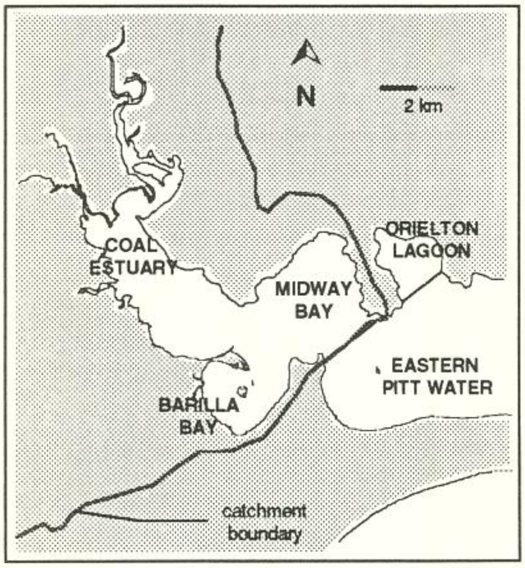


Figure 10: Pitt Water Estuary

Tidal flats, salt marshes and cliffs formed by Triassic outcrops fringe an irregular shoreline of peninsulas and bays. Harris (1968) details the range of landforms to be found within Pitt Water - salt marsh, estuarine mud flats, estuarine bars, lagoon floors, sandy tidal flats, beaches, aeolian dunes, shallow bays and channels, tidal deltas and deep channels - which provide specialised habitats for fauna and flora.

Because of its ecological diversity and the presence of rare animal and plant species, Pitt Water Estuary is an area of both state and international significance. Fauna include the rare Chequered Blue Butterfly at Barilla Bay, the endemic seastar *Patiriella vivipara* and the Great Crested Grebe at Orielton Lagoon. Flora include the salt marsh species *Lawrencia spicata*, *Limonium australe*, and *Wilsonia humilis* (Gaffney *pers. comm.*[1]).

The decline in estuarine seagrass beds is of concern because of consequent habitat and productivity loss. Coverage has declined from 1276 ha in 1950 to 75 ha in 1990, a reduction of nearly 95 percent (Rees 1993).

The sheltered embayments of the Coal River Estuary near Shark Point provide an important nursery site for the School Shark (*Galeorhinus galeus*) and Gummy Shark (*Mustelus antarcticus*) - both main components of the Southern Shark Fishery (CSIRO 1993). The estuary provides a safe habitat for newly born sharks over the warmer months (November to April) where they feed on fish, cephalopods and crustaceans. CSIRO Fisheries have been tagging school and gummy sharks in Pitt Water puppy and nursery areas in the summer months for the last five years. Comparison of recent data with abundance data from the 1940s indicates big reductions in all Tasmanian nursery areas, including Pitt Water (Stevens *pers.comm.*[2]). Underlying causes may be one or more of the following: overfishing of adults, agricultural runoff or seagrass decline. A report is due in the near future.

The upper Pitt Water estuarine zone is also a significant area for Pacific Oyster (*Crassostrea gigas*) production (ASIC 1996; DPIF 1996).

The flow of water from catchment to estuary means that water quality problems arising from catchment activities (pesticides, nutrients, bacteria or suspended solids) may ultimately be transferred to the estuarine environment. Any deterioration in estuarine water quality will impact upon both the significant natural resources found at Pitt Water and commercial oyster farming operations.

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[2] John Stevens CSIRO Marine Research Division

ESTUARINE WATER QUALITY

Natural variation in estuarine water quality occurs with variation in tide or freshwater input. Wind and current action control mixing processes within the water column and can be critical in determining the concentrations of variables such as salinity and dissolved oxygen.

Salinity

Typical salinity concentrations in western Pitt Water lie within the 33 to 35 °/₀₀ range. This reflects the considerable marine influence where sea water is 35 °/₀₀. Occasional salinities in the low 20s recorded at in-shore areas and mid-channel salinities in the high 20s may represent the impact of rainfall events in the catchment. These produce substantial inflows of water into the estuary and consequent reductions in salinity and temperature levels.

Harris (1968) detected high salinity concentrations (up to 55 °/₀₀) in areas of salt marsh and upper tidal flats probably due to evaporation and concentration in very dry summer conditions. Surface water temperatures range between 5 °C and 26 °C.

Nutrients

Chlorophyll-*a* (a measure of algal abundance) and nutrient data have been collected for two Upper Pitt Water sites (Shark Pt. and Barilla Bay) as part of a nutrient modelling study for the entire estuary (DPIF 1996). Results indicate :

- Chlorophyll-*a* ranges from 1-8 µg/L with values at the lower end of estuarine guidelines (1-10 µg/L). Greater variation and higher values are evident post-1993.
- NO_x concentrations (nitrate plus nitrite) are typically less than levels at which algal blooms have been recorded (approximate guideline for estuaries of 45 µg/L). Low values of less than 10 µg/L and minimal variation from 1992 onwards may be indicative of nitrate uptake by phytoplankton. Nitrogen tends to be the limiting nutrient in more saline environments with phtyoplankton more reliant on nitrogen uptake.
- Phosporus levels (PO_4-P) for both sites are within the 5-15 µg/L estuarine guideline.
- Surface water temperature showed obvious seasonal variation over a range of 7-24 °C.
- Of all sites sampled (including a marine site) Barilla Bay was the most saline with salinity ranging from 32-38 °/₀₀. Shark Pt. was the next most saline site. Occasional low salinity episodes indicate rainfall events and freshwater inflows to the estuary.

Bacterial

Freshwater inflows into the estuary may carry a range of bacteria, viruses and protozoans. The origins of these pathogens may lie further up the catchment as sewage effluent, septic leakage or animal faeces washed into waterways by overland flow. If estuarine waters are to be used for aquaculture or recreational amenity, stringent microbiological criteria need to be adhered to[3].

The Dept. of Community and Health Services undertakes bacteriological monitoring adjacent to oyster leases in upper Pitt Water as part of the Tasmanian Shellfish Quality Assurance Programme (TSQAP). Results are generally below guideline values. Occasional increases in faecal coliforms coincide with rainfall events and/or depressed salinity levels in the estuary are indicative of freshwater inflows.

Reduction in peak flows and estuarine bacterial levels following construction of Craigbourne Dam allowed a change in the status of aquaculture operations from "approved conditional" to "approved" in 1992.

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[3] Suggested guidelines for the protection of consumers of fish and other aquatic organisms are for a median faecal coliform concentration no greater than 14 MPN/100 mL and not more than 10 % of sample greater than 43 MPN. For primary contact (ie. swimming) median faecal coliforms should be less than 150 (four out of five < 600) (ANZECC 1992).