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Environment and Conservation (NSW)

Maria River,
Maria and Kumbatine National Parks
Wild River Assessment 2006

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Executive summary

The NSW *National Parks and Wildlife Act 1987* (the NPW Act) permits formal recognition and protection of wild rivers. Whereas most rivers in NSW have been greatly changed by modern society, wild rivers remain in a substantially unmodified condition and, accordingly, are of high conservation value.

A river, or part of a river, may be declared a wild river by the Director General (DG) of the Department of Environment and Conservation (DEC) following a detailed assessment of its conservation value in accordance with DEC's Framework for wild river assessment.

Wild rivers may be declared on lands reserved under the NPW Act. Wild rivers are managed to maintain and, where possible, restore natural processes associated with river health and to permit the identification, conservation and appropriate management of Aboriginal objects and places. A wild river may also be used as a focal point for associated protection and rehabilitation works within the catchment.

The Maria River, located near Kempsey on the NSW north coast, has been assessed for its wild river values. The river's headwaters are in Kumbatine National Park and it joins the Hastings River 54 kilometres downstream. The catchment of the river is approximately 42,536 hectares; about 17% of this is in DEC reserves and 17% in state forests.

A detailed assessment was made of the upper third of the Maria River and its subcatchment which flows through, or close to, land reserved under the NPW Act. The lower reaches of the river mainly flow through private land and a somewhat degraded landscape, consequently this part of the river cannot be declared wild.

The upper river was assessed for its biological, geomorphic and hydrological condition. The study found that those parts of the river within the Kumbatine and Maria River National Parks, and for up to seven kilometres downstream, were in a substantially unmodified geomorphic and hydrological condition. The upper Maria River was also in good biological condition, although timber cutting, agriculture and increased fire frequencies had modified the biology of much of the catchment.

The upper Maria River and its tributaries within the Kumbatine and Maria National Parks met many of the NPW Act's criteria for wild rivers. However, it was not recommended for declaration as a wild river because this part of the river occurred on a number of different tenures. Five kilometres of the upper Maria River occurs in reserves; however, this is divided into four sections separated by other tenures (state forest and freehold). (Only those sections within reserves may be declared under the NPW Act). It was considered impractical to declare these sections of the river at this stage, but declaration of the upper Maria River could be reconsidered should additional sections be reserved or subjected to conservation agreements in the future.

A key recommendation of this report is that DEC investigate acquisition or conservation agreements under the Act for private land abutting the highest quality off-park sections of the upper Maria River, which occur up to 6.5 river kilometres downstream of the Maria National Park.

The upper river is a substantially unmodified example of a low-gradient coastal (black water) stream. Unsympathetic land use and management, such as mining, clearing and drainage, have significantly modified many similar coastal rivers and streams on the NSW north coast. A range of actions may be undertaken by government agencies (including DEC) and private land holders to protect and further enhance the wild river qualities of the upper Maria River and of the entire catchment.

1. Introduction

1.1 Wild rivers under the National Parks and Wildlife Act

The wild river provisions under the NPW Act present an opportunity to identify some of the most pristine rivers in NSW and ensure these rivers, including their cultural features, are well managed.

Wild rivers may only be declared within land reserved under the NPW Act. To be considered wild, a river must be in a largely natural condition. Consideration is also given to the condition of those parts of the catchment affecting the river.

The NPW Act states:

> Wild rivers are those exhibiting substantially natural flow and containing remaining examples in a condition substantially undisturbed since European occupation of:
>
> (a) the biological, hydrological and geomorphological processes associated with river flow, and
>
> (b) the biological, hydrological and geomorphological processes in those parts of the catchment with which the river is intrinsically linked (section 61 (4) NPW Act).

The purpose of declaring a wild river is to identify, protect and conserve:

> any water course or water course network, or any connected network of water bodies, or any part of those, of natural origin, exhibiting substantially natural flow (whether perennial, intermittent or episodic), (section 61 (4) NPW Act).

Rivers are assessed in accordance with DEC's 'Framework for wild river assessment'. If the water course meets the NPW Act's requirements, a wild river is declared by the of DG of DEC placing a gazettal notice in the Government Gazette. Where the declaration may affect functions carried out under the *Water Management Act 2000* or, in the case of State Conservation Areas, the *Mining Act 1992,* the concurrence of the responsible ministers may be required prior to declaration (section 61 (3) NPW Act).

Wild rivers are managed by DEC to maintain and restore (if necessary) their wild river values and to identify, conserve and protect associated Aboriginal objects and places (s61 (5) (a) and (b) NPW Act). Wild river declarations can trigger investigations of Aboriginal objects and places, and the development of conservation plans.

A wild river can only be declared if it is consistent with any plan of management in operation for the reserve/s where the water course is located (s61A NPW Act). The Maria River catchment falls within the Maria and Kumbatine National Parks. There is a draft Plan of Management for Kumbatine National Park and a final Plan of Management for Maria National Park. Neither of these plans state that the Maria River is a wild river. Should DEC declare the Maria River to be a wild river in the future, these plans will require amendment.

1.2 Why declare wild rivers?

Wild River declaration can raise the profile of the most pristine rivers in the state and provide a focus for environmental monitoring and scientific study.

All rivers within the existing reserve system fulfil a role in protecting freshwater and riparian dependent flora and fauna. Wild rivers, because of their excellent condition, potentially play a wider role in providing a range of environmental services for other parts of their catchment

including a source for recolonisation, water quality improvement, water supply assurance and flood mitigation. They also have a role in protecting cultural and historic heritage.

Wild rivers can provide a focus for land managers who wish to identify and manage high conservation value streams as part of their activities. Those managing lands outside of the reserve system may wish to complement the wild rivers program with conservation programs in other parts of the catchment.

2. Assessment techniques

Biological, geomorphic and hydrological aspects of the Maria River were assessed to determine whether it was substantially undisturbed and met the definition of a wild river. The assessment was undertaken in accordance with DEC's Framework for wild river assessment (DEC 2005). A range of existing information on the condition of the Maria River and its catchment was reviewed and local knowledge was sought.

The following assessment techniques were used to measure the current biological and geomorphic conditions and these were compared to a reference condition:

- Biological health was assessed using 'AUSRIVAS' (Davies 2000) analysis. This method samples and analyses freshwater invertebrates and uses the presence or absence of groups of invertebrates as a surrogate for biological health.
- Geomorphic condition was assessed using River Styles (Brierley and Fryirs 2005). This method measures a range of physical features of rivers to determine whether there are unnatural rates of change in the river system.

These methods have been used extensively in NSW.

AUSRIVAS uses those rivers in the most pristine condition as benchmarks against which other rivers are compared. These benchmarks, or reference sites, are considered to be rivers which are the least affected by post-European human activities.

Under the River Styles system, each section of a river is classified according to factors such as rainfall, geology and topography of the landscape (e.g. whether the river occurs in a rocky gorge or on a floodplain). Certain features of the river, such as extent of bank vegetation or the presence of deep pools, are compared with predicted or reference features for that particular river type. River condition is determined according to how well the river's features meet the reference condition. River condition assessed using this method is indicative of whether the river's geomorphology is changing at an unnatural rate due to human disturbance.

Changes in river hydrology may be determined with some accuracy where flow monitoring stations have been located for some years. However, this information is unavailable for most rivers. Hydrological changes may only be deduced using information on water and land use in the catchment; for example, extent of clearing in the catchment, impediments to river flow such as dams or weirs and estimates of water usage from water extraction licences.

Current and historical land use practices were investigated within the catchment of the Maria River where these had the potential to directly impact on river condition. Current land use information was also used to highlight any management practices that might impact on the river or catchment in the future. Disturbances that may impact on the biology, hydrology and geomorphology of the river include logging, clearing, roads, mining, drainage works, water extraction, frequent or severe fire, intensive recreational activities, grazing, the presence of certain weeds and feral animals. Sources of information used include maps of vegetation structure, aerial photographs, physical evidence and any documents relating to the history, use and management of the area. Local knowledge was also obtained. Data sources used and experts consulted for the technical assessment are listed in Appendix 1.

3. Results

3.1 Description of the Maria River and catchment

The Maria River subcatchment is located in the Hastings River catchment (Figure 1). The Maria River catchment covers approximately 42,536 hectares; approximately 17% of this is in DEC reserves and a further 17% is in state forests. The Maria River is approximately 54 kilometres long from the headwaters in Kumbatine National Park to its junction with the Hastings River.

The lower 40 kilometres of the Maria River is estuarine and drains the low-lying floodplains known as the Gladstone Alluvial Plains and the Limeburners Barrier Dunefield physiographic regions. The subcatchment also drains the physiographic regions known as the Ballengarra Hills and Kempsey Low Hills in the west and north-west.

The creeks and drainage lines that form the headwaters of the Maria River are approximately six kilometres south of Kempsey. The upper sections of the Maria River flow from Kumbatine National Park to Kalateenee and Maria River State Forests, then through Maria National Park to private lands. The middle to lower and tidal reaches of the river mainly flow through private lands. The Maria River joins the Wilson River downstream and then flows into the Hastings River, which reaches the sea at Port Macquarie.

The upper 14 kilometres of the Maria River is a generally narrow stagnant river, best described as a low-gradient coastal, black water stream (DEC unpublished 2005). This upper section drains the Kempsey Low Hills physiographic region (Atkinson 1999).

The catchment is not a major source of drinking water for local populations. The main economic pursuits associated with the catchment include cattle grazing, timber harvesting, oyster production, recreational fishing and tourism.

The catchment has significant natural values. Landsat imagery suggests that over 64% of the catchment supports native vegetation. About half of this area has been moderately to intensely harvested for timber in the last 40 years and some of the natural remnant vegetation is affected by cattle grazing.

3.2 Description of the study area

3.2.1 Scope and description of the study area

This assessment report relates to:

- the section of the Maria River and tributaries flowing through Kumbatine and Maria National Parks
- that part of the catchment which is likely to affect these sections of river, including private land and state forest (the study area).

The location of the Maria subcatchment is shown in Figure 1 and the study area is shown in Figure 2.

The private lands immediately downstream of Maria National Park have been included in this assessment.

The Kumbatine National Park section of the river is a small, ephemeral creek-line which is separated from Maria National Park by six kilometres of private land, state forests and the Pacific Highway.

The subcatchment study area represents the upper third of the Maria River subcatchment, which is associated with the Kempsey Low Hills physiographic region.

3.2.2 Physical features of the study area in the upper Maria River catchment

The upper Maria River catchment consists of undulating to rolling low hills and a narrow floodplain referred to collectively as the Kempsey Low Hill physiographic region.

The Kempsey Beds is a geological association that occupies the majority of the Kempsey Low Hills. These beds represent a marine turbidite succession and consist of laminated siltstones, shales, lithic sandstones and conglomerates (Lennox and Roberts 1988).

The lower part of the Maria catchment is at high risk of forming acid sulfate soils and the Maria National Park contains acid sulfate sediment (Atkinson 1995); however, no major acid sulfate soil pollution events are known to have occurred within the reserve. Acid sulphate soils include clays, muds and sands that contain the sulfidic mineral pyrite, which is formed under estuarine conditions. These soils can become extremely acidic following exposure or drainage because pyrite is oxidised to form sulfuric acid and the pH may fall below 4 (Atkinson 1999). Very acidic drainage waters from these soils can cause fish kills, fish diseases, reduced recruitment and can profoundly disturb aquatic ecosystems (Sammut and Lines–Kelly 1996).

Significant acid sulphate leaching will usually only occur if soils are exposed because of land clearing or other activities such as road works. The vegetation and soils associated with the risk areas in the study area are still relatively intact; therefore, acid sulphate leaching is thought to be negligible to low in this section of the upper Maria River.

Lower down the Maria River and on the main tributaries of Pipers Creek and Connection Creek (all outside of the study area) a significant acid sulphate event was recorded in November 2004. This event followed a substantial rainfall of 242 millimetres at Kempsey over a nine day period in October 2004. These reaches of the Maria River and tributaries have been cleared for grazing or other agricultural enterprises.

The study area occurs in a subtropical climatic zone. The mean annual rainfall for Kundabung, which is five kilometres south of the study area, is 1337 millimetres. High intensity rainfall events are usually associated with cyclonic depression occurring off the northern NSW and southern Queensland coasts during summer.

The area has a marked dry season in spring and a summer–autumn wet period. Mean daily maximum temperatures range from 27–28 °C in summer to 18–20 °C in winter (Woodward–Clyde 1993).

Figure 1. Location of the Maria River catchment.

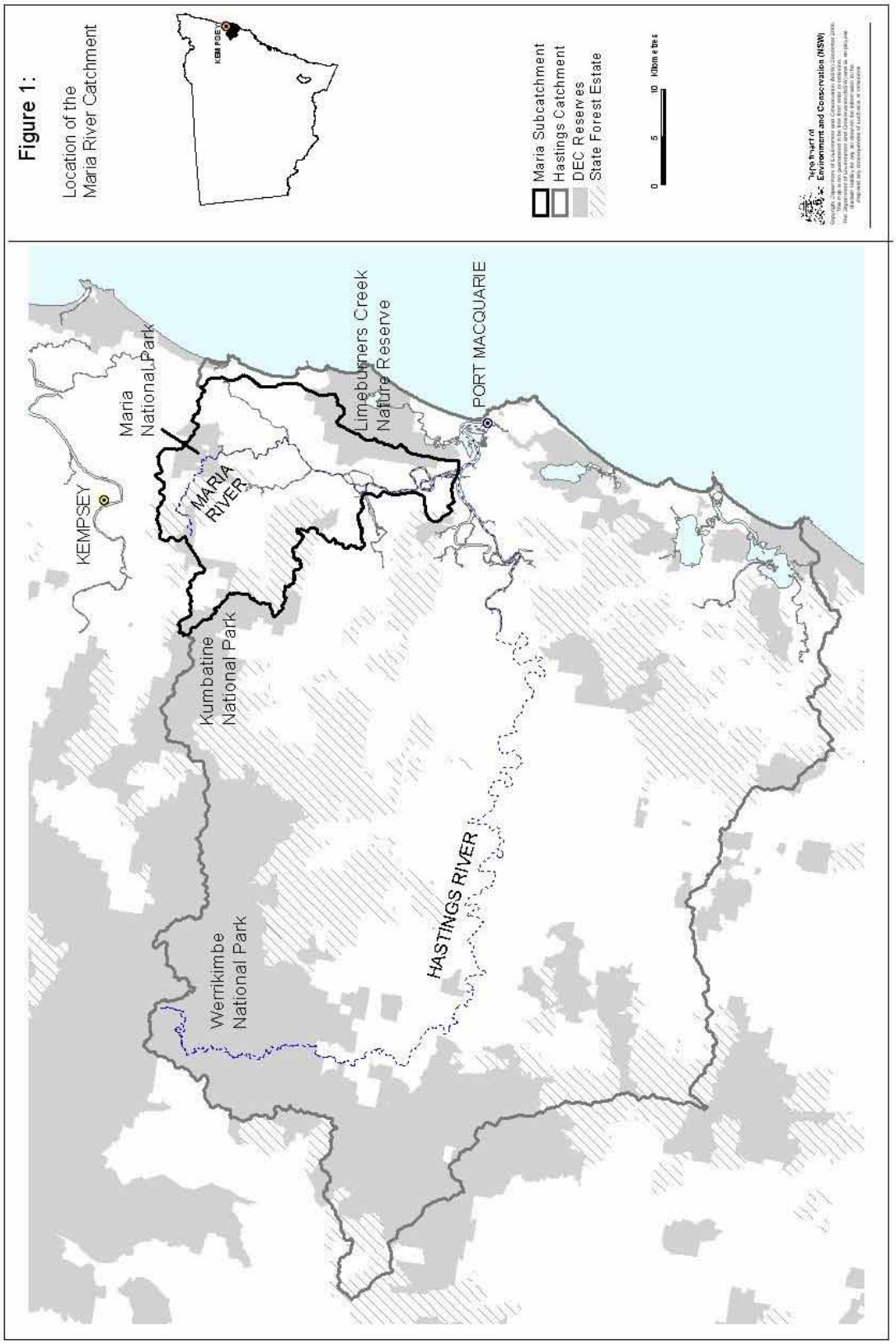
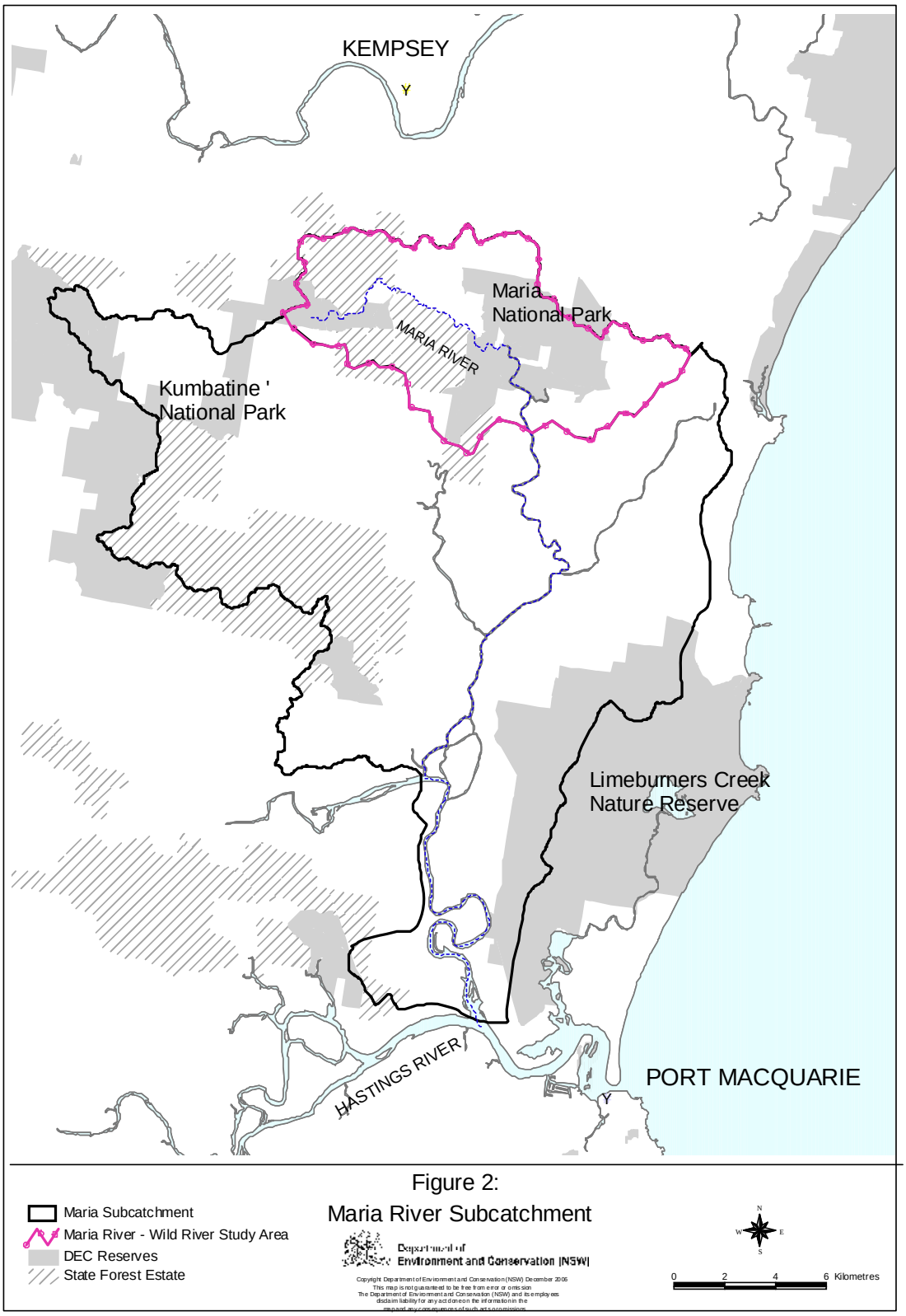


Figure 2. The Maria River subcatchment.



3.2.3 Natural values

Vegetation

The following vegetation information for the area has been extracted from the Maria National Park Plan of Management (DEC 2004) and Kendall and Kendall (2000). Five plant communities have been identified.

Kumbatine National Park within the Maria catchment is dominated by grey gum (*Eucalyptus propinqua)*, grey ironbark (*E. siderophloia*), white mahogany (*E. acmenoides*), creating a dry coastal complex which is a semi-mesic forest type. Patches of wet sclerophyll forest dominated by brush box also occur and a blackbutt plantation occurs adjacent to the highway within the park.

Maria National Park north of Maria River is dominated by the dry sclerophyll forest types of scribbly gum (*E. signata*), pink bloodwood (*Corymbia intermedia*), smooth-barked apple (*Angophera costata*) and contains a large number of mature trees. This is in contrast to the heavily logged grassy dry sclerophyll forest dominated by tallowwood (*E. microcorys*), grey ironbark (*E. siderophloia*) and blackbutt (*E. pilularis*), which occurs in the southmost section of the park.

Wet sclerophyll forest accounts for 8.8% of Maria National Park. This forest type occurs in narrow bands along the moister and more protected areas of the Maria River, Reedy Creek and some of the smaller creek lines within the park. Areas of flooded gum (*E. grandis*) are revegetating following logging. There are also some small patches of rainforest with scattered eucalypt emergents along the Maria River on the western fringe of the park. Rainforest accounts for less than 5% of the park area.

The remainder of the park supports two swamp sclerophyll forest communities, which are confined to poorly drained soils adjacent to minor creek lines. The more common of these is dominated by swamp mahogany (*E. robusta*). Less than 1% of the park supports a swamp sclerophyll forest dominated by red bloodwood (*C. gummifera*) and forest red gum (*E. teriticornis*).

Maria National Park contains a number of significant plant species which are regionally uncommon, such as the screw fern (*Lindsaea dimorpha*) and swamp lily (*Ottelia ovalifolia*), or at the edge of their distriubution, such as dwarf blue trumpet (*Brunoniella pumilio*) and red mahogany (*E. resinifera subsp. hemilampra*).

No threatened plant species have been recorded in the park.

The surrounding state forests and remnant vegetation communities on private lands within the study area contain similar vegetation communities.

Native fauna

Despite previous disturbance, the forest communities in the park provide habitat for a diversity of animal species, including 10 threatened native animals such as the koala (*Phascolarctus cinereus)*, squirrel glider (*Petaurus norfolcensis)*, powerful (*Ninox strenua*) and masked owls (*Tyto novaehollandiae*), and golden tipped bat (*Kerivoula papuensis*). The park provides potential habitat for five more threatened species (DEC 2004).

Kumbatine National Park and Maria National Park form part of a vegetated corridor which links the ranges to the west with the coast. This corridor is likely to be important for species dispersal in the region.

3.2.4 Aboriginal and European cultural heritage

The park and surrounds are within the Kempsey Local Aboriginal Land Council area, which is part of the Dunghutti tribal area. No Aboriginal cultural heritage studies have been undertaken within the study area. There are no Aboriginal sites recorded within Maria National Park, although open campsites, stone arrangements and Bora/ceremonial grounds have been recorded close to the park and there is reportedly a scarred tree near the Maria River in the vicinity of Mariaville. It is likely that Aboriginal people used the Maria River for hunting and gathering. A combination of topography, soils and past land-use are likely to have erased most evidence of the occupation and use of the area by Aboriginal people.

There are no European heritage sites recorded within the Maria National Park and no European heritage studies have been undertaken within Maria National Park.

In Kumbatine National Park open camp sites, isolated objects and scarred trees have been recorded. South of the catchment of the upper Maria River, Kumbatine National Park contains lime kilns constructed by convicts in the 1830s. The kilns are listed on the National Trust register as a 'classified' item.

Several trees are scattered throughout Kumbatine National Park with numerals or alphabetic letters incised in their trunks. These trees were mapped as reference points by early surveyors.

3.2.5 Land use history

European settlement of the mid-north coast began in the 1820s at Port Macquarie and spread along the Hastings River and associated valleys. In the following decades European settlers cleared the majority of quality agricultural land on the surrounding floodplains for cropping and grazing. Logging camps extended into the valleys where red cedar became the most sought after timber. Timber cutting and agriculture sustained the economy of the region well into the 20th century; however, in recent decades there has been a steady shift toward urban development and tourism.

Land use and impacts within the study area

Logging

Timber harvesting has been reasonably intensive in the last 25–30 years within the study area. Prior to 1999 all of Maria National Park was part of Maria River State Forest (SF). According to harvesting records held by Forests NSW most of Maria National Park, Maria River SF and adjacent state forests had been selectively harvested at least twice since 1980.

Logging intensity was highly variable across the study area and was dictated by the presence of valuable timbers and accessibility.

Within Maria National Park, the dry sclerophyll forest communities of scribbly gum (*E. signata*) and of pink bloodwood (*C. intermedia*) and smooth-barked apple (*Angophera costata*) were not subjected to intensive logging due to poor timber values; therefore, these communities still contain a high proportion of large mature trees. These communities cover over half of the Maria National Park and also dominate the low-lying forest to the south of the park.

The grassy dry-sclerophyll forest in the southern section of the park, dominated by tallowwood (*E. microcorys*), grey ironbark (*E. siderophloia*) and blackbutt (*E. pilularis*), has been substantially disturbed. Logging and silvicultural practices such as ringbarking and burning have resulted in this being the most modified community in the park, with a high proportion of young regrowth trees and few large mature trees.

In the easternmost part of Kumbatine National Park adjacent to the Pacific Highway there is a blackbutt (*E. pilularis*) plantation. The plantation covers about 280 hectares and is now of significant age.

Timber cutting continues in the state forests within the study area. It is expected that selective timber cutting also occurs on some of the private lands within the study area.

Fire

Accurate fire records exist for the study area from 1990 to 2005. Much of the forested areas within the study area have burnt at least once since 1990 with some areas being burnt twice. Most fires have been unplanned and have resulted from arson (personal communication DEC area staff).

Accurate fire records do not exist prior to 1990; however, broad-based fire frequency maps held by Forests NSW indicate that during the period 1970 to 1985 fire frequency was high in the study area. Note that this information is of limited accuracy because it is based on frequency of fire attendance and not on accurate mapping of fire perimeters or fire intensities (Forestry Commission of NSW 1988).

Bushfire regimes are a major determinant of the distribution and abundance of plants and animals in the study area. Fire also affects erosion patterns, hydrological regimes and nutrient cycles. Ecological research suggests that a fire frequency of between 7 and 35 years is appropriate for the dry vegetation communities within these parks. Wet sclerophyll forest should have a less frequent fire regime with 25 to 60 year intervals (National Parks and Wildlife Service (NPWS) 2003). Wet sclerophyll forest is considered a fire-sensitive community because it contains many rainforest species in the mid and lower strata. Indications are that this community has not burnt but has acted as a natural firebreak, at least in the past 15 years. The vegetation diversity of the wet sclerophyll community is likely to be enhanced by the continued exclusion of fire for the next 40 years or more (DEC 2004).

The recorded fire history and anecdotal accounts from Forests NSW and DEC staff indicate that much of the study area has been subjected to fire at a greater frequency than is ecologically desirable to maintain biodiversity (DEC 2004). With stricter management of the park area, the number of unplanned fire events should decrease in coming decades.

Trails and easements

There is an extensive network of roads and trails throughout the study area. All roads and trails in the park and wider study area are unsealed, except the Pacific Highway. Trails are associated with private property access, state forest management, recreation access, and access to the rail easement, which buffers the western side of Maria National Park. Trails and roads in the study area outside of the national parks are usually open and accessible for public use.

The following is an extract from the Maria National Park plan of management (DEC 2004) and details erosion and water quality issues associated with the trail network:

> The majority of the park's soils are weathered in situ from the underlying sedimentary rock, except for alluvial soils on the southern end of Reedy Creek and the Maria River (Atkinson 1999). The roads north of Maria River are on a duplex soil, with thin, white clay overlaying red clay. This soil has moderate general erosion risk, but the subsoil is highly erodible and highly plastic. If the subsoil is exposed, rapid gully erosion occurs on moderate slopes and roads on level terrain become untrafficable in wet weather. Previous gravelling of some sections of roads in the park has been ineffective as the gravel has been ultimately forced below the soil surface. The soils south of the Maria River are derived from a different parent rock which contains fine red gravel, the result being that roads in this area are much more stable.

DEC has a strategy in place to decrease or stop vehicle access to erosive, boggy or unnecessary trails within the parks, although the history of recreational use and access to private properties means that key roads will remain as public access or vested in the minister. Fire trails in the park will be kept open for fire management purposes; however, the public will be discouraged from using them.

Agriculture and land clearing

Agricultural activities and land clearing in the study area are largely associated with grazing and hobby-farm enterprises. Most clearing in the subcatchment occurs along the eastern fringe of Maria National Park, west of the park along the Maria River, and on the southern extremity of the subcatchment boundary. There are no clearings visible within Maria and Kumbatine National Parks along the Maria River. Of the 8000 hectares (approximate) within the catchment area that flow into those river sections within national park, 8% is cleared and 4% is plantation.

Other land use and disturbance sites include the local rubbish tip, a rifle range on the northern perimeter of the subcatchment and the hardwood forestry plantation along the Maria River, which is directly west of the park. There are two private land in-holdings within the national park. Clearing on these properties is currently small and associated with the immediate house sites.

Although the extent and percentage of land clearing in the study area is low there would be some erosion and increased sedimentation impacts on the Maria River. This would occur particularly from clearings that abut the Maria River, west of the Maria National Park and from plantation and forestry operations west and upstream of the park. Biological impacts on the Maria River from logging are likely to be intense at the time of harvesting but recovery is likely to be rapid.

3.2.6 Threatening processes

Weeds

Local DEC managers consider weeds to be a minor problem within Maria National Park because they occur at low densities. A low number of weed species have been recorded. Most weed species in the parks appear to be associated with past disturbance or occur along roadsides.

In Kumbatine National Park, lantana (*Lantana camara)* is common particularly in moist and semi-moist areas. Giant Parramatta grass, (*Sprobolus fertilis)* occurs in isolated patches along roadways.

The extent of weeds outside of reserves is unknown. The occurrence of weeds is likely to be greater on disturbed sites such as agricultural and forestry land.

Introduced animals

There is little information on the density or abundance of introduced animals in the park, however, foxes (*Vulpes vulpes*), cats (*Felis catus*) and wild dogs (*Canis familiaris*) are known to occur (Rural Lands Protection Board 1998). There have been several reports of unattended domestic dogs within the park (DEC 2004). There are no known occurrences of wild horses, feral goats or pigs. No cane toads (*Bufo marinus*) have been recorded in the park or its surrounds.

Straying cattle are considered an occasional, minor problem in the national park. Intermittent cattle-grazing occurs in parts of the adjacent Maria River State Forest and on much of the private land within the subcatchment study area.

A number of occupation permits have been issued for apiary sites within the park. The apiary sites predate gazettal of the parks and are generally used once every 3–5 years, depending on fire and the flowering of favoured plants, such as ironbark, tea tree, native peas and other heathland species. It is DEC policy to continue to permit existing apiary sites in national parks outside of wilderness areas but no additional sites will be approved (DEC 2004).

3.2.7 Recreational uses

Recreational uses of the national parks are usually low key and there are no developed sites. There is no established use of the park for camping and more desirable camping sites are available at the formal boat launching ramp and picnic area provided by Kempsey Shire Council at Kundabung, downstream from the park (DEC 2004).

The only site regularly visited by the public is the 'Fishing Spot' on the Maria River in Maria National Park. This site is used for launching canoes, mainly for fishing downstream, and has no facilities (DEC 2004). Bank erosion is currently not a problem; however, increasing usage may lead to erosion and degradation of the site's values. The Fishing Spot is accessed via Collins and Perch Roads through the western part of the park. The park is used for recreational horse riding, mostly by park neighbours and by a volunteer group providing an annual ride for disadvantaged and disabled persons (DEC 2004).

Recreational use in Kumbatine National Park is limited to low-impact activities and there are no formalised recreation activities or sites within the study area. It is assumed that recreational fishing will remain a relatively popular activity on the Maria River. It is assumed that four-wheel driving, trail bike riding, and horse riding will continue to occur on most of the state forest trails and public roads outside of the national park.

3.3 Technical assessment

3.3.1 Biological condition

AUSRIVAS

The Maria River is a low-gradient coastal (black water) stream. Rivers of this type are closely associated with coastal heath swamps or coastal swamp forests and are unusual in having particularly low dissolved oxygen and pH, very high nitrogen levels, and a substratum consisting of gravel, sand and organic silt.

AUSRIVAS samples were collected from the Maria River at Collins Road in the Maria National Park in April 2005. Edge samples were taken from the logs and debris at the junction of Collins Road as well as the surrounding macrophytes. Additional sampling was also undertaken to obtain a more complete picture of aquatic invertebrate diversity in running waters. These samples included sediment, direct search of woody debris (particularly logs), riparian vegetation sweeps and light trapping.

The Maria River seems typical of a low-gradient coastal river system. On sampling the Maria River at Collins Road, it appeared quite turbid with a high degree of sediment in the substrate. The water quality was indicative of acidic–anoxic conditions (dissolved oxygen 0.2 mg/L, pH 4.46 and alkalinity undetectable). The AUSRIVAS scores at this site were high indicating little or no impairment of the reach. A total of 27 taxa were collected from each edge sample (Appendix 2) and 52 taxa, including material from additional samples, were identified to the lowest possible taxonomic level (Appendix 3). Families that were collected, which are often associated with unimpaired habitats, included Scirtidae, Odontoceridae and Leptophlebiidae. It is likely that the high degree of fine particulate matter, woody detritus and macrophytes provide excellent conditions for the macroinvertebrate community.

Reedy Creek in the northern section of Maria National Park was sampled as part of the National River Health Program which occurred between 1994 and 1999. Reedy Creek flows into the Maria River below the 2005 AUSRIVAS sampling point on Collins Road. Additional testing was done using the SIGNAL technique (Chessman 2003).

The AUSRIVAS score for Reedy Creek showed this creek to be equivalent to the reference condition and the SIGNAL score was also high. The scores were indicative of a potential 'biodiversity hotspot' and/or a site of exceptionally high water quality. The riparian zone comprised undisturbed native vegetation with no signs of alteration and a high degree of bank stability. The riparian vegetation was dominated by grasses, ferns and bracken, with trailing bank vegetation and submerged and emergent macrophytes present in the edge habitat. These attributes all potentially contribute to an excellent edge habitat community.

A site inspection of the Maria River in Kumbatine National Park was undertaken in April 2005; however, no AUSRIVAS samples were taken. The river is a small creek in this locality and at the time of inspection appeared to be unaffected by sedimentation and aquatic or riparian weeds. The riparian area contained a high diversity of plant species. Overall, the environmental factors indicated this section of the river would be in a high biological condition.

The high AUSRIVAS scores of the upper Maria River within Maria National Park are indicative of a healthy macroinvertebrate community. This, and the physical characteristics of the river in Kumbatine National Park, indicate that the upper Maria River is an excellent example of an unregulated coastal black water stream which meets the biological criteria for wild rivers.

3.3.2 Geomorphic condition

A geomorphic assessment of streams has been undertaken across the Hastings Basin (Cohen and Brierley 1999). This study assessed the Hastings River and its major tributaries, the Wilson, Forbes, Ellenborough, Maria and Camden Haven Rivers. The rivers were assessed for their geomorphic style, geomorphic condition and ability to recover from disturbance.

The river styles in the Maria River study area are predominantly bedrock from the top of study area to well within Maria National Park. Within Maria National Park the river starts to display a mix of bedrock and discontinuous floodplain river styles. As the river flows out of the park and through private lands the river style changes into a meandering gravel-bed river. As the Maria River approaches the coastal plain, a fine-grained meandering river develops before entering the coastal plain and the associated tidal reaches.

The Maria River is considered a low energy system. It displays a concave longitudinal profile and the downstream pattern of river styles reflects an increase in valley width and decrease in stream energy downstream (Cohen and Brierley 1999).

A large proportion of the minimally impacted reaches in the Hastings Basin are found in the headwaters, either in the high country landscape unit or in the coastal valleys, such as the Maria subcatchment, and the associated ranges landscape. Bedrock rivers tend to be the least impacted rivers within the Hastings basin (Cohen and Brierley 1999).

The middle to upper Maria River is the only example of a minimally impacted alluvial river style in the Hastings Basin. Although much of the minimally impacted area falls within state forests and national park, geomorphic structure, riparian associations and woody debris loadings are in excellent condition (Cohen and Brierley 1999).

Cohen and Brierley (1999) state that to maintain the integrity of the bedrock river structure, vegetation associations and ecological values, joint weed management programs with NPWS or Forests NSW are required to reduce the downstream supply of weed seeds.

The middle reaches of the Maria system downstream of the national park has changed as a result of drainage manipulation, which has increased the occurrence of acid-sulfate soils. The nontidal reaches are in good condition. Continuous riparian zones in national parks, state forests and agricultural settings have maintained the stability of these systems. Channel stability, floodplain vegetation, including plantation timber, and high woody debris loadings have resulted in excellent geomorphic heterogeneity (Cohen and Brierley 1999).

It has been recommended that no timber harvesting occur on the small alluvial flats that exist within this system. This will maintain existing supplies of woody debris and maintain ecological associations (Cohen and Brierley 1999).

The geomorphological study indicates that the upper Maria River meets this criterion for wild rivers.

3.3.3 Hydrological condition

There are no water extraction licences in the Maria River subcatchment study area. No weirs, agricultural drainage or floodgates are located in the study area. Several relatively small dams are located on private agricultural land within the study area. These are considered to have a low to negligible effect on natural flow of water into the upper Maria River.

The Maria River is considered to be a low energy system and the river within the park is often naturally stagnant, particularly in times of low or no rainfall. Flow decreases rapidly after high rainfall events in the upper Maria River because of the relatively small size of the upper catchment.

The hydrology of the river in the study area is considered to be sufficiently natural for the section within the Maria National Park to satisfy the NPW Act's hydrological requirements for wild river declaration.

4. Referrals

Where a wild river declaration may affect functions carried out under the *Water Management Act 2000* or in the case of State Conservation Areas, the *Mining Act 1992,* the concurrence of the responsible ministers may be required prior to declaration. *The Water Management Act 2000* does not currently cover the Maria River (it is still covered by the *Water Act 1912*) and as such does not require concurrence from the minister responsible for this Act. Similarly, the Maria River is not in a State Conservation Area and thus does not require concurrence with the minister responsible for the *Mining Act 1992*.

5. Recommendations

Although some sections of the study area have undergone substantial change, mainly caused by forestry, land clearing and increased fire frequency, the upper Maria River and its tributaries within Maria National Park and Kumbatine National Park remains substantially undisturbed in terms of biology, hydrology and geomorphology. This section of the river is considered to meet these criteria of the NPW Act.

Another requirement of the NPW Act is that wild rivers can only be declared on DEC reserves. The total length of river that has DEC reserve on both sides is a relatively short five kilometres. More significantly, this length occurs in four discreet sections, separated by lands of different tenure. Very few of the tributaries flowing into the Maria River fall wholly within DEC reserves. The declaration of the sections within DEC reserves as a wild river would have little ecological meaning because they are inextricably linked with the sections which separate them.

It is recommended that the Maria River not be declared as a wild river at this time, but that it be reconsidered in the event that additional sections of the river become eligible for declaration. This may occur if there are reserve additions. Conservation agreements on lands within the upper Maria River catchment may also help to secure the future of this river.

Further recommendations

A key recommendation of this report is that DEC investigate acquisition or conservation agreements under the NPW Act for private land abutting the highest quality off-park sections of the upper Maria River which occur up to 6.5 river kilometres downstream of Maria National Park.

A number of management actions would help to protect the upper Maria River from further degradation and enhance river and catchment qualities. The following actions are relevant to all land managers and regulators in the upper Maria River catchment.

- The middle to upper Maria River is suitable to use as a core area to expand catchment conservation practices and planning. As such it should be considered as a priority for riparian protection (e.g. through fencing from stock), rehabilitation and revegetation within the study area and immediately downstream of Maria National Park.
- Roads and trails that are deemed to provide no advantage for fire, access or other key management issues should be considered for closure.
- Retain native vegetation throughout the study area.

- Reduce or remove grazing by domestic stock.

River condition may be maintained by the continuation of best management practices within the DEC estate as specified in the relevant Plans of Management such as:

- closing and rehabilitating trails not required for management and private property access
- monitoring of weed species which are likely to impact on catchment and river quality such, as lantana, camphor laurel and bitou bush
- implementing fire regimes which are ecologically appropriate for the vegetation communities and threatened species in the reserves; this will allow the recovery of biodiversity and will help to reduce fire-associated soil erosion.

Best management practices which are currently applied outside of the DEC estate include:

- Adhering to timber harvesting conservation prescriptions in state forests with regard to actions affecting erosion and river sedimentation. (It has been noted that a geomorphological study of the area (Cohen and Brierley 1999) recommended that no timber harvesting occur on the small alluvial flats within this system to maintain existing supplies of woody debris and ecological associations).
- Ensuring roads and trails in the catchment are constructed and maintained properly to avoid erosion and increased sediment loads in the catchment.

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7. Appendices

7.1 Appendix 1: Data sources

Technical assessment: criteria for wild rivers

	Biological Condition	**Geomorphic Condition**	**Hydrological Condition**
Data sources	AUSRIVAS biological assessment undertaken and written by Turak E and Miller L (DEC unpub. 2005). Maria National Park plan of management (DEC 2004). State Forests – Harvesting records and the management plan for the kempsey management area (1998). Acid sulphate event records held by the Kempsey Shire Council.	Cohen T and Brierley G 1999, River styles in the Hastings Basin, mid-north coast, NSW, report completed for NSW Department of Land and Water Conservation, Department of Physical Geography, Macquarie University.	Department of Natural Resources – Water licenses data. Department of Natural Resources – Bores, drains and floodgates data.
Technical advice	Eren Turak, Research Scientist, Policy and Science, Department of Environment and Conservation. Liza Miller, Project Officer, Policy and Science, Department of Environment and Conservation. Glenn Atkinson, Senior Natural Resource Officer – Resource Analysis, Department of Natural Resources. Tim Morris, Acid Sulphate Soils Officer, Kempsey Shire Council. Bryce Laut, Fire Management Officer, DEC mid-north coast region.	Glenn Atkinson, Senior Natural Resource Officer – Resource Analysis, Department of Natural Resources.	Glenn Atkinson, Senior Natural Resource Officer – Resource Analysis, Department of Natural Resources.

7.2 Appendix 2: Aquatic macroinvertebrate fauna (AUSRIVAS)

Acarina	*Hydrochidae*
Araneae	*Hydrometridae*
Baetidae	*Hydrophilidae*
Chironomidae	*Leptoceridae*
Chironominae	*Leptophlebiidae*
Chrysomelidae	*Notonectidae*
Collembola	*Odontoceridae*
Corixidae	*Oligochaeta*
Culicidae	*Orthoptera*
Dytiscidae	*Psychodidae*
Gelastocoridae	*Scirtidae*
Gerridae	*Synthemistidae*
Hydraenidae	*Veliidae*

7.3 Appendix 3: Aquatic macroinvertebrate fauna

A number of the samples were classified to lower taxomonic order as follows.

Taxa	**AUSRIVAS Name**
Acarina	*Acarina*
Araneae	*Araneae*
Baetidae	*Baetidae*
Chironomidae	*Chironomidae*
Chironominae	*Chironominae*
Chrysomelidae	*Chrysomelidae*
Collembola	*Collembola*
Sigara sublaevifrons	*Corixidae*
Culex	*Culicidae*
Culicidae	*Culicidae*
Dugesiidae	*Dugesiidae*
Biodessodes	*Dytiscidae*
Chostonectes	*Dytiscidae*
Dytiscidae	*Dytiscidae*
Gibbidessus	*Dytiscidae*
Necterosoma	*Dytiscidae*
Sternopriscus	*Dytiscidae*
Nerthra EPA sp.1	*Gelastocoridae*
Aquarius antigone	*Gerridae*
Rheumatometra dimorpha	*Gerridae*
Hydraena	*Hydraenidae*
Ochthebius	*Hydraenidae*
Hydrochus	*Hydrochidae*
Hydrometra	*Hydrometridae*
Hydrometra EPA sp.1	*Hydrometridae*
Berosus	*Hydrophilidae*

Hydrophilidae	*Hydrophilidae*
Hydrophilus	*Hydrophilidae*
Hydropsychidae	*Hydropsychidae*
Lepidoptera	*Lepidoptera*
Leptoceridae	*Leptoceridae*
Leptorussa	*Leptoceridae*
Leptorussa darlingtoni	*Leptoceridae*
Triplectidina nigricornis	*Leptoceridae*
Atalophlebia	*Leptophlebiidae*
Anisops	*Notonectidae*
Anisops EPA sp.1	*Notonectidae*
Anisops EPA sp.4	*Notonectidae*
Marilia bola	*Odontoceridae*
Oligochaeta	*Oligochaeta*
Orthoptera	*Orthoptera*
Psychodidae	*Psychodidae*
Pythidae	*Pythidae*
Scirtidae	*Scirtidae*
Staphylinidae	*Staphylinidae*
Synthemistidae	*Synthemistidae*
Tipulidae	*Tipulidae*
Microvelia	*Veliidae*
Microvelia distincta	*Veliidae*