Department of Environment and Heritage Protection

Aquatic Conservation Assessment using AQUABAMM

for the Riverine and non-riverine wetlands of south-east Queensland

Queensland Government

Aquatic Conservation Assessment using AQUABAMM

for the riverine and non-riverine wetlands of Southeast Queensland

Prepared by: Biodiversity Assessment, Ecosystem Outcomes, Department of Environment and Heritage Protection

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1 Introduction

1.1 Aquatic Conservation Assessments

The Aquatic Biodiversity Assessment and Mapping Method (AquaBAMM) (Clayton et al. 2006), was developed to assess conservation values of wetlands in Queensland, and may also be applied in broader geographical contexts. It is a comprehensive method that uses available data (including data resulting from expert opinion), to identify relative wetland conservation/ecological values within a specified study area, usually a catchment. The product of applying this method is an Aquatic Conservation Assessment (ACA) for the study area.

An ACA using AquaBAMM is non-social, non-economic and identifies the conservation/ecological values of wetlands at a user-defined scale. It provides a robust and objective conservation assessment using criteria, indicators and measures that are founded on a large body of national and international literature. The criteria, each of which may have variable numbers of indicators and measures, are: naturalness (aquatic); naturalness (catchment); diversity and richness; threatened species and ecosystems; priority species and ecosystems; special features; connectivity and representativeness. An ACA using AquaBAMM is a powerful decision support tool that is easily updated and simply interrogated through a geographic information system (GIS).

AquaBAMM is focused on the assessment of aquatic conservation values. Terrestrial conservation values are assessed through application of the Biodiversity Assessment and Mapping Methodology (BAMM) to create Biodiversity Planning Assessments (BPA).

Where they have been conducted, ACAs can provide a source of baseline wetland conservation/ecological information to support natural resource management and planning processes. They are useful as an independent product or as an important foundation upon which a variety of additional environmental and socio-economic elements can be added and considered (i.e. an early input to broader 'triple-bottom-line' decision-making processes). An ACA can have application in:

- determining priorities for protection, regulation or rehabilitation of wetlands and other aquatic ecosystems
- on-ground investment in wetlands and other aquatic ecosystems
- contributing to impact assessment of large-scale development (e.g. dams)
- water resource and strategic regional planning processes
- providing input to broader social and economic evaluation and prioritisation processes.

To date, ACAs have contributed to the following:

- State Planning Policy (04/11) for Protecting Wetlands of High Ecological Significance in the Great Barrier Reef.
- Water Resource Management and Planning.
- Identification of significant ecological values on State Rural Leasehold Land Strategy leases which are pastoral/agricultural leases, comprising most of the leasehold land in Queensland.
- Identification of significant aquatic values when assessing possible additions to the protected area estate.
- Identification of significant aquatic values when assessing development applications.
- Habitat mapping of wetlands species across Queensland.
- Areas of Ecological Significance (AES) mapping.
- Wetlands State Planning Policy through the AES process.
- Queensland Wetlands Program (QWP).
- Identification of assets for the Queensland side of the Murray Darling Basin, which were then supplied to the MDB Authority as the Queensland contribution to the QMDB Plan.
- Wide Bay-Burnett Regional Plan.
- Regional plans.

The AquaBAMM criteria are consistent with the High Ecological Value Aquatic Ecosystems (HEVAE) process which is the result of a joint project between the Australian Government and all jurisdictions. One outcome from the HEVAE report was that Queensland is the most advanced state for the mapping, classification and valuing of wetlands.

The Department of Environment and Heritage Protection (EHP) has conducted ACAs for the freshwater nonriverine (i.e. palustrine and lacustrine) and riverine wetlands in each of the 16 Southeast Queensland (SEQ) catchments.

Data for three of the AquaBAMM criteria are primarily derived by expert elicitation (criterion 5 Priority Species and Ecosystems, criterion 6 Special Features, and criterion 7 Connectivity). To consider the measures within these criteria, an expert panel was conducted to address aquatic fauna, aquatic and riparian flora and wetland ecology for the 16 SEQ catchments (Table 1). The panels, held in Brisbane during February 2014, involved invited experts with expertise in aquatic fauna, aquatic and riparian flora and/or wetland ecology. Experts were presented with ecological data relevant to their area of expertise and asked to make decisions relevant to the respective measures, such as which aquatic species should be included in the assessment or whether there were special features in the landscape that contained ecological significance. The expert panel reports contained within Attachment A present the findings and recommendations from the panel.

A Biodiversity Planning Assessment (BPA) has been completed for the SEQ bioregion. The BPA is focused on the identification and significance of primarily terrestrial values, although some riparian values are included (EPA 2007). The results from the BPA should be considered in conjunction with ACA results presented in this report.

1.2 The Southeast Queensland study area

The Southeast Queensland study area (Figure 1) covers ,more than 22000 km^2 of the southeast corner of Queensland from the NSW border to the coastal plains around Maryborough and from the large sand islands of Moreton Bay inland to the Great Dividing Range. The area contains the most urbanised parts of Queensland but also some of the most exceptional natural areas in the state, including the Gondwana Rainforests of Australia World Heritage Area.

Southeast Queensland has a humid sub-tropical climate with mild winters and warm, wet summers. It is the most densely populated area of Queensland, accommodating 65% of the state population, and is subject to a range of land uses including grazing, nature conservation, irrigated agriculture, urban uses (including industrial and residential) and rural living. The region's major agricultural products include dairy, fodder crops, cereal and a variety of horticultural produce.

The region has rich terrestrial, marine and freshwater biodiversity. Riverine and swamp (palustrine) wetlands cover 415 km^2 and 697 km^2 respectively of the study area (Queensland wetland program). More than half of the palustrine wetlands are in the Noosa and Maroochy drainage areas where they provide habitat for many threatened species including four different species of acid frogs.

The main pressure on the environment in SEQ is the impact of rapid population growth and concomitant growth of services that fragment the landscape. Other important threats are unsustainable land management practices, native vegetation clearing, point source and diffuse pollutants (from urban, industrial and agricultural areas) entering waterways and the impacts of introduced plants and animals. As a result of significant water storage infrastructure (> 24 dams of >15m wall height), most of the region's rivers experience altered flow regimes (Rolls and Arthington 2014). These changes along with water extraction, inter- and intra-basin water transfers and land use changes have impacted both riverine and non-riverine wetlands in SEQ. Such impacts when combined with climate change may lead to a decline in the native instream fauna (Mantyka-Pringle et al 2014).

Table 1 catchments subject to an ACA using AquaBAMM

ACA study areas or catchments	Study area code	Catchment area (ha)	Number of freshwater non-riverine wetlands	Area of freshwater non-riverine wetlands (ha)	Number of subsections	Number of riverine spatial units
Albert	al	78,332	91	520	12	319
Bremer	br	203,068	232	2,059	47	863
Bribie Island	bi	14,722	44	6,660	7	75
Brisbane Lower	bs	156,328	231	1,863	57	541
Brisbane Upper	bb	551,504	39	11,760	86	1,436
Lockyer	ly	297,146	173	2,554	56	1014
Logan	lg	337,783	563	5,017	93	1,370
Maroochy	mc	138,454	803	12,361	57	423
Moreton Bay Islands	mb	9,633	52	585	131	393
Moreton Island	mt	17,430	50	1,344	14	115
Nerang/Coomera	nc	129,282	377	5,066	59	630
Noosa	ns	196,223	617	39,012	74	727
Pine	pn	140,936	526	6,812	33	487
SEQ Islands (other)	si	3,492	6	75	74	169
Stanley	sl	154,728	94	4,742	32	437
Stradbroke Islands	sb	28,895	81	5,079	21	186
	TOTAL	2,457,955	3,979	105,509	853	9,185

A description for each of these catchments is provided in the following sections.

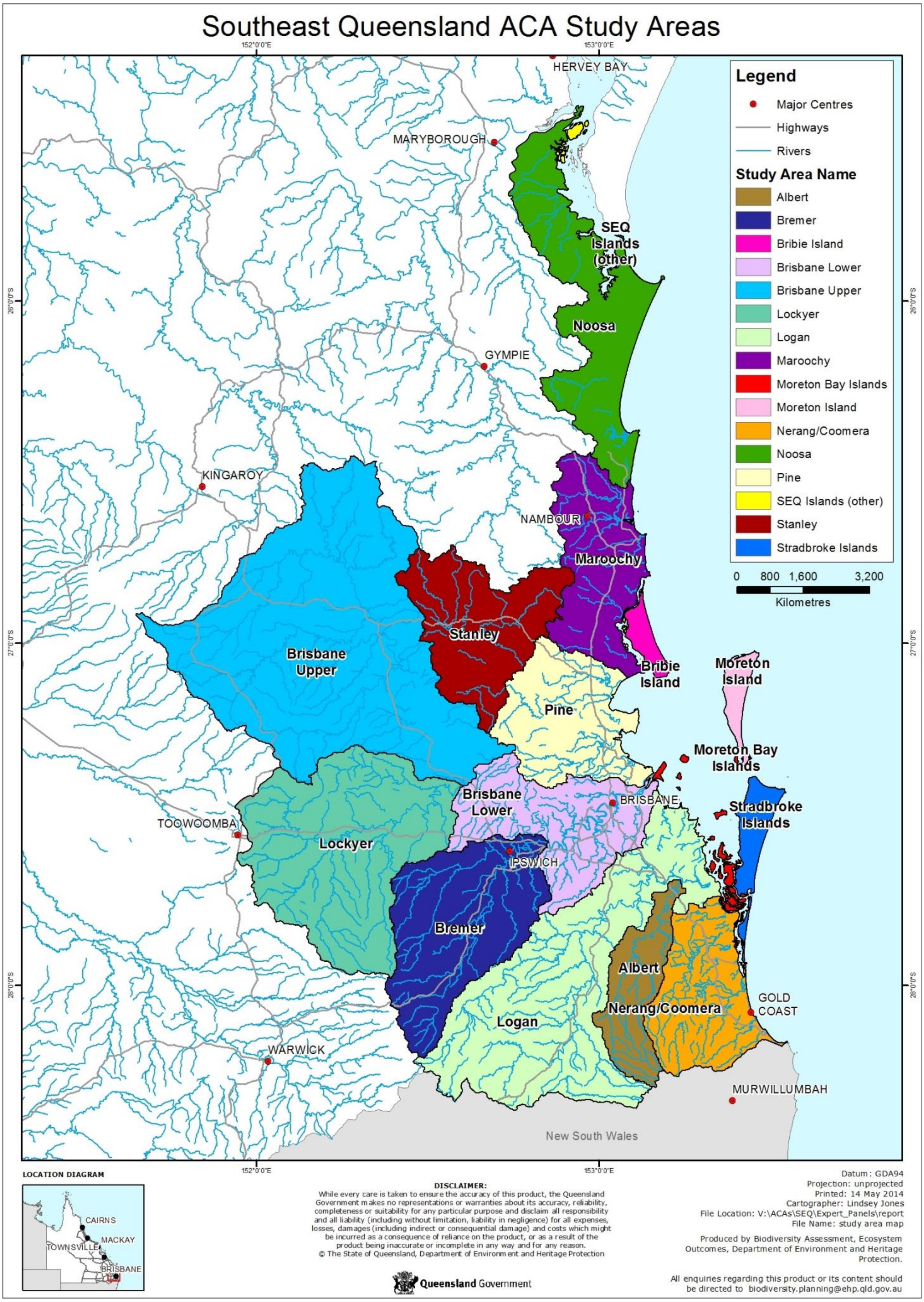


Figure 1 Southeast Queensland Study Areas

1.2.1 Noosa River catchment

The Noosa River catchment encompasses 1952 km^2 of coastal lowlands from Coolum Beach to Maryborough. The catchment includes parts of the Sunshine Coast, Noosa, Gympie and Fraser Coast local government areas.

In the northern part, from Tin Can Bay to Maryborough, the dominant land use is forestry. Outside Tuan State Forest, most of the area is remnant vegetation made up of palustrine wetlands or wetlands in heterogenous regional ecosystem complexes. This section of the catchment drains east to the Great Sandy Strait, an internationally important wetland (Ramsar).

From Tin Can Bay to Coolum Beach the dominant land uses are grazing and conservation. There are large areas of conservation estate in the Noosa Regional Council area, principally the Great Sandy National Park. This southern part of the catchment is 862 km2 with a stream network more than 1500 km long. The Noosa River is a largely intact coastal lagoon system with headwaters in Great Sandy National Park. There is no point source discharge into the river and the greatest impact is in the downstream reaches where urban development is concentrated. Urban land use constitutes less than 3% of land area in this southern section but there is extensive land clearing around populated areas.

Palustrine wetlands are the dominant wetland type in the catchment, comprising 74% of total wetland area. There are large areas of sedge and heath wetlands as well as Melaleuca swamps, particularly in the southern section of the Great Sandy National Park.

1.2.2 Maroochy River catchment

The Maroochy River catchment comprises around 1350 km^2 of the Sunshine Coast and Moreton Bay Regional Councils.

Most wetlands in the catchment are palustrine – around 60%. There are large areas of wallum heath wetlands in the coastal lowland areas that provide habitat for threatened acid frog species. Riverine wetlands account for 20% of the total wetland area and there are several artificial or highly modified wetlands viz. Ewen Maddock Dam (Mooloolah River), Wappa Dam, Poona Dam and Cooloolabin Dam (Rocky Creek and South Maroochy River).

Several nationally important wetland sites are located in the catchment: Coolum Creek and Lower Maroochy River, Lower Mooloolah River, Pumicestone Passage and Upper Pumicestone Coastal Plain, in addition to the northern end of the Moreton Bay, an internationally important wetland area (Ramsar).

In the northern Maroochy River subcatchment, land use is primarily agriculture with major urban centres in Maroochydore, Marcoola and Coolum Beach. The Mooloolah subcatchment is dominated by agriculture, managed forestry, rural residential living and major urban centres in Mooloolaba and Caloundra. The Pumicestone subcatchment in the south also has large areas of managed forests, native bush, grazing and agriculture. This southern area from Caloundra to the Pine River catchment has a 1500 km stream network draining into the Pumicestone Passage (Ramsar).

1.2.3 Bribie Island catchment

Bribie Island is a 190 km^2 sand island that rises to a maximum elevation of 47 metres. It is in the Moreton Bay and Sunshine Coast Regional Council areas and is separated from the mainland by Pumicestone Passage, part of the broader Moreton Bay Ramsar site.

Bribie Island has a different ecology to other sand islands in the region. Wetlands, groundwater dependent ecosystems, perched lakes and dunes support a rich diversity of flora and fauna. The groundwater retention properties of the island's geology mean this water resource supports unique ecology and also provides a local, high quality source of water for human consumption.

Land use is primarily native vegetation and managed forestry and a relatively small amount of urban development in the southwest corner. Almost all of the remnant vegetation on the island is mapped as a palustrine wetland.

1.2.4 Pine River catchment

The Pine River catchment is comprised of the Caboolture and the North Pine and South Pine River subcatchments. Most of the 1409 km^2 catchment is in the Moreton Bay Regional Council area, with a small urbanised section in Brisbane City Council area.

Dominant land uses in the catchment are grazing, rural residential living and urban development as well as open space areas with native vegetation. The upper catchment still contains remnant vegetation, more so in the south. Most of the western boundary of the study area is higher elevation remnant vegetation along the D’Aguilar Range. The mid reaches are characterised by agricultural and rural residential living and the lower catchment is highly urbanised. Urban development is the major pressure on the southern part of the catchment. In the northern, Caboolture subcatchment, agriculture and poultry farming are also prominent land uses.

Riverine, palustrine and estuarine wetlands occur across the study area in similar proportions. Artificial or highly modified wetlands comprise more than 20% of the total wetland area. Pine River Dam and Lake Kurwongbah are major water storages on the North Pine River and its tributary Sideling Creek.

The study area contains the Pine River and Hayes Inlet internationally important wetland site (Directory of Important Wetlands (DIWA), Ramsar), an important wetland for migratory waders.

1.2.5 Stanley River catchment

The Stanley River catchment covers 1538 km^2 of the Somerset, Moreton Bay and Sunshine Coast Regional Councils. The catchment is bounded by the D'Aguilar Range in the east and the Conondale Range in the north where altitude reaches a peak of 870 m at Mount Langley.

The Lake Somerset water storage is the major wetland in the catchment; artificial and highly modified wetlands comprise 73% of the total wetland area. Natural wetlands are almost entirely riverine and the stream network is about 3280 km long. Most major waterways have headwaters in protected areas and flow to the southwest of the catchment into Somerset Dam.

The dominant land use in the catchment is grazing of beef cattle in the extensively cleared mid reaches. The fertile alluvial valleys and basalt uplands are used for intensive agricultural production including dairying, cropping, turf and horticulture. Timber production is also a significant land use as is the provision water supply dams.

Almost one quarter of the catchment is in either national park, forest reserve or state forest. The main protected areas are Conondale and D'Aguilar National Parks in the north and south respectively.

1.2.6 Brisbane Upper catchment

The Brisbane Upper catchment is a large area, 5493 km^2, and is mostly comprised of parts of Toowoomba and Somerset Regional Councils, with a small section of South Burnett Regional Council. The boundaries of the basin are the Great Dividing Range in the west, Brisbane and Jimna Ranges in the north and the D'Aguilar Range in the east. The ranges and their low hills circumscribe the valleys of the Brisbane River and its tributaries which drain south to Wivenhoe Dam. The altitude range in the catchment is from 25 m up to 950 m in the northwest in the vicinity of Bunya Mountains National Park.

The upper catchment along the mountain ranges is still in a relatively natural state while lower areas are largely cleared and there is limited riparian vegetation present in lowland areas.

Beef cattle grazing is a major land use across the catchment, and dairying and farming are concentrated along the fertile alluvial valleys and basalt uplands. There is also a significant timber industry based around managed native forests and Hoop Pine plantations. Provision of water supplies is also a major land use; the catchment includes the largest dam in SEQ, Lake Wivenhoe.

1.2.7 Brisbane Lower catchment

The Brisbane Lower catchment includes most of the Brisbane metropolitan area so it consists of a large and highly modified area as well as large areas that are still in a very natural state. The catchment comprises most of Brisbane City Council area and smaller parts of Somerset Regional, Ipswich City and Logan City council areas. The total area of the catchment is around 2000 km^2 with more than 4000 km of rivers and streams.

The eastern half of the study area is a highly urbanised environment with very little remnant vegetation, including riparian vegetation, remaining. Urban development, point source and diffuse discharges to waterways and large stormwater runoff after storms are significant pressures on the freshwater environment in this area.

The western part of the catchment is far less urbanised and includes the protected areas of the D'Aguilar Range as well as agricultural and rural areas just east of the Lockyer Creek catchment. Dominant land uses in the west of the catchment are grazing, managed forests, intensive agriculture, rural residential living and open space with native vegetation.

The remnant vegetation in the upper catchment of the D'Aguilar Range, incorporating D'Aguilar National Park, and the Flinders Karawatha Corridor (White Rock/Spring Mountain and the Greenbank Military Area) makes up a large proportion of the catchment's land area that is set aside for conservation purposes or low impact use.

The catchment also contains the Greenbank Army Training Area C, a nationally important wetland site (DIWA), at the northern end of the Flinders Karawatha Corridor.

1.2.8 SEQ other islands catchment

This small catchment includes numerous undisturbed islands in the Great Sandy Strait between Fraser Island and the mainland. The largest island, Turkey Island, is only 6 km long and about 3.5 km wide.

All the islands are mapped as wetlands (Queensland Wetland Program), the majority classified as estuarine regional ecosystems; mangrove shrubland to low closed forest. A variety of endangered and of concern regional ecosystems on Turkey Island and Walsh Island are included in the Great Sandy Conservation Park.

1.2.9 Moreton Bay islands catchment

The Moreton Bay islands catchment consists of all the smaller islands that occur north from Jumpinpin Channel between North and South Stradbroke Islands and the mouth of the Brisbane River. It includes the large Russell-Macleay group, Coochiemudlo and Peel Islands and the almost completely developed Fisherman Islands at the Brisbane River mouth. The dominant wetland systems on the islands are estuarine, with small patches of palustrine wetlands on the larger islands in the Russell-Macleay group.

The main habited islands are Russell and Macleay Islands, the largest, neighbouring Karragarra and Lamb Islands and Coochiemudlo Island off Victoria Point. Russell Island has the most significant residential development. This island was originally farming and fishing community, and has been progressively developed and subdivided into suburban blocks.

1.2.10 Moreton Island catchment

Moreton Island is a 172 km^2 sand island located on the eastern edge of Moreton Bay. It is 37 km long and 10 km at its widest with a maximum elevation of 285 m at Mt Tempest. It is the least disturbed large coastal sand island in SEQ and is regarded as one of the most outstanding records of ongoing geological, geomorphological and biological processes which formed the regional sand island masses.

The island has a very high density of natural dune lakes and swamps, including sedge dominated swamps, perched and window lakes. Around 94% of the total wetland area on the island is palustrine wetland, mapped as waterbodies, palustrine regional ecosystems or as wetland aggregations among heterogeneous regional ecosystems in the east coast dunes and swales.

The island is almost entirely remnant vegetation with little development except for three small townships and tourism enterprises. Around 95% of the island is in the Moreton Island National Park. This island is located in a habitat protection zone of the Moreton Bay Marine Park and almost the entire island surface is mapped as part of the Moreton Island Ramsar wetland site (wetland of international significance).

1.2.11 Stradbroke Islands catchment

The Stradbroke Islands drainage area includes North and South Stradbroke Islands with an area of 290 km^2. The islands consist of sand dunes and swamps or swamp deposits. South Stradbroke Island is a low, barrier island that separates the western Broadwater foreshore from the Pacific Ocean. It is an area of continuous erosion and deposition as wind, tide and waves change the shoreline that is built by northward longshore drift. North Stradbroke Island has more extreme topography, reaching an elevation at the peak of Mt Hardgrave of over 200 m.

Of the total wetland area in the catchment, 82% is palustrine and a further 16% estuarine. Important wetlands in the catchment are the Moreton Bay Ramsar site and the North Stradbroke Island nationally important wetland site (DIWA), which comprises most of the north island. Despite a relatively depauperate aquatic fauna, the islands' wetlands include a number of rare and highly restricted wallum specialist taxa, and several unexpected taxa more commonly found either elsewhere in SEQ or in high altitude rainforest streams (Marshall et al 2011).

The islands are still dominated by native vegetation and are relatively undeveloped for urban use. North Stradbroke Island has permanent settlements at Point Lookout, Amity Point and Dunwich. However, a significant amount of vegetation has been cleared for sand mining operations. The dunes of North Stradbroke contain commercial quantities of zircon, rutile, monazite and ilmenite and mining has been carried out there since the 1940s. South Stradbroke Island has some residential and tourism uses.

1.2.12 Coomera and Nerang Rivers catchment

The total area of the Coomera and Nerang Rivers catchment is 1303 km^2. It is made up of the Nerang, Pimpama, Coomera, Tallebudgera and Currumbin and Broadwater sub-catchments. The catchment is made up of a large part of Gold Coast City Council area, and in the west a part of Scenic Rim Regional Council along the west of the Beechmont Range.

The coastal half of the catchment is highly urbanised and is dissected by major transport corridors. The western areas are characterised by large tracts of remnant vegetation in the Beechmont, Wunburra, Tallai and Nimmel Ranges and the World Heritage listed Gondwana Rainforests of Australia in the southwest, comprising areas of Springbrook and Lamington National Parks.

The catchment has a 2600 km long stream network based around the three major rivers: Coomera, Nerang and Pimpama. The dominant wetland type in the catchment is estuarine. Palustrine wetlands in the coastal lowlands comprise 20% of total wetland area. Artificial and highly modified wetlands make up 26% of total wetland area; the catchment has several water storages, the largest being Hinze Dam.

The catchment is an area of rapid population growth and supports a range of land uses including intensive agriculture, grazing, rural lifestyle living and high density urban development with accompanying major transport and service corridors. The mid reaches of most waterways flow through rural or rural residential areas, and the lower reaches of many rivers, particularly in the north of the catchment, are highly modified into canal estates.

The catchment contains wetlands of international significance: Moreton Bay Ramsar site in the northern-most part of the catchment, including Lake Coombabah, a migratory wader and significant fish habitat area. The Upper Coomera River in Lamington National Park is also a nationally significant wetland (DIWA).

The significant natural values in the catchment are threatened by increasing population growth, deterioration of water quality, fragmentation of habitat and unsustainable land use practices.

1.2.13 Albert River catchment

The Albert River catchment is a relatively narrow drainage basin extending from the NSW border to Beenleigh just south of Brisbane. It includes parts of Scenic Rim, Gold Coast City and Logan City local government areas and covers an area of 781 km^2. Elevation ranges from sea level at the confluence with the Logan River to 1196 m in the Lamington Plateau along the border.

The Albert River, a tributary of the Logan River, has headwaters in Lamington National Park and flows through sub-tropical rainforests to the largely cleared lowland areas before joining the Logan River 11 km upstream from the mouth. Dominant land uses include grazing, intensive crop farming and rural residential living areas.

The catchment has a stream network around 1700 km long. About 73% of the catchment wetland area is comprised of riverine wetlands and a further 16% is palustrine wetland.

Lamington National Park, along the southern boundary of the catchment is part of the Gondwana Rainforests of Australia World Heritage Area. The other signification area of conservation estate is Tamborine National Park which is the headwaters for Cedar Creek, a major tributary of the Albert River.

1.2.14 Logan River catchment

The Logan River study area is 3368 km^2 , and is comprised of large parts of the Scenic Rim and Logan local government areas, as well as smaller parts of Ipswich, Brisbane and Redland councils. The elevation in the catchment ranges from sea level at the coast to 1368 m in the south west at the headwaters of Teviot Brook.

The two main waterways, the Logan River and its tributary Teviot Brook, both have sources in the undisturbed high country of the McPherson and Great Dividing Ranges along the NSW border. The largest conservation areas in the catchment, Mount Barney and Lamington National Parks, occur in this border range area. These national parks are part of the Gondwana Rainforest World Heritage Area. Mount Chinghee National Park and small sections of Main Range National Park are also part of the McPherson Range/Great Dividing Range conservation estate links.

The catchment stream network length is about 6000 km but riverine wetlands comprise a smaller proportion (31%) of total wetland area compared to neighbouring catchments. Palustrine (31%) and estuarine (21%) wetlands that are more prevalent in the coastal lowlands make up a larger proportion of total wetland area. The Moreton Bay Ramsar site (internationally important wetland) and several smaller nationally important wetlands (DIWA) are located in the coastal and near coastal areas of the catchment.

Land in the upper catchment areas has been cleared for grazing (including horse agistment), dairying and intensive agriculture. However, there are still large tracts of remnant vegetation remaining in the upper catchment. In the mid reaches chicken farms, turf farms, beef production and rural residential and urban development are prevailing land uses. In the coastal areas of Redland City Council, land use is dominated by urban development, intensive agriculture, market gardens and also some aquaculture. Most of the lowland areas have been cleared for various purposes but some remnant riparian vegetation remains.

1.2.15 Bremer River catchment

The Bremer River catchment covers around 2030 km^2 and extends from Ipswich in the north to near the NSW border. The catchment is comprised of most of Ipswich City Council in the north and the western third of Scenic

Rim Regional Council in the south. Catchment elevation varies from 3 m to as high as 1325 m in Great Dividing Range along the western boundary.

Main Range National Park, part of the Gondwana Rainforests of Australia World Heritage Area, which runs along the catchment's entire western bioregion boundary is the only national park of significant size in the catchment. The Bremer River and its major tributary creeks (including Boyd, Coulson, Oakey, Reynolds and Warrill Creeks) have headwaters in or adjacent to this large area of conservation estate.

Riverine wetlands make up half the total wetland area in the catchment and palustrine wetlands are 15% of the total area. The remaining wetland area is comprised of artificial or highly modified wetlands, primarily Lake Moogerah which provides a significant irrigation water supply.

The catchment is subject to a variety of land uses. More than half of the area is grazed and the remainder is used for horticulture, mining, urban and industrial development and lifestyle blocks. Crops such as potatoes and carrots are grown in the rich alluvial soil areas.

Natural areas are becoming more degraded in parts of the catchment. Most of the lowland areas of the catchment have been cleared of native vegetation, including riparian areas, resulting in widespread channel and gully erosion in the Bremer River and its tributaries. Population growth in the SEQ region, and resulting supply and demand pressure on primary production and natural resources, are challenges for land managers.

1.2.16 Lockyer Creek catchment

The Lockyer Creek catchment covers an area of around 3000 km^2 on the southwest boundary of the SEQ bioregion. It incorporates parts of the Toowoomba, Lockyer Valley, Somerset and Ipswich City local government areas.

The catchment is bordered on the north, south and west by the Great Dividing Range and drainage is to the east over undulating low hills to the relatively narrow alluvial plains of Lockyer Creek and its tributaries. The catchment varies in altitude from a peak of 1135 m to 35 m in the lowland areas. Drainage consists of a stream network more than 6000 km long and includes the Dalrymple and Blackfellow Creeks nationally important wetlands (DIWA). Around 75% of mapped wetlands are riverine with a further 12% both palustrine and lacustrine.

The Lockyer Valley has some of Queensland's most productive alluvial soils and much of the mid and lower catchment areas have been cleared for intensive agriculture; vegetables, grains, lucerne and fruits. The catchment has the highest proportion of land used for intensive agriculture in SEQ. Irrigation schemes accompanying this development have resulted in regulated water flows and changed groundwater dynamics. Other dominant land uses in the catchment are grazing, predominantly in the upland areas, and rural residential development, both of which have required clearing of native vegetation.

Large tracts of remnant vegetation remain in the upper catchment along the margins of the basin. Much of this is protected in conservation estate including Main Range National Park and adjacent Glen Rock State Forest, in the south, and Lockyer National Park in the north.

A combination of intensification of rural industries and population growth present challenges for land management in the catchment, with increased demand for land for infrastructure, primary production and natural resources . Threats to waterways include instability of stream banks and gully erosion due to clearing of riparian vegetation.

2 Methods and implementation

2.1 AquaBAMM

The SEQ ACAs were undertaken using AquaBAMM (Clayton et al. 2006). The method as published in 2006 was revised to incorporate non-riverine wetlands measures, and minor changes made to the AquaBAMM tool.

2.2 Spatial units

In implementing an ACA, spatial units need to be defined in order to assign conservation/ecological values when they are calculated. This issue is dealt with in detail in the published methodology (Clayton et al. 2006).

For a non-riverine ACA a map of the palustrine and lacustrine wetlands is normally used and the individual mapped wetlands are employed as the ACA spatial units. Clearly, this way of defining spatial units is dependent on an accurate map of classified wetlands being available for the study area. In Queensland, EHP is producing wetland maps statewide which define wetland location, extent and attributes by applying the Wetland Mapping and Classification Methodology (EPA, 2005). These maps, where available, are used as the platform for ACAs using AquaBAMM.

The number of spatial units included in an ACA can vary greatly between study areas. For the SEQ study area, there were 3,979 non-riverine spatial units (mapped palustrine or lacustrine wetlands) drawn directly from EHP's wetland mapping v3.0. All wetlands were included, regardless of hydrological modification (see the Wetland Mapping and Classification Methodology 2005 for more information on these hydrological modifier codes).

For the riverine ACA, the spatial units were based on the Bureau of Meteorology's Geospatial Fabric (Geofabric) (http://www.bom.gov.au/water/geofabric) dataset. This layer was clipped to the coastline. Polygons smaller than 64ha were dissolved into the surrounding polygons with the largest shared boundary. A number of hydrologically inconsistent polygons were also dissolved based on a visual inspection of the GIS layer. The riverine ACAs included 9,185 Geofabric spatial units. These are grouped into 853 subsections. The subsections are also used in a number of non-riverine measure calculations.

2.3 Assessment parameters

The criteria, indicators and measures (CIM) list outlined in Table 2 outlines the CIM that were implemented as part of the riverine and non-riverine ACAs in the SEQ catchments. The list has been developed from a default list of criteria, indicators and measures that may be considered for an ACA. The default CIM list is not mandatory for any particular ACA; however, it provides a 'starter set' for consideration in setting the assessment parameters for each ACA.

Table 2 CIM list for the SEQ catchments

Criteria and Indicators	Measures		Riverine	Non-riverine
1 Naturalness aquatic				
1.1 Exotic flora/fauna	1.1.1	Presence of 'alien' fish species within the wetland	Y	Y
	1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	Y	Y
	1.1.3	Presence of exotic invertebrate fauna within the wetland		Y
	1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	Y	Y
1.3 Habitat features modification	1.3.4	Presence/absence of dams/weirs within the wetland	Y	
	1.3.5	Inundation by dams/weirs (% of waterway length within the wetland)	Y	
	1.3.7	% area of remnant wetland relative to preclear extent for each spatial unit	Y	Y
	1.3.8	Presence of dredging/extraction (including for navigation) and channel modification within the wetland		
1.4 Hydrological modification	1.4.5	Hydrological disturbance/modification of the wetland (e.g. as determined through EHP wetland mapping and classification)		Y
2 Naturalness catchment				
2.1 Exotic flora/fauna	2.1.1	Presence of exotic terrestrial plants in the assessment unit	Y	Y
2.2 Riparian disturbance	2.2.1	% area remnant vegetation relative to preclear extent within buffered riverine wetland or watercourses	Y	
	2.2.2	Total number of REs relative to preclear number of REs within buffered riverine wetland or watercourses	Y	
	2.2.5	% area of remnant vegetation relative to pre-clear extent within buffered non-riverine wetland: 500m buffer for wetlands >= 8Ha, 200m buffer for smaller wetlands		Y
	2.2.9	Percentage tree cover within the waterway corridor	Y	
2.3 Catchment disturbance	2.3.1	% "agricultural" land-use area (i.e. cropping and horticulture)	Y	Y
	2.3.2	% "grazing" land-use area	Y	Y
	2.3.3	% "vegetation" land-use area (i.e. native veg + regrowth)	Y	Y
	2.3.4	% "settlement" land-use area (i.e. towns, cities, etc)	Y	Y

Criteria and Indicators	Measures		Riverine	Non-riverine
2.4 Flow Modifications	2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	Y	Y
3 Diversity and richness				
3.1 Species	3.1.1	Richness of native amphibians (riverine wetland breeders)	Y	
	3.1.2	Richness of native fish	Y	Y
	3.1.3	Richness of native aquatic dependent reptiles	Y	Y
	3.1.4	Richness of native waterbirds	Y	Y
	3.1.5	Richness of native aquatic plants	Y	Y
	3.1.6	Richness of native amphibians (non-riverine wetland breeders)		Y
	3.1.7	Richness of native aquatic dependent mammals	Y	Y
3.2 Communities/ assemblages	3.2.1	Richness of macroinvertebrate taxa	Y	Y
	3.2.2	Richness of REs along riverine wetlands or watercourses within a specified buffer distance	Y	
3.3 Habitat	3.3.2	Richness of wetland types within the local catchment (e.g. SOR sub-section)	Y	Y
	3.3.3	Richness of wetland types within the sub-catchment	Y	Y
4 Threatened species and ecosystems				
4.1 Species	4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species – NCAct, EPBCAct	Y	Y
	4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species - NCAct, EPBCAct	Y	Y
4.2 Communities/ assemblages	4.2.1	Conservation status of wetland Regional Ecosystems – Herbarium biodiversity status, NCAct, EPBCAct	Y	Y
5 Priority species and ecosystems				
5.1 Species	5.1.1	Presence of aquatic ecosystem dependent 'priority' fauna species (expert panel list/discussion or other lists such as ASFB, WWF, etc)	Y	Y
	5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	Y	Y
	5.1.3	Habitat for, or presence of, migratory species (expert panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention)	Y	Y
	5.1.4	Habitat for significant numbers of waterbirds	Y	Y
5.2 Ecosystems	5.2.1	Presence of 'priority' aquatic ecosystem	Y	Y
6 Special features				
6.1 Geomorphic features	6.1.1	Presence of distinct, unique or special geomorphic features	Y	Y

Criteria and Indicators	Measures		Riverine	Non-riverine
6.2 Ecological processes	6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	Y	Y
6.3 Habitat	6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	Y	Y
	6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.	Y	Y
	6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	Y	Y
6.4 Hydrological	6.4.1	Presence of distinct, unique or special hydrological regimes (eg. Spring fed stream, ephemeral stream, boggomoss)	Y	Y
7 Connectivity				
7.1 Significant species or populations	7.1.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of significant species or populations, including those features identified through criteria 5 and/ or 6	Y	
	7.1.2	Migratory or routine 'passage' of fish and other fully aquatic species (upstream, lateral or downstream movement) within the spatial unit	Y	
7.2 Groundwater dependent ecosystems	7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6 (e.g., karsts, cave streams, artesian springs)	Y	Y
7.3 Floodplain and wetland ecosystems	7.3.1	The contribution of the spatial unit to the maintenance of floodplain and wetland ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6	Y	
	7.3.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist, with floodplains, rivers, groundwater, etc.		Y
7.5 Estuarine and marine ecosystems	7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6		
8 Representativeness				
8.1 Wetland protection	8.1.1	The percent area of each wetland type within Protected Areas.		Y
	8.1.2	The percent area of each wetland type within a coastal/estuarine area subject to the Fisheries Act, Coastal Management Act or Marine Parks Act		Y

Criteria and Indicators	Measures		Riverine	Non-riverine
8.2 Wetland uniqueness	8.2.1	The relative abundance of the wetland management group to which the wetland type belongs within the catchment or study area (management groups ranked least common to most common)		Y
	8.2.2	The relative abundance of the wetland management group to which the wetland type belongs within the sub-catchment or estuarine/marine zone (management groups ranked least common to most common)		Y
	8.2.3	The size of each wetland type relative to others of its management group within the catchment or study area		Y
	8.2.4	The size of each wetland type relative to others of its type within a sub-catchment (or estuarine zone)		Y
	8.2.5	Wetland type representative of the study area – identified by expert opinion		Y
	8.2.6	The size of each wetland type relative to others of its type within the catchment or study area		Y

2.4 Stratification

Study area stratification for application to relevant measures of AquaBAMM is a user decision and is not mandatory for a successful assessment. However, AquaBAMM makes provision for data to be stratified in any user-defined manner that is determined to be ecologically appropriate. Stratification mitigates the effects of data averaging across large study areas, and is particularly important where ecological diversity and complexity is high. An example where stratification may be appropriate is fish diversity where fewer species inhabit the upland zone compared to lowland floodplains. For measure datasets where there is an equal probability of scoring across a range of values throughout the study area, stratification is unwarranted. To date, the use of strata in completed ACAs has been based on elevation (e.g. 150m ASL for coastal catchments and 400 m ASL for catchments west of the Great Dividing Range in the Murray-Darling Basin) or bioregional boundaries.

Stratification was considered by the expert panels and the project team but was not recommended, and therefore not implemented for the SEQ ACA version 1.1.

2.5 Datasets

Typically, an ACA using AquaBAMM draws on a wide range of datasets with a wide range of formats. This will generally include published scientific documents, unpublished data (grey literature) and officially collated data from various Queensland Government sources including data from the Queensland Museum; Queensland Herbarium; Department of Science, Information Technology, Innovation and Arts; and Department of Natural Resources and Mines.

In addition, data derived from one or more expert elicitation processes is included for every ACA for a number of measures. Expert advice and data is sought through an expert panel process. For the SEQ ACAs, expert panels were conducted to address aquatic and riparian flora, aquatic fauna and wetland ecology. ACA expert panels involve a range of internal and external experts. The report for the expert panel is presented in Attachment A of this report.

2.6 Implementation

Each ACA may have a different combination of assessment parameters (refer to section 2.3), and is likely to draw on a different combination of datasets, thus having a different set of criteria, indicators and measures. Implementation to complete the assessment can be complex and comprehensive. Implementation tables are maintained by EHP throughout each ACA. A description of how each measure was implemented as part of the ACA is provided in Table 3 and Table 4.

Table 3 Non-riverine implementation table for the SEQ ACA

Measure	Description	Implementation	Primary datasets used	Threshold type
1.1.1	Presence of ‘alien' fish species within the wetland	A list of non-riverine alien species was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their presence in each. Based on the subsection with the highest area of overlap against the <nr_spatialunits>, the number of records were recorded.	Fauna species records from QHFD / expert panels)	Presence negative
1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	A list of non-riverine exotic aquatic and semi-aquatic plants was identified in the SEQ flora expert panel. Using point records, an identity was run against <subsections> to determine their presence in each. Based on the subsection with the highest area of overlap against the <nr_spatialunits>, the number of records were recorded.	Flora species records from Wildnet / herbrecs/Corveg / expert panels	Presence negative
1.1.3	Presence of exotic invertebrate fauna within the wetland	A list of non-riverine exotic invertebrate fauna was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their presence in each. Based on the subsection with the highest area of overlap against the <nr_spatialunits>, the number of records were recorded.	Fauna species records from QHFD / expert panels)	Presence negative
1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	A list of non-riverine exotic invertebrate fauna was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their presence in each. Based on the subsection with the highest area of overlap against the <nr_spatialunits>, the number of records were recorded.	Fauna species records from QHFD / expert panel	Presence negative
1.3.7	% area of remnant wetland relative to preclear extent for each spatial unit	Using the remnant and pre-clear vegetation version 8, the percentage area occupied by remnant non-riverine wetland types (P,L) was calculated as a proportion of pre-clear P and L in each subsection. Based on the subsection with the highest area of overlap against the <nr_spatialunits>, percentage value for the dominant subsection was applied.	Herbarium RE mapping / QLD wetlands mapping	Continuous ascending - quartile

Measure	Description	Implementation	Primary datasets used	Threshold type
1.4.5	Hydrological disturbance/modification of the wetland (e.g. as determined through DERM wetland mapping and classification)	Each <nr_wethabitat> was assessed based on their [SPUNITID] membership. A list of hydromods was compiled. The highest corresponding value was given based on {4:set(['H1','H2M8']),2:set(['H2M1','H2M2','H2M3']),1:set(['H2M4', 'H2M5', 'H2M6', 'H3C1', 'H3C3'])}	QLD Wetlands mapping	Categorical
2.1.1	Presence of exotic terrestrial plants in the assessment unit	A list of exotic terrestrial plants was identified in the SEQ flora expert panel. Using point records, an identity was run against <subsections> to determine their presence in each. Based on the subsection with the highest area of overlap against the <nr_spatialunits>, the number of records were recorded. Presence was assigned when >0	Flora species records from Wildnet / herbrecs/Corveg / expert panels	Presence negative
2.2.5	Per cent (%) area of remnant vegetation relative to preclear extent within buffered non-riverine wetland: 500 m buffer for wetlands >= 8 ha, 200 m buffer for smaller wetlands	Each <nr_spatialunit> was buffered by 500m buffer for wetlands >= 8Ha, 200m buffer for smaller wetlands. A multiring buffer was used as it allowed for the exclusion of the wetland itself from the analysis. The remant and pre-clear vegetation mapping was then intersected with area calculated. De-concatenating the RE_LABEL and PC_LABEL, The area of each value with a valid RE vegetation code was calculated to get the total area occupied by RE for pre-clear and remant. The percentage of remnant to pre-clear was calculated and applied to each <nr_spatialunits> feature.	QLD Herbarium Remnant Vegetation mapping and perclear mapping / QLD wetlands mapping	Quartile - continuous ascending
2.3.1	Per cent (%) "agricultural" land-use area (i.e. cropping and horticulture)	As per the method used to calculate the total proportion of cropping LC_Crop_P], use the formula as follows:([DryCroph]+ [Irrigh]+ [Plantnh]+ [Tree_croph!]/ area total being assessed *100.0 Apply quartiling split based on the average of the maximum 3 subsection values where there is subsections associated with non-riverine wetlands.	SEQ Catchments risk assessment data	Quartile - continuous descending
2.3.2	Per cent (%) "grazing" land-use area	This is calculated using the number of hectares of grazing within each subsection as a percentage. As per the above comments about accounting for water bodies, the assessment area is deducted where appropriate. Proportion is calculated as follows: [GrazingH]/ area total being assessed *100.0 Any value over 100.0 will be rounded down to 100 Apply quartiling split based on the average of the maximum 3 subsection values where there is subsections associated with non-riverine wetlands.	SEQ Catchments risk assessment data	Quartile - continuous descending

Measure	Description	Implementation	Primary datasets used	Threshold type
2.3.3	Per cent (%) "vegetation" land-use area (i.e. native veg + regrowth)	A vegetation index was created based upon the extent of forest vegetation [LC_Veg_P] and [REM_VEG_P], and categorising this using by quartiling the average of of the top three values for each subsections, and adding the score to each other to get a final index.	SEQ Catchments risk assessment data	Quartile - continuous ascending
2.3.4	Per cent (%) "settlement" land-use area (i.e. towns, cities, etc)	As per the method used to calculate the total proportion of cropping [LC_Urban_P], use the formula as follows. (!Roadh!+ !Urbanh!+ !Mineh!)/ total area being assessed * 100.0. Apply quartiling split based on the average of the maximum three subsection values where there is subsections associated with non-riverine wetlands.	SEQ Catchments risk assessment data	Quartile - continuous descending
2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	A feature selection from the Queensland Wetland Mapping where "HYDROMOD" IN ('H2M6', 'H2M7', 'H2C1', 'H2C2', 'H2C3', 'H3C1' ,'H3C2') was saved as a feature class in Scratch.gdb. Reservoir polygons from the NRM reservoirs fc where "TYPE" = 2 were appended to this feature class and flattened by a full dissolve. The subsections were identified against the dissolved dams/reservoirs layer and areas calculated for the identity product. The riverine output table was populated with percentages of the area of each subsection occupied by dams / reservoirs. The same percentages were associated with the non-riverine wetlands falling within each subsection using a subsection ID /non-riverine wetland ID lookup table.	Queensland Wetlands Mapping . NRM reservoirs.	Continuous descending quantiling (4 classes)
3.1.2	Richness of native fish	A list of native fish (riverine wetland breeders) was identified in the SEQ fauna expert panel. Using point records, an identity was run against a 100m buffer of the <nr_spatialunit> to determine their richness in each.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
3.1.3	Richness of native aquatic dependent reptiles	A list of native aquatic dependent reptiles was identified in the SEQ fauna expert panel. Using point records, an identity was run against a 1000m buffer of the <nr_spatialunit> to determine their richness in each.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined

Measure	Description	Implementation	Primary datasets used	Threshold type
3.1.4	Richness of native waterbirds	A list of native aquatic dependent reptiles was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their richness in each. Based on the subsection with the highest area of overlap against the <nr_spatialunits> the value was assigned.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
3.1.5	Richness of native aquatic plants	A list of native aquatic plants was identified in the SEQ flora expert panel. Using point records, an identity was run against a 1000m buffer of the <nr_spatialunit> to determine their richness in each.	Flora species records from Wildnet / herbrecs/Corveg / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
3.1.6	Richness of native amphibians (non-riverine wetland breeders)	A list of native amphibians (non-riverine wetland breeders) was identified in the SEQ fauna expert panel. Using point records, an identity was run against a 1000m buffer of the <nr_spatialunit> to determine their richness in each.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
3.1.7	Richness of native aquatic dependent mammals	A list of native aquatic dependent mammals was identified in the SEQ fauna expert panel. Using point records, an identity was run against a 1000m buffer of the <nr_spatialunit> to determine their richness in each.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
3.2.1	Richness of macroinvertebrate taxa	A list of macroinvertebrate taxa was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their richness in each. Based on the subsection with the highest area of overlap against the <nr_spatialunits> the value was assigned.	Fauna species records from QHFD / expert panels	Continuous ascending - quartile

Measure	Description	Implementation	Primary datasets used	Threshold type
3.3.2	Richness of wetland types within the local catchment (e.g. SOR subsection)	An identity was run on <nr_wethabitats> where the [HYDROMOD] was 'H1', 'H2M2', 'H2M3', 'H2M8' against <subregions>. A list of unique [TYPE_RE] values was counted for each subsection. To be allocated, the [SPUNITID] and its associated subsections, had to match those identified in the wethabitat x subsection intersect. Any that were missed were assigned to the subsection that occupied the maximum area of the nr spunit. Assign to each nr spunit the number of TYPE_REs present in the subsection allocated to it based on maximum area.	QLD wetlands mapping	Continuous ascending - quartile
3.3.3	Richness of wetland types within the sub-catchment	An identity was run on <nr_wethabitats> where the [HYDROMOD] was 'H1', 'H2M2', 'H2M3', 'H2M8' against <subregions>. A list of unique [TYPE_RE] values was counted for each subsection. To be allocated, the [SPUNITID] and its associated subsections, had to match those identified in the wethabitat x subsection intersect. Any that were missed were assigned to the subsection that occupied the maximum area of the nr spunit. Assign to each nr spunit the number of TYPE_REs present in the sub-catchment allocated to it based on maximum area.	QLD wetlands mapping	Continuous ascending - quartile
4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species – NC Act, EPBC Act	A list of rare or threatened aquatic ecosystem dependent fauna species based on NCAct, EPBCAct in the SEQ fauna expert panel. Using point records, an identity was run against a 1000m buffer of the <nr_spatialunit> to determine their richness in each.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species – NC Act, EPBC Act	A list of rare or threatened aquatic ecosystem dependent flora species based on NCAct, EPBCAct in the SEQ flora expert panel. Using point records, an identity was run against a 1000m buffer of the <nr_spatialunit> to determine their richness in each.	Flora species records from Wildnet / herbrecs/Corveg / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
4.2.1	Conservation status of wetland regional ecosystems – Herbarium biodiversity status, NC Act, EPBC Act	Using <nr_wethabitats>, and the [WETRE]fields, a lookup of REDD biodiversity status and EPBC status for each RE with values applied as follows for only riverine (P,L) wetland types.{ BDSTATUS … 'Endangered':4,'Of concern':3,'No concern at present':2, EPBC: 'E':4,'OC':3,'NOC':2,'CE':4,'V':3}. The maximum score was applied.	QLD wetlands mapping	Categorical E = 4, OC = 3, NOC = 2, noRE = 1

Measure	Description	Implementation	Primary datasets used	Threshold type
5.1.1	Presence of aquatic ecosystem dependent 'priority' fauna species (expert panel list/discussion, or other lists such as ASFB, WWF, etc)	A list of aquatic ecosystem dependent 'priority' fauna species was identified in the SEQ fauna expert panel. Using point records, an identity was run against a 1000m buffer of the <nr_spatialunit> to determine their richness in each.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	A list of aquatic ecosystem dependent 'priority' flora species was identified in the SEQ flora expert panel. Using point records, an identity was run against a 1000m buffer of the <nr_spatialunit> to determine their richness in each.	Flora species records from Wildnet / herbrecs/Corveg / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
5.1.3	Habitat for, or presence of, migratory species (expert panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention)	A list of migratory species (expert panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention) was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their presence in each. Based on the subsection with the highest area of overlap against the non-riverine wetland the value was assigned to each.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
5.1.4	Habitat for significant numbers of waterbirds	The expert panels identified these special features. The assigned conservation ratings for this measure were attributed. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Expert panels	Categorical
5.2.1	Presence of 'priority' aquatic ecosystem	The expert panels identified these special features. The assigned conservation ratings for this measure were attributed. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Expert panels	Categorical
6.1.1	Presence of distinct, unique or special geomorphic features	The expert panels identified these special features. The assigned conservation ratings for this measure were attributed. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Expert panels	Categorical

Measure	Description	Implementation	Primary datasets used	Threshold type
6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	The expert panels identified these special features. The assigned conservation ratings for this measure were attributed. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Expert panels	Categorical
6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	The expert panels identified these special features. The assigned conservation ratings for this measure were attributed. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Expert panels	Categorical
6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, regional coastal management planning, World Heritage Areas, etc.	Spatial units that occurred within the mapped boundaries of Ramsar and WHA, (world heritage areas) and Directory of Important Wetlands were identified. Those spatial units that had at least 50% of their area within this special areas layer were allocated a score of 4. No score was allocated to spatial units that were not identified as significant by such methods (i.e. they were treated as a missing value).	DOIW, Ramsar, WHA	Categorical
6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	The expert panel considered these special features from other documented studies and assigned conservation ratings for this measure. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Biodiversity planning assessments (BPAs) and other documented reports external to the ACA process	Categorical
6.4.1	Presence of distinct, unique or special hydrological regimes (e.g. spring fed stream, ephemeral stream, boggomoss)	The expert panels identified these special features. The assigned conservation ratings for this measure were attributed. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Expert panels	Categorical
7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6 (e.g., karsts, cave streams, artesian springs)	For special features relating to measures 6.4.1 with a rating of 4. All Geofabric units upstream within the same subsection as the special feature get a 4. All Geofabric units within the next subsection immediately upstream also get a 4. All Geofabric units in the next subsection upstream get a 3, then 2 then 1. Any overlaps between values will default to the maximum value. <nr_spatialunits> were selected based on the subection relationship with the highest value.	Expert panels	Categorical

Measure	Description	Implementation	Primary datasets used	Threshold type
7.3.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist, with floodplains, rivers, groundwater, etc	Using <Geofabric> units that overlap DIOW. <nr_spatialunits> were identified that overlapped with the selected Geofabric for more than 50% of their area and were assigned a 4.	Expert panel, Directory of Important Wetlands	Categorical
7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6	Non-riverine wetlands in Geofabric units that contain estuarine wetland without a barrage are rated 4. Non-riverine wetlands in Geofabric units upstream from those containing an un-barraged estuarine wetland are rated 3 unless there is a barrier in the unit. Non-riverine wetlands in Geofabric units upstream from those rated 3 are rated 2 unless a barrier is present. Non-riverine wetlands in Geofabric units upstream from those rated 2 are rated 1 unless a barrier is present.	Expert panels	Categorical
8.1.1	The percent area of each wetland habitat type within protected areas	Using protected areas with 'EST_TENURE' = ['FR','NP','NY','RP'] and nature refuges where 'EST_TYPE' = ['NR','CCA']. Union with the <nr_wethabitats> where the hydromod = 'H1', 'H2M2', 'H2M3', 'H2M8'. The area populated for TYPE_RE in the study area was calculated within PA/NR and without. For each <nr_spatialunit> the [TYPE_RE] with the least area occupied in protected area was given that proportional score.	QLD Wetlands mapping	Continuous descending (Sattler & Williams 1999)
8.1.2	The percent area of each wetland habitat type within a coastal/estuarine area subject to the Fisheries Act 1994, Coastal Protection and Management Act 1995 or Marine Parks Act 2004.	Using the fish habitat areas. Union with the <nr_wethabitats> where the hydromod = 'H1', 'H2M2', 'H2M3', 'H2M8'. The area populated for TYPE_RE in the study area was calculated within PA/NR and without. For each <nr_spatialunit> the [TYPE_RE] with the least area occupied in protected area was given that proportional score. Note that the Coastal Act areas and Marine Parks act were not used in this analysis.	QLD Wetlands mapping	Continuous descending (Sattler & Williams 1999)
8.2.1	The relative abundance of the wetland management group to which the wetland habitat belongs within the catchment or study area (management groups ranked least common to most common)	Applies only to 'H1', 'H2M2', 'H2M3', 'H2M8' wetlands. Assess <nr_wethabitats>. Using the [HAB] field, obtain a richness of habitat types in the study area. Also compile a list of habitat types for each [SPUNITID]. When giving a richness score, determine the habitat richness values present in the [SPUNITID] and apply the lowest score.	QLD Wetlands mapping	Continuous descending logarithmic

Measure	Description	Implementation	Primary datasets used	Threshold type
8.2.2	The relative abundance of the wetland management group to which the wetland habitat belongs within the sub-catchment or estuarine/marine zone (management groups ranked least common to most common)	Applies only to 'H1', 'H2M2', 'H2M3', 'H2M8' wetlands. Assess <nr_wethabitats> run an identity against the <sub_catchments> layer. Using the [HAB] field, obtain a richness of habitat types in the sub-catchment where the sub-catchment is allocated to the relevant [SPUNITID] being assessed, allocation in this instance is based on the maximum area. Also compile a list of habitat types for each [SPUNITID]. When giving a richness score, determine the habitat richness values present in the [SPUNITID] and apply the lowest score.	QLD Wetlands mapping	Continuous descending logarithmic
8.2.3	The size of each wetland habitat relative to others of its management group within the catchment or study area	For <nr_habitats> and using the [HAB] attribute. Determine the area covered by each HAB for each study area. Quartile the result. For each SPUNITID determine the maximum quartile value for the habitat type. ('H1', 'H2M2', 'H2M3', 'H2M8') were the only wetland types included	QLD Wetlands mapping	Categorical
8.2.4	The size of each wetland habitat relative to others of its management group within a sub-catchment (or estuarine zone)	For <nr_habitats> and using the [HAB] attribute. Determine the area covered by each HAB for each sub-catchment for which the SPUNIT belongs (In this case the maximum area). Quartile the result. For each SPUNITID determine the maximum quartile value for the habitat type. ('H1', 'H2M2', 'H2M3', 'H2M8') were the only wetland types included	QLD Wetlands mapping	Categorical
8.2.5	Wetland (either wetland habitat or SPUNITID) representative of the study area – identified by expert opinion	The expert panels identified these special features. The assigned conservation ratings for this measure were attributed. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Expert panels QLD Wetlands mapping	Categorical
8.2.6	The size of each wetland habitat relative to others of its 'type' within the catchment or study area	For <nr_wethabtiats> where the [HYDROMO] = ('H1', 'H2M2', 'H2M3', 'H2M8'). Using the [TYPE_RE] and [SA_ID] fields determine the area occupied by each and quartile by study area. For each [SPUNITID] where [HYDROMO] = ('H1', 'H2M2', 'H2M3', 'H2M8') determine a list of [TYPE_RE] present. Assign the maximum quartiled TYPE_RE value for the SA_ID	QLD Wetlands mapping	Categorical

Table 4 Riverine implementation table for the SEQ ACA

Measure	Description	Implementation	Primary datasets used	Threshold type
1.1.1	Presence of 'alien' fish species within the wetland	A list of riverine alien species was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their presence in each.	Fauna species records from QHFD / expert panels	Presence negative
1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	A list of riverine exotic aquatic and semi-aquatic plants was identified in the SEQ flora expert panel. Using point records, an identity was run against <subsections> to determine their presence in each.	Flora species records from Wildnet / herbrecs/Corveg / expert panels	Presence negative
1.1.3	Presence of exotic invertebrate fauna within the wetland	A list of riverine exotic invertebrate fauna was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their presence in each.	Fauna species records from QHFD / expert panels	Presence negative
1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	A list of riverine feral/exotic vertebrate fauna (other than fish) was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their presence in each.	Fauna species records from QHFD / expert panels	Presence negative
1.3.4	Presence/absence of dams/weirs within the wetland	Dams_Weirs_Barrages_QLD_100k_NRM.shp was intersected with the subsections. A Set of subsection ID codes for subsections that contain a point was constructed from the intersection product. The latter was used to attribute the output table with 1 if at least one dam/weir/barrage present, 0 if not.	DNRM Dams, Weirs, Barrages - QLD 100k	Presence Negative
1.3.5	Inundation by dams/weirs (% of waterway length within the wetland)	The NRM river line layer was identitied successively against the NRM reservoir feature classs, the NRM lakes feature class (filtered for un-named lakes only because most named lakes are natural and most un-named ones are dammed or bunded) and the Queensland Wetland Mapping H2M1 wet habitats. A summary table was produced of total lengths of watercourse that intersect one or more of the 3 polygon feature classes, and total length of watercourses that do not intersect them within each subsection, and from that table, percentages were calculated into the output table.	r_stream_lines, nr_wethabitats, NRM lakes and NRM reservoirs.	Continuous descending - logarithmic
1.3.7	% area of remnant wetland relative to preclear extent for each spatial unit	Using the remnant and preclear vegetation version 8, the percentage area occupied by remnant riverine wetland types (R) was calculated as a proportion of pre-clear R in each subsection.	RE mapping / QLD wetlands mapping	Continuous ascending - quartile

Measure	Description	Implementation	Primary datasets used	Threshold type
1.3.8	Presence of dredging/extraction (including for navigation) and channel modification within the wetland	An SQL IN-list was used to extract SPA permits that involve dredging from bnegis03\ENTDBA.PERM_ACTIVITY. The selected permits were saved in the scratch gdb, then intersected with the NRM watercourse lines, the NRM watercourse polygons and with the subsections. The intersection product was flattened by dissolving on subsection ID, then areas of the dissolved polygons were calculated. The output table was attributed with 1 from a list of subsections containing a dissolved permit polygon.	Register of permits granted under the SPA, NRM watercourse lines, NRM watercourse polygons.	Presence negative
2.1.1	Presence of exotic terrestrial plants in the assessment unit	A list of exotic terrestrial plants was identified in the SEQ flora expert panel. Using point records, an identity was run against <subsections> to determine their presence in each.	Flora species records from Wildnet / herbrecs/Corveg / expert panels	Presence negative
2.2.1	Per cent (%) area remnant vegetation relative to preclear extent within buffered riverine wetland or watercourses	Pre-clear, RE, and study area feature classes were intersected. Study area by study area, the intersection product was intersected with the river buffers. Areas of all polygons were calculated, then percentages of remnant/preclear within the river buffers was calculated into the output table.	DSITIA RE mapping / QLD wetlands mapping	Quartile - continuous ascending
2.2.2	Total number of REs relative to preclear number of REs within buffered riverine wetland or watercourses	Using the pre-clear x RE x study area intersection product from 2.1.1, the numbers of distinct REs and pre-clear RE's in each subsection's riverbuffers were recorded into a table, then divided one by the other. The percentages were copied to the measure's output table.	DSITIA RE and preclear mapping. Riverbuffers derived from NRM rivers line features.	Quartile - continuous ascending
2.2.9	Percentage tree cover within the waterway corridor.	Using the land cover data SEQC have calculated the % forest and shrub within the riparian zone. This is represented by field [RipWVeg_P]. The scoring would be applied using the mean of the top 3 values and quartering. Filtering would be applied as per the field [RIPLC_yes] = 1, as per the SEQC method for calculating [ripscore].	SEQ catchments risk assessment data.	Quartile - continuous ascending
2.3.1	Per cent (%) "agricultural" land-use area (i.e. cropping and horticulture)	As per the method used to calculate the total proportion of cropping LC_Crop_P], use the formula as follows:([DryCroph]+ [Irrigh]+ [Plantnh]+ [Tree_croph!]/ area total being assessed *100.0 Apply quartiling based on the average of the maximum 3 subsection values for riverine assessment.	SEQ catchments risk assessment data	Quartile - continuous descending

Measure	Description	Implementation	Primary datasets used	Threshold type
2.3.2	Per cent (%) "grazing" land-use area	This is calculated using the number of hectares of grazing within each subsection as a percentage. As per the above comments about accounting for water bodies, the assessment area is deducted where appropriate. Proportion is calculated as follows: [GrazingH]/ area total being assessed *100.0 Any value over 100.0 will be rounded down to 100 Apply quartiling based on the average of the maximum 3 subsection values for riverine assessment.	SEQ catchments risk assessment data	Quartile - continuous descending
2.3.3	Per cent (%) "vegetation" land-use area (i.e. native veg + regrowth)	A vegetation index was created based upon the extent of forest vegetation [LC_Veg_P] and [REM_VEG_P], and categorising this using by quartiling the average of of the top three values for each subsections, and adding the score to each other to get a final index.	SEQ catchments risk assessment data	Quartile - continuous ascending
2.3.4	Per cent (%) "settlement" land-use area (i.e. towns, cities, etc)	As per the method used to calculate the total proportion of cropping [LC_Urban_P], use the formula as follows. (!Roadh!+ !Urbanh!+ !Mineh!)/ total area being assessed * 100.0. Apply quartiling based on the average of the maximum 3 subsection values for riverine assessment.	SEQ catchments risk assessment data	Quartile - continuous descending
2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	A feature selection from the Queensland Wetland Mapping where "HYDROMOD" IN ('H2M6', 'H2M7', 'H2C1', 'H2C2', 'H2C3', 'H3C1' ,'H3C2') was saved as a feature class in Scratch.gdb. Reservoir polygons from the NRM reservoirs fc where "TYPE" = 2 were appended to this feature class and flattened by a full dissolve. The subsections were identitied against the dissolved dams/reservoirs layer and areas calculated for the identity product. The riverine output table was populated with percentages of the area of each subsection occupied by dams / reservoirs. The same percentages were associated with the non-riverine wetlands falling within each subsection using a subsection ID /non-riverine wetland ID lookup table.	QLD Wetlands mapping. NRM reservoirs / dams feature class.	Continuous descending - quantile
3.1.1	Richness of native amphibians (riverine wetland breeders)	A list of native amphibians (riverine wetland breeders) was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their richness in each.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined

Measure	Description	Implementation	Primary datasets used	Threshold type
3.1.2	Richness of native fish	A list of native fish (riverine wetland breeders) was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their richness in each.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
3.1.3	Richness of native aquatic dependent reptiles	A list of native aquatic dependent reptiles was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their richness in each.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
3.1.4	Richness of native waterbirds	A list of native aquatic dependent reptiles was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their richness in each.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
3.1.5	Richness of native aquatic plants	A list of native aquatic plants was identified in the SEQ flora expert panel. Using point records, an identity was run against <subsections> to determine their richness in each.	Flora species records from Wildnet / herbrecs/Corveg / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined

Measure	Description	Implementation	Primary datasets used	Threshold type
3.1.7	Richness of native aquatic dependent mammals	A list of native aquatic dependent mammals was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their richness in each.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
3.2.1	Richness of macroinvertebrate taxa	A list of macroinvertebrate taxa was identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their richness in each.	Fauna species records from QHFD / expert panels	Continuous ascending - quartile
3.2.2	Richness of REs along riverine wetlands or watercourses within a specified buffer distance	Using the pre-clear x RE x study area intersection product from 2.1.1, the numbers of distinct REs within the riparian buffers within each subsection were counted and the count entered into the riverine results table.	Queensland Herbarium Remnant Vegetation Mapping (Ver. 8.0, 2013)	Continuous ascending - quartile
3.3.2	Richness of wetland types within the local catchment (e.g. SOR subsection)	An identity was run on <nr_wethabitats> where the [HYDROMOD] was 'H1', 'H2M2', 'H2M3', 'H2M8' against <subregions>. A list of unique [TYPE_RE] values was counted for each subsection. To be allocated, the [SPUNITID] and its associated subsections, had to match those identified in the wethabitat x subsection intersect. Any that were missed were assigned to the subsection that occupied the maximum area of the nr spunit.	QLD wetlands mapping	Continuous ascending - quartile
3.3.3	Richness of wetland types within the sub-catchment	An identity was run on <nr_wethabitats> where the [HYDROMOD] was 'H1', 'H2M2', 'H2M3', 'H2M8' against <subregions>. A list of unique [TYPE_RE] values was counted for each sub-catchment. To be allocated, the [SPUNITID] and its associated sub-catchment, had to match those identified the wethabitat x sub-cathcment intersect. Any that were missed were assigned to the sub-catchment that occupied the maximum area of the nr spunit.	QLD wetlands mapping	Continuous ascending - quartile

Measure	Description	Implementation	Primary datasets used	Threshold type
4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species – NC Act, EPBC Act	A list of rare or threatened aquatic ecosystem dependent fauna species based on NCAct, EPBCAct in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their richness in each. Presence was based on richness greater than 0.	Fauna species records from QHFD / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species – NC Act, EPBC Act	A list of rare or threatened aquatic ecosystem dependent flora species - NCAct, EPBCAct in the SEQ flora expert panel. Using point records, an identity was run against <subsections> to determine their richness in each. Presence was based on richness greater than 0.	Flora species records from Wildnet / herbrecs/Corveg / expert panels	Dependent on number of species: Presence positive, continuous ascending – quartile, User Defined
4.2.1	Conservation status of wetland regional ecosystems – Herbarium biodiversity status, NC Act, EPBC Act	Using <r_wethabitats>, and the [WETRE] and [WETRE_PCT] fields, a lookup of REDD biodiversity status and EPBC status for each RE with values applied as follows for only riverine (R) wetland types.{ BDSTATUS … 'Endangered':4,'Of concern':3,'No concern at present':2, EPBC: 'E':4,'OC':3,'NOC':2,'CE':4,'V':3}. A sum area for each score was applied to the subsections. Using a minimum area cut off of 1 hectare to avoid slithers and account for positional errors, the highest score was applied.	QLD wetlands mapping	Categorical E = 4, OC = 3, NOC = 2, noRE = 1
5.1.1	Presence of aquatic ecosystem dependent 'priority' fauna species (expert panel list/discussion or other lists such as ASFB, WWF, etc)	A list of aquatic ecosystem dependent 'priority' fauna species were identified in the SEQ fauna expert panel. Using point records, an identity was run against <subsections> to determine their presence in each.	Fauna species records from QHFD / expert panels	Dependent on number of species:
5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	A list of aquatic ecosystem dependent 'priority' flora species was identified in the SEQ flora expert panel. Using point records, an identity was run against <subsections> to determine their presence in each.	Flora species records from Wildnet / herbrecs/Corveg / expert panels	Presence positive, continuous ascending – quartile,

Measure	Description	Implementation	Primary datasets used	Threshold type
5.1.3	Habitat for, or presence of, migratory species (expert panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention)	A list of migratory species (expert panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention) was compiled. Using point records, an identity was run against <subsections> to determine their presence in each. No modelling of habitat was done for this measure.	Fauna species records from QHFD / expert panels	User Defined
5.1.4	Habitat for significant numbers of waterbirds	Geofabric units identified in the expert panels	Fauna species records from QHFD / expert panels	Categorical
5.2.1	Presence of 'priority' aquatic ecosystem	The expert panels identified these special features. The assigned conservation ratings for this measure were attributed. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Expert panel	Categorical
6.1.1	Presence of distinct, unique or special geomorphic features	The expert panels identified these special features. The assigned conservation ratings for this measure were attributed. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Expert panel	Categorical
6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	The expert panels identified these special features. The assigned conservation ratings for this measure were attributed. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Expert panel	Categorical
6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	The expert panels identified these special features. The assigned conservation ratings for this measure were attributed. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Expert panel	Categorical
6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, regional coastal management planning, World Heritage Areas, etc.	Assigning a value of 4 for Ramsar and WHA and a 3 for DOIW. <subsections> that intersect obtain the maximum value.	DOIW, Ramsar, WHA	Categorical

Measure	Description	Implementation	Primary datasets used	Threshold type
6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	The expert panel considered these special features from other documented studies and assigned conservation ratings for this measure. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Biodiversity planning assessments (BPAs) and other documented reports external to the ACA process	Categorical
6.4.1	Presence of distinct, unique or special hydrological regimes (e.g. spring fed stream, ephemeral stream, boggomoss)	The expert panels identified these special features. The assigned conservation ratings for this measure were attributed. There was no need to apply thresholds as conservation ratings represent the final score for this measure.	Expert panels	Categorical
7.1.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of significant species or populations, including those features identified through criteria 5 and/ or 6	For special features relating to measures 5.1.4, 6.3.1 or 6.3.2 with a rating of 4. All Geofabric units upstream within the same subsection as the special feature get a 4. All Geofabric units within the next subsection immediately upstream also get a 4. All Geofabric units in the next subsection upstream get a 3, then 2 then 1. Any overlaps between values will default to the maximum value.	Riverine expert panel measures 5.1.4 and 6.3.1 and calculations for 6.3.2	Categorical
7.1.2	Migratory or routine 'passage' of fish and other fully aquatic species (upstream, lateral or downstream movement) within the spatial unit	Fish passage rating was calculated by cross referencing stream order and fish passage rating. Where there is a 100k dam, barrage or weir score is 0, otherwise the maximum is applied for the fish passage rating for the Geofabric as well as its stream order.	DNRM Dams and Weirs coverage	Categorical
7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6 (e.g. karsts, cave streams, artesian springs)	The connectivity value of spatial units upstream from a special feature identified (and implemented) in Measure 6.4.1 was scored in this measure. For spatial unit with a rating of four for 6.4.1 assign four to the next SU upstream, then 3 to the next, then 2 then 1 as per the methodology for Measure 7.1.1. If a spatial unit has been nominated by the panel as having a CIM number of 7.2.1 then assign 4 to the next spatial unit upstream then 3, 2, 1. The spatial unit nominated as having 7.2.1 would not get a value for connectivity under 7.2.1, only the spatial units upstream. If a spatial unit only had a CIM number of 7.2.1 then is interpreted as 6.4.1 and the usual rules apply.	Riverine expert panel decision 6.4.1	Categorical

Measure	Description	Implementation	Primary datasets used	Threshold type
7.3.1	The contribution of the spatial unit to the maintenance of floodplain and wetland ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6	The connectivity value of spatial units that contained the special features identified in the non-riverine ACA for measure 6.3.2 and 6.3.3 was assessed. Subsections (spatial units) that contained features identified in the non-riverine SEQ ACA Version 1.1 (only those with a conservation rating of 4), were given a value of 4.	Expert panel decision 6.3.2 and 6.3.3	Categorical
7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6	Any riverine subsection containing an estuarine wetland is assigned a four, as long as the estuarine wetland does not contain a barrage. The next subsections upstream score a 4 until the stream order changes and then the score drops by one progressively as the stream order changes. Wherever there is a barrage, this scoring stops.	Expert panel	Categorical

2.7 Transparency of results

ACAs produce results at a number of levels despite its initial presentation as a single score called AquaScore. After running the AquaBAMM tool, ACA results are available at AquaScore, criterion, indicator, measure, or raw data levels. The results are also available through the use of user-defined queries that may interrogate one or more levels within the assessment in an almost infinite number of possible combinations. This transparency of results provides the ACA end user (e.g. scientists, resource managers and conservation organisations) with a unique level of flexibility for ACA interrogation, interpretation and presentation. Links between the ACA results and a geographic information system (GIS) facilitate this interrogation and provide a means of visualising the ACA results (Figure 2 and Figure 3).

This data access and interrogation flexibility is important and enables investigation of the influence of different data contributions to the overall conservation value, investigation of missing data, and an ability to tailor the ACA output for a particular purpose.

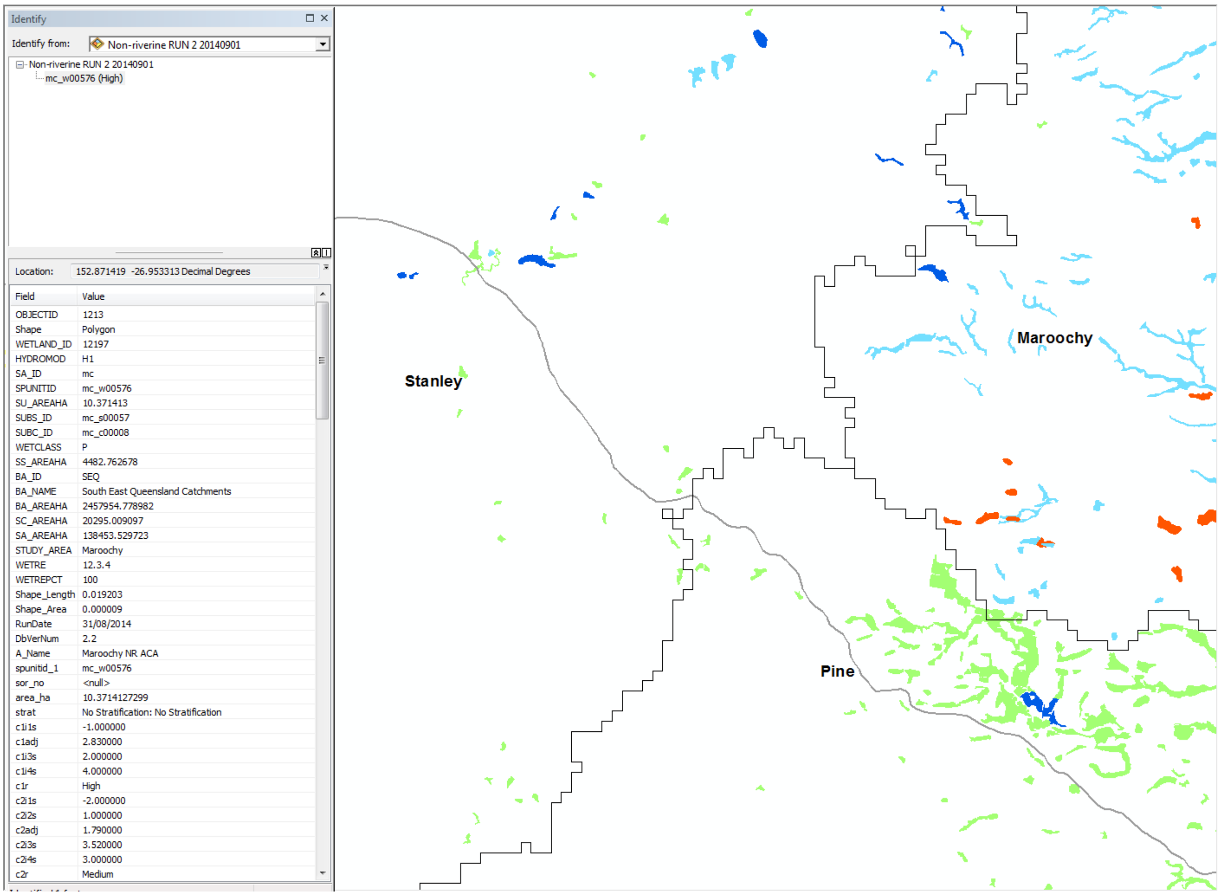


Figure 2 Interrogating the non-riverine ACA results for a spatial unit in the GIS environment

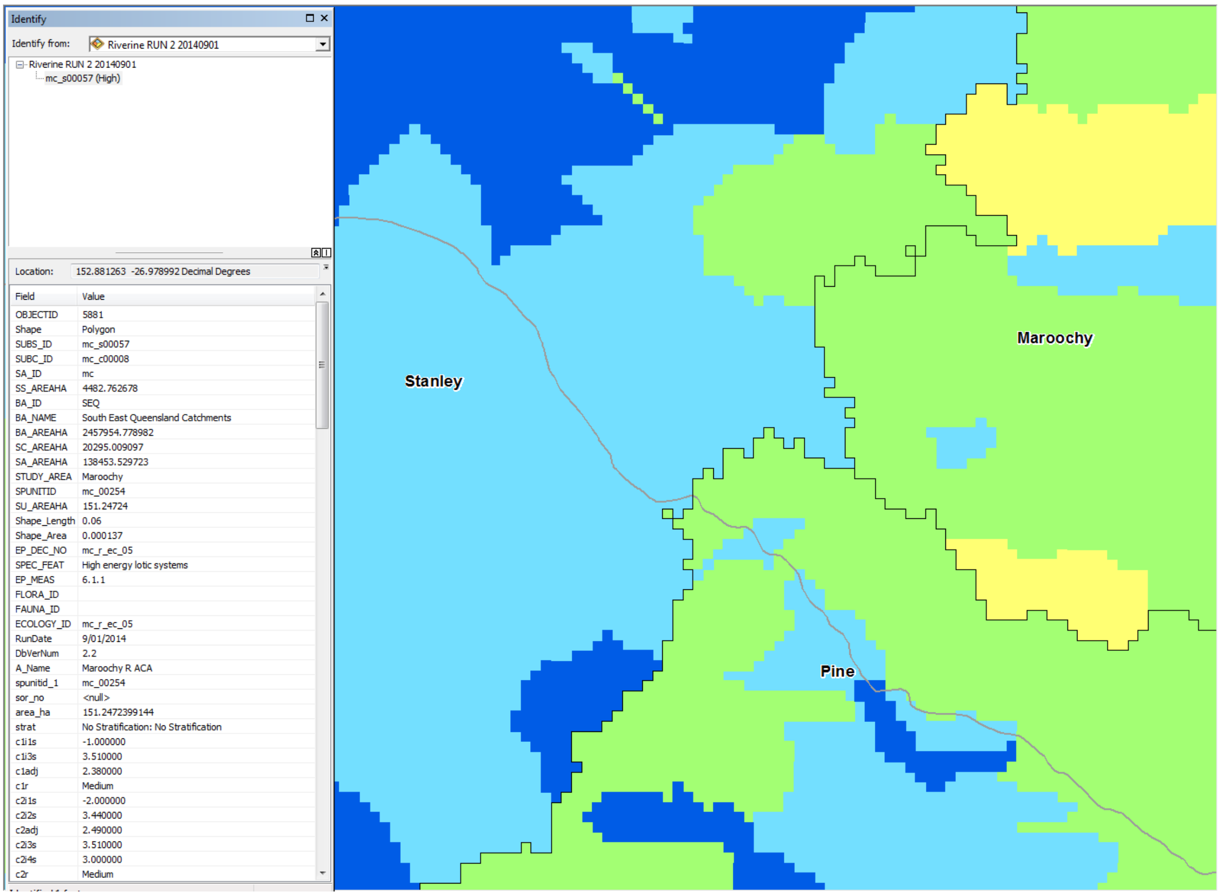


Figure 3 Interrogating the riverine ACA results for a spatial unit in the GIS environment

3 Results

3.1 Conservation value categories

The conservation value results for wetlands are referential within each study area, but each value category has characteristics in common. AquaBAMM uses combinations of criterion level scores to determine a wetland's final AquaScore and based on these combinations, the following descriptions provide context for each AquaScore value category.

"Very High" wetlands

These wetlands have very high values across all criteria (aquatic naturalness, catchment naturalness, diversity and richness, threatened species, special features and representativeness), or they have very high representativeness values in combination with very high aquatic naturalness, catchment naturalness or threatened species values. They may also be wetlands nominated as a special feature by an expert panel for their very high flora, fauna and/or ecological values, regardless of values across other criteria.

"High" wetlands

These wetlands are mainly those that have very high aquatic naturalness or representativeness values in combination respectively with very high/high threatened species values or very high diversity and richness values. Other combinations of very high or high values amongst the criteria may also indicate one of these wetlands.

"Medium" wetlands

These wetlands have varied combinations of high and medium values amongst the criteria.

"Low" wetlands

These wetlands have limited aquatic and catchment naturalness values. They have varied combinations of medium and low values amongst the other criteria.

"Very Low" wetlands

These wetlands have very limited or no aquatic and catchment naturalness values and they lack any other known significant value. They may also be wetlands that are largely data deficient.

3.2 Accuracy and dependability

Wetland data is the core dataset that this ACA is built upon. This data is mapped at a scale of 1:100,000 with a positional accuracy of ±100 metres, except for areas along the east coast that may be mapped at a scale of 1:50,000 with a positional accuracy of ±50 metres. Wetlands smaller than 1 hectare are not delineated in the wetland data.

The dependability score is a percentage of how many measures, out of those calculated, have data. The dependability does not influence or change the final AquaScore. The ACA results should be interpreted in conjunction with the dependability score. For example, where spatial units with 'Very Low' AquaScore values have low dependability, the results should be used with caution as the AquaScore may be due to the inherent lack of values or the lack of data. In the case of missing data, further survey work may add more data which may, or may not, change the AquaScore.

The interpretation, accuracy and use of the ACA results is discussed further in section 3.6.

3.3 SEQ catchment overall results - riverine

An ACA was conducted for the riverine wetlands in each of the catchments of the SEQ region. The results outlined below are a summary of the results for all study areas. Table 5 summarises the overall AquaScore results for the riverine subsections. Table 6 provides charts of the summary information along with dependability results and further summaries for each study area. Figure 4 and Figure 5 present the overall AquaScore results by subsection and buffered stream respectively. Figure 5 represents the scores for each criterion contributing to the overall AquaScore.

Table 5 AquaScore summary for riverine wetlands

AquaScore	Number of spatial units	Percent of spatial units (%)	Area (ha)	Area (%)
Very High	2,948	32%	760,787	31%
High	1,909	21%	534,407	21.5%
Medium	3,972	43%	1,053,104	43%
Low	270	3%	86,384	3.5%
Very Low	86	1%	23,273	1%
Total	9,185		2,457,955	

A few broad trends in wetland conservation values were shown in the results:

- Overall, approximately 53 per cent of subsections scored 'Very High' or 'High' for the overall AquaScore. The riverine spatial units with these overall values tended to be in the higher elevation areas of many catchments and the islands. These areas are relatively less fragmented compared to many lowland areas in SEQ. Aquatic and catchment naturalness tended to score well. The higher elevation areas and islands also tended to be captured by expert panel special feature decisions. As an example, all subsections on Moreton Island scored a very high for criterion 6 Special Features. This criterion is based on the expert panel decisions and is weighted highly in the filtering table that produces the final AquaScore.
- The Albert and Noosa catchments were mainland catchments that contained the greatest proportion of 'Very High' or 'High' spatial unit values. Both had approximately 84% of their spatial units rating 'Very High' or 'High' for Aquascore
- Mainland catchments that had over 50% of their area rating 'Very High' or 'High' riverine AquaScore were: Albert (89%); Noosa (87%); Stanley (68%); Maroochy (65%); Nerang Coomera (65%); Pine (56%); Maroochy (55%);Logan (51%).
- Mainland catchments that had over 50% of their area rating 'Medium', 'Low' or 'Very Low' riverine AquaScore were: Bremer (71%); Brisbane Upper (63%); Lockyer (53.5%).
- Mainland catchments that had the largest area in good catchment condition (criterion 2 = 'Very High' or 'High') were: Noosa (72% area); Nerang Coomera (58%). All other mainland catchments had below 50 % good catchment condition.
- Mainland catchments that had the largest area in relatively low catchment condition (criterion 2 = 'Medium' or 'Low') were: Stanley (63% area); Albert and Brisbane Upper (62%).
- Connectivity values (criterion 7) were lowest in the Lockyer, Bremer and Logan catchments.
- AquaScore dependability was proportionally highest in the coastal study areas, with the exception of the Northern half of the Noosa study area. The western study areas (Stanley, Brisbane Upper, Lockyer and Bremer) were notably data poor.

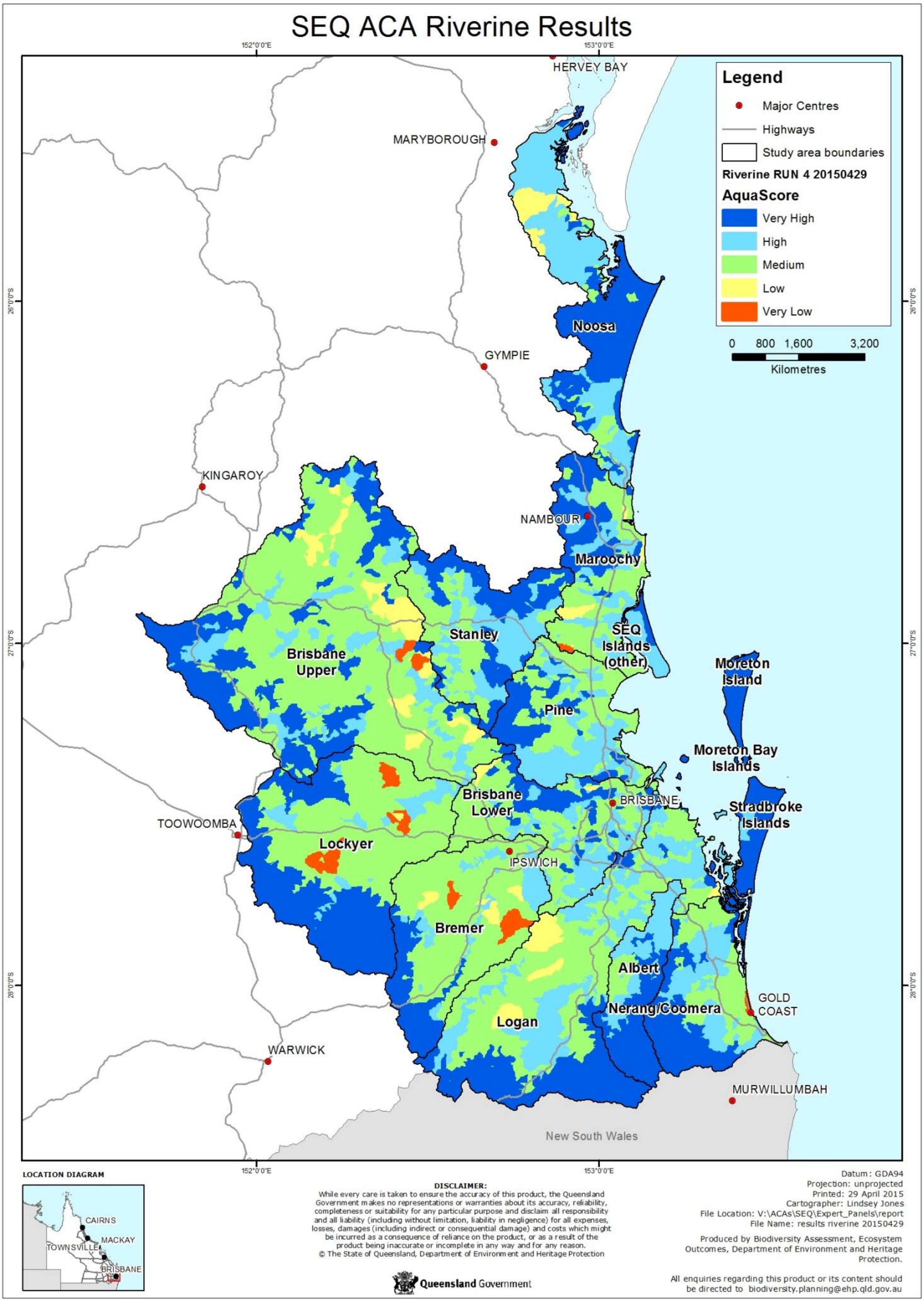


Figure 4 Riverine AquaScore for all catchments shown by riverine subsection

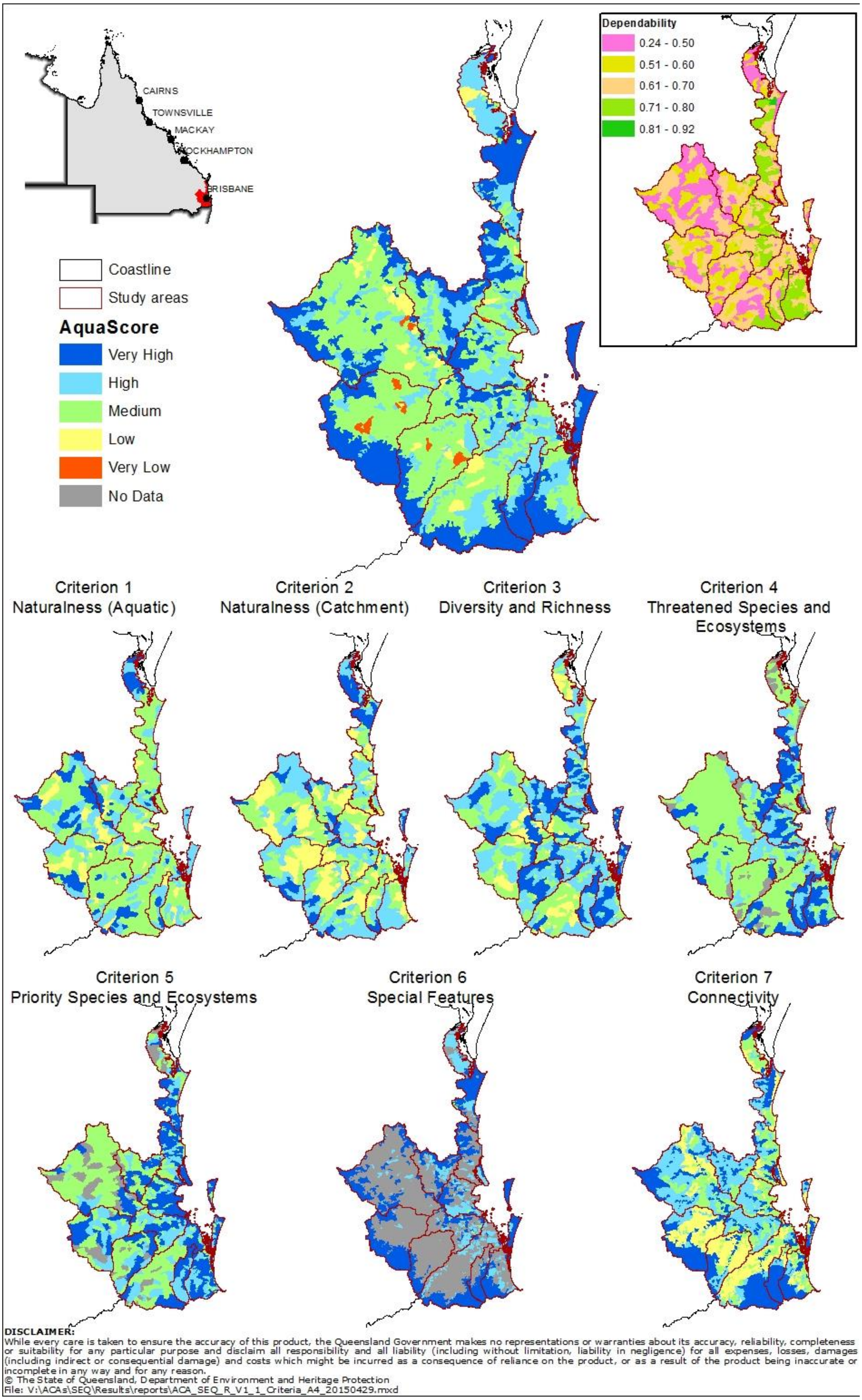


Figure 5 AquaScore criteria for all catchments shown by riverine subsection

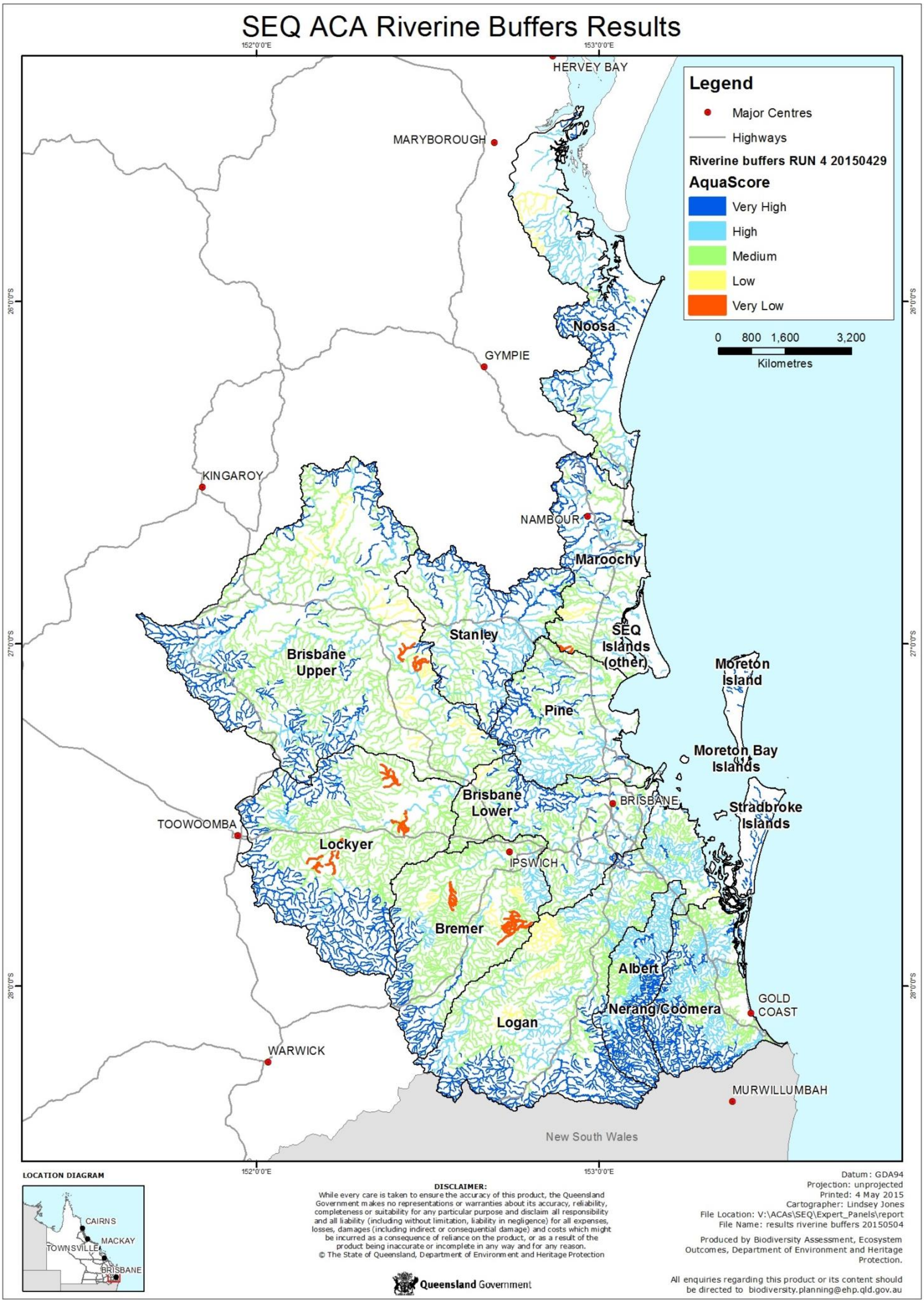
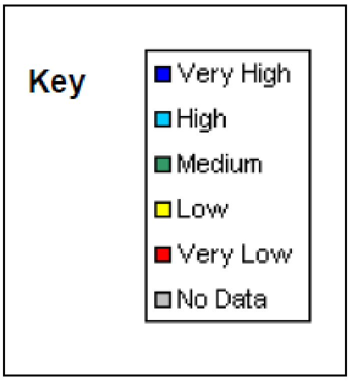
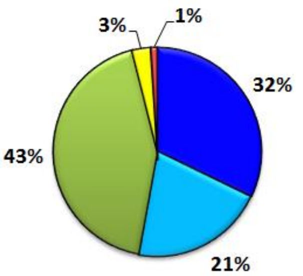
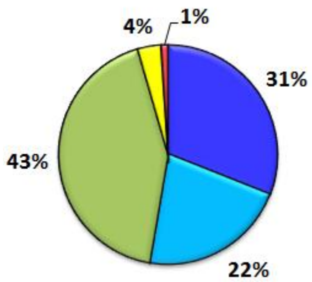
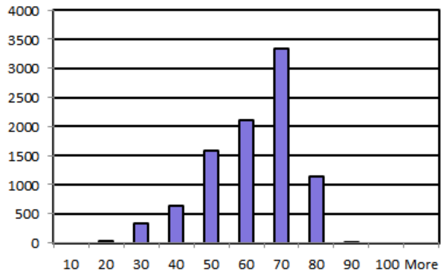
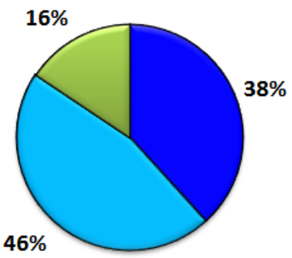
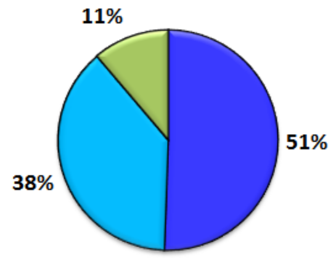
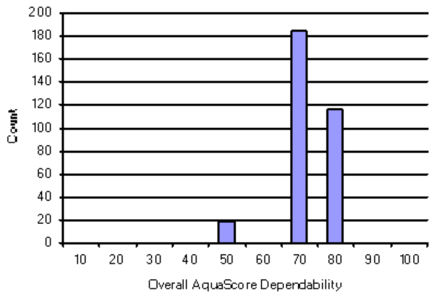
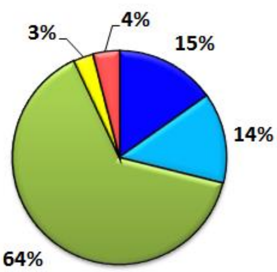
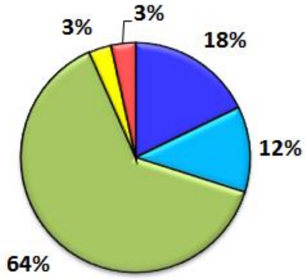
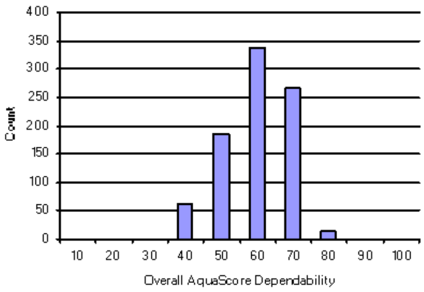
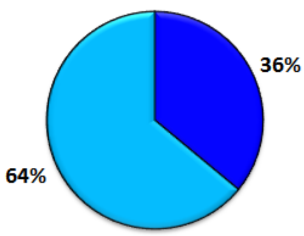
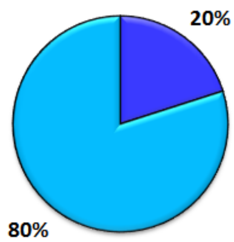
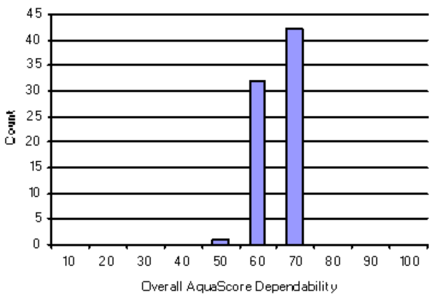


Figure 6 Riverine AquaScore for all catchments shown by buffered stream

Table 6 Riverine AquaScore and dependability summary for all study areas



Catchment	Aquascore by number of spatial units	Aquascore by total area of spatial units	Aquascore dependability
All catchments (riverine)			
Albert			
Bremer			
Bribie Island			

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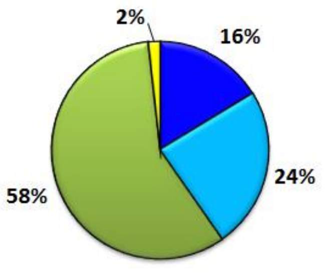
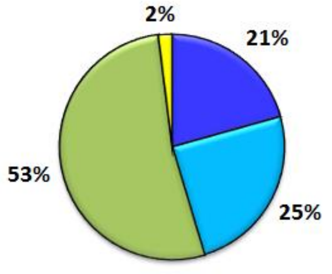
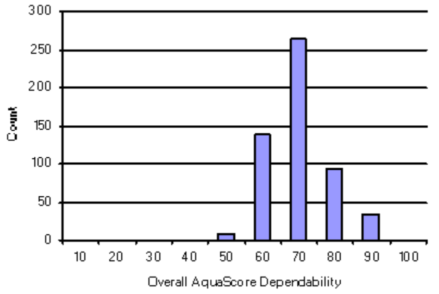
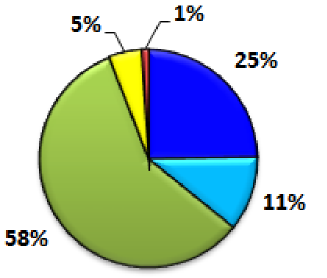
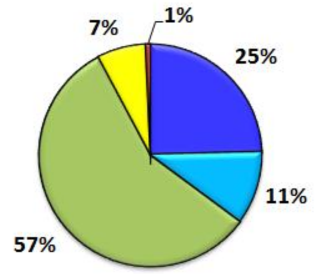
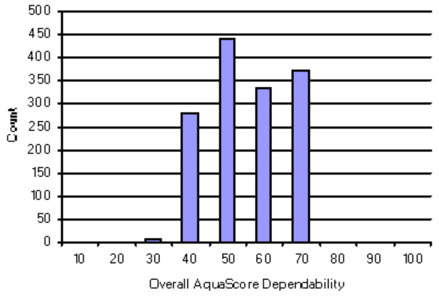
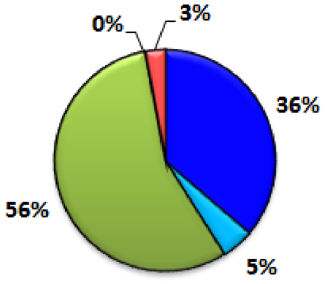
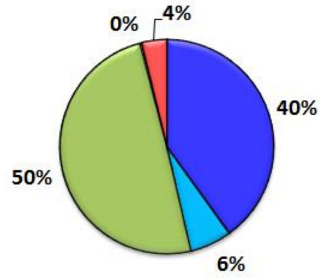
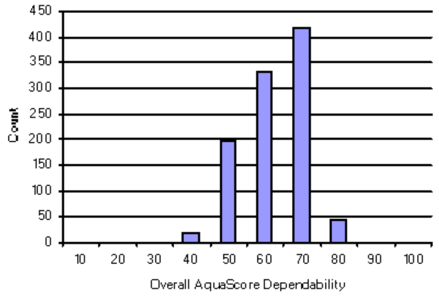
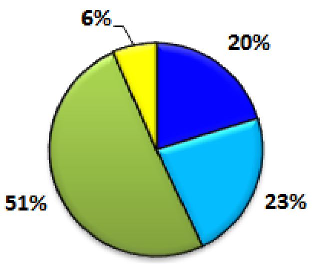
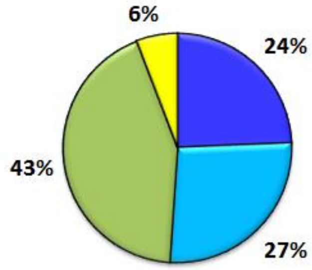
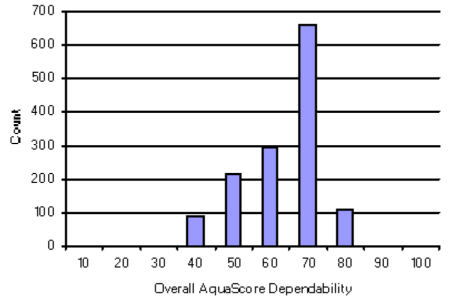
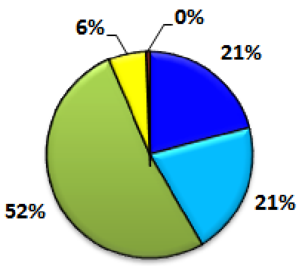
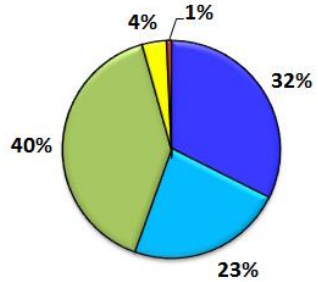
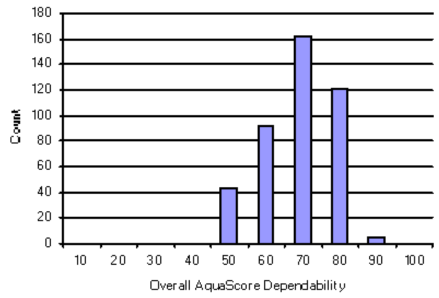
<tr><td>Brisbane lower</td><td></td><td></td><td></td></tr>
<tr><td>Brisbane upper</td><td></td><td></td><td></td></tr>
<tr><td>Lockyer</td><td></td><td></td><td></td></tr>
<tr><td>Logan</td><td></td><td></td><td></td></tr>
<tr><td>Maroochy</td><td></td><td></td><td></td></tr>
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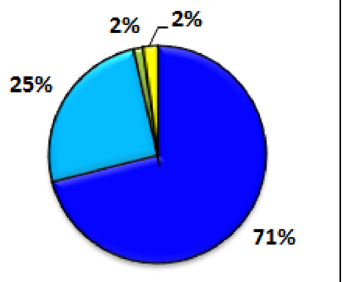
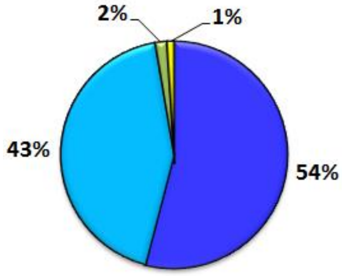
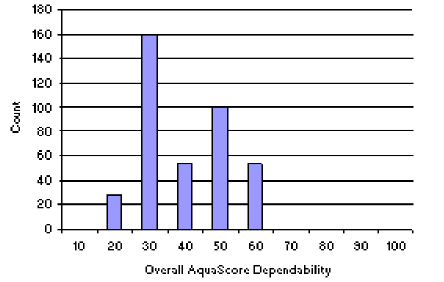
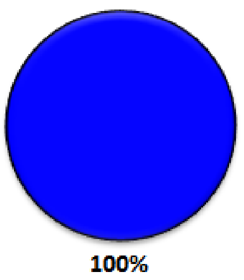
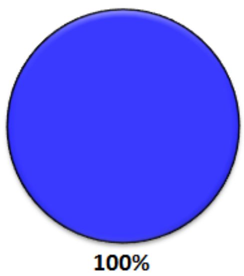
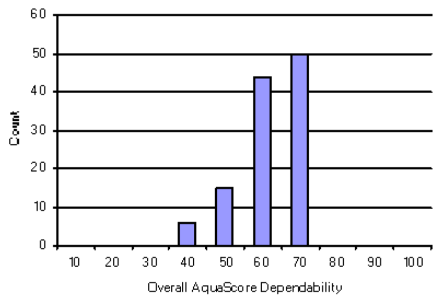
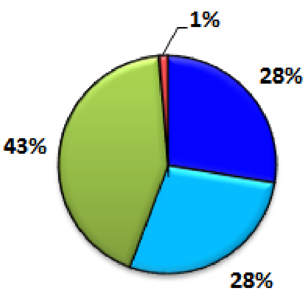
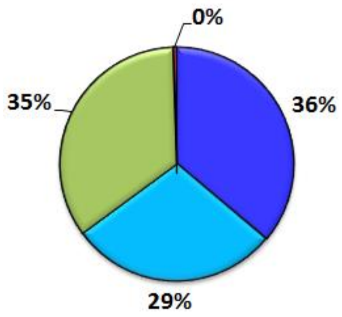
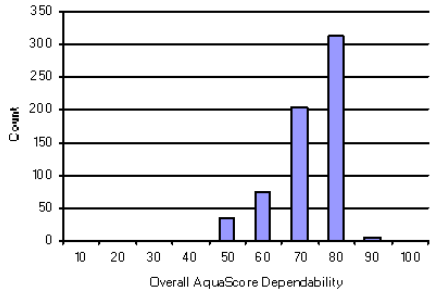
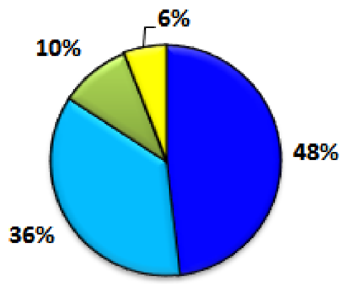
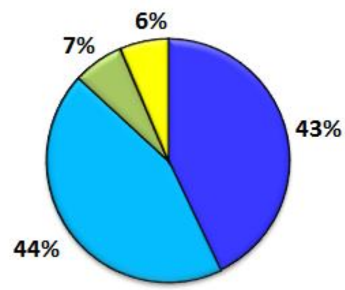
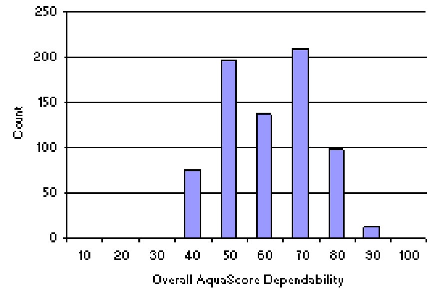
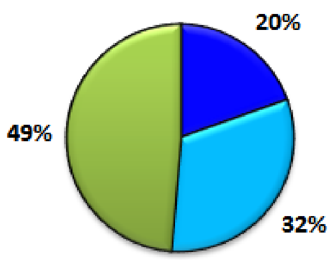
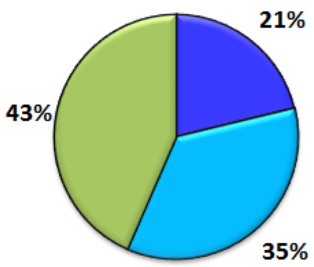
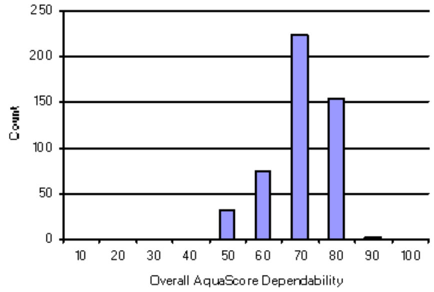
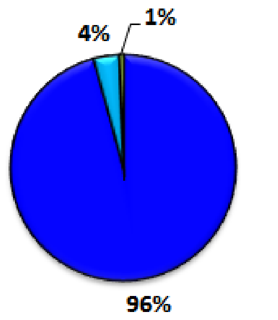
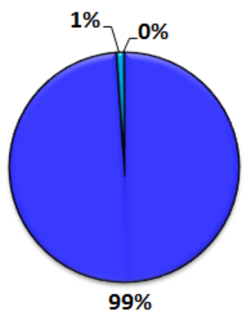
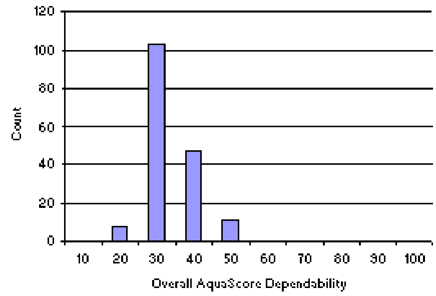
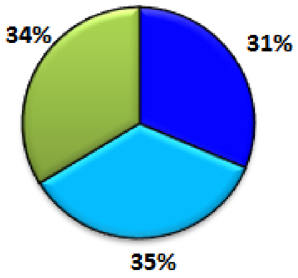
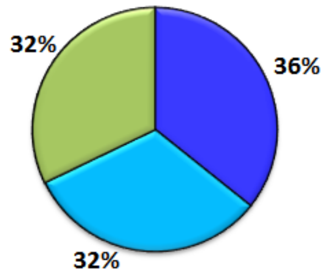
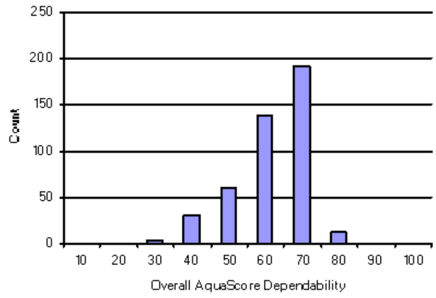
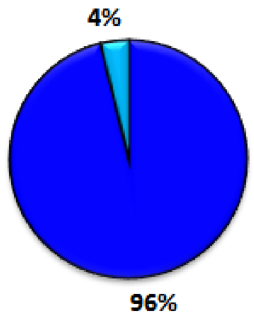
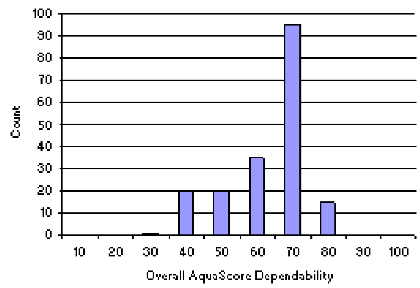
Catchment	Aquascore by number of spatial units	Aquascore by total area of spatial units	Aquascore dependability
Moreton Bay islands			
Moreton island			
Nerang /Coomera			
Noosa			
Pine			

Catchment	Aquascore by number of spatial units	Aquascore by total area of spatial units	Aquascore dependability
SEQ islands (other)			
Stanley			
Stradbroke islands			

3.4 SEQ catchment overall results - non-riverine

An ACA was conducted for the non-riverine wetlands in each of the catchments of the SEQ region. The results outlined below are a summary of the results for 16 study areas. Table 7 summarises the overall AquaScore results for the non-riverine wetlands. Table 8 provides charts of the summary information along with dependability results and further summaries for each study area. Figure 7 presents the overall AquaScore results for non-riverine wetlands. Figure 8 represents the scores for each criterion contributing to the overall AquaScore.

Table 7 AquaScore summary for non-riverine wetlands

AquaScore	Number of spatial units	Percent of spatial units (%)	Area (ha)	Area (%)
Very High	1,004	25%	53,870	51%
High	1,360	34%	19,412	18%
Medium	1,185	30%	30,430	29%
Low	43	1%	272	<1%
Very Low	387	10%	1,525	1%
Total	3,979			

A few broad trends in wetland conservation values were shown in the results:

- Overall, approximately 59 per cent of all wetlands scored 'Very High' or 'High' for AquaScore. This equated to 69 per cent of all wetland area. All spatial units on the island study areas (Bribie Island, Moreton Island, Moreton Bay Islands, SEQ other islands) scored 'Very High' or 'High' for AquaScore.
- The highly modified wetlands, e.g. farm dams in the H3 hydromodification category tended to score relatively low. This is to be expected as aquatic naturalness is low and these wetlands have no value in terms of connectivity or representativeness (criteria 7 and 8). Any values attributed to these wetlands are derived primarily from species diversity and the presence of threatened and or priority species (criteria 3, 4, and 5).
- The large waterbodies in SEQ, e.g. Wivenhoe dam, Hinze dam, North Pine dam etc. all score 'Medium' for AquaScore. All had 'Low' aquatic naturalness values and any other values attributed to them were based on results derived from criteria 2, 3, 4, and 5.
- Five catchments have greater than 50% of their wetland area scoring 'Medium' or less for overall AquaScore. These catchments, in order, are: Brisbane Upper (99%), Stanley (96%), Brisbane Lower (73%), Bremer (70%), and Pine (66%). The Brisbane Lower catchment has the greatest area (20%) of 'Very Low' AquaScore wetlands.
- Dependability tended to be lowest for the wetlands in the Brisbane Upper catchment.

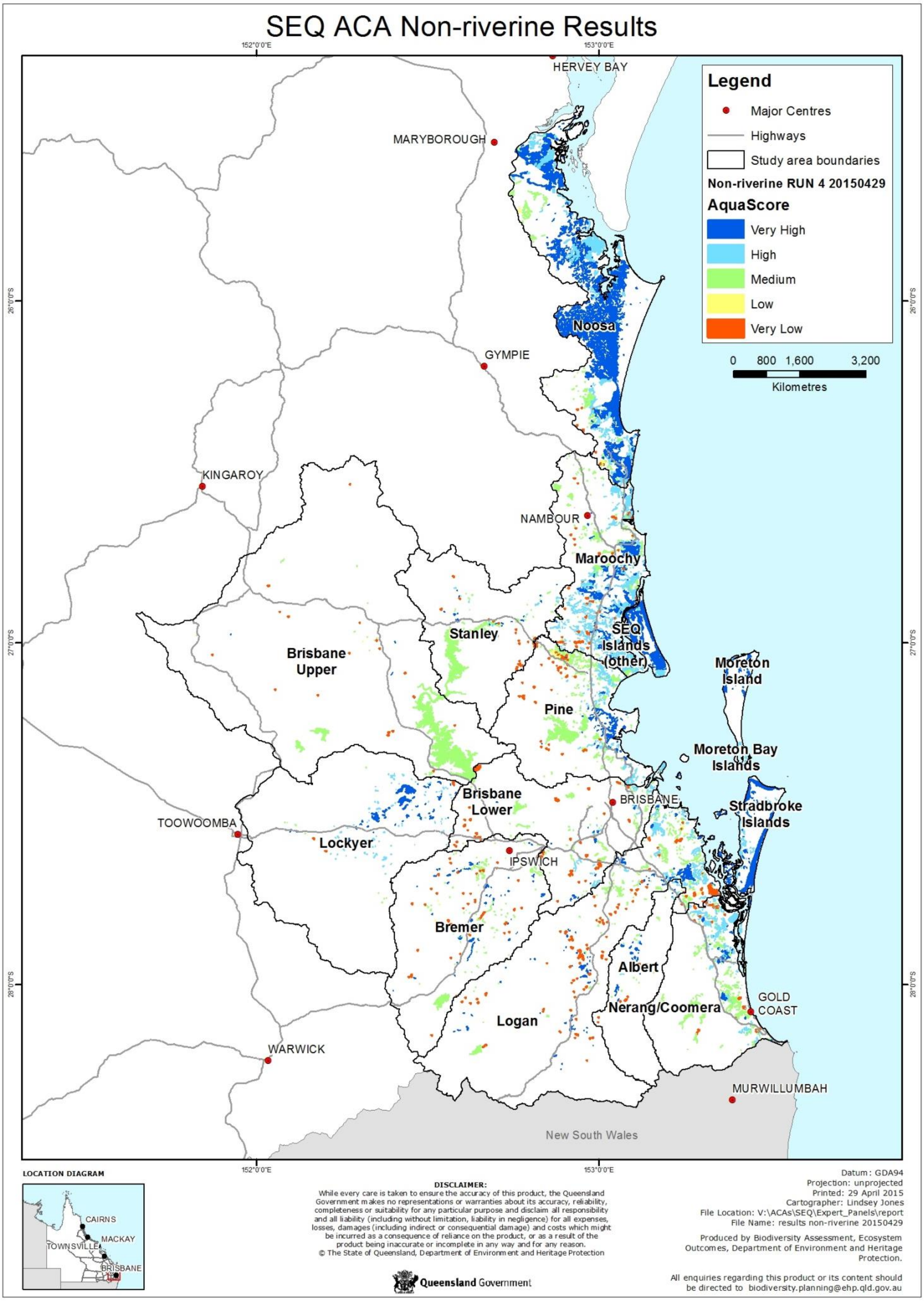


Figure 7 Non-riverine AquaScore for all catchments

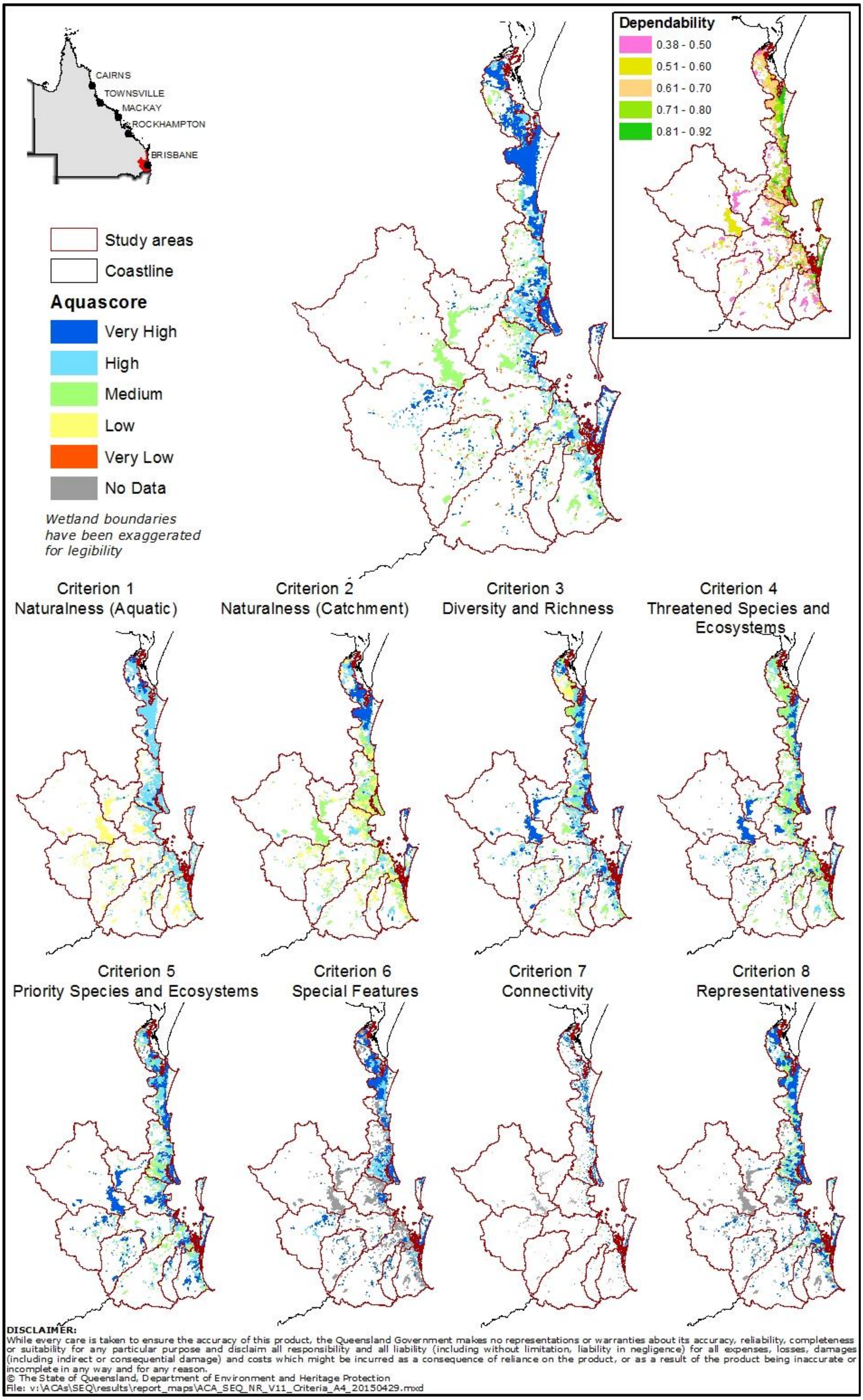
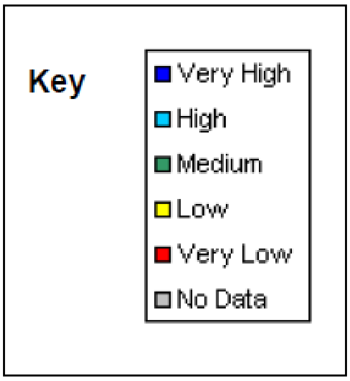
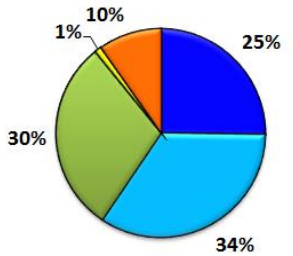
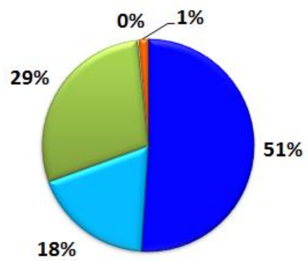
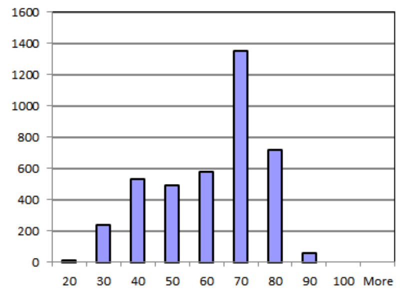
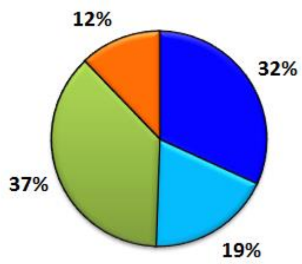
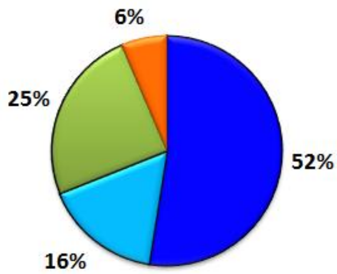
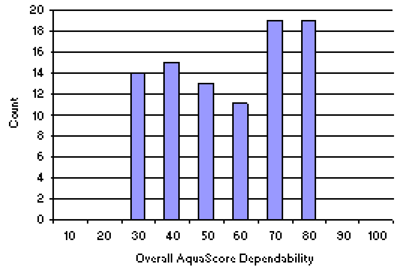
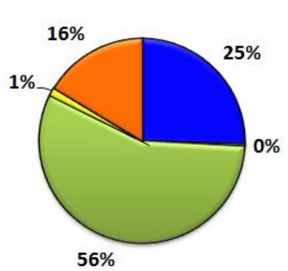
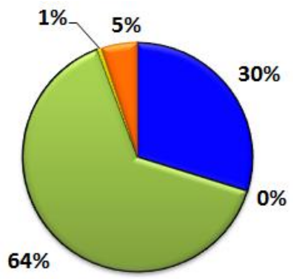
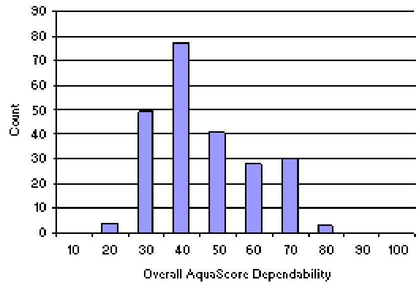
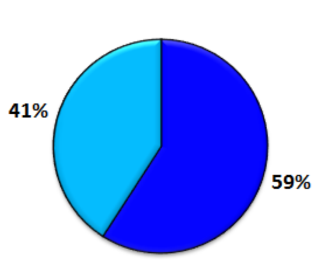
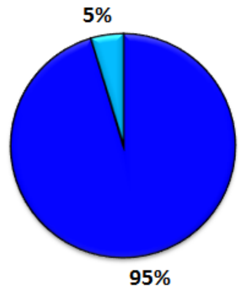
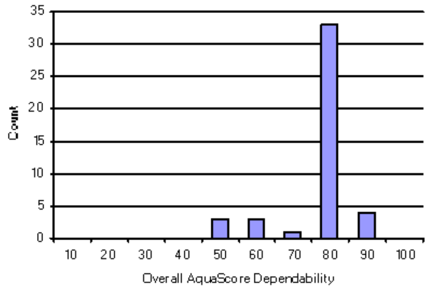
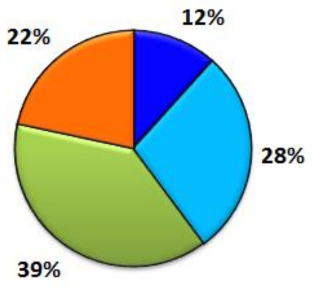
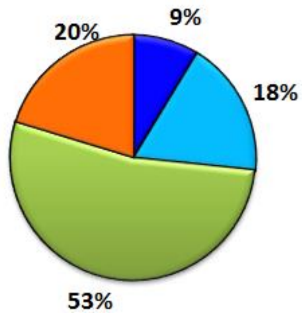
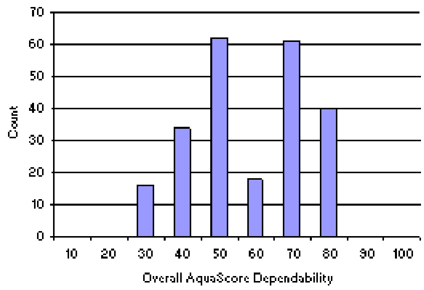
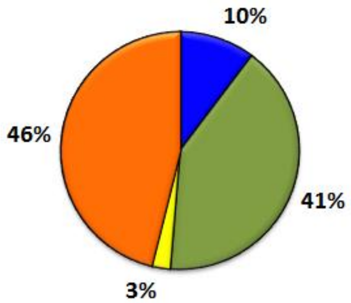
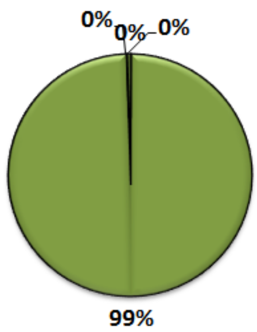
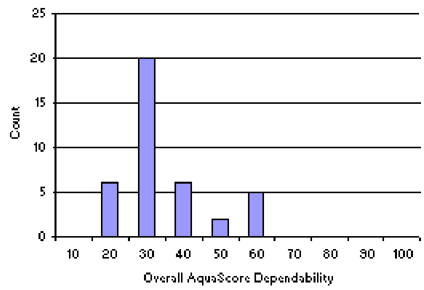
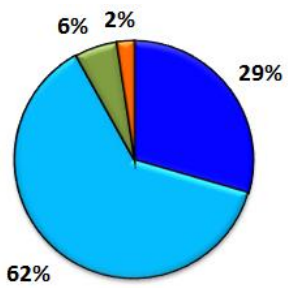
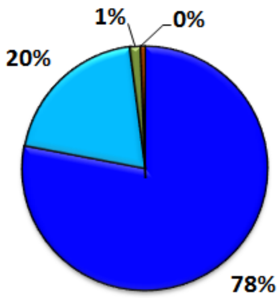
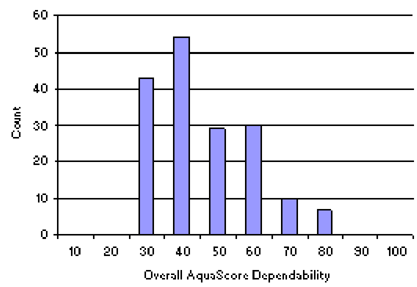
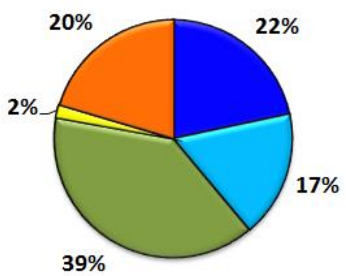
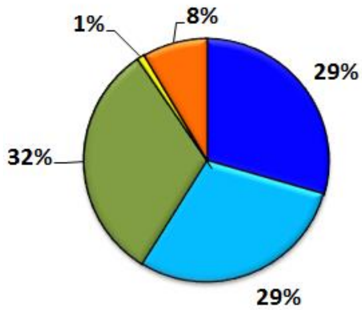
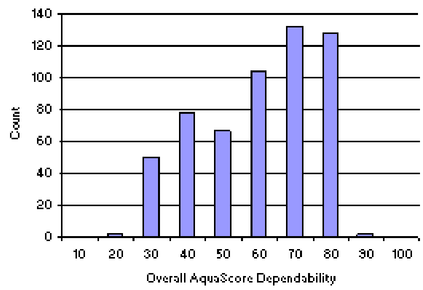
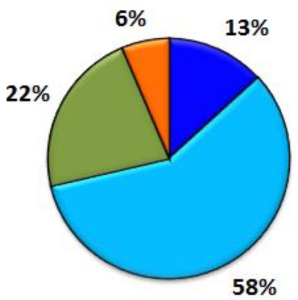
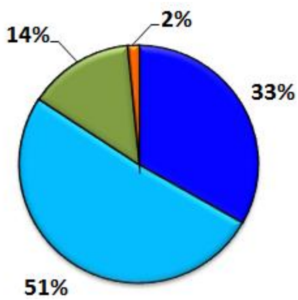
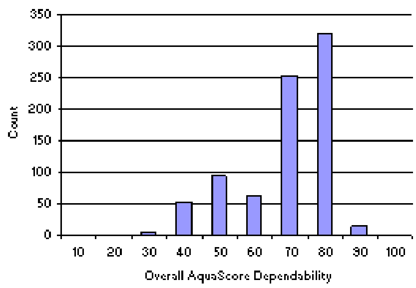


Figure 8 Non-riverine AquaScore criteria for all catchments

Table 8 Non-riverine AquaScore criteria for all catchments



Catchment	Aquascore by number of spatial units	Aquascore by total area of spatial units	Aquascore dependability
All catchments (Non-riverine)			
Albert			
Bremer			
Bribie Island			

Catchment	Aquascore by number of spatial units	Aquascore by total area of spatial units	Aquascore dependability
Brisbane lower			
Brisbane upper			
Lockyer			
Logan			
Maroochy			

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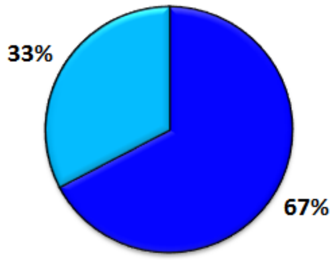
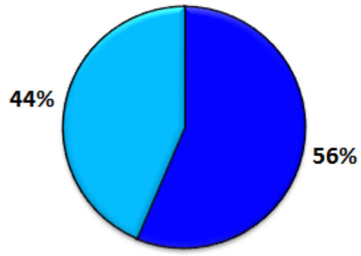
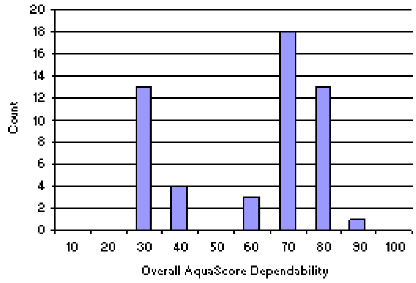
<tr><td>Moreton Bay islands</td><td>
</td><td>
</td><td>
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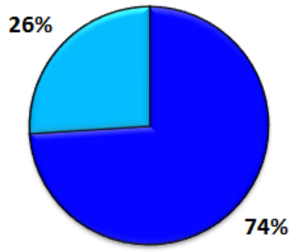
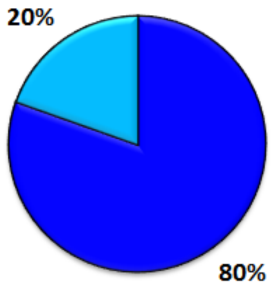
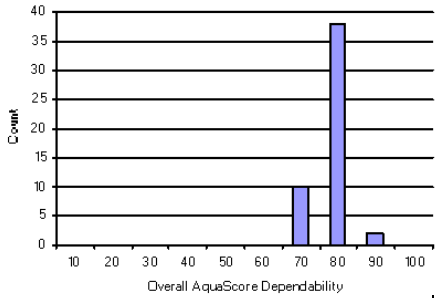
<tr><td>Moreton Island</td><td>
</td><td>
</td><td>
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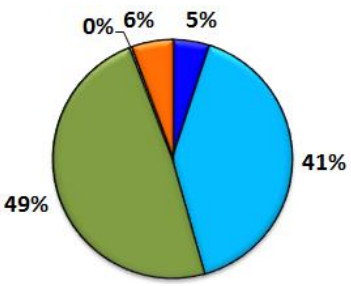
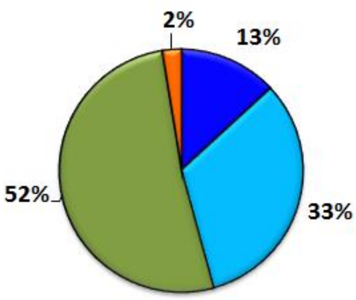
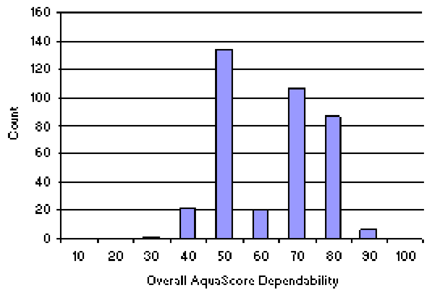
<tr><td>Nerang /Coomera</td><td>
</td><td>
</td><td>
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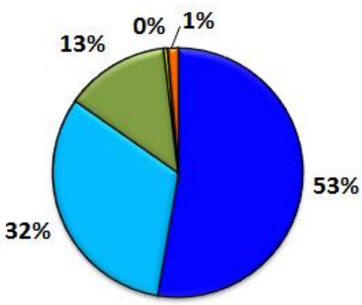
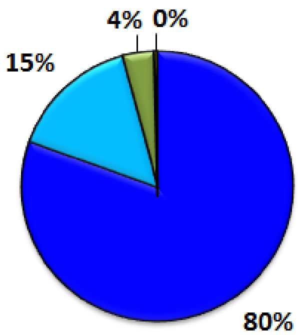
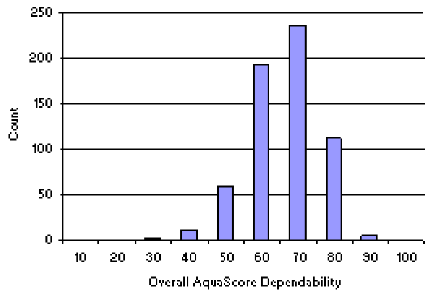
<tr><td>Noosa</td><td>
</td><td>
</td><td>
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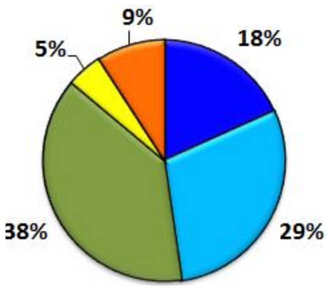
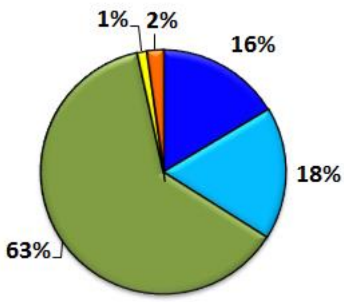
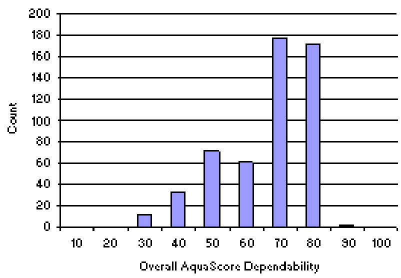
<tr><td>Pine</td><td>
</td><td>
</td><td>
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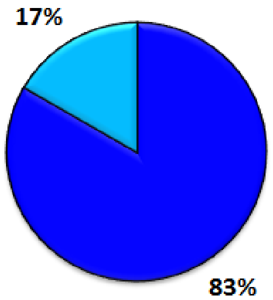
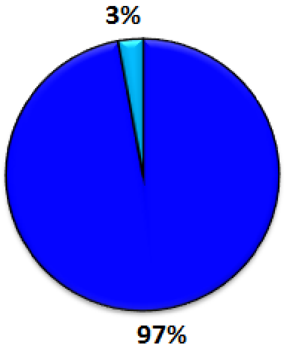
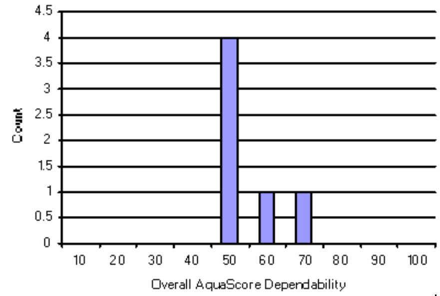
<tr><td>SEQ islands (other)</td><td>
</td><td>
</td><td>
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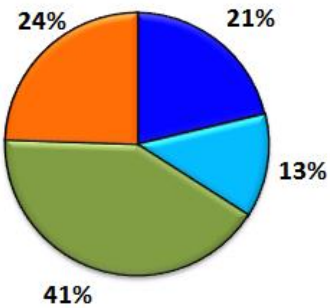
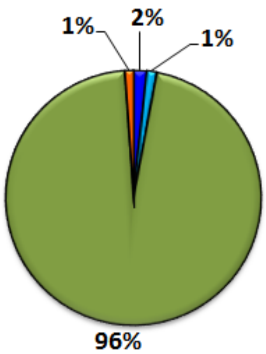
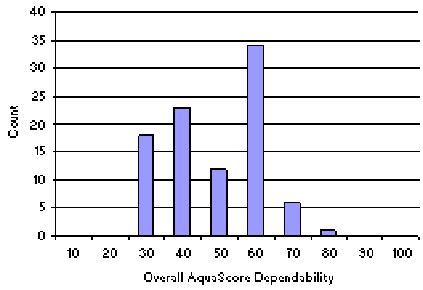
<tr><td>Stanley</td><td>
</td><td>
</td><td>
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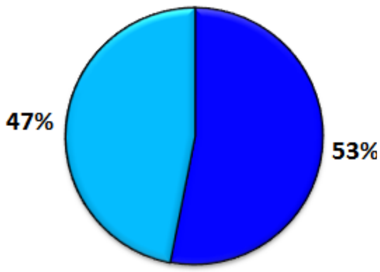
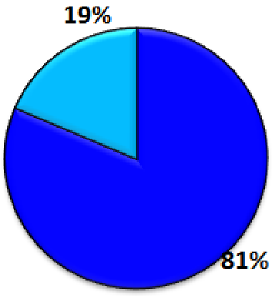
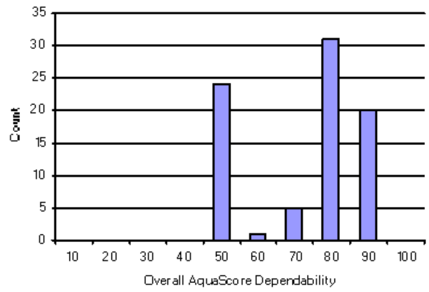
<tr><td>Stradbroke islands</td><td>
</td><td>
</td><td>
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3.5 Field-truthing

3.5.1 Field-truthing principles

Field validation of the ACA results is important to test the accuracy of the wetland values attributed. Field-truthing is a critical step in any ACA using AquaBAMM and it precedes final data corrections, resulting from the field work and a final re-run of the assessment.

The outcomes from field-truthing are regularly:

- minor changes to the filtering table and/or
- missing datasets identified and implemented.

In general the field-truthing will:

- Check spatial units across the range of values from 'Very Low' to 'Very High'. There is usually a focus on the 'Very Low' and 'Very High' valued spatial units as these are considered to have the most influence to reduce the potential of a false negative (type I error) or a false positive (type II error) result.
- Check spatial units where there is a 'Very Low 'right next to a 'Very High'.
- Check stratification.
- Preference for field-truthing spatial units is given to units in the coastal areas as this is where the regulations will impact the most. There is also a preference to validate the 'Medium' and 'High' spatial units as this is the borderline between whether they will be included in the regulations (i.e. the difference between wetlands of general ecological significance (GES) and high ecological significance (HES)).
- Field-truthing is not an attempt to confirm individual measure data (e.g. there is no effort to confirm the presence of a particular threatened species).

When looking at wetlands or spatial units in a catchment and comparing them to their AquaScore, there is a strong tendency to observe a spatial unit's 'condition'. Wetland 'condition' or 'health' has been a major focus of aquatic assessment in Australia (such as the nationally agreed protocol of Monitoring River Health Initiative, Index of Stream Condition, Queensland State of the Rivers) (Dunn 2000). However, several authors make a clear distinction between 'river health' and 'ecological value' of a river (Dunn 2000; Bennett et al. 2002; Chessman 2002). Wetland health data may inform assessment of 'value', and usually does so where data are available, but is not interchangeable with it and the two are not necessarily correlated.

ACAs are primarily focussed on aquatic ecological or conservation value such that the condition contributes to, but does not solely determine a spatial unit's value. A spatial unit's value is a composite of several criteria, indicators and measures. Of the measures used in these assessments, usually less than 10 per cent are related to aquatic, riparian and/or catchment condition.

Consequently, when in the field, the successful interpretation of a spatial unit's conservation value is reliant on the observer to not view 'condition' in isolation from other values (seen or unseen).

3.5.2 Confidence in the AquaScore

Conservation assessments of landscapes, by their very nature, apply ratings along a continuum of values. Hence, the extremes in values (very highs and very lows) are relatively easier to determine in the field than defining the cut-offs in between these extreme values (e.g. lows, mediums and highs). This is particularly difficult to distinguish between spatial units rated as either medium or high. Possible reasons for this difficulty whilst in the field may include:

- insufficient datasets for some spatial units to allow for a precise determination of conservation value
- the differences between spatial units are real, but are not easily observed in the field because of 'hidden' instream values and
- often, only a small part of a spatial unit can be seen and assessed in the field. For instance, smaller tributaries within a spatial unit may be devoid of values but the main channel may have significant values that increase the spatial unit's overall value.

A lack of data for some spatial units is recognised as a limitation to any ACA. This limitation has been addressed in part by calculating a per cent dependability score for each wetland. The spatial unit's dependability score is the proportion of measures with data for that spatial unit against measures that had 'missing values' or no data. The dependability score is an important parameter when interpreting the AquaScore, or any other conservation value score from criterion or indicator level within the ACA. The lower the dependability score for a spatial unit means a lower confidence level the user will have in the conservation value. Conversely, the higher the dependability scores for a spatial unit, the more confident the user is in the conservation value assigned to the spatial unit (Clayton et al. 2006).

In the end, wetlands or spatial units are ecologically complex and field-truthing must be undertaken with observer perspective driven strictly by the limitations of each ACA, such as scale, datasets, etc. With this approach, an indication of confidence in the accuracy of any ACA using AquaBAMM can be reached.

3.5.3 Spatial units inspected (trip 1 September 2014)

The sixteen catchments of SEQ contain a total of 9185 riverine Geofabric spatial units which are grouped into 854 riverine subsections. There are a total number of 3979 non-riverine spatial units (wetlands) across the sixteen catchments.

Two field trips were undertaken as part of this project. The first was conducted over a two week period in September 2014 and covered approximately 1400km. A total of 210 riverine subsections and 174 non-riverine wetlands across eleven SEQ catchments were inspected and or traversed by vehicle as part of the field truthing exercise (Table 9 and Table 11). This equated to approximately 25 per cent of the total riverine subsections and approximately 4.4% per cent of the total non-riverine spatial units within the SEQ catchment areas. As non-riverine spatial units can be difficult to access, the majority were inspected from gazetted roads or, where possible, by foot. The issue of accessibility together with the scale of the SEQ catchment area accounted for the relatively small number of spatial units visited. There were 19 non-riverine wetlands near the existing field route that were unable to be visited but nevertheless – were discussed en route.

No spatial units were visited in the Stradbroke Island, Moreton Island, Bribie Island, Moreton Bay Islands, SEQ other Islands, majority of Lockyer, and middle / upper Noosa catchments. This was considered low risk, as these study areas contain mostly 'High' and 'Very High' AquaScore wetlands. Despite the relatively small number visited, the exercise allowed the direct checking of many of the riverine and non-riverine wetlands and covered a range of AquaScores (Table 10 and Table 12). A map of the route taken during the field truthing exercise is provided in Figure 9 and Figure 10. Images of spatial units inspected during the field are provided in the following plates.

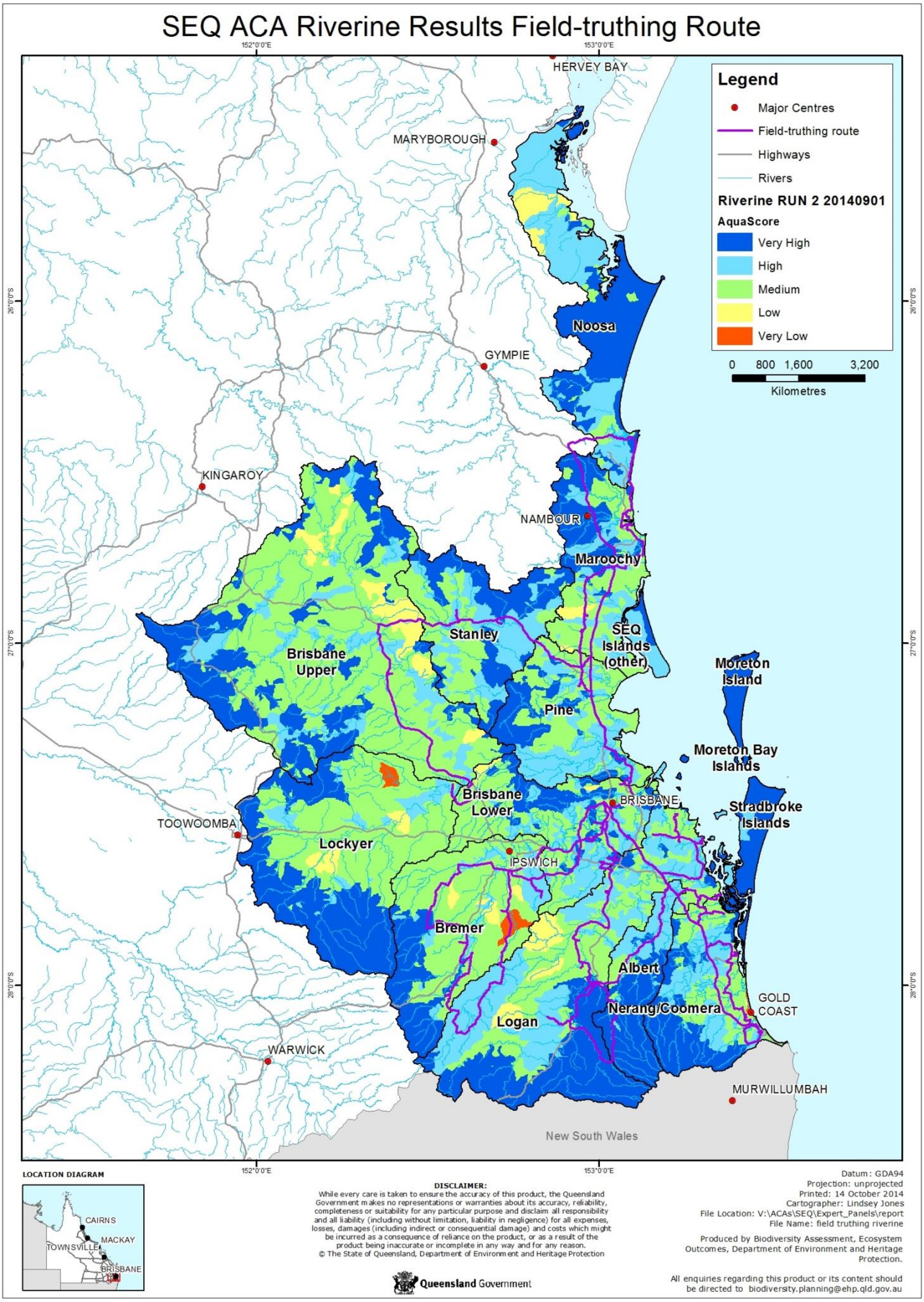

Figure 9 Route undertaken for field-truthing of riverine wetlands (Trip 1, September 2014)

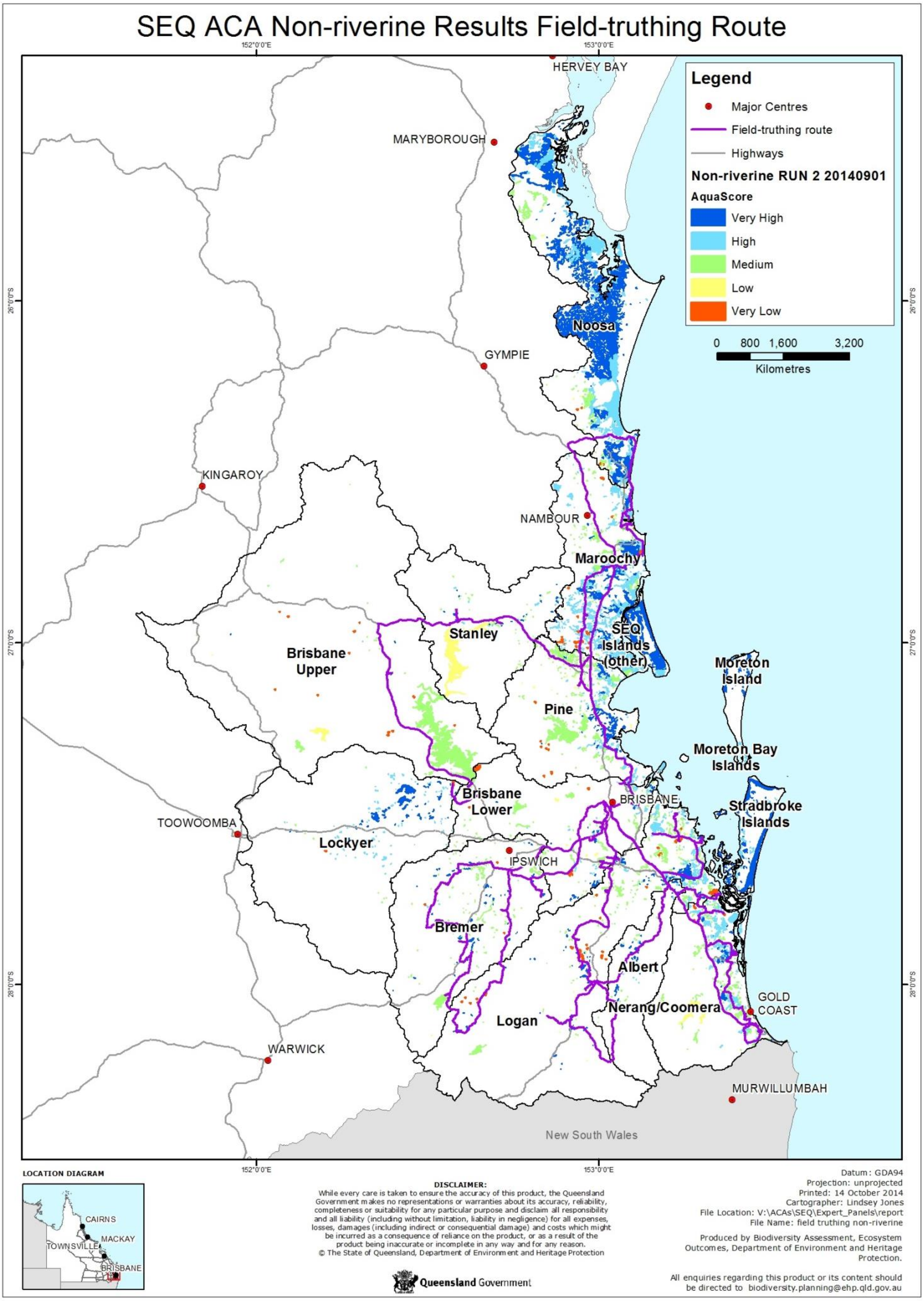

Figure 10 Route undertaken for field-truthing of non-riverine wetlands (Trip 1, September 2014)

Table 9 Riverine subsections traversed during field-truthing by catchment (Trip 1, September 2014)

ACA Study Areas or catchments	Subsections traversed	Percent of subsections within study area
Albert	6	50%
Bremmer	23	49%
Bribie Island	0	0
Brisbane lower	26	45.5%
Brisbane upper	15	17.5%
Lockyer	1	1.75%
Logan	45	48.5%
Maroochy	33	58%
Moreton Bay islands	0	0
Moreton island	0	0
Nerang Coomera	26	44%
Noosa	7	9.5%
Pine	14	42.5%
SEQ islands other	0	0
Stanley	8	25%
Stradbroke islands	0	0
	Total 210 **25% of total number of riverine subsections**	

Table 10 Riverine spatial units (Geofabric) traversed during field-truthing by catchment (Trip 1, September 2014)

ACA Study Areas or catchments	spatial units traversed	Percent of spatial units within study area
Albert	75	23.5%
Bremmer	158	18.3%
Bribie Island	0	0
Brisbane lower	86	15.9%
Brisbane upper	51	3.5%
Lockyer	5	0.5%
Logan	236	17.2%
Maroochy	106	25%
Moreton Bay islands	0	0
Moreton island	0	0
Nerang Coomera	100	15.9%
Noosa	26	3.6%
Pine	57	11.7%
SEQ Islands other	0	0
Stanley	27	6.1%
Stradbroke islands	0	0
	Total 927 units **10.1% of total number of riverine spatial units**	

Table 11 Riverine spatial units (Geofabric) by AquaScore, that were traversed during field-truthing (Trip 1, September 2014)

AquaScore	Total number of riverine spatial units	Number of spatial units traversed	Percent traversed
Very High	3,173	148	4.7%
High	1,945	284	14.6%
Medium	3,760	470	12.5%
Low	265	15	5.7%
Very Low	42	10	23.8%

Table 12 Non-riverine spatial units inspected during field truthing by catchment (Trip 1, September 2014)

ACA Study Areas or catchments	Spatial units (wetlands) inspected	Percent of spatial units within study area
Albert	8	8.8%
Bremmer	19	8.2%
Bribie Island	0	0
Brisbane lower	10	4.3%
Brisbane upper	4	10%
Lockyer	2	1.1%
Logan	49	8.7%
Maroochy	31	3.9%
Moreton Bay islands	0	0
Moreton island	0	0
Nerang Coomera	30	8%
Noosa	5	0.8%
Pine	8	1.5%
SEQ islands other	0	0
Stanley	8	8.5%
Stradbroke islands	0	0
	Total 174 inspected **4.4% of total number of spatial units**	

Table 13 Non-riverine spatial units inspected during field truthing by AquaScore (Trip 1, September 2014)

AquaScore	Total number of spatial units (wetlands)	Number of spatial units field truthed	Percent field truthed
Very High	1,034	63	6%
High	1,457	32	2.2%
Medium	1,300	44	3.4%
Low	63	3	4.75%
Very Low	125	16	12.8%

Figure 11 lg_w00402 (Logan catchment) (Trip 1, September 2014)

This ephemeral wetland (criterion 1 = 'High') is located on Kilmoylar road, west of Mt Lindesay highway between Jimboomba and Beaudesert. The ‘Very High' AquaScore attributed to this wetland is based on an expert panel ecology decision to class ephemeral wetlands has highly valued special features. The surrounding land use is grazing. Criterion 8 (representativeness) scored 'Very High' as wetlands of this type are poorly represented within Protected Areas. There are also threatened and priority species records within the locality of this wetland (criteria 4 and 5 = 'High').

Its overall result dependability is 58%.

Figure 12 br_w00029 (Bremer catchment) (Trip 1, September 2014)

This ephemeral wetland is located on the Ipswich Rosewood road. The ‘Very High' AquaScore attributed to this wetland is based on an expert panel ecology decision to class ephemeral wetlands has highly valued special features. The surrounding land use is grazing (criterion 2 = 'Medium'). Criterion 8 (representativeness) scored 'Very High' as wetlands of this type are poorly represented within Protected Areas. It is also one of the largest wetlands of its type in the subcatchment. The general locality of this wetland also has good species diversity (criterion 3 = High) and contains priority species records (criterion 5 = 'Very High').

Its overall result dependability is 77%.

Figure 13 Subsection bs_s00096 (Brisbane Lower catchment) (Trip 1, September 2014)

This section of the Brisbane River is located at “Twin bridges” just outside Fernvale.

All riverine wetlands in this subsection get a 'Medium' AquaScore. The surrounding land use is a mixture of grazing, agriculture and rural residential blocks. The subsection contains threatened (criterion 4 = 'High') and priority species records (criterion 5 = 'Very High') and relatively high species diversity (criterion 3 = 'High'). This section of river also provides good connectivity for maintaining floodplain and wetland ecosystems and connectivity as a fish passage ('Very High' score for criterion 7).

Its overall dependability score is 65%.

Figure 14 Cressbrook Creek. Riverine subsection bb_s00052 (Trip 1, September 2014)

This section of stream is located near Toogoolawah. This riverine spatial unit has a 'Medium' AquaScore. The surrounding landuse is predominantly grazing. The subsection has a 'High' value for Diversity (criterion 3). There are few Threatened and Priority species records with criteria 4 and 5 being assigned a score of 'Medium'. No special features (criterion 6) have been identified by the expert panels.

Its overall dependability score is 61%.

Figure 15 Subsection lg_s00073 (Logan catchment) (Trip 1, September 2014)

This section of the Logan River is located 200 metres downstream of the bridge separating North and South Maclean. The overall AquaScore is 'Medium'. The surrounding area is rural residential. While connectivity values (criterion 7) are Very High – all other criteria score a 'Medium'. There are no special feature values assigned to this subsection.

Its overall dependability score is 48%.

3.5.4 Actions following field-truthing trip 1 (September 2014)

A number of trends were identified through the course of field-truthing, which warranted further investigation and action.

- It was noted that criterion 2 (naturalness catchment) seemed to be overrated in many areas, with most areas coming up as 'High' or 'Very High' for this criterion, despite extensive clearing and heavy agriculture. Further investigation revealed that the quartiling in measure 2.4.1 was not being done in an informative way, and this was amended for the next run (run 3).
- It was noted that many artificial wetlands were getting 'High' AquaScore due to species measures, when the surrounding area was heavily impacted by grazing and agriculture. This was due to species measures being attributed to an entire subsection, rather than an individual wetland. Given SEQ's very fragmented and urbanised landscape, it was more valid to buffer records and assign them to wetlands that intersect that buffer. This new buffering approach was applied for the final run.
- It was noted that many artificial wetlands were getting a 'High' AquaScore in part due to connectivity (criterion 7), when in fact most of them are not connected to natural systems. The decision was made to exclude all H3 modified wetlands and some H2 modified wetlands from criterion 7, consistent with the decision to exclude them from criterion 8 (representativeness). This change was implemented in the final run.
- It was noted that there appeared to be unique combinations of criteria values that were missing from the filter table, causing wetlands to have lower AquaScore values than expected. These were amended for the final run.

- It was noted that the 'basalt ground fed permanent refugia pools' special area decision was being mapped too extensively, especially in the Beaudesert area. The spatial extent of this decision was reduced for the final run.

3.5.5 Field-truthing trip 2 (May 2015)

As a result of the first field trip, thresholds and quartiling methods for criteria 2 were adjusted to more accurately reflect what was found in the field. Additional landuse data and catchment health metrics were acquired from SEQ Catchments to further refine the results of criteria 2. This work did little to change the overall Aquascore, but resulted in some significant changes to the criteria 2 scores. The largest areas of change were in the Maroochy and Nerang/Coomera study areas.

A second field trip was undertaken in May 2015 to examine the areas where criteria 2 rating went from 'Medium' (run 3) to 'High' (run 4) in the Nerang/Coomera study area (Figure 16). Only criteria 2 scores were assessed during this trip, as the overall AquaScores had not changed from the previous database runs.

The general finding from driving through these areas and surrounding subsections which remained 'Medium' is that the upgrade of these spatial units to 'High' for criteria 2 was justified. They had much more intact vegetation, and the residential development was quite low density compared to surrounding spatial units. Previous measure calculations that had used Queensland Land Use Mapping Program (QLUMP) data had overestimated the extent and intensity of suburban development. They had also underestimated the percentage of vegetation cover, as it was limited to remnant vegetation. These two factors had resulted in these spatial areas being considered 'Medium' for criteria 2 in previous runs. The new metrics used finer-scale landuse mapping and included regrowth in the vegetation calculations, giving a more realistic estimate of the naturalness of the catchments, resulting in 'High' for these spatial units.

The general landuse trend for the spatial units inspected was relatively intact riparian vegetation and upper slopes, with patchy clearing for rural residential, hobby farms, low density cattle grazing and horse paddocks (Figure 17, Figure 18 and Figure 19).

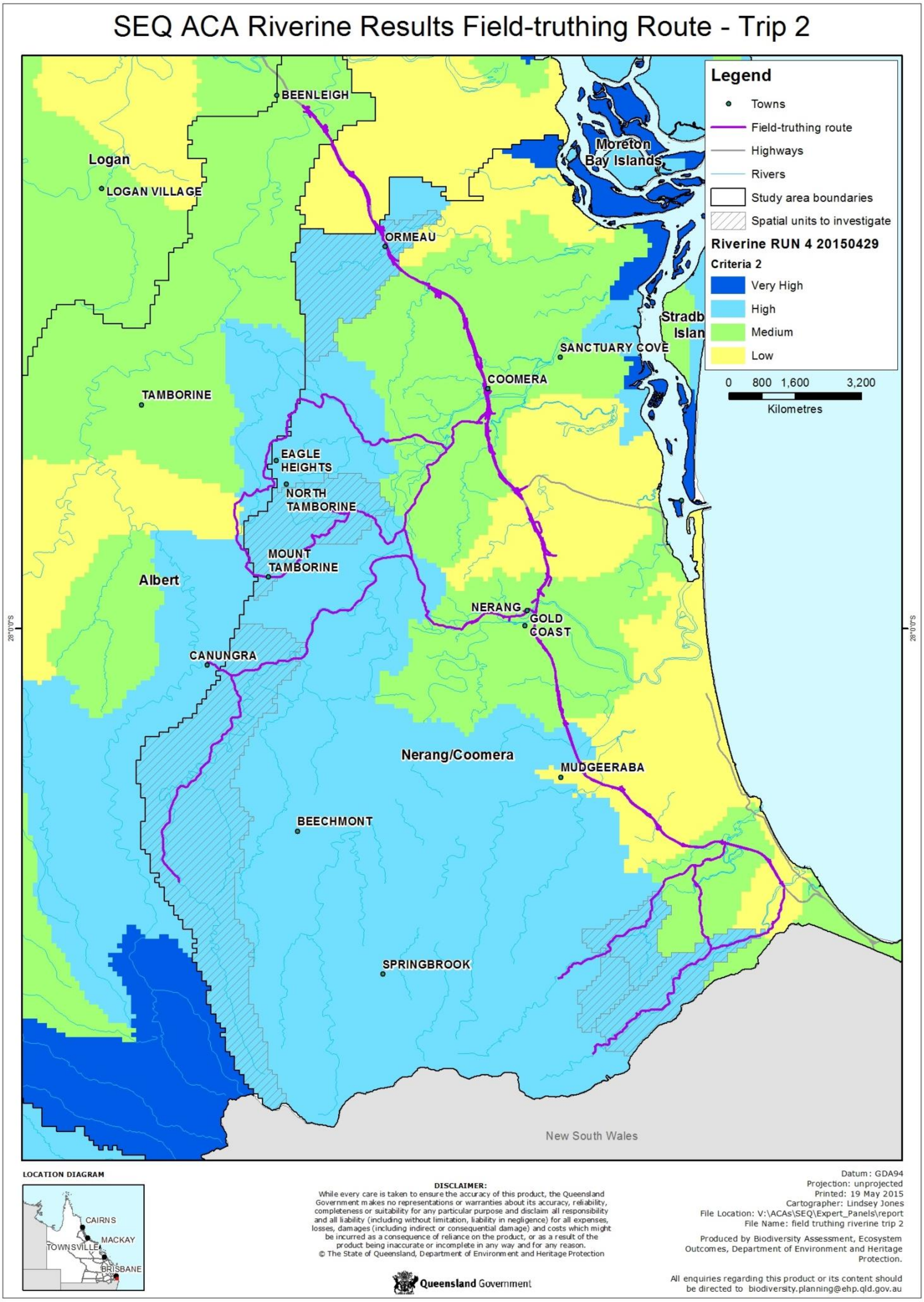

Figure 16 Trip 2 field truthing route

Figure 17 Subsection nc_s00048 (Nerang/Coomera catchment, trip 2 May 2015)

This section of the Currumbin Creek catchment is directly opposite Currumbin Valley Rock Pools.

All riverine wetlands in this subsection get a 'High' criteria 2 (naturalness catchment) value. The surrounding land use is a mixture of low density grazing and rural residential blocks.

Figure 18 Subsection nc_s00011 (Nerang/Coomera catchment, trip 2 May 2015)

This section of Tallebudgera Creek is in Harley Smith Reserve on Araluen R, Tallebudgera Valley.

All riverine wetlands in this subsection get a 'High' criteria 2 (naturalness catchment) value. The surrounding land use is a council reserve, and a mixture of low density grazing and rural residential blocks.

Figure 19 Subsection nc_s00034 (Nerang/Coomera catchment, trip 2 May 2015)

This section of the Coomera River catchment is upstream from Bass Bridge on Illinbah Road, Illinbah.

This area is part of a very large subsection. The northern and southern ends of this subsection are intact, and the Bass Bridge area is more heavily cleared. If this area was considered on its own, it would likely be 'Medium' for criteria 2, but considering the landuse in the remainder of the subsection, 'High' is justified for criteria 2.

3.6 General summary

The SEQ ACA study areas are more fragmented and urbanised in comparison to areas in other ACAs. In addition, the SEQ ACA catchments are generally data rich as is reflected in the dependability values which are often 50 percent or greater. These characteristics of the SEQ landscape influenced some methodological adaptations in order to enhance the robustness of overall wetland ecological and conservation ratings (AquaScores).

Data availability is never equal for all wetlands in a study area. In the same way, expert knowledge is not usually available for every wetland in a study area. Dataset completeness is influenced spatially by research effort, search effort by enthusiasts, political focus, etc. AquaBAMM is designed to cope with data deficiencies however, wetlands with complete datasets are more likely to show an accurate final conservation value and they are more likely to have a species record of significance or other special feature (most likely due to increased investigative effort or functional understanding) that results in a 'Very High' or 'High' conservation value score.

The dependability score is a percentage of how many available measures have data. The dependability does not influence or change the final AquaScore. The ACA results should be interpreted in conjunction with the dependability score. For example, where spatial units with 'Very Low' AquaScore values have low dependability, the results should be used with caution as the AquaScore may be due to the inherent lack of values or the lack of data. In the case of missing data, further survey work may add more data which may, or may not, change the AquaScore.

The margin of spatial error for individual wetlands is dependent on the scale of mapping of underlying datasets. As an example, the wetlands mapping is the fundamental spatial input into this ACA and the wetlands are mapped at a scale of 1:100,000, except for areas along the east coast which are mapped at the 1:50,000 scale. The ACA utilises many "landscape" scale datasets. Care needs to be taken when interpreting results for an individual wetland at a "ground" scale.

Field validation (truthing) of the ACA results is an important part of the ACA process to assist in assessing the ecological robustness of the outputs. Field truthing is a critical step in any ACA and it precedes final data corrections and a final re-run of the assessment. Field truthing was conducted prior to the release of the current ACA results. Based on the information gathered from the field-truthing process, the criteria ratings and AquaScore for a number of riverine and non-riverine wetlands was confirmed. For a number of wetlands where ecological integrity was in question, a revision of some aspects of methodology was undertaken which resulted in some corrections and adjustments being made to the data and calculations for the current version.

Expert panel input surrounding identification of special features and ecological processes has a major influence on overall AquaScore. When features are identified from one type of assessment (e.g. riverine) then these are also presented to the non-riverine expert panels to assess any relevance of decisions for the latter assessment.

Overall approximately 59 percent of all non-riverine wetlands scored 'Very High' or 'High' AquaScores. This equated to 69 per cent of all wetland area. Approximately 53 percent of all riverine subsections scored 'Very High' or 'High' for the overall AquaScore which equates also to 53 percent of riverine spatial unit area. The riverine spatial units with these overall values tended to be in the higher elevation areas of many catchments and also on the islands.

Significant environmental features (or geographic areas) that are identified through agreements or instruments such as Ramsar, Directory of Important Wetlands and World Heritage Area, greatly influence AquaScores for non-riverine wetlands. These features/areas are not evenly distributed throughout the SEQ catchments and are especially focussed in the coastal areas. Wetlands in these areas usually score 'Very High' or 'High'with respect to their conservation values primarily due to the distribution of the significant environmental areas. Wetlands in the coastal areas are often spatially concentrated. For these reasons, for example, catchments such as Noosa have large numbers of 'Very High' value non-riverine wetlands.

The Bremer and Brisbane Upper catchments had the largest area of riverine spatial unit scoring relatively low overall - 70% and 64% respectively with AquaScore of 'Medium' or below.

There were five catchments in which relatively lower AquaScores ('Medium', 'Low', 'Very Low') were calculated, in more than 50% of non-riverine wetland areas. In order these are: Brisbane Upper (99%), Stanley (96%), Brisbane Lower (73%), Bremer (70%), and Pine (66%).

There were several modifications made to the standard ACA methodology, to accommodate the unique characteristics of the SEQ region. This is the first time that artificial wetlands have been included in an ACA. Due to the fragmented nature of the SEQ study area, it was decided to include all artificial wetlands in the assessment, as all wetlands can have significant ecological values. They were excluded from calculations for criterion 7 (riverine and non-riverine connectivity) and criterion 8 (representativeness), but were included in the calculations of all other measures.

This was the first ACA to use Geofabric to derive spatial units. Geofabric is a dataset that is produced by the Bureau of Meteorology, which is designed to be a single, consistent, national framework and is a national standard for catchment reporting. It contains abundant connectivity information to allow for delineation of upstream and downstream units, and is useful for calculating connectivity measures. Riverine subsections were created by amalgamating Geofabric units up to a scale that was ecologically meaningful and comparable with surrounding ACAs. Some measures were calculated at the subsection scale, and some at the Geofabric scale. All criterion 6 special features were created using the Geofabric units.

In this version of the ACA, changes were made to the way measures in criterion 2 were calculated, specifically measure 2.4.1 (Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area). In previous versions it was calculated based on area, but in this version it was decided to use percent of study area, which is more ecologically meaningful. When the results were applied using the previous method of thresholding, nearly all subsections received a 'Very High' or 'High' value for criterion 2, even in areas that were in relatively low catchment condition. To produce a more meaningful result with a good spread of values across the study areas, the method of thresholding was also changed. The use of higher resolution and more up-to-date landuse data from SEQ Catchments was also very helpful in giving a more accurate estimate of the catchment naturalness of each subsection for criteria 2.

Due to the relative abundance of species records in the SEQ study area, and the fragmented nature of the landscape, calculation and thresholding of species measures was completed differently for SEQ than for previous ACAs. Previous ACAs have calculated non-riverine species measures by intersecting records with subsections and assigning the same value to all wetlands within the subsection. In a highly fragmented and urbanised landscape such as SEQ, this is not ecologically meaningful. Some H3C1 wetlands were getting a 'High' AquaScore based on species measures when the surrounding area is heavily impacted by grazing and agriculture. For some measures e.g. 3.1.4 (waterbirds, 5.1.3 (migratory species), and pest species measures, intersecting species records with subsection is still considered valid. However, for SEQ the majority of measures for species richness, threatened and priority species, were calculated by buffering wetlands by 1km and assigning values to wetlands based on the point records that intersected that wetland buffer.

The usual thresholding method for Threatened and Priority species uses presence positive and user defined thresholds respectively. The user defined method assigns ratings based on specific number of species. Usually this entails spatial units with one species scoring a 'three' and spatial units with more than one priority species scored a 'four'. This has worked well in the past, as most areas of the state contain relatively few species records. The large number of Threatened and Priority species and records in SEQ meant that when the previous methods were applied, most spatial units scored either a 'three' or a 'four' for these measures, and therefore received a 'Very High' score for criteria 4 and 5. While this did not necessarily result in an inflated final Aquascore for these spatial units, it is more desirable to have a good spread of values for each criteria. Many options to achieve a more meaningful spread of values were investigated, and in the end the best result was achieved through the method described below. This is based on the maximum number of species assigned to a wetland within a catchment.

- If one species - then presence positive, i.e. presence = 4 (measure rating)
- If two species - then user defined: 1 species = rating of 3; 2 species = rating of 4
- If 3 species - then user defined: 1 species = rating of 2; 2 species = rating of 3; 3 species = rating of 4
- If >= 4 species then quartiling was utilised with measure rating categories being combined and assigned a value of 2

This thresholding method gave a more meaningful set of values and was implemented for both riverine and non-riverine species measures.

There were changes to the riverine and non-riverine to address issues identified in earlier drafts. The issues related to:

- the lack of wetlands assigned an overall AquaScore of 'Low' (riverine and non-riverine)
- unique criteria combinations that are missed and fall in to a lower category than they deserve.

Extra filter table decisions were compiled to capture values that could be assigned a 'Low' AquaScore. Four non-riverine filter table decisions were refined to capture the missed unique combinations. The relevant criteria for each of these decisions remained unchanged; however the wording within these criteria was modified.

The Brisbane City Council (BCC) riverine and estuarine ACA was completed in 2009, but has not been released to the public. Seventy (70) riverine and estuarine measures were assessed under this ACA. In the current SEQ ACA, 93 riverine and non-riverine measures were assessed. Since the BCC ACA was completed, there have been changes to the base wetlands mapping, species records, measures assessed etc. All riverine measures were newly calculated, non-riverine measures for the BCC area were calculated for the first time, and estuarine measures were not considered in the SEQ ACA.

The expert panels for the current SEQ ACA (v1.1) reviewed the original BCC ACA riverine expert panel decisions and of the original 84 decisions (covering flora, fauna and wetland ecology), only seven were not implemented in SEQ ACA version 1.1 as the values were no longer considered to be present, or were too small to be mapped. The spatial units used to define the special area decisions were different between the two versions. The original BCC decisions were remapped using the SEQ ACA Geofabric units, which will account for any differences.

The Wide-Bay Burnett (WBB) riverine and non-riverine ACA was released in 2010. The Noosa catchment results from the SEQ ACA supersede the Cooloola Coast catchment assessment from the WBB ACA.

Due to the comparatively small size of islands, the values can sometimes not be attributed and calculated correctly. In the Great Barrier Reef ACA for example, the islands were included together as a single study area. In the SEQ ACA, 126 islands were included as part of the Moreton Bay islands study area, some of which include:

- Coochiemudlo Island – mb_s00117
- Pannikin Island – mb_s00108
- Macleay Island – mb_s00115
- Russell Island – mb_s00105
- Peel Island (Turkrooar) – mb_s00120
- Lamb Island (Ngudooroo) – mb_s00112
- Snipe Island – mb_s00113
- Mud Island (Bungumba) – mb_s00129.

Each island is a separate spatial unit, with the larger islands containing multiple Geofabric units. After further investigation of the results, the values for the islands appear to have been attributed and calculated correctly. The data is only as accurate as the coastline, catchments layer and wetlands mapping.

In previous riverine ACAs in coastal areas the predominantly estuarine subsections were excluded from the riverine assessment. The exclusion rule does not apply to non-riverine ACAs and the subsections are still used for the calculations. There is minimal impact from not excluding the riverine subsections that are predominately estuarine. Due to time constraints these subsections remained in the riverine ACA.

During field truthing it was identified that some non-riverine wetlands that received significant values for criterion 6 (Special features, in particular ephemeral wetlands and oxbows) but are in low condition, received a 'Very High' AquaScore. AquaBAMM is a values assessment rather than a condition assessment thus caution is needed so as not to devalue a wetland that has significant threatened species habitat and/or is a unique or unprotected wetland type. No changes were made to the filtering combination table to account for this, but it is important to note when interpreting ACA results on ground.

3.7 Weighting of measures

As part of the AquaBAMM methodology, the panel members and project officers that attended the ACA expert panel workshop were asked to weight the measures within each indicator. Measures were weighted according to their importance to an indicator and based on the following rules:

1. At least one measure within each indicator must be weighted 10 which is the highest weighting.
2. The other measures within each indicator were weighted compared to the weighting of 10 assigned in the first step.
3. It was okay to have different measures with the same weight (i.e. all measures could be weighted 10).
4. Some indicators only had one measure and had already been given a weighting of 10.
5. Measures shouldn't be weighted down because of the quality or lack of data for that measure.

The individual weights were then averaged and reviewed with particular attention to averages having a high variance. The resulting weights for riverine and non-riverine measures can be found in Table 14 and Table 15.

The use of weighted measures allows for expert knowledge of the relative importance of the measures to be integrated into the AquaScore calculations.

Table 14 The average weights for each non-riverine measure.

Maximum score is 10.

Criteria and Indicators	Measures		Weight
1 Naturalness aquatic			
1.1 Exotic flora/fauna	1.1.1	Presence of 'alien' fish species within the wetland	9
	1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	9.9
	1.1.3	Presence of exotic invertebrate fauna within the wetland	8.3
	1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	8.7
1.3 Habitat features modification	1.3.7	% area of remnant wetland relative to preclear extent for each spatial unit	10
1.4 Hydrological modification	1.4.5	Hydrological disturbance/modification of the wetland (e.g. as determined through EPA wetland mapping and classification)	10
2 Naturalness catchment			
2.1 Exotic flora/fauna	2.1.1	Presence of exotic terrestrial plants in the assessment unit	10
2.2 Riparian disturbance	2.2.5	% area of remnant vegetation relative to preclear extent within buffered non-riverine wetland: 500m buffer for wetlands >= 8Ha, 200m buffer for smaller wetlands	10
2.3 Catchment disturbance	2.3.1	% "agricultural" land-use area (i.e. cropping and horticulture)	9
	2.3.2	% "grazing" land-use area	8.9
	2.3.3	% "vegetation" land-use area (i.e. native veg + regrowth)	9.1
	2.3.4	% "settlement" land-use area (i.e. towns, cities, etc)	9.8

Criteria and Indicators	Measures		Weight
2.4 Flow modification	2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	10
3 Diversity and richness			
3.1 Species	3.1.2	Richness of native fish	9.5
	3.1.3	Richness of native aquatic dependent reptiles	9.5
	3.1.4	Richness of native waterbirds	9.3
	3.1.5	Richness of native aquatic plants	9.6
	3.1.6	Richness of native amphibians (non-riverine wetland breeders)	9.6
	3.1.7	Richness of native aquatic dependent mammals	9.1
3.2 Communities/ assemblages	3.2.1	Richness of macroinvertebrate taxa	10
3.3 Habitat	3.3.2	Richness of wetland types within the local catchment (e.g. SOR sub-section)	8.9
	3.3.3	Richness of wetland types within the sub-catchment	9.3
4 Threatened species and ecosystems			
4.1 Species	4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species – NCAct, EPBCAct	9.9
	4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species - NCAct, EPBCAct	9.9
4.2 Communities/ assemblages	4.2.1	Conservation status of wetland Regional Ecosystems – Herbarium biodiversity status, NCAct, EPBCAct	10
5 Priority species and ecosystems			
5.1 Species	5.1.1	Presence of aquatic ecosystem dependent 'priority' fauna species (expert panel list/discussion or other lists such as ASFB, WWF, etc)	9.8
	5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	9.8
	5.1.3	Habitat for, or presence of, migratory species (Expert Panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention)	9.3
	5.1.4	Habitat for significant numbers of waterbirds	8.8
5.2 Ecosystems	5.2.1	Presence of 'priority' aquatic ecosystem	10
6 Special features			
6.1 Geomorphic features	6.1.1	Presence of distinct, unique or special geomorphic features	10

Criteria and Indicators	Measures		Weight
6.2 Ecological processes	6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	10
6.3 Habitat	6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	9.5
	6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.	9.6
	6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	9.4
6.4 Hydrological	6.4.1	Presence of distinct, unique or special hydrological regimes (e.g. spring fed stream, ephemeral stream, boggomoss)	10
7 Connectivity			
7.2 Groundwater dependent ecosystems	7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6 (e.g. karsts, cave streams, artesian springs)	10
7.3 Floodplain and wetland ecosystems	7.3.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist, with floodplains, rivers, groundwater, etc.	10
7.5 Estuarine and marine ecosystems	7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6	10
8 Representativeness			
8.1 Wetland protection	8.1.1	The percentage of each wetland type within Protected Areas.	9.6
	8.1.2	The percentage of each wetland type within a coastal/estuarine area subject to the Fisheries Act, Coastal Management Act or Marine Parks Act.	9.2

Criteria and Indicators	Measures		Weight
8.2 Wetland uniqueness	8.2.1	The relative abundance of the wetland management group to which the wetland type belongs within the catchment or study area (management groups ranked least common to most common)	9.7
	8.2.2	The relative abundance of the wetland management group to which the wetland type belongs within the subcatchment or estuarine/marine zone (management groups ranked least common to most common)	9.5
	8.2.3	The size of each wetland type relative to others of its management group within the catchment or study area	8.8
	8.2.4	The size of each wetland type relative to others of its type within a subcatchment (or estuarine zone)	8.5
	8.2.5	Wetland type representative of the study area – identified by expert opinion	8.6
	8.2.6	The size of each wetland type relative to others of its type within the catchment or study area	8.8

Table 15 The average weights for each riverine measure.

Maximum score is 10.

Criteria and Indicators	Measures		Weight
1 Naturalness aquatic			
1.1 Exotic flora/fauna	1.1.1	Presence of 'alien' fish species within the wetland	9.3
	1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	9.8
	1.1.3	Presence of exotic invertebrate fauna within the wetland	8.3
	1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	8.5
1.3 Habitat features modification	1.3.4	Presence/absence of dams/weirs within the wetland	9.3
	1.3.5	Inundation by dams/weirs (% of waterway length within the wetland)	9.6
	1.3.7	% area of remnant wetland relative to preclear extent for each spatial unit	9
	1.3.8	Presence of dredging/extraction (including for navigation) and channel modification within the wetland	8.6

Criteria and Indicators	Measures		Weight
2 Naturalness catchment			
2.1 Exotic flora/fauna	2.1.1	Presence of exotic terrestrial plants in the assessment unit	10
2.2 Riparian disturbance	2.2.1	% area of remnant vegetation relative to preclear extent within buffered riverine wetland or watercourses	9.8
	2.2.2	Total number of REs relative to preclear number of REs within buffered riverine wetland or watercourses	7.8
	2.2.9	Percentage tree cover within the waterway corridor	9.0
2.3 Catchment disturbance	2.3.1	% "agricultural" land-use area (i.e. cropping and horticulture)	8.9
	2.3.2	% "grazing" land-use area	8.6
	2.3.3	% "vegetation" land-use area (i.e. native veg + regrowth)	8.9
	2.3.4	% "settlement" land-use area (i.e. towns, cities, etc)	9.5
2.4 Flow Modifications	2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	10
3 Diversity and richness			
3.1 Species	3.1.1	Richness of native amphibians (riverine wetland breeders)	9.5
	3.1.2	Richness of native fish	9.8
	3.1.3	Richness of native aquatic dependent reptiles	9.4
	3.1.4	Richness of native waterbirds	9.3
	3.1.5	Richness of native aquatic plants	9.7
	3.1.7	Richness of native aquatic dependent mammals	9.1
3.2 Communities/ assemblages	3.2.1	Richness of macroinvertebrate taxa	9.8
	3.2.2	Richness of REs along riverine wetlands or watercourses within a specified buffer distance	8.8
3.3 Habitat	3.3.2	Richness of wetland types within the local catchment (e.g. SOR sub-section)	8.8
	3.3.3	Richness of wetland types within the sub-catchment	9.3
4 Threatened species and ecosystems			
4.1 Species	4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species – NCAct, EPBCAct	9.9
	4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species - NCAct, EPBCAct	9.9
4.2 Communities/ assemblages	4.2.1	Conservation status of wetland Regional Ecosystems – Herbarium biodiversity status, NCAct, EPBCAct	10

Criteria and Indicators	Measures		Weight
5 Priority species and ecosystems			
5.1 Species	5.1.1	Presence of aquatic ecosystem dependent 'priority' fauna species (expert panel list/discussion or other lists such as ASFB, WWF, etc)	9.8
	5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	9.8
	5.1.3	Habitat for, or presence of, migratory species (Expert Panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention)	9.4
	5.1.4	Habitat for significant numbers of waterbirds	8.9
5.2 Ecosystems	5.2.1	Presence of 'priority' aquatic ecosystem	10
6 Special Features			
6.1 Geomorphic features	6.1.1	Presence of distinct, unique or special geomorphic features	10
6.2 Ecological processes	6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	10
6.3 Habitat	6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	9.6
	6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.	9.6
	6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	9.4
6.4 Hydrological	6.4.1	Presence of distinct, unique or special hydrological regimes (e.g. spring fed stream, ephemeral stream, boggomoss)	10

Criteria and Indicators	Measures		Weight
7 Connectivity			
7.1 Significant species or populations	7.1.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of significant species or populations, including those features identified through criteria 5 and/ or 6	9.4
	7.1.2	Migratory or routine 'passage' of fish and other fully aquatic species (upstream, lateral or downstream movement) within the spatial unit	9.6
7.2 Groundwater dependent ecosystems	7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6 (e.g., karsts, cave streams, artesian springs)	10
7.3 Floodplain and wetland ecosystems	7.3.1	The contribution of the spatial unit to the maintenance of floodplain and wetland ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6	10
7.5 Estuarine and marine ecosystems	7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6	10

3.8 Ranking of indicators

Panel members and project officers that attended the ACA expert panels workshops were asked to rank the indicators within each criterion. Indicators were ranked according to their importance to a criterion and based on the following rules:

1. At least one indicator within each criterion must be ranked 'one' which is the highest ranking.
2. The other indicators were ranked within each criterion relative to the ranking of 'one' assigned in the first step.
3. It was okay to have different indicators with the same ranking (i.e. all indicators may be ranked 1).
4. Indicator shouldn't be ranked down because of the quality or lack of data for that indicator.

The individual rankings were averaged and reviewed with particular attention to averages having a high variance. The use of ranks for indicators is similar, though generally more influential than the use of weights for measures (discussed above). The resulting ranks for riverine and non-riverine indicators can be found in Table 16 and Table 17.

Table 16 The average rank for each non-riverine indicator.

Maximum rank is 1.

Criteria	Indicator	Rank
1 Naturalness aquatic		
1.1	Exotic flora / fauna	2
1.3	Habitat features modification	2
1.4	Hydrological modification	1
2 Naturalness catchment		
2.1	Exotic flora / fauna	2
2.2	Riparian disturbance	1
2.3	Catchment disturbance	2
2.4	Flow modification	1
3 Diversity and richness		
3.1	Species	1
3.2	Communities / assemblages	1
3.3	Habitat	1
4 Threatened species and ecosystems		
4.1	Species	1
4.2	Communities / assemblages	2
5 Priority species and ecosystems		
5.1	Species	1
5.2	Communities / assemblages	1
6 Special features		
6.1	Geomorphic features	3

Criteria	Indicator	Rank
6.2	Ecological processes	2
6.3	Habitat	2
6.4	Hydrological	1
7 Connectivity		
7.2	Groundwater dependent ecosystems	2
7.3	Floodplain and wetland ecosystems	1
7.5	Estuarine and marine ecosystems	1
8 Representativeness		
8.1	Wetland protection	1
8.2	Wetland uniqueness	1

Table 17 The average rank for each riverine indicator.

Maximum rank is 1.

Criteria	Indicator	Rank
1 Naturalness aquatic		
1.1	Exotic flora / fauna	2
1.3	Habitat features modification	1
2 Naturalness catchment		
2.1	Exotic flora / fauna	3
2.2	Riparian disturbance	2
2.3	Catchment disturbance	2
2.4	Flow modification	1
3 Diversity and richness		
3.1	Species	1
3.2	Communities / assemblages	1
3.3	Habitat	1
4 Threatened species and ecosystems		
4.1	Species	1
4.2	Communities / assemblages	1
5 Priority species and ecosystems		
5.1	Species	1
5.2	Communities / assemblages	1
6 Special features		
6.1	Geomorphic features	2
6.2	Ecological processes	2
6.3	Habitat	2
6.4	Hydrological	1
7 Connectivity		
7.1	Significant species or populations	2
7.2	Groundwater dependent ecosystems	3
7.3	Floodplain and wetland ecosystems	1
7.5	Estuarine and marine ecosystems	2

3.9 Filter tables

For each spatial unit, a single summary score is derived by combining all of the final criteria scores/ratings. This summary score is called AquaScore.

A series of arithmetic techniques are used to bring data from their raw form through to scores for each criterion. To combine the criterion scores/ratings in this final step however, arithmetic techniques were considered to mask a number of important effects (as perceived by expert opinion) or to insufficiently discriminate between spatial units. Other authors (e.g. Chessman 2002) also discuss this issue.

Rather than a final arithmetic combination, AquaBAMM uses a criterion rating combination table (or filtering decision table) that provides an ordered series of decisions that are tested against the final criterion ratings for each spatial unit (Table 5). Each decision is a unique combination of criterion ratings that is associated with a final AquaScore category. The decisions are effectively a number of 'if-then' statements and are tested in sequence for each spatial unit. An AquaScore is assigned immediately when a match is achieved between the criterion rating combination of the decision and that of the 'spatial unit'. This filtering table technique has previously been used successfully in EPA's terrestrial BAMM (EPA 2002).

It is important to note that, unlike previous steps through the AquaBAMM tool, the AquaScore may be one of five categories (i.e. 'Very Low', 'Low', 'Medium', 'High' or 'Very High'). This increased level of discrimination at the AquaScore level provides for a more useful conservation assessment tool and enables more informed management decisions.

Table 18 Criteria rating combination (filter table) as used for the SEQ riverine ACA

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	Additional criteria	AquaScore
0	0	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data)		No data
1	1	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High)		Very High
2	2	equal to (Very High) and			equal to (Very High) and	equal to (Very High) and		equal to (Very High)		Very High
3	3	equal to (Very High or High)							and number of criteria with Very High >= 4	Very High
4	4						equal to (Very High)			Very High

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	Additional criteria	AquaScore
5	5	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low)		Very Low
6	6	equal to (Low) and	equal to (Medium) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low)		Very Low
7	7	equal to (Very High) and			equal to (Very High)					High
8	8	equal to (Very High) and				equal to (Very High)				High
9	9		equal to (Very High) and		equal to (Very High)					High
10	10			equal to (Very High) and				equal to (Very High)		High
11	11	equal to (Very High) and	equal to (Very High) and	equal to (Very High)						High
12	12	equal to (High) and		equal to (Very High)						High
13	13	equal to (Very High or High) and						equal to (Very High)		High
14	14			equal to (Very High) and	equal to (Very High) and	equal to (Very High)				High
15	15					equal to (High) and		equal to (Very High)		High

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	Additional criteria	AquaScore
16	16		equal to (Very High) and	equal to (Very High) and			equal to (High)			High
17	17		equal to (Very High) and				equal to (High)			High
18	18	equal to (High) and	equal to (Very High) and				equal to (High)			High
19	19		equal to (Very High) and		equal to (High) and		equal to (High)			High
20	20		equal to (Very High) and			equal to (High) and	equal to (High)			High
21	21	equal to (High) and			equal to (High) and	equal to (High)				High
22	22					equal to (Very High or High) and	equal to (High)			High
23	23	equal to (Very High or High) and		equal to (High) and	equal to (High)					High
23a	24						equal to (High)			High
24	25				equal to (Very High or High)					Medium
25	26					equal to (Very High or High)				Medium
26	27			equal to (High) and				equal to (High)		Medium

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	Additional criteria	AquaScore
27	28	equal to (Medium) and		equal to (High)						Medium
28	29	equal to (Very High or High or Medium) and	equal to (Very High or High or Medium) and					equal to (High)		Medium
29	30			equal to (High) and		equal to (Medium)				Medium
30	31					equal to (Medium) and		equal to (High)		Medium
31	32		equal to (High) and	equal to (High) and			equal to (High)			Medium
32	33		equal to (High) and				equal to (High) and	equal to (High)		Medium
33	34	equal to (Medium) and	equal to (High) and				equal to (High)			Medium
34	35		equal to (High) and		equal to (Medium) and		equal to (High)			Medium
35	36		equal to (High) and			equal to (Medium) and	equal to (High)			Medium
36	37	equal to (Medium) and			equal to (Medium) and	equal to (Medium)				Medium
36a	38						equal to (Medium)			Medium

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	Additional criteria	AquaScore
37	39	equal to (Very High or High or Medium) and	equal to (Very High or High or Medium) and	equal to (Very High or High or Medium) and				equal to (Very High or High or Medium)		Medium
37a	40								and number of criteria with Very High >= 3	Medium
37b	41								and number of criteria with High >= 3	Medium
37c	42	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High)	and number of criteria with Very High >= 2	Medium
37d	43								and number of criteria with Very High >= 2	Low
37e	44								and number of criteria with High >= 2	Low
37f	45	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High)	and number of criteria with Very High >= 1	Low

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	Additional criteria	AquaScore
38	46	not equal to (Very High) and	not equal to (Very High)						and number of criteria with Low or No data >= 4	Very Low
1000	47	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data)		Low

Table 19 Criteria rating combination (filter table) as used for the SEQ non-riverine ACA

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	8 Representativeness	Additional criteria	AquaScore
0	0	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data) and	equal to (No data)		No data
1	1	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High) and	equal to (Very High)		Very High
2	2	equal to (Very High) and			equal to (Very High) and	equal to (Very High) and		equal to (Very High) and	equal to (Very High)		Very High
3	3	equal to (Very High) and	equal to (Very High) and						equal to (Very High)		Very High

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	8 Representativeness	Additional criteria	AquaScore
4	4	equal to (Very High or High or Medium) and	equal to (Very High or High or Medium) and		equal to (Very High) and				equal to (Very High)		Very High
5	5						equal to (Very High)				Very High
6	6	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low)		Very Low
7	7		equal to (Medium or Low) and	equal to (Low) and	equal to (Low) and	equal to (Low) and	equal to (Low or No data) and	equal to (Low) and	equal to (Medium or Low)		Very Low
8	8	equal to (Very High) and			equal to (Very High or High) and				equal to (High)		High
9	9	equal to (Very High) and				equal to (Very High) and			equal to (High)		High
10	10	equal to (Very High) and	equal to (Very High) and			equal to (Very High)					High
10a	11			equal to (Very High) and				equal to (Very High)			High
11	12			equal to (Very High) and					equal to (Very High)		High

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	8 Representativeness	Additional criteria	AquaScore
11a	13	equal to (Very High or High) and						equal to (Very High)			High
12	14	equal to (Very High) and				equal to (Very High or High) and			equal to (Very High)		High
13	15	equal to (High) and	equal to (Very High) and		equal to (Very High or High)						High
14	16	equal to (High) and	equal to (Very High) and			equal to (Very High)					High
15	17	equal to (High) and	equal to (High) and	equal to (Very High) and					equal to (High)		High
15a	18						equal to (High)				High
16	19		equal to (Very High or High) and	equal to (Very High)							Medium
17	20			equal to (Very High) and					equal to (High)		Medium
18	21	equal to (Very High or High) and	equal to (Very High or High or Medium) and						equal to (Very High or High)		Medium

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	8 Representativeness	Additional criteria	AquaScore
19	22				equal to (Very High or High)						Medium
20	23					equal to (Very High or High)					Medium
20a	24					equal to (High) and		equal to (Very High)			Medium
20b	25			equal to (High) and				equal to (Very High)			Medium
21	26	equal to (Medium) and	equal to (High) and				equal to (Medium)				Medium
22	27		equal to (High) and	equal to (High) and		equal to (Very High or High or Medium)					Medium
23	28		equal to (High) and		equal to (Medium) and		equal to (Medium)				Medium
24	29	equal to (Medium) and			equal to (Medium) and				equal to (Medium)		Medium
25	30	equal to (High or Medium) and	equal to (Very High)								Medium

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	8 Representativeness	Additional criteria	AquaScore
25a	31	equal to (Very High or High or Medium) and	equal to (Very High or High or Medium) and					equal to (High)			Medium
26	32	equal to (Very High or High or Medium) and	equal to (Very High or High or Medium) and	equal to (Medium) and					equal to (Medium)		Medium
26a	33						equal to (Medium)				Medium
26b	34	equal to (Very High) and	equal to (Very High) and	equal to (Very High)							Medium
26c	35					equal to (Medium) and		equal to (High)			Medium
26d	36		equal to (High) and				equal to (High) and	equal to (High)			Medium
27	37	equal to (Very High or High)								and number of criteria with Very High >= 4	Very High
29	38									and number of criteria with High >= 3	Medium

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	8 Representativeness	Additional criteria	AquaScore
30	39									and number of criteria with Medium >= 4	Medium
30a	40									and number of criteria with Very High >= 3	Medium
30b	41									and number of criteria with High >= 3	Medium
30c	42	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High)	and number of criteria with Very High >= 2	Medium
30d	43									and number of criteria with Very High >= 2	Low
30e	44									and number of criteria with High >= 2	Low

Decision	Order	1 Naturalness aquatic	2 Naturalness catchment	3 Diversity and richness	4 Threatened species and ecosystems	5 Priority species and ecosystems	6 Special features	7 Connectivity	8 Representativeness	Additional criteria	AquaScore
30f	45	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High) or	equal to (High)	and number of criteria with Very High >= 1	Low
28	46									and number of criteria with Low or No data >= 4	Very Low
1000	47	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data) and	equal to (Very High or High or Medium or Low or No data)		Low

4 Recommendations

The results of an ACA, or AquaBAMM assessment output, may be used in a number of ways and for a number of purposes. Well founded ecological or conservation values for aquatic ecosystems are a useful input to many natural resource management decision making processes including, for example, regional planning, development assessment, tenure negotiations or protected area estate review. In addition to the use of final AquaBAMM analysis scores, subordinate elements from each assessment may also be used for management and planning purposes. For example, prioritising natural resource management actions within a catchment (or other spatial unit) for rehabilitation, protection of high ecological value areas, or other on-ground works may be achieved through the use of data from individual measures within AquaBAMM.

Interpretation of the SEQ ACA results for the purposes of management priority or for development of management actions has not been undertaken as part of this project.

An analysis of the filtering table and how many spatial units triggered at each decision was performed. There does not appear to be any major inconsistencies in the hit analysis. In the longer term the hit analysis for all the ACAs should be compared to see if there are any redundant or inconsistent decisions.

Species habitat models and pest habitat mapping from DAFF were available but were unable to be implemented due to time constraints and as an alternative, the species records were used. Habitat models usually provide a more ecologically realistic indication of habitat and are the preferred avenue for including species information in the ACAs. Future ACA versions should incorporate these habitat models, where possible.

Riverine wetlands as mapped by the Queensland Wetlands Program were not included in the riverine ACA. The ACA was based on the stream network from the QWP and the Geofabric units. The ACA values are assigned to the subsection or Geofabric unit, and the assumption is that all riverine wetlands (regardless of mapping source) have the relevant values. Further work is required to incorporate the excluded riverine wetlands into the riverine ACA.

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6 Attachments

Attachment A An Aquatic Conservation Assessment for the riverine and non-riverine wetlands of the Southeast Queensland catchments: Flora, fauna and ecology expert panel report

Department of Environment and Heritage Protection

An Aquatic Conservation Assessment for the riverine and non-riverine wetlands of the South East Queensland catchments

Flora, fauna and ecology expert panel report

Queensland Government

Prepared by: Biodiversity Assessment, Ecosystem Outcomes, Department of Environment and Heritage Protection

Disclaimer

Citation

EHP. 2015. An Aquatic Conservation Assessment for the riverine and non-riverine wetlands of Southeast Queensland catchments: Flora, fauna and ecology expert panel report. Brisbane: Department of Environment and Heritage Protection Government.

September 2015

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1 Introduction

The Department of Environment and Heritage Protection (EHP) conducted an Aquatic Conservation Assessment (ACA) for the riverine and non-riverine wetlands in the Southeast Queensland region using the Aquatic Biodiversity Assessment and Mapping Method (AquaBAMM) (Clayton et al 2006).

AquaBAMM provides a robust and easily accessible analysis of wetland conservation values associated with a catchment or other defined study area. The AquaBAMM is a decision support tool that utilises existing information, with moderation by expert panels (e.g. flora, fauna and wetland ecology expert panels) to ensure scientific rigour and accountability, resulting in an ACA for a nominated geographic area—in this case, the Southeast Queensland region.

The potential for adding additional data into the system as it becomes available, with consequent updates to planning outcomes, is not limited. The AquaBAMM tool is a map/data output in a geographic information system (GIS) environment based on spatial mapping units that describe conservation significance or value for planning and assessment purposes.

The Southeast Queensland region ACA is made up of 16 individual catchments. EHP is applying AquaBAMM separately to the riverine and non-riverine (palustrine and lacustrine) wetlands within each of the 16 Southeast Queensland catchments. In effect, there are 16 ACAs for the area—covering riverine and non-riverine wetlands in each of the catchments. A map of the Southeast Queensland region showing each study area is provided in Figure 1.

Three expert panels were conducted to address aquatic fauna, aquatic and riparian flora and wetland ecology for the 16 Southeast Queensland catchments. The panels, held in Brisbane in February 2014, involved invited experts with expertise in aquatic and riparian flora, aquatic fauna and/or wetland ecology.

This report documents the findings and recommendations of the expert panel and includes follow up information provided post panel by panel members and other experts. The report presents supporting information and panel input that addresses riverine, non-riverine and estuarine wetland systems. Terms of reference for the panel are provided in Appendix A.

2 Method

2.1 Study area

The Southeast Queensland study area covers over 22000 km^2 of the southeast corner of Queensland from the NSW border to the coastal plains around Maryborough and from the large sand islands of Moreton Bay inland to the Great Dividing Range. The area contains the most urbanised parts of Queensland but also some of the most exceptional natural areas in the state, including the Gondwana Rainforests of Australia World Heritage Area.

Southeast Queensland has a humid sub-tropical climate with mild winters and warm, wet summers. It is the most densely populated area of Queensland, accommodating 65% of the state population, and is subject to a range of land uses including grazing, nature conservation, irrigated agriculture, urban uses (including industrial and residential) and rural living. The region's major agricultural products include dairy, fodder crops, cereal and a variety of horticultural produce.

The region has rich terrestrial, marine and freshwater biodiversity. Riverine and swamp (palustrine) wetlands cover 415 km^2 and 697 km^2 respectively of the study area (Queensland wetland program). Over half the palustrine wetlands are in the Noosa and Maroochy drainage areas where they provide habitat for many threatened species including 4 different species of acid frogs.

The main pressure on the environment in SEQ is the impact of rapid population growth and concomitant growth of services that fragment the landscape. Other important threats are unsustainable land management practices, native vegetation clearing, point source and diffuse pollutants (from urban, industrial and agricultural areas) entering waterways and the impacts of introduced plants and animals. As a result of significant water storage infrastructure (> 24 dams of >15m wall height), most of the region's rivers experience altered flow regimes (Rolls and Arthington 2014). These changes along with water extraction, inter- and intra-basin water transfers and land use changes have impacted both riverine and non-riverine wetlands in SEQ. Such impacts when combined with climate change may lead to a decline in the native instream fauna (Mantyka-Pringle et al 2014).

2.1.1 Noosa River catchment

The Noosa River catchment encompasses 1952 km^2 of coastal lowlands from Coolum Beach to Maryborough. The catchment includes parts of the Sunshine Coast, Noosa, Gympie and Fraser Coast local government areas.

In the northern part, from Tin Can Bay to Maryborough, the dominant land use is forestry. Outside Tuan State Forest, most of the area is remnant vegetation made up of palustrine wetlands or wetlands in heterogenous regional ecosystem complexes. This section of the catchment drains east to the Great Sandy Strait, an internationally important wetland (Ramsar).

From Tin Can Bay to Coolum Beach the dominant land uses are grazing and conservation. There are large areas of conservation estate in the Noosa Regional Council area, principally the Great Sandy National Park. This southern part of the catchment is 862 km^2 with a stream network over 1500 km long. The Noosa River is a largely intact coastal lagoon system with headwaters in Great Sandy National Park. There is no point source discharge into the river and the greatest impact is in the downstream reaches where urban development is concentrated. Urban land use constitutes less than 3% of land area in this southern section but there is extensive land clearing around populated areas.

Palustrine wetlands are the dominant wetland type in the catchment, comprising 74% of total wetland area. There are large areas of sedge and heath wetlands as well as Melaleuca swamps, particularly in the southern section of the Great Sandy National Park.

2.1.2 Maroochy River catchment

The Maroochy River catchment comprises around 1350 km^2 of the Sunshine Coast and Moreton Bay Regional Councils.

Most wetlands in the catchment are palustrine – around 60%. There are large areas of wallum heath wetlands in the coastal lowland areas that provide habitat for threatened acid frog species. Riverine wetlands account for 20% of the total wetland area and there are several artificial or highly modified wetlands viz. Ewen Maddock Dam (Mooloolah River), Wappa Dam, Poona Dam and Cooloolabin Dam (Rocky Creek and South Maroochy River).

Several nationally important wetland sites are located in the catchment: Coolum Creek and Lower Maroochy River, Lower Mooloolah River, Pumicestone Passage and Upper Pumicestone Coastal Plain, in addition to the northern end of the Moreton Bay, an internationally important wetland area (RAMSAR).

In the northern Maroochy River subcatchment, land use is primarily agriculture with major urban centres in Maroochydore, Marcoola and Coolum Beach. The Mooloolah subcatchment is dominated by agriculture, managed forestry, rural residential living and major urban centres in Mooloolaba and Caloundra. The Pumicestone subcatchment in the south also has large areas of managed forests, native bush, grazing and agriculture. This southern area from Caloundra to the Pine River catchment has a 1500 km long stream network draining into the Pumicestone Passage (Ramsar).

2.1.3 Bribie Island catchment

Bribie Island is a 190 km^2 sand island that rises to a maximum elevation of 47 metres. It is in the Moreton Bay and Sunshine Coast Regional Council areas and is separated from the mainland by Pumicestone Passage, part of the broader Moreton Bay Ramsar site.

Bribie Island has a different ecology to other sand islands in the region. Wetlands, groundwater dependent ecosystems, perched lakes and dunes support a rich diversity of flora and fauna. The groundwater retention properties of the island's geology mean this water resource supports unique ecology and also provides a local, high quality source of water for human consumption.

Land use is primarily native vegetation and managed forestry and a relatively small amount of urban development in the southwest corner. Almost all the remnant vegetation on the island is mapped as a palustrine wetland.

2.1.4 Pine River catchment

The Pine River catchment is comprised of the Caboolture and the North Pine and South Pine River subcatchments. Most of the 1409 km^2 catchment is in the Moreton Bay Regional Council area, with a small urbanised section in Brisbane City Council area.

Dominant land uses in the catchment are grazing, rural residential living and urban development as well as open space areas with native vegetation. The upper catchment still contains remnant vegetation, moreso in the south. Most of the western boundary of the study area is higher elevation remnant vegetation along the D’Aguilar Range. The mid reaches are characterised by agricultural and rural residential living and the lower catchment is highly urbanised. Urban development is the major pressure on the southern part of the catchment. In the northern, Caboolture subcatchment agriculture and poultry farming also prominent land uses.

Riverine, palustrine and estuarine wetlands occur across the study area in similar proportions. Artificial or highly modified wetlands comprise more than 20% of the total wetland area. Pine River Dam and Lake Kurwongbah are major water storages on the North Pine River and its tributary Sideling Creek.

The study area contains the Pine River and Hayes Inlet internationally important wetland site (DIWA, Ramsar), an important wetland for migratory waders.

2.1.5 Stanley River catchment

The Stanley River catchment covers 1538 km^2 of the Somerset, Moreton Bay and Sunshine Coast Regional Councils. The catchment is bounded by the D'Aguilar Range in the east and the Conondale Range in the north where altitude reaches a peak of 870 m at Mount Langley.

The Lake Somerset water storage is the major wetland in the catchment; artificial and highly modified wetlands comprise 73% of the total wetland area. Natural wetlands are almost entirely riverine and the stream network is around 3280 km long. Most major waterways have headwaters in protected areas and flow to the southwest of the catchment into Somerset Dam.

The dominant land use in the catchment is grazing of beef cattle in the extensively cleared mid reaches. The fertile alluvial valleys and basalt uplands are used for intensive agricultural production including dairying, cropping, turf and horticulture. Timber production is also a significant land use as is the provision water supply dams.

Almost one quarter of the catchment is in either national park, forest reserve or state forest. The main protected areas are Conondale and D'Aguilar National Parks in the north and south respectively.

2.1.6 Brisbane Upper catchment

The Brisbane Upper catchment is a large area, 5493 km^2, and is mostly comprised of parts of Toowoomba and Somerset Regional Councils, with a small section of South Burnett Regional Council. The boundaries of the basin are the Great Dividing Range in the west, Brisbane and Jimna Ranges in the north and the D'Aguilar Range in the east. The ranges and their low hills circumscribe the valleys of the Brisbane River and its tributaries which drain south to Wivenhoe Dam. The altitude range in the catchment is from 25 m up to 950 m in the northwest in the vicinity of Bunya Mountains National Park.

The upper catchment along the mountain ranges is still in a relatively natural state while lower areas are largely cleared and there is limited riparian vegetation present in lowland areas.

Beef cattle grazing is a major land use across the catchment, and dairying and farming are concentrated along the fertile alluvial valleys and basalt uplands. There is also a significant timber industry based around managed native forests and Hoop Pine plantations. Provision of water supplies is also a major land use; the catchment includes the largest dam in SEQ, Lake Wivenhoe.

2.1.7 Brisbane Lower catchment

The Brisbane Lower catchment includes most of the Brisbane metropolitan area so it consists of a large and highly modified area as well as large areas that are still in a very natural state. The catchment comprises most of Brisbane City Council area and smaller parts of Somerset Regional, Ipswich City and Logan City council areas. The total area of the catchment is around 2000 km^2 with over 4000 km of rivers and streams.

The eastern half of the study area is a highly urbanised environment with very little remnant vegetation, including riparian vegetation, remaining. Urban development, point source and diffuse discharges to waterways and large stormwater runoff after storms are significant pressures on the freshwater environment in this area.

The western part of the catchment is far less urbanised and includes the protected areas of the D'Aguilar Range as well as agricultural and rural areas just east of the Lockyer Creek catchment. Dominant land uses in the west of the catchment are grazing, managed forests, intensive agriculture, rural residential living and open space with native vegetation.

The remnant vegetation in the upper catchment of the D'Aguilar Range, incorporating D'Aguilar National Park, and the Flinders Karawatha Corridor (White Rock/Spring Mountain and the Greenbank Military Area) make up a large proportion of the land area of the catchment that is set aside for conservation purposes or low impact use.

The catchment also contains the Greenbank Army Training Area C, a nationally important wetland site (DIWA), at the northern end of the Flinders Karawatha Corridor.

2.1.8 SEQ other islands catchment

This small catchment includes numerous undisturbed islands in the Great Sandy Strait between Fraser Island and the mainland. The largest island, Turkey Island, is only 6 km long and about 3.5 km wide.

All the islands are mapped as wetlands (Queensland Wetland Program), the majority classified as estuarine regional ecosystems; mangrove shrubland to low closed forest. A variety of endangered and of concern regional ecosystems on Turkey Island and Walsh Island are included in the Great Sandy Conservation Park.

2.1.9 Moreton Bay islands catchment

The Moreton Bay islands catchment consists of all the smaller islands that occur north from Jumpinpin Channel between North and South Stradbroke Islands and the mouth of the Brisbane River. It includes the large Russell-Macleay group, Coochiemudlo and Peel Islands and the almost completely developed Fisherman Islands at the Brisbane River mouth. The dominant wetland systems on the islands are estuarine, with small patches of palustrine wetlands on the larger islands in the Russell-Macleay group.

The main habited islands are Russell and Macleay Islands, the largest, neighbouring Karragarra and Lamb Islands and Coochiemudlo Island off Victoria Point. Russell Island has the most significant residential development. This island was originally farming and fishing community and has been progressively developed and subdivided into suburban blocks.

From early fishing and agricultural use, on the fertile red soils characteristic of the Redland peninsula, the islands have been progressively developed and subdivided for rural residential living.

2.1.10 Moreton Island catchment

Moreton Island is a 172 km^2 sand island located on the eastern edge of Moreton Bay. It is 37 km long and 10 km at its widest with a maximum elevation of 285 m at Mt Tempest. It is the least disturbed large coastal sand island in SEQ and is regarded as one of the most outstanding records of ongoing geological, geomorphological and biological processes which formed the regional sand island masses.

The island has a very high density of natural dune lakes and swamps, including sedge dominated swamps, perched and window lakes. Around 94% of the total wetland area on the island is palustrine wetland, mapped as waterbodies, palustrine regional ecosystems or as wetland aggregations among heterogeneous regional ecosystems in the east coast dunes and swales.

The island is almost entirely remnant vegetation with little development except for 3 small townships and tourism enterprises. Around 95% of the island is in the Moreton Island National Park. This island is located in a habitat protection zone of the Moreton Bay Marine Park and almost the entire island surface is mapped as part of the Moreton Island Ramsar wetland site (wetland of international significance).

2.1.11 Stradbroke Islands catchment

The Stradbroke Islands drainage area includes North and South Stradbroke Islands with an area of 290 km^2. The islands consist of sand dunes and swamps or swamp deposits. South Stradbroke Island is a low, barrier island that separates the western Broadwater foreshore from the Pacific Ocean. It is an area of continuous erosion and deposition as wind, tide and waves change the shoreline that is built by northward longshore drift. North Stradbroke Island has more extreme topography, reaching an elevation at the peak of Mt Hardgrave of over 200 m.

Of the total wetland area in the catchment, 82% is palustrine and a further 16% estuarine. Important wetlands in the catchment are Moreton Bay Ramsar site and the North Stradbroke Island nationally important wetland site (DIWA), which comprises most of the north island. Despite a relatively depauperate aquatic fauna, the islands' wetlands include a number of rare and highly restricted wallum specialist taxa, and several unexpected taxa more commonly found either elsewhere in SEQ or in high altitude rainforest streams (Marshall et al 2011).

The islands are still dominated by native vegetation and are relatively undeveloped for urban use. North Stradbroke Island has permanent settlements at Point Lookout, Amity Point and Dunwich. However, a significant amount of vegetation has been cleared for sand mining operations. The dunes of North Stradbroke contain commercial quantities of zircon, rutile, monazite and ilmenite and mining has been carried out there since the 1940s. South Stradbroke Island has some residential and tourism uses.

Moreton Bay and its islands is Quandamooka Country and the Quandamooka Yoolooburrabee Aboriginal Corporation is based on North Stradbroke Island. In 2011 the federal government recognised the Quandamooka People's native title rights and interests over land and waters surrounding North Stradbroke Island and several other Moreton Bay islands.

2.1.12 Coomera and Nerang Rivers catchment

The total area of the Coomera and Nerang Rivers catchment is 1303 km^2. It is made up of the Nerang, Pimpama, Coomera, Tallebudgera and Currumbin and Broadwater sub-catchments. The catchment is made up of a large part of Gold Coast City Council area and in the west a part of Scenic Rim Regional Council along and west of the Beechmont Range.

The coastal half of the catchment is highly urbanised and is dissected by major transport corridors. The western areas are characterised by large tracts of remnant vegetation in the Beechmont, Wunburra, Tallai and Nimmel Ranges and the World Heritage listed Gondwana Rainforests of Australia in the southwest, comprising areas of Springbrook and Lamington National Parks.

The catchment has a 2600 km long stream network based around the three major rivers: Coomera, Nerang and Pimpama. The dominant wetland type in the catchment is estuarine. Palustrine wetlands in the coastal lowlands comprise 20% of total wetland area. Artificial and highly modified wetlands make up 26% of total wetland area; the catchment has several water storages, the largest being Hinze Dam.

The catchment is an area of rapid population growth and supports a range of land uses including intensive agriculture, grazing, rural lifestyle living and high density urban development with accompanying major transport and service corridors. The mid reaches of most waterways flow through rural or rural residential areas and the lower reaches of many rivers, particularly in the north of the catchment, are highly modified into canal estates.

The catchment contains wetlands of international significance: Moreton Bay Ramsar site in the northern-most part of the catchment, including Lake Coombabah, a migratory wader and significant fish habitat area. The Upper Coomera River in Lamington National Park is also a nationally significant wetland (DIWA).

The significant natural values in the catchment are threatened by increasing population growth, deterioration of water quality, fragmentation of habitat and unsustainable land use practices.

2.1.13 Albert River catchment

The Albert River catchment is a relatively narrow drainage basin extending from the NSW border to Beenleigh just south of Brisbane. It includes parts of Scenic Rim, Gold Coast City and Logan City local government areas and covers an area of 781 km^2. Elevation ranges from sea level at the confluence with the Logan River to 1196 m in the Lamington Plateau along the border.

The Albert River, a tributary of the Logan River, has headwaters in Lamington National Park and flows through sub-tropical rainforests to the largely cleared lowland areas before joining the Logan River 11 km upstream from the mouth. Dominant land uses include grazing, intensive crop farming and rural residential living areas.

The catchment has a stream network around 1700 km long. About 73% of the catchment wetland area is comprised of riverine wetlands and a further 16% is palustrine wetland.

Lamington National Park, along the southern boundary of the catchment is part of the Gondwana Rainforests of Australia World Heritage Area. The other signification area of conservation estate is Tamborine National Park which is the headwaters for Cedar Creek, a major tributary of the Albert River.

2.1.14 Logan River catchment

The Logan River study area is 3368 km^2 and comprised of large parts of the Scenic Rim and Logan local government areas, as well as smaller parts of Ipswich, Brisbane and Redland councils. The elevation in the catchment ranges from sea level at the coast to 1368 m in the south west at the headwaters of Teviot Brook.

The two main waterways, the Logan River and its tributary Teviot Brook, both have sources in the undisturbed high country of the McPherson and Great Dividing Ranges along the NSW border. The largest conservation areas in the catchment, Mount Barney and Lamington National Parks, occur in this border range area. These national parks are part of the Gondwana Rainforest World Heritage Area. Mount Chinghee National Park and small sections of Main Range National Park are also part of the McPherson Range/Great Dividing Range conservation estate links.

The catchment stream network length is about 6000 km but riverine wetlands comprise a smaller proportion (31%) of total wetland area compared to neighbouring catchments. Palustrine (31%) and estuarine (21%) wetlands that are more prevalent in the coastal lowlands make up a larger proportion of total wetland area. Moreton Bay Ramsar site (internationally important wetland) and several smaller nationally important wetlands (DIWA) are located in the coastal and near coastal areas of the catchment.

Land in the upper catchment areas has been cleared for grazing (including horse agistment), dairying and intensive agriculture. However, there are still large tracts of remnant vegetation remaining in the upper catchment. In the mid reaches, chicken farms, turf farms, beef production and rural residential and urban development are prevailing land uses. In the coastal areas of Redland City Council land use is dominated by urban development, intensive agriculture, market gardens and also some aquaculture. Most of the lowland areas have been cleared for various purposes but some remnant riparian vegetation remains.

2.1.15 Bremer River catchment

The Bremer River catchment covers around 2030 km2 and extends from Ipswich in the north to near the NSW border. The catchment is comprised of most of Ipswich City Council in the north and the western third of Scenic Rim Regional Council in the south. Catchment elevation varies from 3 m to as high as 1325 m in Great Dividing Range along the western boundary.

Main Range National Park, part of the Gondwana Rainforests of Australia World Heritage Area, which runs along the catchment's entire western bioregion boundary is the only national park of significant size in the catchment. The Bremer River and its major tributary creeks (including Boyd, Coulson, Oakey, Reynolds and Warrill Creeks) have headwaters in or adjacent to this large area of conservation estate.

Riverine wetlands make up half the total wetland area in the catchment and palustrine wetlands are 15% of the total area. The remaining wetland area is comprised of artificial or highly modified wetlands, primarily Lake Moogerah which is significant irrigation water supply.

The catchment is subject to a variety of land uses. Over half the area is grazed and the remainder used for horticulture, mining, urban and industrial development and lifestyle blocks. Crops such as potatoes and carrots are grown in the rich alluvial soil areas.

Agricultural and natural areas are becoming more degraded in parts of the catchment. Most of the lowland areas of the catchment have been cleared of native vegetation, including riparian areas, resulting in widespread channel and gully erosion in the Bremer River and its tributaries. Population growth in the SEQ region, and resulting supply and demand pressure on primary production and natural resources are challenges for land managers.

2.1.16 Lockyer Creek catchment

The Lockyer Creek catchment covers an area of around 3000 km^2 on the southwest boundary of the SEQ bioregion. It incorporates parts of the Toowoomba, Lockyer Valley, Somerset and Ipswich City local government areas.

The catchment is bordered on the north, south and west by the Great Dividing Range and drainage is to the east over undulating low hills to the relatively narrow alluvial plains of Lockyer Creek and its tributaries. The catchment varies in altitude from a peak of 1135 m to 35 m in the lowland areas. Drainage consists of a stream network over 6000 km long and includes the Dalrymple and Blackfellow Creeks nationally important wetlands (DIWA). Around 75% of mapped wetlands are riverine with a further 12% both palustrine and lacustrine.

The Lockyer Valley has some of Queensland's most productive alluvial soils and much of the mid and lower catchment areas have been cleared for intensive agriculture; vegetables, grains, lucerne and fruits. The catchment has the highest proportion of land used for intensive agriculture in SEQ. Irrigation schemes accompanying this development have resulted in regulated water flows and changed groundwater dynamics. Other dominant land uses in the catchment are grazing, predominantly in the upland areas, and rural residential development, both of which have required clearing of native vegetation.

Large tracts of remnant vegetation remain in the upper catchment along the margins of the basin. Much of this is protected in conservation estate including Main Range National Park and adjacent Glen Rock State Forest, in the south, and Lockyer National Park in the north.

A combination of intensification of rural industries and population growth present challenges for land management in the catchment, as the demand for land for infrastructure, primary production and natural resources increases. Threats to waterways include instability of stream banks and gully erosion due to clearing of riparian vegetation.

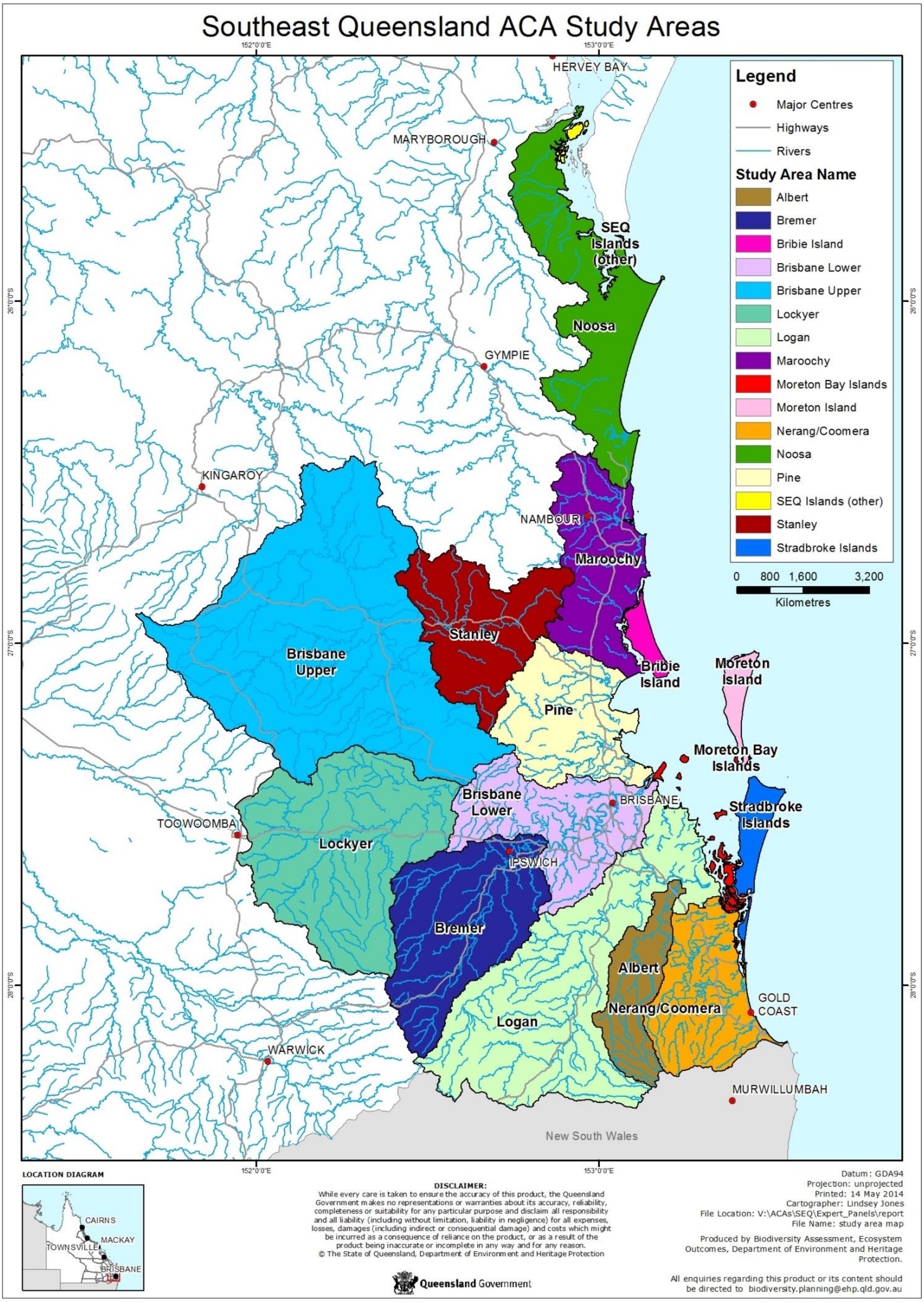


Figure 1. Southeast Queensland study areas

2.2 Panel composition

The expert panel was comprised of the persons listed in Table 1 who are familiar with aquatic fauna, flora and ecology in the Southeast Queensland region. Some members who were unavailable to attend the workshop were consulted prior to, or after, the workshop.

Table 1. Panel members

Participant	Organisation	Expertise	Attendance day(s)
Grant Periott	Gold Coast City Council		flora, ecology
Dale Watson	Redland City Council		ecology day 2
Karen McNeale	Redland City Council		ecology day 2
Keith McCosh	Scenic Rim Regional Council		flora, fauna
Phil Smith	Ipswich City Council		ecology
Bernadette May	Moreton Bay Regional Council		flora
Joadie Hardy	SEQ Catchments		ecology
Liz Gould	SEQ Catchments		flora, fauna
Maree Prior	Cooloola coastcare	wetland plants	flora
Phillip Moran	Noosa Landcare	macrophytes, aquatic weeds	ecology day 1
Jill Brown	Birds Queensland	birds, incl waterbirds	fauna
Rod Brown	Birds Queensland	birds, incl waterbirds	fauna
Angela Arthington	Griffith University	Wetland ecology/fw fish	fauna, ecology day 2
Patrick Moss	University of Queensland	wetland ecosystems	flora, ecology
Ed Meyer	Ecological Consultant	Frogs	fauna
Peter Young	Private consultant - Vegworx	Wetland plants and REs, biodiversity planning assessments	flora
Andrew Berghuis	Consultant - Aquatic Biopassage	Fauna - freshwater fish connectivity	fauna
Michael Lowe	Consultant - Cooloola Native Plants	coastal wallum	flora
Ulrike Nolte	Consultant for Freshwater Ecosystems	freshwater macroinvertebrates	fauna
Paul Clayton	RPS Australia Asia Pacific	consultant, freshwater ecology	Ecology
Kieran Richardt	Natura Pacific Pty Ltd	consultant, freshwater plants	flora
Harry Hines	NPSR - Queensland Parks and Wildlife Service	Fauna - waterbirds, frogs	fauna
Satish Choy	DSITI - Water Planning and Coastal Sciences	water quality, macroinvertebrates	fauna
Tim Ryan	DSITI - Queensland Herbarium	Flora, regional ecosystems, groundwater dependant	ecology

Participant	Organisation	Expertise	Attendance day(s)
		ecosystems	
Ronald Booth	DSITI - Queensland Herbarium	flora, regional ecosystems	flora
Stephen Mackay	DNRM - formerly Griffith Uni	macrophytes, riverine flora	flora
Ian Gynther	EHP - Threatened species	False water rat, Coxen's FP, riparian birds	fauna
Maria Zann	EHP - Maryborough	Landscape ecology, ACA, ecosystem processes	ecology day 1
Michael Robinson	EHP - Southern Region		ecology
Carole Rayner	EHP - Southern Region		flora, fauna, ecology
Steven Howell	EHP - Biodiversity Assessment	support staff	flora, fauna, ecology
Lindsey Jones	EHP - Biodiversity Assessment	support staff	flora, fauna, ecology
Simon Goudkamp	EHP - Biodiversity Assessment	support staff	flora, fauna, ecology
Peter Richardson	EHP - Biodiversity Assessment	support staff	flora, fauna, ecology
Shane Chemello	EHP - Biodiversity Assessment	flora	flora, fauna, ecology
David Mcfarland	EHP - Biodiversity Assessment	fauna	flora, fauna, ecology
Darren Fielder	Consultant - Red Leaf Projects	aquatic ecology, facilitator	flora, fauna, ecology

2.3 Workshop format

Three expert panels were held over 6 days in February 2014 in Brisbane. The flora panel was held 10-11 February, the fauna panel was held 13-14 February, and the ecology panel was held 24-25 February.

The workshops used an interactive approach of ArcView GIS software to display point records of species and their spatial distributions. Where necessary, a background of topographic maps, roads, rivers and other relevant datasets were used to identify areas of interest. Additional supporting information on flora, fauna and ecology in the Southeast Queensland region was also sourced from various technical reports.

3 Flora

3.1 Near threatened and threatened flora

The panel identified 47 threatened flora taxa in the Southeast Queensland catchments region (Table 2). Of these, four will not be included in this measure due to a NCA status change. They will however be included on the native species list (measure 3.1.5). This list of flora in Table 2 will be used as the basis for identifying areas of significance for criterion 4 (Threatened species and ecosystems) (4.1.2).

Table 2. Aquatic, semi-aquatic and riparian flora species listed under Queensland or Commonwealth legislation

This list was used to generate the values for the AquaBAMM measure 4.1.2.

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Acacia baueri subsp. baueri	tiny wattle		Y	V		
Aponogeton elongatus		Y		NT		No filtered (year >1950 and precision <2000m) records in study area.
Aponogeton elongatus subsp. elongatus		Y		NT		
Arthraxon hispidus		Y	Y	V	V	
Blandfordia grandiflora	christmas bells		Y	E		
Boronia keysii	Key's boronia		Y	V	V	
Boronia rivularis	Wide Bay boronia		Y	NT		
Brasenia schreberi		Y	Y	NT		
Clematis fawcettii		Y		V	V	
Durringtonia paludosa	durringtonia		Y	NT		
Eleocharis difformis			Y	E		Found at Blue Lake on Stradbroke island and also on Moreton Island
Eucalyptus conglomerata	swamp stringybark		Y	E	E	
Gossia gonoclada		Y		E	E	

1 Riverine

2 Non-riverine

3 Queensland Nature Conservation Act 1992 (E – endangered, V – vulnerable, NT – near threatened)

4 Environment Protection and Biodiversity Conservation Act 1999 (E – endangered, V – vulnerable)

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Helmholtzia glaberrima		Y	Y	NT		
Lilaeopsis brisbanica		Y		E		
Lobelia membranacea			Y	NT		
Lychnothamnus barbatus		Y		V	E	Submerged aquatic freshwater macrophyte . Found in Warrill ck west of Boonah and Wallace ck. south of Boonah.
Maundia triglochinoides		Y	Y	V		
Melaleuca cheelii		Y	Y	NT		
Melaleuca formosa		Y	Y	NT		
Melaleuca irbyana			Y	E		
Olearia hygrophila	swamp daisy		Y	E	E	
Persicaria elatior		Y	Y	V	V	
Phaius australis			Y	E	E	
Phaius bernaysii	yellow swamp orchid		Y	E	E	
Prasophyllum exilis			Y	NT		
Pterostylis nigricans			Y	NT		
Randia moorei		Y		E	E	
Rhaponticum australe			Y	V	V	
Samadera bidwillii		Y		V	V	
Schoenus scabripes			Y	NT		
Syzygium moorei		Y		V	V	Occurs in warm, protected, fertile soils in riverine and gully rainforests at low altitudes at three sites in Upper Mudgeeraba Creek and Upper Tallebudgera Creek.
Tecomanthe hillii		Y	Y	NT		On Fraser in Melaleuca swamps. Also found in Melaleuca swamps and creeks on mainland.
Thelypteris confluens			Y	V		
Xanthostemon oppositifolius	southern penda	Y		V	V	

3.2 Priority flora

Priority species are those species NOT listed as Endangered, Vulnerable or Near Threatened however they are considered important for the integrity of aquatic ecosystems and must exhibit one or more of the following significant values:

1. It forms significant macrophyte beds (in shallow or deep water).
2. It is an important/critical food source.
3. It is important/critical habitat.
4. It is implicated in spawning or reproduction for other fauna and/or flora species.
5. It is at its distributional limit or is a disjunct population.
6. It provides stream bank or bed stabilisation or has soil-binding properties.
7. It is a small population and subject to threatening processes.

Post panel, a number of riverine, non-riverine priority flora species have been identified (Table 3). These species are to be included as part of criterion 5 (Priority species and ecosystems) (5.1.2).

The panel identified 25 priority species. Two of these species have been moved to measure 4.1.2 (threatened species) as they have undergone a status change since the original lists were compiled.

Table 3. Identified priority flora species and their significant values

This list was used to generate the values for the AquaBAMM measure (5.1.2).

Scientific Name	Common Name	R[1]	NR[2]	Priority Number[3]	Comments
Baumea articulata	jointed twigrush	Y	Y	1, 3, 4, 6	
Castanospermum australe	black bean	Y		2, 3, 6	
Casuarina cunninghamiana	river she-oak	Y		2, 3, 6	
Casuarina glauca	swamp she-oak	Y		2, 3, 6	
Eleocharis dulcis			Y	2, 3, 7	Under threat in SEQ. Food source for water birds & nesting material.
Empodisma minus	spreading rope rush	Y	Y	2, 3, 4	Critical habitat: formation of patterned fens unique to subtropical Australia. Mooloola River. Food source for Ground Parrot & Wallum Froglet.
Eucalyptus tereticornis		Y	Y	2, 3, 6	
Ficus coronata	creek sandpaper fig	Y		2, 3, 6	
Ficus fraseri	white	Y		2, 3, 6	

1 Riverine

2 Non-riverine

3 The priority numbers are the values that a species must exhibit to be a priority species as listed in dot points above Table 3

Scientific Name	Common Name	R[1]	NR[2]	Priority Number[3]	Comments
	sandpaper fig				
Ficus macrophylla	moreton bay fig	Y		2, 3, 6	
Ficus virens		Y		2, 3, 6	
Gahnia clarkei	tall sawsedge		Y	2	Food source for Sword-grass Butterfly
Hydrilla verticillata	hydrilla	Y		4	Provides spawning habitat for lungfish. http://www.nativefish.asn.au/lungfish.html
Lepironia articulata	grey sedge	Y	Y	1, 3, 4, 6	
Lomandra hystrix		Y		3, 6	
Melaleuca bracteata	black tea tree	Y	Y	3, 6	Adds to structural complexity
Melaleuca quinquenervia	swamp paperbark	Y	Y	2, 3, 6	Small populations in the Brisbane and Nerang/Coomera catchments.
Melaleuca viminalis	weeping bottlebrush	Y		2, 3, 6	
Typha domingensis		Y	Y	2, 3, 4,6	
Typha orientalis	broad-leaved cumbungi	Y	Y	2, 3, 4,6	
Utricularia gibba	floating bladderwort	Y	Y	1, 3	
Vallisneria nana		Y		2, 3, 4	
Waterhousea floribunda	weeping lilly pilly	Y		2, 3, 6	

3.3 Species richness

Species richness (total number of species) was scored for wetland indicator species. The 16 catchments of the Southeast Queensland region have a number of non-riverine and riverine plants that are referred to in this report as 'wetland indicator species' (Table 4). The datasets for these species were accessed from DSITI corporate databases of WildNet and Herbrecs and from panel member records.

The panel defined a 'wetland indicator species' to mean 'those species that are adapted to and dependent on living in wet conditions for at least part of their life and are found either within or immediately adjoining a riverine, non-riverine or estuarine wetland'.

This definition of a wetland indicator species extends beyond the more traditional definition of submerged and floating aquatic plants to include plants inhabiting the littoral zone (waters edge) and plants that usually have 'wet feet' on the toe of the bank. This meaning was chosen because it was considered to best capture the intent of the AquaBAMM indicator and measure of species richness "Richness of wetland dependent plants" (3.1.5). The indicator is a measure of floristic richness of a particular spatial unit's aquatic environment, and hence, a broad definition will better depict the flora richness value at a given location.

Table 4. Wetland-dependent native flora species including priority species

This list will be used to calculate an aquatic and riparian flora richness score (3.1.5), threatened flora species (4.1.2) and priority flora species (5.1.2).

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Acacia baueri subsp. baueri	tiny wattle		Y	V		
Acrostichum speciosum	mangrove fern	Y	Y	LC		
Aldrovanda vesiculosa	waterwheel plant		Y	LC		
Aponogeton elongatus		Y	Y	NT		No records passed filters.
Aponogeton elongatus subsp. elongatus		Y		NT		
Aponogeton elongatus subsp. fluitans		Y	Y	V		No records passed filters.
Arthraxon hispidus		Y	Y	V	V	
Avicennia marina		Y		LC		
Azolla filiculoides	red azolla	Y	Y	LC		
Azolla pinnata	ferny azolla	Y	Y	LC		
Bacopa floribunda		Y	Y	LC		
Bacopa monnieri		Y	Y	LC		
Baeckea frutescens			Y	LC		

1 Riverine

2 Non-riverine

3 Queensland Nature Conservation Act 1992 (E – endangered, V – vulnerable, NT – near threatened)

4 Environment Protection and Biodiversity Conservation Act 1999 (E – endangered, V – vulnerable)

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Baloskion pallens		Y	Y	LC		
Baloskion tenuiculme		Y	Y	LC		
Baloskion tetraphyllum subsp. meiostachyum		Y	Y	LC		
Banksia robur	broad-leaved banksia		Y	LC		
Baumea acuta	pale twigrush		Y	LC		No records passed filters.
Baumea arthrophylla		Y	Y	LC		
Baumea articulata	jointed twigrush	Y	Y	LC		
Baumea gunnii	slender twigrush	Y	Y	LC		
Baumea juncea	bare twigrush	Y	Y	LC		
Baumea muelleri		Y	Y	LC		
Baumea nuda		Y	Y	LC		
Baumea rubiginosa	soft twigrush	Y	Y	LC		
Baumea teretifolia		Y	Y	LC		
Blandfordia grandiflora	christmas bells		Y	E		
Blechnum indicum	swamp water fern	Y	Y	LC		
Blyxa aubertii		Y		LC		No records passed filters.
Bolboschoenus caldwellii		Y	Y	LC		
Bolboschoenus fluviatilis		Y	Y	LC		
Boronia falcifolia	wallum boronia		Y	LC		
Boronia keysii	Key's boronia		Y	V	V	
Boronia parviflora	swamp boronia		Y	LC		
Boronia rivularis	Wide Bay boronia		Y	NT		
Boronia safrolifera	safrole boronia		Y	LC		
Brasenia schreberi		Y	Y	NT		
Bruguiera gymnorhiza	large-fruited orange mangrove	Y		LC		
Burchardia umbellata			Y	LC		
Callitriche muelleri		Y	Y	LC		

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Callitriche sonderi		Y	Y	LC		
Carex fascicularis	tassel sedge	Y	Y	LC		
Carex gaudichaudiana		Y	Y	LC		
Castanospermum australe	black bean	Y		LC		
Casuarina cunninghamiana	river she-oak	Y		LC		
Casuarina cunninghamiana subsp. cunninghamiana		Y		LC		
Casuarina glauca	swamp she-oak	Y		LC		
Ceratophyllum demersum	hornwort	Y		LC		
Ceratopteris thalictroides		Y	Y	LC		
Chara corallina		Y	Y	LC		
Chara fibrosa		Y	Y	LC		
Chara globularis		Y	Y	LC		
Chara vulgaris		Y	Y	LC		
Chorizandra cymbaria		Y	Y	LC		
Chorizandra sphaerocephala			Y	LC		
Cladium procerum	leafy twigrush	Y	Y	LC		
Clematis fawcettii		Y		V	V	
Crinum flaccidum	Murray lily	Y	Y	LC		
Crinum pedunculatum	river lily	Y	Y	LC		
Cyclosorus interruptus		Y	Y	LC		
Cycnogeton dubius		Y	Y	LC		
Cycnogeton microtuberosus		Y	Y	LC		
Cycnogeton multifructus		Y	Y	LC		
Cycnogeton procerus		Y	Y	LC		
Cynometra iripa		Y		LC		
Cyperus aquatilis		Y	Y	LC		
Cyperus concinnus		Y	Y	LC		

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Cyperus difformis	rice sedge	Y	Y	LC		
Cyperus digitatus		Y	Y	LC		
Cyperus distans		Y		LC		
Cyperus enervis		Y		LC		
Cyperus exaltatus	tall flatsedge	Y	Y	LC		
Cyperus flaccidus		Y	Y	LC		
Cyperus gunnii subsp. gunnii		Y	Y	LC		No records passed filters.
Cyperus gunnii subsp. novae-hollandiae		Y	Y	LC		
Cyperus gymnocaulos	spiny flatsedge	Y	Y	LC		
Cyperus haspan		Y	Y	LC		
Cyperus haspan subsp. haspan		Y	Y	LC		
Cyperus haspan subsp. juncoides		Y	Y	LC		
Cyperus laevigatus		Y	Y	LC		
Cyperus lucidus		Y	Y	LC		
Cyperus nutans var. eleusinoides	flatsedge	Y	Y	LC		
Cyperus odoratus		Y	Y	LC		
Cyperus pilosus		Y	Y	LC		
Cyperus platystylis			Y	LC		
Cyperus polystachyos		Y	Y	LC		
Cyperus polystachyos var. laxiflorus		Y	Y	LC		No records passed filters.
Cyperus polystachyos var. polystachyos		Y	Y	LC		
Cyperus procerus		Y	Y	LC		
Cyperus pygmaeus	dwarf sedge	Y	Y	LC		
Cyperus sanguinolentus		Y	Y	LC		
Cyperus scariosus		Y	Y	LC		
Cyperus squarrosus	bearded flatsedge	Y	Y	LC		
Cyperus unioloides		Y	Y	LC		

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Cyperus vaginatus		Y	Y	LC		
Damasonium minus	starfruit	Y	Y	LC		
Dicranopteris linearis var. linearis			Y	LC		
Diplachne fusca		Y	Y	LC		
Diplachne fusca var. fusca			Y	LC		
Drosera auriculata		Y	Y	LC		
Drosera binata	forked sundew	Y	Y	LC		
Drosera burmanni			Y	LC		
Drosera hookeri		Y	Y	LC		
Drosera indica		Y	Y	LC		
Drosera lanata		Y	Y	LC		
Drosera lunata		Y	Y	LC		
Drosera peltata	pale sundew		Y	LC		
Drosera pygmaea			Y	LC		
Drosera spatulata		Y	Y	LC		
Drosera spatulata var. spatulata		Y	Y	LC		
Durringtonia paludosa	durringtonia		Y	NT		
Echinochloa telmatophila	swamp barnyard grass	Y	Y	LC		
Eclipta prostrata	white eclipta	Y	Y	LC		
Elatine gratioloides	waterwort	Y	Y	LC		
Eleocharis acuta		Y	Y	LC		
Eleocharis atricha	tuber spikerush	Y	Y	LC		
Eleocharis cylindrostachys		Y	Y	LC		
Eleocharis dietrichiana		Y	Y	LC		
Eleocharis difformis			Y	E		
Eleocharis dulcis			Y	LC		
Eleocharis equisetina		Y	Y	LC		
Eleocharis geniculata			Y	LC		

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Eleocharis ochrostachys		Y	Y	LC		
Eleocharis philippinensis		Y	Y	LC		
Eleocharis plana	ribbed spikerush	Y	Y	LC		
Eleocharis pusilla	small spikerush	Y	Y	LC		No records passed filters.
Eleocharis sphacelata	tall spikerush	Y	Y	LC		
Eleocharis spiralis		Y	Y	LC		
Eleocharis tetraquetra			Y	LC		
Empodisma minus	spreading rope rush	Y	Y	LC		
Eriocaulon australe		Y	Y	LC		
Eriocaulon nanum		Y	Y	LC		
Eriocaulon scariosum		Y	Y	LC		
Eucalyptus conglomerata	swamp stringybark		Y	E	E	
Eucalyptus robusta	swamp mahogany	Y	Y	LC		
Eucalyptus tereticornis		Y	Y	LC		
Eurychorda complanata			Y	LC		
Ficus coronata	creek sandpaper fig	Y		LC		
Ficus fraseri	white sandpaper fig	Y		LC		
Ficus macrophylla	moreton bay fig	Y		LC		
Ficus virens		Y		LC		
Fimbristylis ferruginea		Y	Y	LC		
Fimbristylis microcarya		Y	Y	LC		
Fimbristylis nuda		Y	Y	LC		
Fimbristylis nutans		Y	Y	LC		
Fimbristylis pauciflora		Y	Y	LC		
Fimbristylis polytrichoides			Y	LC		
Fimbristylis schoenoides		Y	Y	LC		
Fimbristylis sieberiana			Y	LC		

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Fuirena incrassata		Y	Y	LC		
Fuirena nudiflora		Y		LC		No records passed filters.
Fuirena umbellata		Y	Y	LC		
Gahnia clarkei	tall sawsedge		Y	LC		
Gahnia sieberiana	sword grass	Y	Y	LC		
Gleichenia mendellii			Y	LC		
Gossia gonoclada		Y		E	E	
Helmholtzia glaberrima		Y	Y	NT		
Hemarthria uncinata		Y	Y	LC		
Hemarthria uncinata var. spathacea			Y	LC		
Hemarthria uncinata var. uncinata		Y	Y	LC		
Hydrilla verticillata	hydrilla	Y		LC		
Hydrocotyle verticillata	shield pennywort	Y	Y	LC		
Hygrophila angustifolia		Y	Y	LC		
Hypolaena fastigiata	tassel rope rush		Y	LC		
Ipomoea aquatica			Y	LC		
Isachne globosa	swamp millet		Y	LC		
Ischaemum australe var. australe			Y	LC		
Ischaemum fragile			Y	LC		
Isolepis inundata	swamp club rush	Y	Y	LC		
Juncus aridicola	tussock rush	Y	Y	LC		No records passed filters.
Juncus continuus		Y	Y	LC		
Juncus holoschoenus			Y	LC		
Juncus mollis			Y	LC		
Juncus planifolius		Y	Y	LC		
Juncus prismatocarpus	branching rush	Y	Y	LC		
Juncus usitatus		Y	Y	LC		
Leersia hexandra	swamp rice grass	Y	Y	LC		
Lemna aequinoctialis	common	Y	Y	LC		

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
	duckweed					
Lemna trisulca			Y	LC		
Lepidosperma longitudinale	pithy swordsedge	Y	Y	LC		
Lepironia articulata		Y	Y	LC		
Leptocarpus tenax		Y	Y	LC		
Leptospermum liversidgei			Y	LC		
Leptospermum semibaccatum	wallum tea-tree		Y	LC		
Lepyrodia imitans			Y	LC		
Lepyrodia scariosa			Y	LC		
Lilaeopsis brisbanica		Y		E		
Limnophila aromatica		Y	Y	LC		
Limnophila brownii		Y	Y	LC		
Liparophyllum exaltatum			Y	LC		
Lipocarpha chinensis			Y	LC		
Lipocarpha microcephala		Y	Y	LC		
Lobelia membranacea			Y	NT		
Lomandra hystrix		Y		LC		
Lophostemon suaveolens	swamp box	Y	Y	LC		
Ludwigia adscendens		Y	Y	LC		
Ludwigia octovalvis	willow primrose	Y	Y	LC		
Ludwigia peploides subsp. montevidensis		Y	Y	LC		
Ludwigia perennis		Y		LC		
Lychnothamnus barbatus		Y		V	E	
Lycopodiella cernua			Y	LC		
Lycopodiella lateralis	slender clubmoss		Y	LC		
Lycopodiella serpentina	bog clubmoss		Y	LC		
Lycopus australis	water horehound	Y	Y	LC		

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Lygodium microphyllum	snake fern	Y	Y	LC		
Lythrum salicaria	purple loosestrife	Y	Y	LC		
Marsilea costulifera	narrow-leaved nardoo	Y	Y	LC		
Marsilea drummondii	common nardoo	Y	Y	LC		
Marsilea hirsuta	hairy nardoo	Y	Y	LC		
Marsilea mutica	shiny nardoo	Y	Y	LC		
Maundia triglochinoides		Y	Y	V		
Melaleuca bracteata		Y	Y	LC		
Melaleuca cheelii		Y	Y	NT		
Melaleuca dealbata	swamp tea-tree	Y	Y	LC		
Melaleuca formosa		Y	Y	NT		
Melaleuca irbyana			Y	E		
Melaleuca leucadendra	broad-leaved tea-tree	Y	Y	LC		
Melaleuca linariifolia	snow-in summer	Y	Y	LC		
Melaleuca pachyphylla			Y	LC		
Melaleuca quinquenervia	swamp paperbark	Y	Y	LC		
Melaleuca thymifolia	thyme honeymyrtle		Y	LC		
Melaleuca trichostachya		Y	Y	LC		No records passed filters.
Melaleuca viminalis		Y		LC		
Melastoma malabathricum subsp. malabathricum			Y	LC		
Monochoria cyanea		Y	Y	LC		
Myriophyllum crispatum		Y	Y	LC		
Myriophyllum gracile		Y	Y	LC		
Myriophyllum gracile var. gracile		Y	Y	LC		
Myriophyllum implicatum		Y	Y	LC		
Myriophyllum jacobsii		Y	Y	LC		
Myriophyllum latifolium		Y	Y	LC		No records passed filters.

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Myriophyllum papillosum	common water-milfoil	Y	Y	LC		
Myriophyllum striatum			Y	LC		No records passed filters.
Myriophyllum verrucosum	water milfoil	Y	Y	LC		
Najas marina			Y	LC		No records passed filters.
Najas tenuifolia	water nymph	Y	Y	LC		
Nauclea orientalis	Leichhardt tree	Y		LC		
Nitella cristata		Y	Y	LC		
Nitella flexilis		Y		LC		
Nitella furcata		Y		LC		
Nitella furcata subsp. furcata		Y		LC		No records passed filters.
Nitella furcata subsp. orientalis		Y		LC		No records passed filters.
Nitella hyalina		Y		LC		
Nitella myriotricha		Y		LC		No records passed filters.
Nitella penicillata		Y	Y	LC		
Nitella pseudoflabellata		Y	Y	LC		
Nitella pseudoflabellata var. imperalis		Y		LC		No records passed filters.
Nitella stuartii		Y		LC		
Nitella tasmanica		Y	Y	LC		No records passed filters.
Nitella tasmanica subsp. gelatinifera		Y		LC		No records passed filters.
Nymphaea gigantea		Y	Y	LC		
Nymphoides crenata	wavy marshwort	Y	Y	LC		
Nymphoides exiliflora		Y	Y	LC		
Nymphoides geminata		Y	Y	LC		
Nymphoides indica	water snowflake	Y	Y	LC		
Olearia hygrophila	swamp daisy		Y	E	E	
Ornduffia reniformis			Y	LC		
Ottelia alismoides		Y	Y	LC		
Ottelia ovalifolia	swamp lily	Y	Y	LC		

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Panicum larcomianum		Y	Y	LC		
Panicum obseptum	white water panic		Y	LC		No records passed filters.
Panicum paludosum	swamp panic		Y	LC		
Paspalum distichum	water couch	Y	Y	LC		
Paspalum vaginatum	saltwater couch		Y	LC		
Persicaria attenuata		Y	Y	LC		
Persicaria barbata		Y	Y	LC		
Persicaria decipiens	slender knotweed	Y	Y	LC		
Persicaria dichotoma		Y	Y	LC		
Persicaria elatior		Y	Y	V	V	
Persicaria hydropiper	water pepper	Y	Y	LC		
Persicaria lapathifolia	pale knotweed	Y	Y	LC		
Persicaria orientalis	princes feathers	Y	Y	LC		
Persicaria praetermissa		Y	Y	LC		
Persicaria prostrata	creeping knotweed	Y	Y	LC		
Persicaria strigosa		Y	Y	LC		
Persicaria subsessilis	hairy knotweed	Y	Y	LC		
Phaius australis	Swamp orchid		Y	E	E	
Phaius bernaysii	yellow swamp orchid		Y	E	E	
Philydrum lanuginosum	frogsmouth	Y	Y	LC		
Phragmites australis	common reed	Y	Y	LC		
Potamogeton crispus	curly pondweed	Y	Y	LC		
Potamogeton ochreatus	blunt pondweed	Y	Y	LC		
Potamogeton octandrus		Y	Y	LC		
Potamogeton perfoliatus	perfoliate pondweed	Y	Y	LC		
Potamogeton sulcatus		Y	Y	LC		No records passed filters.
Potamogeton tepperi		Y	Y	LC		
Potamogeton tricarinatus	floating pondweed	Y	Y	LC		

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Prasophyllum exilis	Leek Orchid		Y	NT		
Pseudoraphis paradoxa	slender mudgrass	Y	Y	LC		
Pseudoraphis spinescens	spiny mudgrass	Y	Y	LC		
Pterostylis nigricans			Y	NT		
Randia moorei	spiny gardenia	Y		E	E	
Ranunculus inundatus	river buttercup	Y	Y	LC		
Rhaponticum australe			Y	V	V	
Rhynchospora brownii	beak rush	Y	Y	LC		
Rhynchospora corymbosa		Y	Y	LC		
Rhynchospora heterochaeta		Y	Y	LC		
Rhynchospora rubra		Y	Y	LC		
Ricciocarpus natans		Y	Y	LC		
Rotala mexicana		Y	Y	LC		
Rotala tripartita			Y	LC		
Ruppia maritima	sea tassel	Y	Y	LC		
Sacciolepis indica	Indian cupscale grass		Y	LC		
Samolus repens	creeping brookweed	Y	Y	LC		
Samolus valerandi	brookweed	Y		LC		
Schoenoplectus mucronatus		Y	Y	LC		
Schoenoplectus subulatus		Y	Y	LC		
Schoenoplectus tabernaemontani		Y	Y	LC		
Schoenus brevifolius		Y	Y	LC		
Schoenus falcatus		Y	Y	LC		No records passed filters.
Schoenus lepidosperma subsp. pachylepis		Y	Y	LC		
Schoenus nitens	shiny bogrush		Y	LC		
Schoenus paludosus			Y	LC		

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
Schoenus scabripes			Y	NT		
Scleria laxa			Y	LC		No records passed filters.
Selaginella andrewsii		Y		LC	V	
Selaginella uliginosa	swamp selaginella		Y	LC		
Sesuvium portulacastrum	sea purslane		Y	LC		
Sowerbaea juncea	vanilla plant		Y	LC		
Sparganium subglobosum	floating bur-reed	Y		LC		
Spirodela oligorrhiza		Y	Y	LC		
Spirodela polyrhiza	large duckweed	Y	Y	LC		
Sporadanthus caudatus		Y	Y	LC		
Sporadanthus interruptus			Y	LC		
Sporobolus virginicus	sand couch		Y	LC		
Sprengelia sprengelioides	sprengelia		Y	LC		
Stuckenia pectinata		Y	Y	LC		
Stylidium debile	frail trigger plant	Y	Y	LC		
Stylidium schizanthum		Y	Y	LC		
Stylidium tenerum			Y	LC		
Syzygium moorei	Durobby	Y		V	V	
Tecomanthe hillii	Fraser Island creeper	Y	Y	NT		
Tecticornia indica			Y	LC		
Tecticornia indica subsp. leiostachya			Y	LC		
Tecticornia pergranulata			Y	LC		
Thelypteris confluens			Y	V		
Triglochin striata	streaked arrowgrass	Y	Y	LC		
Tristaniopsis laurina		Y		LC		
Typha domingensis		Y	Y	LC		
Typha orientalis	broad-leaved	Y	Y	LC		

Scientific Name	Common Name	R[1]	NR[2]	NCA[3]	EPBC[4]	Comments
	cumbungi					
Utricularia aurea	golden bladderwort	Y	Y	LC		
Utricularia biloba	moth bladderwort		Y	LC		
Utricularia caerulea	blue bladderwort	Y	Y	LC		
Utricularia dichotoma	fairy aprons	Y	Y	LC		
Utricularia gibba	floating bladderwort	Y	Y	LC		
Utricularia lasiocaulis			Y	LC		
Utricularia lateriflora	small bladderwort		Y	LC		
Utricularia uliginosa	asian bladderwort	Y	Y	LC		
Vallisneria nana		Y		LC		
Waterhousea floribunda	weeping lilly pilly	Y		LC		
Wolffia angusta	tiny duckweed	Y		LC		
Xanthorrhoea fulva	swamp grasstree		Y	LC		
Xanthostemon oppositifolius	southern penda	Y		V	V	
Xyris complanata	yellow-eye		Y	LC		
Xyris juncea	dwarf yellow-eye		Y	LC		

3.4 Exotic flora

Exotic flora are plants that cause, or have the potential to cause, significant detrimental impact on natural systems within a non-riverine, riverine landscape. A number of non-riverine, riverine taxa that are known to occur within SEQ region were nominated (Table 5). The presence of aquatic and semi-aquatic flora species was recorded under criterion 1 (naturalness aquatic) (1.1.2). Riparian exotic flora species were recorded under criterion 2 (naturalness catchment) (2.1.1).

The degree of infestation and abundance of an exotic plant at a particular locality is an important factor in determining the level of impact to a natural ecosystem. Point records are used to identify the spatial units as having an exotic species present.

Table 5. Exotic flora species

This list was used to calculate the measures for 1.1.2 and 2.1.1 in the AquaBAMM assessment.

Scientific Name	Common Name	R[1]	NR[2]	M1_1_2	M2_1_1	Comments
Ageratina riparia	mistflower	Y	Y		Y	
Alternanthera philoxeroides	alligator weed	Y	Y	Y		
Anredera cordifolia	Madeira vine	Y	Y		Y	
Aristolochia elegans	calico-flower	Y	Y		Y	
Asparagus plumosus	climbing asparagus fern	Y			Y	
Baccharis halimifolia	groundsel bush	Y	Y		Y	
Bryophyllum delagoense	mother of millions	Y	Y		Y	
Cabomba caroliniana var. caroliniana	cabomba	Y	Y	Y		
Caesalpinia decapetala	wait-a-while	Y	Y		Y	
Cardiospermum grandiflorum	heart seed vine	Y	Y		Y	Lower Brisbane catchment
Celtis sinensis	Chinese elm	Y	Y		Y	
Cinnamomum camphora	camphor laurel	Y	Y		Y	
Colocasia esculenta	taro	Y			Y	
Dolichandra unguis-cati	Cats claw creeper	Y	Y		Y	
Echinochloa crus-galli	barnyard grass	Y	Y		Y	
Egeria densa	dense waterweed	Y	Y	Y		
Eichhornia crassipes	water hyacinth	Y	Y	Y		

1 Riverine

2 Non-riverine

Scientific Name	Common Name	R[1]	NR[2]	M1_1_2	M2_1_1	Comments
Gymnocoronis spilanthoides	senegal tea	Y		Y		Growing in Canungra ck
Hygrophila costata	horsetails	Y	Y	Y		
Hymenachne amplexicaulis cv. Olive		Y	Y	Y		
Ipomoea indica	blue morning-glory	Y	Y		Y	
Ipomoea purpurea	common morning glory	Y			Y	
Lantana camara		Y	Y		Y	
Lantana montevidensis	creeping lantana	Y	Y		Y	
Leucaena leucocephala		Y	Y		Y	
Leucaena leucocephala subsp. glabrata		Y	Y		Y	
Leucaena leucocephala subsp. leucocephala		Y	Y		Y	
Ligustrum lucidum	large-leaved privet	Y	Y		Y	
Ligustrum sinense	small-leaved privet	Y	Y		Y	
Megathyrsus maximus		Y	Y		Y	
Megathyrsus maximus var. coloratus		Y	Y		Y	
Megathyrsus maximus var. maximus		Y	Y		Y	
Megathyrsus maximus var. pubiglumis		Y	Y		Y	
Melinis minutiflora	molasses grass	Y	Y	Y	Y	Can grow across water surface
Myriophyllum aquaticum	Brazilian water milfoil	Y	Y	Y		Found in: South Maroochy; downstream of Wappa Dam; Nerang River - downstream of Hinze Dam. Female only.
Neptunia oleracea	water mimosa	Y		Y		
Nymphaea caerulea		Y	Y	Y		Displaces native Nymphoides indica.
Phyla canescens		Y	Y		Y	
Pinus elliottii	slash pine	Y	Y		Y	
Pistia stratiotes	water lettuce	Y	Y	Y		
Pueraria montana var. lobata		Y			Y	

Scientific Name	Common Name	R[1]	NR[2]	M1_1_2	M2_1_1	Comments
Ricinus communis	castor oil bush	Y	Y		Y	Coloniser of disturbed areas
Salvinia molesta	salvinia	Y	Y	Y		
Schinus terebinthifolius	broad-leaved pepper tree	Y	Y		Y	
Setaria sphacelata		Y	Y		Y	
Sorghum halepense	Johnson grass	Y	Y		Y	
Sphagneticola trilobata	Singapore Daisy	Y	Y		Y	
Urochloa mutica		Y	Y	Y		

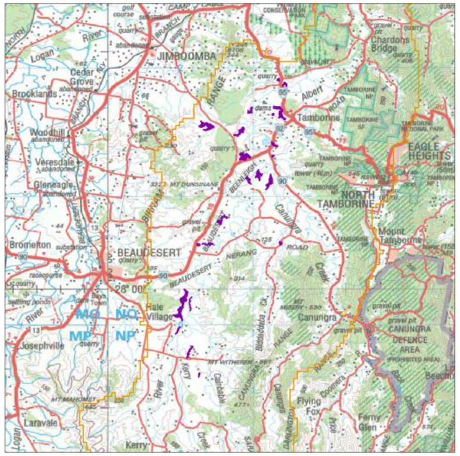
3.5 Special features

The panel identified several riverine and non-riverine special features in the Southeast Queensland region known to contain flora values (Table 6). Where fauna special features were also considered to have additional values (e.g. fauna, ecology), the special area was implemented as a wetland ecology special feature.

Each spatial unit that intersected with a particular ecosystem or feature in Table 6 was given a score equal to the conservation rating. Decisions are listed alphabetically by catchment. These features were intersected with the spatial units to identify the values for criterion 6 (Special features). All implemented special features were given a conservation rating of between 1 and 4 assigned by the panel. Decisions that were not able to be implemented due to a lack of readily available data or unconfirmed values, are indicated with '_not_implemented' in the decision implementation number column. Decisions that have 'to be implemented' in the implementation column are in the process of being implemented assuming available and suitable data and time. Where a single decision crosses a number of study areas, the decision has been duplicated for each study area. Decisions sorted by study area.

Table 6. Identified flora special features and their values

Table sorted by decision number which equates to alphabetically by study area code then non-riverine/riverine.

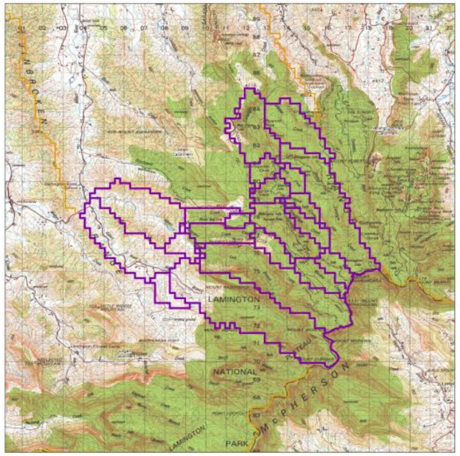
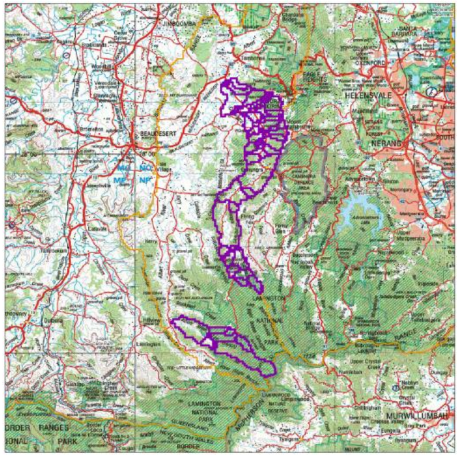
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
al_nr_fl_01	Tamborine mid-catchment floodplain wetlands		Albert		Y	Mid-catchment floodplain wetlands around Tamborine. Tall stands of Eucalyptus tereticornis growing on watercourse margins. Provides habitat for jabiru, usually associated with RE 12.3.3 (E. tereticornis floodplain forests; an endangered ecosystem). Old E. tereticornis are important hollow-forming trees for birds and arboreal fauna. Important refugia in agricultural landscapes. Heavily impacted by surrounding land uses.	6.3.1	3

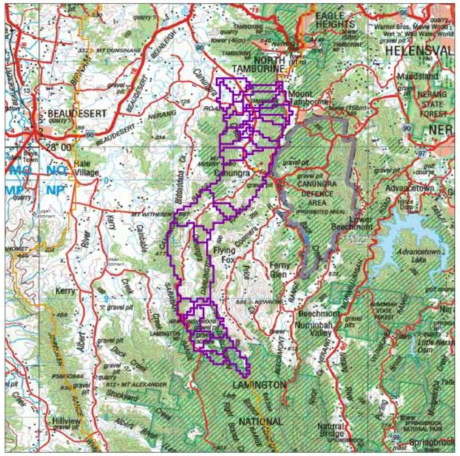
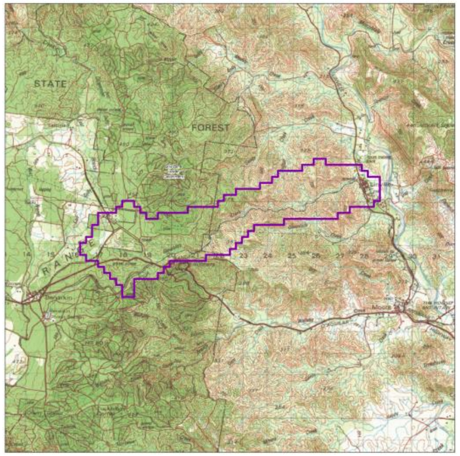
1 Riverine

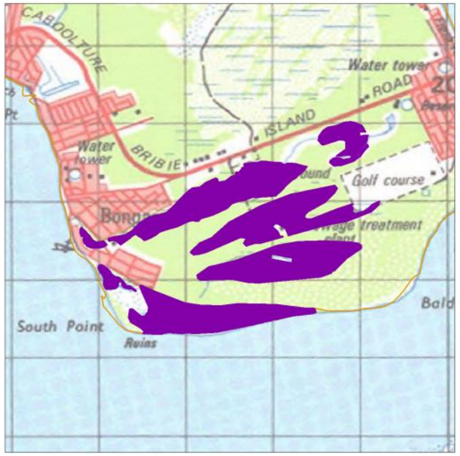
2 Non-riverine

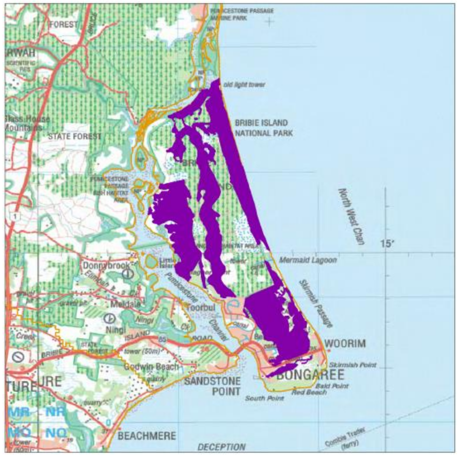
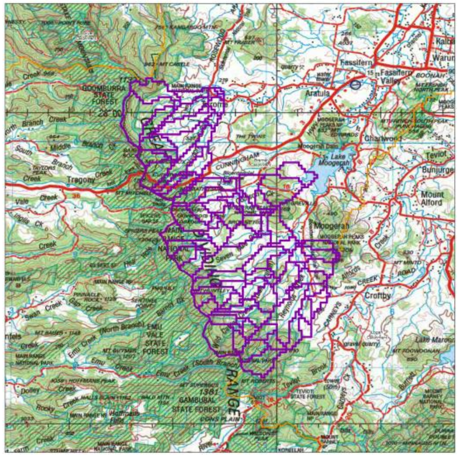
3 Number refers to the values from the generic CIM list in Appendix B

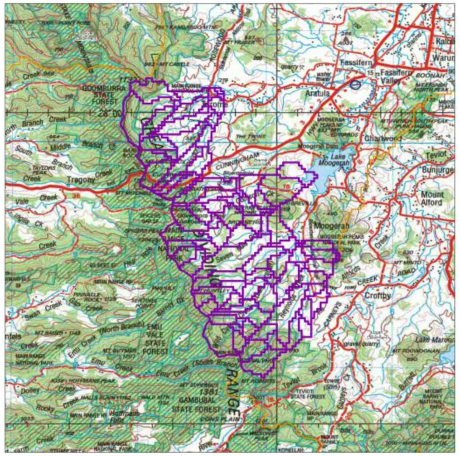
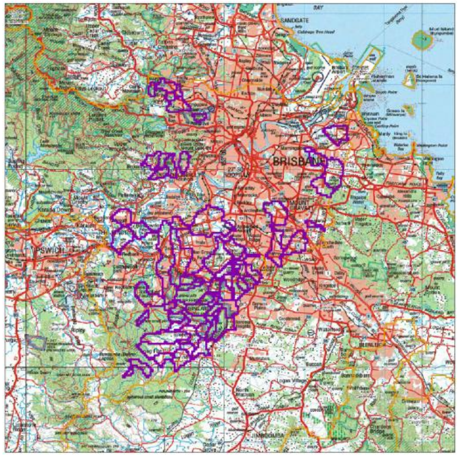
4 4 is the highest value

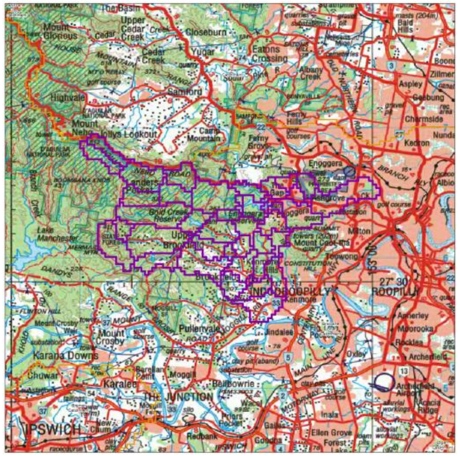
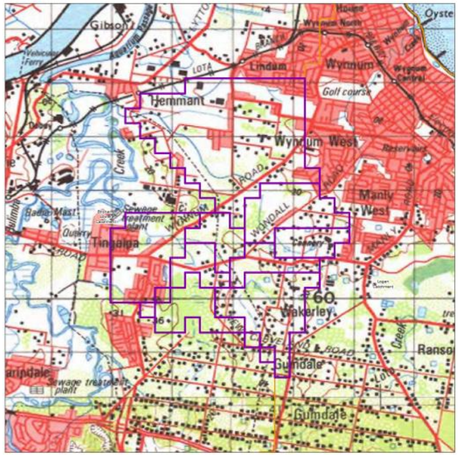
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
al_r_fl_01	Flora values in Albert River headwaters		Albert	Y		Rainforests in the headwaters of the Albert River comprising 2 Broad Veg Groups: 2: Complex to simple, semi-deciduous mesophyll to notophyll vine forest, sometimes with Araucaria cunninghamii. 6: Notophyll vine forest and microphyll fern forest to thicket on high peaks and plateaux. Actual occurrence of rainforest depends on rainfall, substrate and aspect. The rainforest has high plant diversity and is the sole habitat for some priority species. Same values as the adjacent nc_r_fl_01. (Headwaters to Currumbin and Tallebudgera Creeks. New macroinvertebrate species recently discovered here. Linked in to Springbrook Plateau and Mount Warning shield. Headwaters all contain rainforest canopy)	5.2.1, 6.3.1	4,4
al_r_fl_02	Eucalyptus tereticornis communities RE 12.3.11		Albert	Y		RE 12.3.11 provides habitat for flora and fauna and is subject to a number of threatening processes in the coastal catchments. Remnant pockets have good biodiversity. REs 12.3.3, 12.3.7, 12.3.11 in flood plain or riverine system contain E. tereticornis, although the expert panel decision relates specifically to 12.3.11.	6.3.1	3

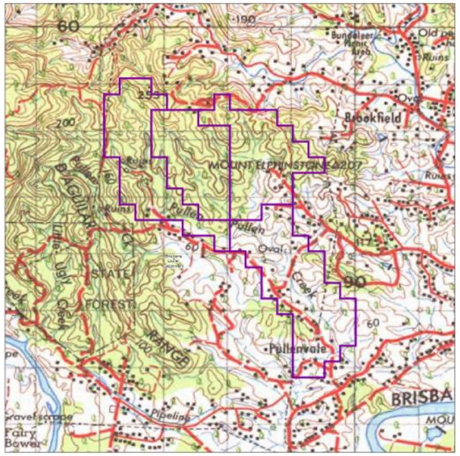
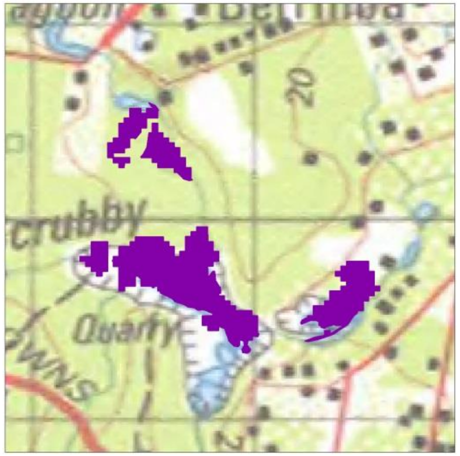
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
al_r_fl_04	Albert black tea tree gallery		Albert	Y		RE 12.3.1/12.3.7 along Canungra Creek: Melaleuca bracteata, Melaleuca viminalis, riverine gallery woodland. Significant macrophyte beds - Potamogeton habitat. Some riparian areas are disturbed. Unique within the Albert study area.	5.2.1	3
bb_r_fl_01	Eucalyptus tereticornis communities RE 12.3.11		Brisbane Upper	Y		RE 12.3.11 provides habitat for flora and fauna and is subject to a number of threatening processes in the coastal catchments. Remnant pockets have good biodiversity. REs 12.3.3, 12.3.7, 12.3.11 in flood plain or riverine system contain E. tereticornis, although the expert panel decision relates specifically to 12.3.11.	6.3.1	3

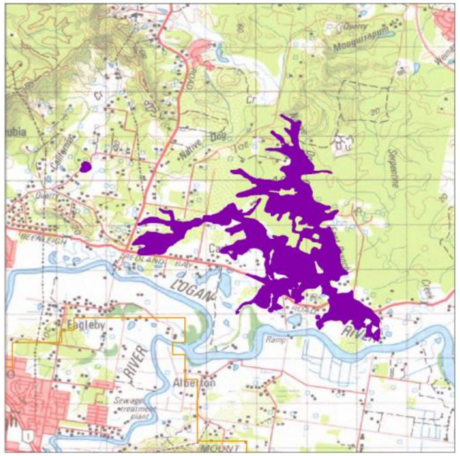
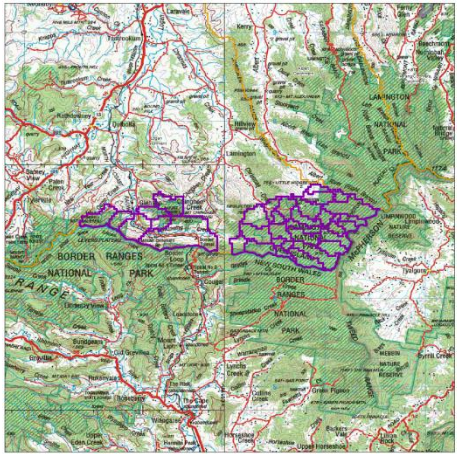
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bi_nr_fl_01	Melaleuca swamp/heath		Bribie Island		Y	Melaleuca swamp/heath ecotone mosaic on the southern part of the island. Similar values to analogous mainland decision.	5.2.1, 6.3.1	3,3
bi_nr_fl_02	Central swamp and littoral lagoons		Bribie Island		Y	Swamps of paperbark/heath mixture in good condition on the northern and central part of island.	6.3.1	4

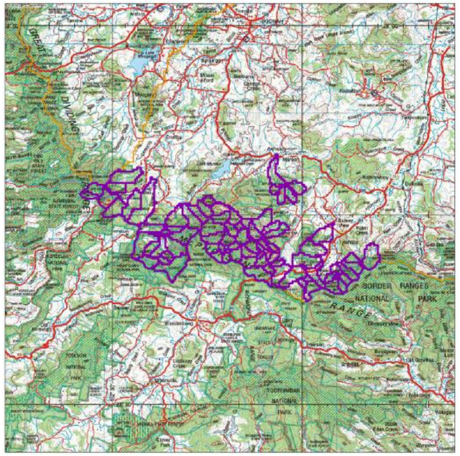
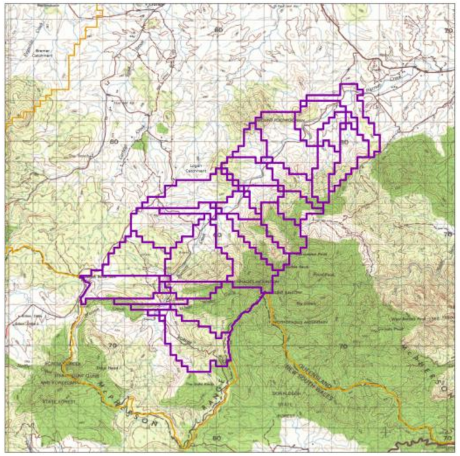
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bi_nr_fl_03	Coastal wet heathlands		Bribie Island		Y	Wet heathland - remnant coastal heaths with high values for endemism, refugia, range limits and disjunct populations. Under threat from weeds, fragmentation, fire, altered hydrology and development.	5.2.1, 6.3.1	4,4
br_r_fl_01	Flora values in the headwaters of the Bremer River		Bremer	Y		Headwaters of Warrill Creek, Coulson Creek, Seven Mile Creek, Wild Cattle Creek and Reynolds Creek, where in rainforest. Actual occurrence of rainforest depends on aspect. Rainforest stream banks contain priority species as discussed previously.	6.3.1	4

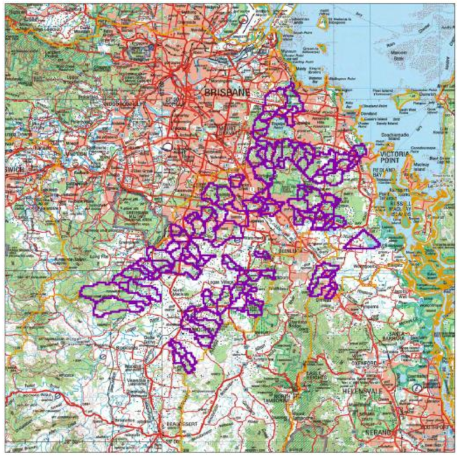
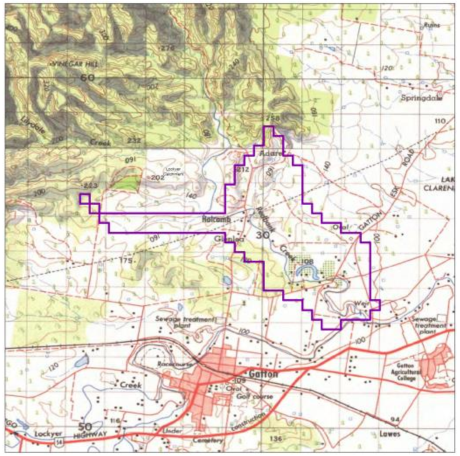
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_fl_01	Flora values in the headwaters of Enoggera Creek		Brisbane Lower	Y		See other headwaters decisions. Note that floristically all these decisions are to do with aspect. Hence westerly facing headwaters are not being included as much. For this reason they are kept as a flora special feature.	6.3.1	4
bs_r_fl_02	Eucalyptus tereticornis communities 12.3.11		Brisbane Lower	Y		RE 12.3.11 provides habitat for flora and fauna and is subject to a number of threatening processes in the coastal catchments. Decision applies to stretches of Bulimba Creek. Remnant pockets have good biodiversity. REs 12.3.3, 12.3.7, 12.3.11 in flood plain or riverine system contain E. tereticornis, although the expert panel decision relates specifically to 12.3.11.	6.3.1	3

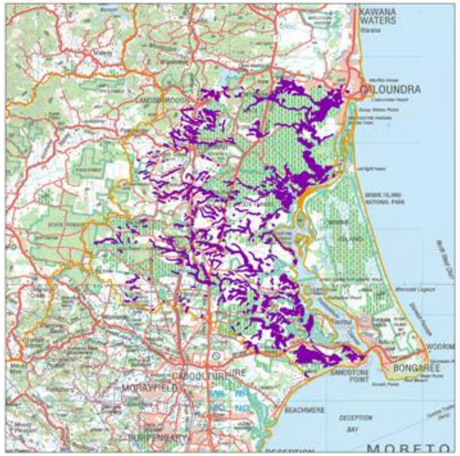
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_fl_03	Enoggera Creek, Moggill Creek, Gold Creek, Gap Creek and McKay Brook		Brisbane Lower	Y		Enoggera Creek, Moggill Creek, Gold Creek, Gap Creek and McKay Brook running through RE 12.11.5 (Corymbia citriodora subsp. variegata, Eucalyptus siderophloia, E. major open forest), RE 12.11.3 (Eucalyptus siderophloia, E. propinqua +/- E. microcorys, Lophostemon confertus, Corymbia intermedia, E. acmenoides open forest) and RE 12.11.10 (Notophyll vine forest +/- Araucaria cunninghamii), on metamorphics +/- interbedded volcanics.	6.3.1	3
bs_r_fl_04	Tingalpa Wetland Reserve (Tinglapa and Hemmant Rd) and Nungubba Swamp.		Brisbane Lower	Y		Refuge and food supply. Triglochin microtuberosum not seen in Brisbane for 100 years. Dec: reep_bcc_3, BM-T2/010, BM-T1/010	6.3.1	4

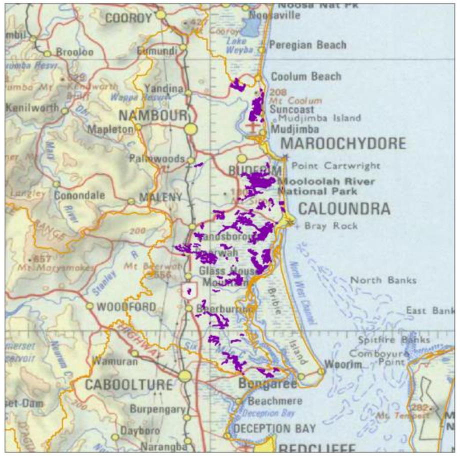
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_fl_05	Pullenvale Forest Park.		Brisbane Lower	Y		Size and age of remnant vegetation significant. Dec: reep_bcc_4, WPU PL/020	5.2.1	2
lg_nr_fl_05	Berrinba wetlands		Logan		Y	Berrinba wetlands. Once a larger system and now compromised by urban development. Habitat for a variety of birds including ducks, egrets and the little grassbird.	6.3.1	3

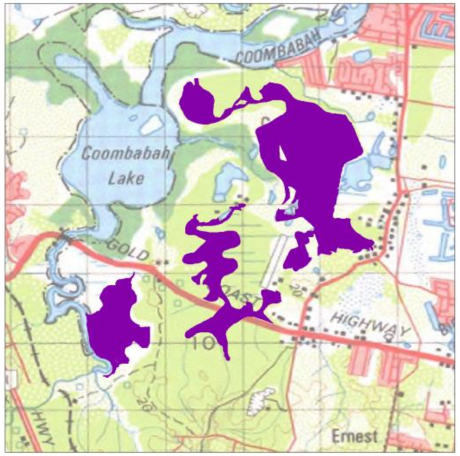
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
lg_nr_fl_06	Coastal wet heathlands		Logan		Y	Wet heathland - remnant coastal heaths with high values for endemism, refugia, range limits and disjunct populations. Under threat from weeds, fragmentation, fire, altered hydrology and development.	5.2.1,6.3.1	4,4
lg_r_fl_01	Flora values in Lamington watercourses		Logan	Y		Same values as nc_r_fl_01: High plant diversity and the sole habitat for some priority species.	5.2.1, 6.3.1	4,4

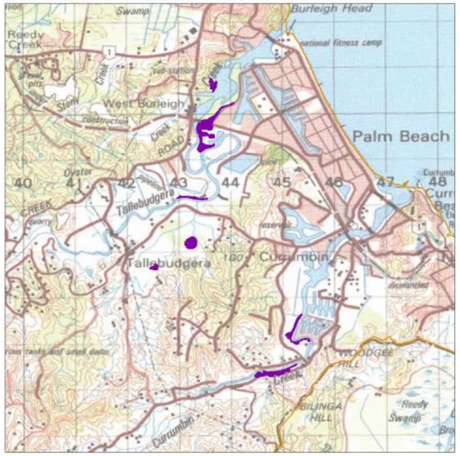
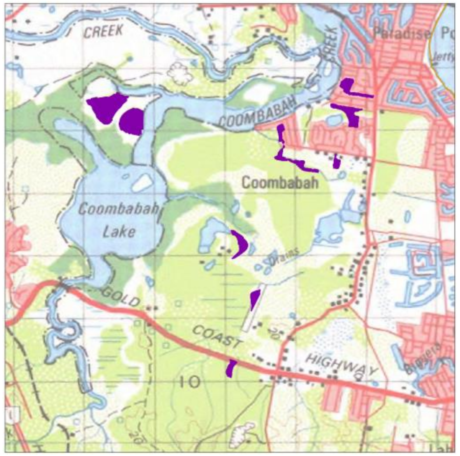
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
lg_r_fl_02	Mt Barney streams		Logan	Y		Mount Barney wet schlerophyll forests. Gorges provide unique floristic habitats, high cool wet systems at elevation. High kinetic energy rainforest streams. Recruitment of Nothofagus moorei (Antarctic beech).	6.3.1	4
lg_r_fl_03	Burnett Creek above the dam		Logan	Y		Melaleuca bracteata, Melaleuca viminalis present and significant macrophyte beds - Potamogeton habitat. Burnett Creek above Maroon Dam (Logan catchment component). Some riparian areas are disturbed.	5.2.1	3

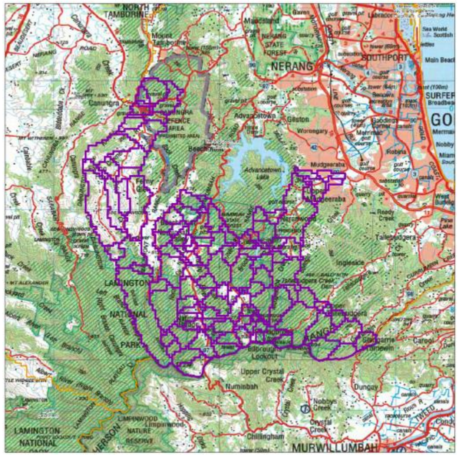
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
lg_r_fl_04	Eucalyptus tereticornis communities 12.3.11		Logan	Y		RE 12.3.11 provides habitat for flora and fauna and is subject to a number of threatening processes in the coastal catchments. Remnant pockets have good biodiversity. REs 12.3.3, 12.3.7, 12.3.11 in flood plain or riverine system contain E. tereticornis, although the expert panel decision relates specifically to 12.3.11.	6.3.1	3
ly_r_fl_01	Eucalyptus tereticornis communities 12.3.11		Lockyer	Y		RE 12.3.11 provides habitat for flora and fauna and is subject to a number of threatening processes in the coastal catchments. Remnant pockets have good biodiversity. REs 12.3.3, 12.3.7, 12.3.11 in flood plain or riverine system contain E. tereticornis, although the expert panel decision relates specifically to 12.3.11.	6.3.1	3

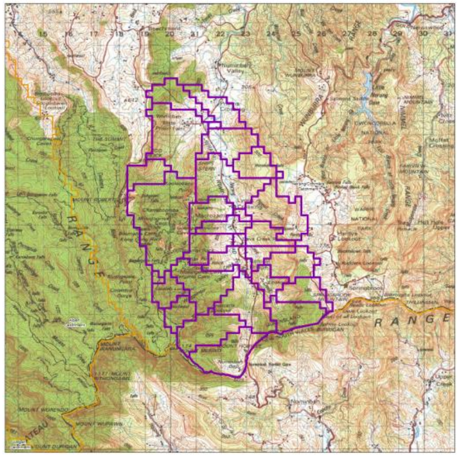
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
mb_nr_fl_01	Coastal wet heathlands		Moreton Bay Islands		Y	Wet heathland - remnant coastal heaths with high values for endemism, refugia, range limits and disjunct populations. Under threat from weeds, fragmentation, fire, altered hydrology and development.	5.2.1, 6.3.1	4,4
mc_nr_fl_02	Paperbark swamps		Maroochy		Y	Paperbark swamps - BPA decision seq_fl_15. Under threat from destruction and degradation. Possibly apply in other study areas.	5.2.1,6.3.1	3,3

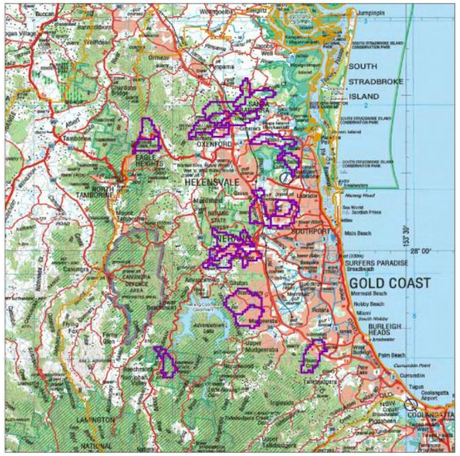
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
mc_nr_fl_03	Coastal wet heathlands		Maroochy		Y	Wet heathland - remnant coastal heaths with high values for endemism, refugia, range limits and disjunct populations. Under threat from weeds, fragmentation, fire, altered hydrology and development.	5.2.1, 6.3.1	4,4
mc_r_fl_01	Eucalyptus tereticornis communities 12.3.11		Maroochy	Y		RE 12.3.11 provides habitat for flora and fauna and is subject to a number of threatening processes in the coastal catchments. Remnant pockets have good biodiversity. REs 12.3.3, 12.3.7, 12.3.11 in flood plain or riverine system contain E. tereticornis, although the expert panel decision relates specifically to 12.3.11.	6.3.1	3

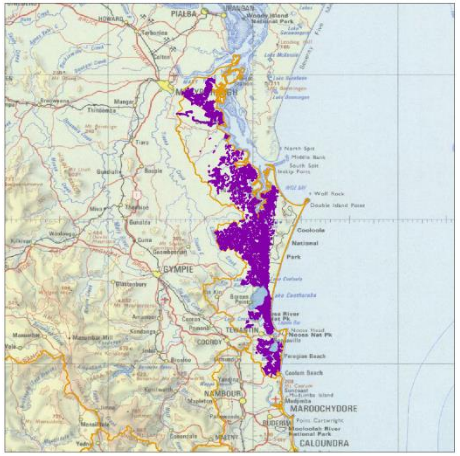
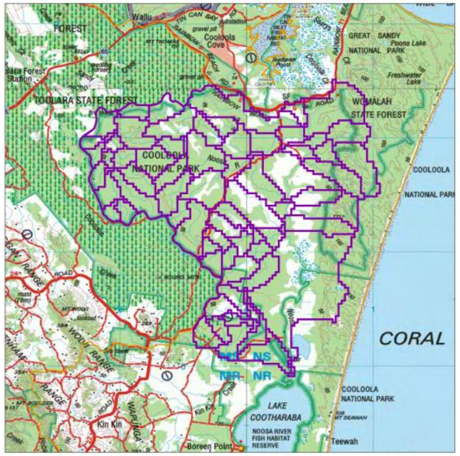
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
nc_nr_fl_02	Coombabah Lakelands C.A. paperbark swamp (large patches)		Nerang Coomera		Y	Periodically inundated paperbark swamp (RE 12.3.5 and 12.3.6.). Same values as Melaleuca swamp in other areas. Adjacent to Coombaba wetlands which is a feeding area for fauna. Largest area remaining on the Gold Coast. Three biggest patches get a conservation rating of 4.	5.2.1, 6.3.1	4,4
nc_nr_fl_03	Burleigh Waters paperbark in middle of the Gold Coast		Nerang Coomera		Y	Periodically inundated paperbark swamp forest. Core remnant in the middle of the Gold Coast. Same values as nc_nr_fl_02.	5.2.1, 6.3.1	4,4

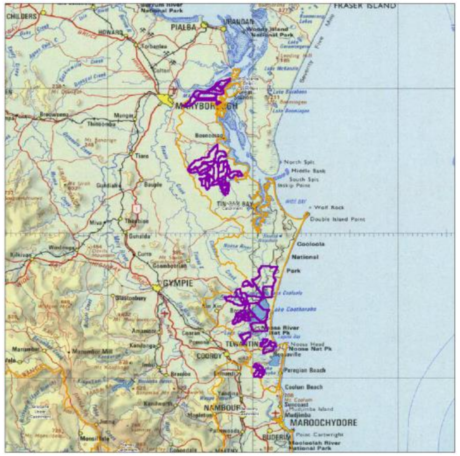
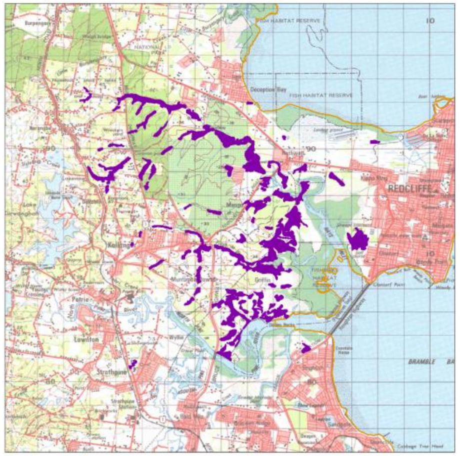
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
nc_nr_fl_04	Tallebudgera Creek paperbark		Nerang Coomera		Y	Periodically inundated paperbark swamp forest (RE 12.3.5a and 12.3.6). Same values as smaller areas of nc_nr_fl_02.	5.2.1, 6.3.1	3,3
nc_nr_fl_06	Coombabah Lakelands C.A. paperbark swamp (small patches)		Nerang Coomera		Y	Periodically inundated paperbark swamp (RE 12.3.5 and 12.3.6). Same values as Melaleuca swamp in other areas. Adjacent to Coombaba wetlands, feeding area for fauna. Largest area remaining on the Gold Coast. Smaller patches get a conservation rating of 3 due to threatening processes and fragmentation.	5.2.1, 6.3.1	3,3

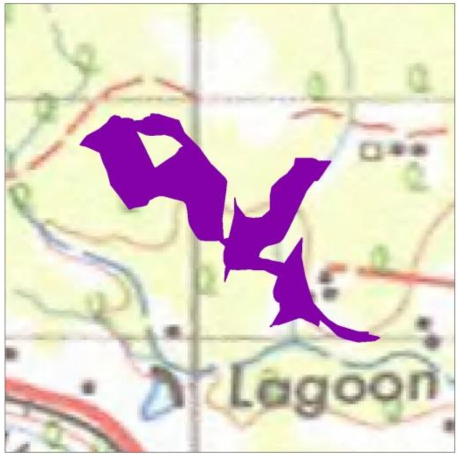
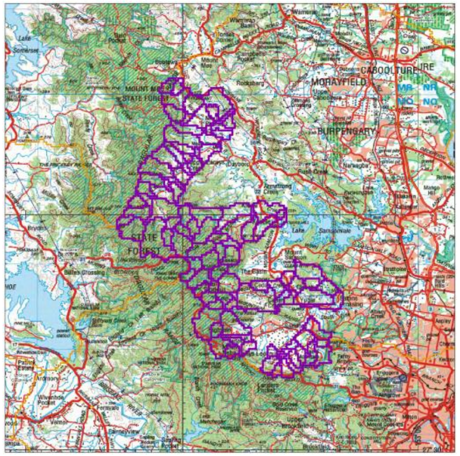
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
nc_nr_fl_07	Coastal wet heathlands		Nerang Coomera		Y	Wet heathland - remnant coastal heaths with high values for endemism, refugia, range limits and disjunct populations. Under threat from weeds, fragmentation, fire, altered hydrology and development.	5.2.1, 6.3.1	4,4
nc_r_fl_01	Headwaters of Currumbin, Tallebudgera creeks, Nerang and Coomera rivers		Nerang Coomera	Y		Rainforests in the headwaters of Tallebudgera Creek includes BVGs: 6. Notophyll vine forest and microphyll fern forest to thicket on high peaks and plateaux 2. Complex to simple, semi-deciduous mesophyll to notophyll vine forest, sometimes with Araucaria cunninghamii. 5. Notophyll to microphyll vine forests, frequently with Araucaria spp. or Agathis spp. High plant diversity and the sole habitat for some priority species along headwaters of Currumbin and Tallebudgera Creeks. (Also Coomera River, Tony's Creek, Purling Brook, Mudgeeraba Creek, Mount Cougal Creek?). New macroinvertebrate species recently discovered here. Linked in to Springbrook Plateau and Mount Warning shield. Headwaters all contain rainforest canopy. Actual occurrence of rainforest depends on aspect..	5.2.1, 6.3.1	4,4

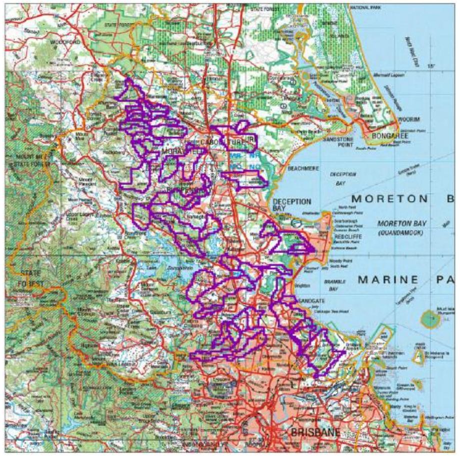
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
nc_r_fl_02	Riparian vegetation Numinbah Valley		Nerang Coomera	Y		Intact riparian vegetation extends across the valley providing connections. Mosaic of different riparian vegetation cover and habitat for threatened species. Impacted by catsclaw and balloon vine.	6.3.1	3
nc_r_fl_03	Old growth riparian trees		Nerang Coomera	Y		Veteran trees along Coomera River. Old growth riparian trees along anabranches.	6.3.1, 5.1.1	3,3

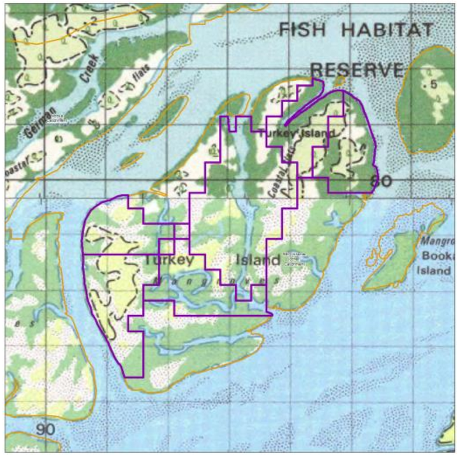
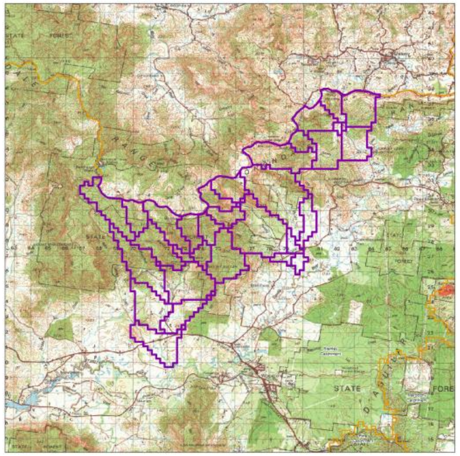
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
nc_r_fl_04	Casuarina cunninghamiana		Nerang Coomera	Y		Casuarina cunninghamiana - priority species habitat. Coomera River and Tallebudgera Creek. Remnant depauperate stands of the species. Important for fauna habitat.	5.2.1	3
nc_r_fl_05	Eucalyptus tereticornis communities 12.3.11		Nerang Coomera	Y		RE 12.3.11 provides habitat for flora and fauna and is subject to a number of threatening processes in the coastal catchments. Remnant pockets have good biodiversity. REs 12.3.3, 12.3.7, 12.3.11 in flood plain or riverine system contain E. tereticornis, although the expert panel decision relates specifically to 12.3.11.	6.3.1	3

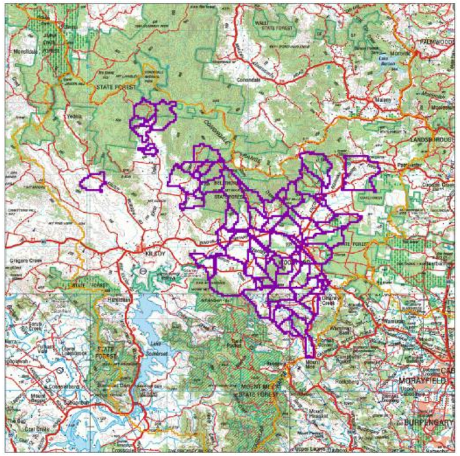
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
ns_nr_fl_02	Coastal wet heathlands		Noosa		Y	Wet heathland - remnant coastal heaths with high values for endemism, refugia, range limits and disjunct populations. Under threat from weeds, fragmentation, fire, altered hydrology and development.	5.2.1, 6.3.1	4,4
ns_r_fl_01	Undisturbed wallum ecosystem upper Noosa catchment		Noosa	Y		Undisturbed wallum ecosystem in good condition - acidic waters - Lepironia habitat. In the Upper Noosa catchment.	5.2.1, 6.3.1, 6.4.1, 6.1.1	4,4,4,4

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
ns_r_fl_02	Eucalyptus tereticornis communities 12.3.11		Noosa	Y		RE 12.3.11 provides habitat for flora and fauna and is subject to a number of threatening processes in the coastal catchments. Remnant pockets have good biodiversity. REs 12.3.3, 12.3.7, 12.3.11 in flood plain or riverine system contain E. tereticornis, although the expert panel decision relates specifically to 12.3.11.	6.3.1	3
pn_nr_fl_01	Hays Inlet		Pine		Y	Melaleuca swamps - RE 12.3.5 and 12.3.6. Significant wetland complex surrounded by urban development. Highly valued by local community. Similar values to Melaleuca communities elsewhere.	5.2.1, 6.3.1	4,4

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
pn_nr_fl_02	Coastal wet heathlands		Pine		Y	Wet heathland - remnant coastal heaths with high values for endemism, refugia, range limits and disjunct populations. Under threat from weeds, fragmentation, fire, altered hydrology and development.	5.2.1, 6.3.1	4,4
pn_r_fl_02	Flora values in the D'Aguilar headwaters		Pine	Y		D'Aguilar headwaters of Caboolture and Pine Rivers. Narrow gorge rainforests (see previous headwater decisions).	6.3.1	4

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
pn_r_fl_03	Eucalyptus tereticornis communities 12.3.11		Pine	Y		RE 12.3.11 provides habitat for flora and fauna and is subject to a number of threatening processes in the coastal catchments. Remnant pockets have good biodiversity. REs 12.3.3, 12.3.7, 12.3.11 in flood plain or riverine system contain E. tereticornis, although the expert panel decision relates specifically to 12.3.11.	6.3.1	3
sb_nr_fl_01	Coastal wet heathlands		Stradbroke Islands		Y	Wet heathland - remnant coastal heaths with high values for endemism, refugia, range limits and disjunct populations. Under threat from weeds, fragmentation, fire, altered hydrology and development.	5.2.1, 6.3.1	4,4

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
si_r_fl_01	Eucalyptus tereticornis communities 12.3.11		SEQ islands (other)		Y	RE 12.3.11 provides habitat for flora and fauna and is subject to a number of threatening processes in the coastal catchments. Remnant pockets have good biodiversity. REs 12.3.3, 12.3.7, 12.3.11 in flood plain or riverine system contain E. tereticornis, although the expert panel decision relates specifically to 12.3.11.	6.3.1	3
sl_r_fl_01	Flora values in the Stanley headwaters		Stanley		Y	Narrow gorge rainforests. Similar values to pn_r_fl_02:	6.3.1	4

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
sl_r_fl_02	Eucalyptus tereticornis communities 12.3.11		Stanley		Y	RE 12.3.11 provides habitat for flora and fauna and is subject to a number of threatening processes in the coastal catchments. Remnant pockets have good biodiversity. REs 12.3.3, 12.3.7, 12.3.11 in flood plain or riverine system contain E. tereticornis, although the expert panel decision relates specifically to 12.3.11.	6.3.1	3

4 Fauna

4.1 Near threatened and threatened fauna

The panel identified 38 threatened or near threatened taxa (Table 7). Twelve were listed as endangered, 14 vulnerable and 12 near threatened. Species that qualify for this measure must be listed as Endangered, Vulnerable or Near-threatened under the NCA and / or listed as Critically Endangered, Endangered, or Vulnerable under the EPBC

Table 7. Threatened and near threatened aquatic dependent fauna species listed under Queensland and/or Commonwealth legislation

This list was used to calculate the values for measure 4.1.1 in the AquaBAMM assessment.

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	NCA[3]	EPBC[4]	COMMENTS
Adelotus brevis	tusked frog	Y	Y	V		
Argyreus hyperbius inconstans	Australian fritillary		Y	E		
Bidyanus bidyanus	silver perch	Y			CE	Translocated
Botaurus poiciloptilus	Australasian bittern		Y		E	
Crinia tinnula	wallum froglet		Y	V		Use model (essential habitat-core only) instead of records
Ephippiorhynchus asiaticus	black-necked stork	Y	Y	NT		
Hemiaspis damelii	grey snake		Y	E		
Kyarranus kundagungan	red-and-yellow mountainfrog	Y		NT		Associated with seepages near streams. Also away from stream. Use all records including spp
Kyarranus loveridgei	masked mountainfrog	Y		NT		
Lewinia pectoralis	Lewin's rail	Y	Y	NT		
Litoria brevipalmata	green-thighed frog	Y	Y	NT		Headwaters of riverine
Litoria cooloolensis	Cooloola sedgefrog		Y	V		Use model (essential habitat-core only) instead of records.

1 Riverine

2 Non-riverine

3 Queensland Nature Conservation Act 1992 (E – endangered, V – vulnerable, NT – near threatened)

4 Environment Protection and Biodiversity Conservation Act 1999 (E – endangered, V – vulnerable)

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	NCA[3]	EPBC[4]	COMMENTS
Litoria freycineti	wallum rocketfrog		Y	V		Use model (essential habitat-core only) instead of records
Litoria olongburensis	wallum sedgefrog		Y	V	V	Use model (essential habitat-core only) instead of records
Litoria pearsoniana	cascade treefrog	Y		NT		
Litoria revelata	whirring treefrog	Y	Y	NT		Mostly non-riverine
Litoria sp. cf. *cooloolensis* (North Stradbroke Is pop.)	'North Stradbroke' sedgefrog		Y	E		Use model (essential habitat-core only) instead of records
Maccullochella ikei?/sp.	eastern cod/cod sp.	Y		E	E	
Maccullochella mariensis	Mary River cod	Y			E	
Maccullochella peelii	Murray cod	Y		V	V	Translocated
Mixophyes fleayi	Fleay's barred frog	Y		E	E	
Mixophyes iteratus	giant barred frog	Y		E	E	
Nannoperca oxleyana	Oxleyan pygmy perch	Y	Y	V	E	
Neoceratodus forsteri	Australian lungfish	Y			V	
Nettapus coromandelianus	cotton pygmy-goose	Y	Y	NT		
Ornithoptera richmondia	Richmond birdwing	Y		V		Food/breed source plant is riparian associated
Pezoporus wallicus	ground parrot		Y	V		Use model (essential habitat-core only) instead of records
Podargus ocellatus plumiferus	plumed frogmouth	Y		V		Riparian association strong. Geoff Smith supports inclusion
Pseudomugil mellis	honey blue eye	Y	Y	V	V	
Pteropus poliocephalus	grey-headed flying-fox	Y	Y		V	Camp records only, often associated with wetlands.
Rheobatrachus silus	southern gastric brooding frog	Y		E	EX	Possibly extinct
Rostratula australis	Australian painted snipe	Y	Y	V	E	
Saproscincus spectabilis		Y		NT		Riparian association
Stictonetta naevosa	freckled duck	Y	Y	NT		

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	NCA[3]	EPBC[4]	COMMENTS
Stipiturus malachurus	southern emu-wren		Y	V		
Tadorna radjah	radjah shelduck	Y	Y	NT		
Taudactylus diurnus	southern dayfrog	Y		E	EX	Possibly extinct
Xeromys myoides	water mouse	Y	Y	V	V	Also estuarine

4.2 Priority fauna

A priority species is not listed as endangered, vulnerable or near threatened, and must exhibit one or more of the following significant values:

1. is endemic to the study area (>75% of its distribution is in the study area/catchment);
2. has experienced, or is suspected of experiencing, a serious population decline;
3. has experienced a significant reduction in its distribution and has a naturally restricted distribution in the study area/catchment;
4. is currently a small population and threatened by loss of habitat;
5. is a significant disjunct population;
6. is a migratory species (other than birds); and/or
7. is a significant proportion of the breeding population (>1% for waterbirds, >75% other species) occurs in a specific waterbody (see Ramsar criterion 6 for waterbirds).

4.2.1 Priority species

Sixty one aquatic dependent fauna taxa were listed by the panel (Table 8). Of these, 43 were invertebrates (worm, molluscs, crustaceans and insects) and 18 were vertebrates (fish, amphibians, reptiles, birds and mammals).

Table 8. Priority aquatic dependent fauna species

This list was used to calculate the values for measure 5.1.1 in the AquaBAMM assessment.

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	CRITERIA[3]	COMMENTS
Acanthaeschna victoria	thylacine darner	Y	Y	1, 2, 4	Very rare, confined to coastal SEQ & north NSW. Listed as Vulnerable IUCN Red List (2014). In need of conservation status in Qld. Larval habitat unknown, probably salt marshes
Anguilla australis	southern shortfin eel	Y	Y	6	
Anguilla reinhardtii	longfin eel	Y	Y	6	
Antipodoecia turneri	caddisfly	Y		4	Sole representative of family Antipodoeciidae. Use all EHMP family records. Rare in SEQ
Aphroteniella filicornis	non-biting midge	Y		2, 4	Rare in SEQ, cool rainforest streams (southern fauna element) SEQ northernmost distribution. In need of conservation status in Qld
Aphroteniella tenuicornis	non-biting midge	Y		2, 4	Rare in SEQ, cool rainforest streams (southern fauna element) recorded south of Brisbane only (Gold Coast hinterland); SEQ northernmost distribution
Archaeophya adamsi	horned urfly	Y		2, 4, 5	One of Australia's rarest dragonflies, known from a few locations in SEQ and around Sydney. Listed endangered in NSW. In need of conservation status in Qld

1 Riverine

2 Non-riverine

3 The priority numbers are the values that a species must exhibit to be a priority species as listed in dot points above Table 8

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	CRITERIA[3]	COMMENTS
Austremerella picta	mayfly	Y		2, 4	
Austroargiolestes chrysoides	golden flatwing	Y		1, 3	Rare, montane rainforest - restricted to SEQ, Moreton Bay Region southernmost distribution
Austrolestes minjerriba	dune ringtail		Y	1, 2, 5	Very rare, confined to islands SEQ (Frazer, Nth Stradbroke, Moreton islands). Listed as Endangered IUCN Red List (2014). In need of conservation status in Qld
Austrosimulium mirabile	blackfly	Y		1, 2, 5	Rare, very limited distribution, but then in good population densities, foothill streams
Barynema australicum	caddisfly	Y		4	Rare (Moreton Bay Region northernmost distribution); fast flowing (cool) largely permanent upland forest streams, rocks & logs
Biziura lobata	musk duck	Y	Y	4	Small threatened pop. Occurs on Lake Samsonvale. Usually one per lake. Aggressive and need large territory, although low density down south
Cherax dispar	slender yabby		Y	2	Restricted distribution; loss/fragmentation of coastal habitat
Cherax robustus	sand yabby		Y	2	Loss of coastal habitat (SEQ Fauna Panel 2007)
Cosmioperla denise	stonefly	Y		1, 4	Very rare, in SEQ restricted to fast flowing (cool) largely permanent upland forest streams, rocks. In need of conservation status in Qld
Cucumerunio novaehollandiae	Australian river mussel	Y		2	Endemic to the coastal rivers of NSW and QLD, from Hunter to Burnett Rivers. Decreasing pop - IUCN Red List (2014) as Data Deficient
Cyclorana alboguttata	greenstripe frog		Y	2, 4	Burrowing frogs associated with alluvial systems. Major loss of habitat. Range limits. Associated with river flats, but not directly reliant on stream habitat
Cyclorana brevipes	superb collared frog		Y	2, 4	Burrowing frogs associated with alluvial systems. Major loss of habitat. Range limits. Associated with river flats, but not directly reliant on stream habitat
Elseya albagula	southern snapping turtle	Y		5	Will be listed soon. It is a 2 priority in areas outside SEQ
Euastacus binzayedi	freshwater crayfish	Y		1	Restricted to Lamington NP
Euastacus hystricosus	giant spiny crayfish	Y		4	Restricted distribution, Endangered in Coughran & Furse (2010)
Euastacus jagara	freshwater crayfish	Y		1, 2	Endemic; Critically Endangered in Coughran & Furse (2010)

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	CRITERIA[3]	COMMENTS
Euastacus maidae	freshwater crayfish	Y		1, 2	Endemic; Critically Endangered in Coughran & Furse (2010)
Euastacus setosus	freshwater crayfish	Y		1, 2	Endemic; Critically Endangered in Coughran & Furse (2010)
Euastacus sulcatus	freshwater crayfish	Y		1, 2	Endemic; Vulnerable in Coughran & Furse (2010)
Euastacus urospinosus	rainforest crayfish	Y		4	Restricted distribution, Endangered in Coughran & Furse (2010) or Near Threatened in McCormack & van der Werf (2013)
Euastacus valentulus	freshwater crayfish	Y		4	Restricted distribution in SEQ
Fluvidona anodonta	North Pine River freshwater snail	Y		1, 2	Endemic to SEQ (Pine River catchment); assumed endemic to Pine River catchment. Listed as Vulnerable IUCN Red List (2014). In need of conservation status in Qld
Gobiomorphus coxii	Cox gudgeon	Y		1, 3	Found in Logan , Albert, Currumbin Ck, Teviot Bk, Tallebudgera Ck - clear water upper stream - restricted
Griseargiolestes albescens	coastal flatwing	Y	Y	1, 4	Uncommon, wallum swamps to foothill streams, restricted to SEQ & north-east NSW. Restricted range - habitat loss - wallum swamp (SEQ Fauna Panel 2007)
Helicopha queenslandensis	caddisfly	Y		1	Rare [rareness of habitat in SEQ] montane, cool shaded streams, waterfilm over rock (hygropetric habitat) often associated with moss
Hyalopsyche disjuncta	caddisfly	Y		4	Sole representative of family Dipseudopsidae in Australia. Use all EHMP family records. Rare in SEQ
Ixobrychus dubius	Australian little bittern	Y	Y	4	Data deficient. Cryptic. Concerns raised in literature. Specific habitat requirements? Habitat affected in sub-coastal areas especially due to cattle and clearing for flood mitigation
Junonia hedonia zelima	brown argus		Y	4	Rare (SEQ Fauna Panel 2007). Habitat loss - melaleuca swamp/gully
Kuhlia rupestris	jungle perch	Y		3, 6	
Limnodynastes salmini	salmon striped frog		Y	2, 4	Burrowing frogs associated with alluvial systems. Major loss of habitat. Range limit
Macquaria novemaculeata	Australian bass	Y		2,6	
Mirawara purpurea	mayfly	Y		2, 4	Cool fast flowing headwaters, cobble - in SEQ in rainforest steams, wide-spread but in low numbers. Rare, in need of conservation status in Qld
Mugil cephalus	sea mullet	Y		2	Much reduced due to barrages

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	CRITERIA[3]	COMMENTS
Ophisternon gutturale	swamp eel	Y	Y	4, 5	Southern limit of range
Ophisternon sp.	swamp eel sp.	Y	Y	4, 5	Southern limit of range
Ornithorhynchus anatinus	platypus	Y	Y	2, 4	Threatened by opera traps, changes in water level in impoundments, and water releases
Orthetrum boumiera	brownwater skimmer		Y	1, 4	Confined to coastal dune lakes in SEQ and north-eastern NSW. In need of conservation status in Qld
Orthotrichia new sp 'caboolture' [*O. aberrans*-group]	micro-caddisfly	Y		1, 4	Very rare; *O. aberrans*-group is the only parasitic caddisfly taxon; Australian endemic; undescribed sp. (adult not yet known), Only record Gregorys Ck, Caboolture R tributary
Ovolara australis	riffle beetle	Y		1, 4	Rare in SEQ; restricted to coastal NSW & SEQ in foothills (northernmost distribution)
Oxyura australis	blue-billed duck	Y	Y	3, 4, 5	Relisted under action plan by Steve Garnett as Near Threatened. Found in Lockyer lowlands and Beaudesert. Breeding population
Petalura litorea	coastal petaltail		Y	1, 2, 4	Rare, confined to islands in SEQ & north NSW, wallum swamps, record 18-Mile Swamp Nth Stradbroke. Listed as Near Threatened (but stable) IUCN (2014). In need of conservation status in Qld
Podonomopsis evansi	non-biting midge	Y		2, 4	Rare in SEQ (seems to tolerate some eutrophication) shaded streams; SEQ northernmost distribution
Rhadinocentrus ornatus	ornate rainbowfish	Y	Y	1, 2, 3, 4	Associated with wallum ecosystems
Rhizodrilus arthingtonae	freshwater worm		Y	1, 4	Endemic to North Stradbroke Island; Brown Lake type locality
Tasimia sp.	caddisfly	Y		4, 5	Uncommon, cool upland streams, rainforest, boulders & cobbles
Telephlebia cyclops	northern evening darner	Y		4, 5	Rare, rainforest upland streams near waterfalls, habitat rare in SEQ; In need of conservation status in Qld
Telephlebia godeffroyi	eastern evening darner	Y		3	In need of conservation status in Qld
Telephlebia tryoni	coastal evening darner	Y		1, 4	Restricted distribution. In need of conservation status in Qld
Telicota eurychlora	southern sedge darter	Y	Y	4	Habitat loss - swamps & watercourses; Vulnerable in Sands & New (2002)
Tenuibranchiurus glypticus	swamp crayfish		Y	1, 2, 4	Very rare, known only from SEQ (greater Brisbane, Sunshine Coast) Wallum swamps. Listed as Endangered IUCN Red List (2014). Habitat loss (SEQ Expert Panel (2007)

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	CRITERIA[3]	COMMENTS
Tisiphone abeona morrisi	varied swordgrass brown (North Coast subsp.)		Y	2	Threatened - loss of *Gahnia* wetlands; Critically Endangered in Sands & New (2002)
Trachystoma petardi	pinkeye mullet	Y		2, 4, 6	Loss of habitat, fish barriers an issue
Triplexa villa	long-horned caddisfly	Y		4	Rare [rareness of habitat in SEQ] upland cool shaded streams, hygropetric and splash-zone
Westriplectes angelae	long-horned caddisfly		Y	4, 5	Rarely recorded; larvae unknown and might be marine

4.2.2 Migratory species

Of the taxa currently listed under international agreements, 20 birds were identified by the panel as being dependent on riverine or non-riverine environments in SEQ (Table 9).

Table 9. Migratory species listed under international agreements

This list was used to calculate the values for measure 5.1.3 in the AquaBAMM assessment.

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	AGREEMENT[3]	COMMENTS
Acrocephalus australis	Australian reed-warbler	Y	Y	B	
Actitis hypoleucos	common sandpiper	Y		C/J/R/B	
Ardea ibis	cattle egret	Y	Y	C/J	
Ardea modesta	eastern great egret	Y	Y	C/J	
Calidris acuminata	sharp-tailed sandpiper		Y	C/J/R/B	
Calidris ferruginea	curlew sandpiper		Y	C/J/R/B	
Calidris melanotos	pectoral sandpiper		Y	J/R/B	
Charadrius bicinctus	double-banded plover		Y	B	
Chlidonias leucopterus	white-winged black tern		Y	C/J/R	Also estuarine
Gallinago hardwickii	Latham's snipe	Y	Y	C/J/R/B	
Haliaeetus leucogaster	white-bellied sea-eagle	Y	Y	C	
Hydroprogne caspia	Caspian tern	Y	Y	C/J	
Limicola falcinellus	broad-billed sandpiper		Y	C/J/R/B	Also estuarine
Limosa limosa	black-tailed godwit		Y	C/J/R/B	Also estuarine
Pandion cristatus	eastern osprey	Y	Y	B	
Plegadis falcinellus	glossy ibis		Y	C/B	
Rostratula australis	Australian painted snipe	Y	Y	C	
Tringa glareola	wood sandpiper		Y	C/J/R/B	
Tringa nebularia	common greenshank		Y	C/J/R/B	Also estuarine
Tringa stagnatilis	marsh sandpiper		Y	C/J/R/B	Also estuarine

1 Riverine

2 Non-riverine

4.3 Species richness

Species richness (i.e. total number of species) was scored for each class of fauna - amphibians (frogs), fish, reptiles, waterbirds, mammals and macroinvertebrates.

4.3.1 Amphibian richness

The panel listed 46 frog taxa for the SEQ region (Table 10). Of these 31 were considered riverine breeders (measure 3.1.1) while 37 bred in non-riverine environments (measure 3.1.6).

Table 10. Richness of native aquatic dependent amphibians

This list was used to calculate the values for measure 3.1.1 (riverine breeders) and 3.1.6 (non-riverine breeders) in the AquaBAMM assessment.

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Adelotus brevis	tusked frog	Y	Y	
Crinia parinsignifera	beeping froglet	Y	Y	Added riverine - often in unconnected or partially connected pools along major drainages
Crinia signifera	clicking froglet	Y	Y	
Crinia tinnula	wallum froglet		Y	Use model (essential habitat-core only) instead of records
Cyclorana alboguttata	greenstripe frog		Y	Burrowing frogs associated with alluvial systems. Major loss of habitat. Range limits. Associated with river flats, but not directly reliant on stream habitat
Cyclorana brevipes	superb collared frog		Y	Burrowing frogs associated with alluvial systems. Major loss of habitat. Range limits. Associated with river flats, but not directly reliant on stream habitat
Kyarranus kundagungan	red-and-yellow mountainfrog	Y		Often breeds in seepage areas along streams, high in the upper catchment of riverine systems
Kyarranus loveridgei	masked mountainfrog	Y		Often breeds in seepage areas along streams, high in the upper catchment of riverine systems
Lechriodus fletcheri	black soled frog	Y	Y	
Limnodynastes dumerilii	grey bellied pobblebonk	Y	Y	
Limnodynastes peronii	striped marshfrog	Y	Y	
Limnodynastes salmini	salmon striped frog		Y	Burrowing frogs associated with alluvial systems. Major loss of habitat. Range limits
Limnodynastes tasmaniensis	spotted grassfrog		Y	

1 Riverine

2 Non-riverine

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Limnodynastes terraereginae	scarlet sided pobblebonk	Y	Y	In addition to breeding in non-riverine wetlands, will readily breed in pools on ephemeral creeks (typically in the upper reaches of riverine systems)
Litoria brevipalmata	green-thighed frog	Y	Y	In addition to breeding in non-riverine wetlands, will readily breed in pools on ephemeral creeks (typically in the upper reaches of riverine systems)
Litoria caerulea	common green treefrog	Y	Y	In addition to breeding in non-riverine wetlands, will occasionally breed in pools on ephemeral creeks (typically in the upper reaches of riverine systems)
Litoria chloris	orange eyed treefrog	Y	Y	
Litoria cooloolensis	Cooloola sedgefrog		Y	Use model (essential habitat-core only) instead of records
Litoria dentata	bleating treefrog	Y	Y	In addition to breeding in non-riverine wetlands, will readily breed in pools on ephemeral creeks (typically in the upper reaches of riverine systems)
Litoria fallax	eastern sedgefrog	Y	Y	
Litoria freycineti	wallum rocketfrog		Y	Use model (essential habitat-core only) instead of records
Litoria gracilenta	graceful treefrog	Y	Y	In addition to breeding in non-riverine wetlands, will readily breed in pools on ephemeral creeks (typically in the upper reaches of riverine systems).
Litoria latopalmata	broad palmed rocketfrog		Y	
Litoria nasuta	striped rocketfrog		Y	
Litoria olongburensis	wallum sedgefrog		Y	Use model (essential habitat-core only) instead of records
Litoria pearsoniana	cascade treefrog	Y		
Litoria peronii	emerald spotted treefrog	Y	Y	In addition to breeding in non-riverine wetlands, will occasionally breed in pools on ephemeral creeks (typically in the upper reaches of riverine systems)
Litoria revelata	whirring treefrog	Y	Y	Added riverine sometimes breeds in slow moving streams
Litoria rothii	northern laughing treefrog	Y	Y	In addition to breeding in non-riverine wetlands, will breed in pools on ephemeral creeks (typically in the upper reaches of riverine systems)
Litoria rubella	ruddy treefrog	Y	Y	In addition to breeding in non-riverine wetlands, will occasionally breed in pools on ephemeral creeks (typically in the upper reaches of riverine systems)
Litoria sp. cf. *cooloolensis* (Nth Stradbroke Is pop.)	'North Stradbroke' sedgefrog		Y	Use model (essential habitat-core only) instead of records
Litoria tyleri	southern laughing treefrog		Y	Possible priority species - patchy distribution, most of Qld range falls in study area - NENSW/SEQ endemic. More extensive range in southern States

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Litoria verreauxii	whistling treefrog	Y		
Litoria wilcoxii	eastern stony creek frog	Y		
Mixophyes fasciolatus	great barred frog	Y	Y	Mainly breeds along streams. Will breed in dams along ephemeral water courses in the upper catchment of riverine systems
Mixophyes fleayi	Fleay's barred frog	Y		
Mixophyes iteratus	giant barred frog	Y		
Platyplectrum ornatum	ornate burrowing frog	Y	Y	In addition to breeding in non-riverine wetlands, will readily breed in pools on ephemeral creeks (typically in the far upper reaches of riverine systems)
Pseudophryne coriacea	red backed broodfrog	Y	Y	In addition to breeding in non-riverine wetlands, will breed in pools on ephemeral creeks (typically in the far upper reaches of riverine systems)
Pseudophryne major	great brown broodfrog	Y	Y	In addition to breeding in non-riverine wetlands, will breed along ephemeral creeks (typically in the far upper reaches of riverine systems)
Pseudophryne raveni	copper backed broodfrog	Y	Y	In addition to breeding in non-riverine wetlands, will breed in pools on ephemeral creeks (typically in the far upper reaches of riverine systems)
Rheobatrachus silus	southern gastric brooding frog	Y		
Taudactylus diurnus	southern dayfrog	Y		
Uperoleia fusca	dusky gungan		Y	
Uperoleia laevigata	eastern gungan		Y	
Uperoleia rugosa	chubby gungan		Y	

4.3.2 Fish richness

Fifty-five fish taxa were listed for use in measure 3.1.2 (Table 11). This total includes at least 6 native taxa that have been introduced into the SEQ region from elsewhere in Queensland.

Table 11. Richness of native fish

This list was used to calculate the values for measure 3.1.2 in the AquaBAMM assessment.

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Ambassis agassizii	Agassiz's glassfish	Y	Y	
Amniataba percoides	barred grunter	Y	Y	
Anguilla australis	southern shortfin eel	Y	Y	
Anguilla reinhardtii	longfin eel	Y	Y	
Arrhamphus sclerolepis	snubnose garfish	Y		
Bidyanus bidyanus	silver perch	Y		Translocated
Carcharhinus leucas	bull shark	Y		
Craterocephalus marjoriae	silverstreak hardyhead	Y		
Craterocephalus stercusmuscarum	flyspecked hardyhead	Y	Y	
Galaxias maculatus	common galaxias	Y		
Glossamia aprion	mouth almighty	Y	Y	
Glossogobius giurus	tank goby	Y		
Gobiomorphus australis	striped gudgeon	Y		
Gobiomorphus coxii	Cox gudgeon	Y		Found in Logan , Albert, Currumbin Ck, Teviot Bk, Tallebudgera Ck - clear water upstream - restricted
Hypseleotris compressa	empire gudgeon	Y	Y	
Hypseleotris galii	firetail gudgeon	Y	Y	
Hypseleotris klunzingeri	western carp gudgeon	Y	Y	
Hypseleotris sp. 1	Midgley's carp gudgeon	Y	Y	
Hypseleotris sp. 2	Lake's carp gudgeon	Y	Y	
Kuhlia rupestris	jungle perch	Y		
Lates calcarifer	barramundi	Y	Y	Translocated? Climate change vagrant?

1 Riverine

2 Non-riverine

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Leiopotherapon unicolor	spangled perch	Y	Y	
Lutjanus argentimaculatus	mangrove jack	Y		Also estuarine
Maccullochella ikei?/sp.	eastern cod/cod sp.	Y		
Maccullochella mariensis	Mary River cod	Y		
Maccullochella peelii	Murray cod	Y		Translocated
Macquaria ambigua	yellowbelly	Y		Translocated
Macquaria novemaculeata	Australian bass	Y		
Megalops cyprinoides	oxeye herring/tarpon	Y	Y	
Melanotaenia duboulayi	crimsonspotted rainbowfish	Y	Y	
Mogurnda adspersa	southern purplespotted gudgeon	Y		
Mordacia mordax/sp.	shorthead lamprey	Y		Possibly undescribed taxon, significant range extension or disjunct population
Mugil cephalus	sea mullet	Y		Much reduced due to barrages
Nannoperca oxleyana	Oxleyan pygmy perch	Y	Y	
Nematalosa erebi	bony bream	Y	Y	
Neoarius graeffei	blue catfish	Y	Y	Also estuarine
Neoceratodus forsteri	Australian lungfish	Y		
Neosilurus hyrtlii	Hyrtl's catfish	Y		
Notesthes robusta	bullrout	Y		
Ophisternon gutturale	swamp eel	Y	Y	Southern limit of range
Ophisternon sp.	swamp eel sp.	Y	Y	Southern limit of range
Oxyeleotris lineolata	sleepy cod	Y		Translocated
Philypnodon grandiceps	flathead gudgeon	Y		
Philypnodon macrostomus	dwarf flathead gudgeon	Y		
Porochilus rendahli	Rendahl's catfish	Y		Include sp. records
Pseudomugil mellis	honey blue eye	Y	Y	
Pseudomugil signifer	Pacific blue eye	Y	Y	
Redigobius bikolanus	speckled goby	Y		
Redigobius macrostomus	largemouth goby	Y		
Retropinna semoni	Australian smelt	Y	Y	

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Rhadinocentrus ornatus	ornate rainbowfish	Y	Y	Associated with wallum ecosystems
Scleropages leichardti	southern saratoga	Y	Y	Translocated
Scortum barcoo	Barcoo grunter	Y		Translocated
Tandanus tandanus	freshwater catfish	Y		
Trachystoma petardi	pinkeye mullet	Y		Loss of habitat, fish barriers an issue

4.3.3 Reptile richness

Of the aquatic dependent reptiles in SEQ, 13 taxa were listed by the panel including the various forms of *Emydura macquarii* (Table 12).

Table 12. Richness of native aquatic dependent reptiles

This list was used to calculate the values for measure 3.1.3 in the AquaBAMM assessment.

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Chelodina expansa	broad-shelled river turtle	Y	Y	
Chelodina longicollis	eastern snake-necked turtle	Y	Y	
Elseya albagula	southern snapping turtle	Y		Will be listed as EVNT soon. It is a 2 priority in areas outside SEQ
Emydura macquarii krefftii	Krefft's river turtle	Y	Y	
Emydura macquarii macquarii	Murray turtle	Y	Y	
Emydura macquarii macquarii (SEQ)	Brisbane short-necked turtle	Y	Y	
Eulamprus quoyii	eastern water skink	Y	Y	Associated with wetlands, although can turn up elsewhere
Hemiaspis damelii	grey snake		Y	
Intellagama lesueurii	eastern water dragon	Y	Y	
Saproscincus oriarus			Y	
Saproscincus spectabilis		Y		
Tropidonophis mairii	freshwater snake	Y	Y	
Wollumbinia latisternum	saw-shelled turtle	Y	Y	

1 Riverine

2 Non-riverine

4.3.4 Waterbird richness

The panel identified 96 bird taxa as being dependent on riverine and/or non-riverine environments in SEQ (Table 13). Taxa dependent on wet heathland were included.

Table 13. Richness of native aquatic dependent birds

This list was used to calculate the values for measure 3.1.4 in the AquaBAMM assessment.

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Acrocephalus australis	Australian reed-warbler	Y	Y	
Actitis hypoleucos	common sandpiper	Y		
Amaurornis moluccana	pale-vented bush-hen	Y	Y	
Anas castanea	chestnut teal	Y	Y	
Anas gracilis	grey teal	Y	Y	
Anas rhynchotis	Australasian shoveler	Y	Y	
Anas superciliosa	Pacific black duck	Y	Y	
Anhinga novaehollandiae	Australasian darter	Y	Y	
Anseranas semipalmata	magpie goose	Y	Y	
Ardea ibis	cattle egret	Y	Y	
Ardea intermedia	intermediate egret	Y	Y	
Ardea modesta	eastern great egret	Y	Y	
Ardea pacifica	white-necked heron	Y	Y	
Ardea sumatrana	great-billed heron	Y	Y	
Aythya australis	hardhead	Y	Y	
Biziura lobata	musk duck	Y	Y	Small threatened pop. Occurs on Lake Samsonvale. Usually one per lake. Aggressive and need large territory, although low density down south
Botaurus poiciloptilus	Australasian bittern		Y	
Butorides striata	striated heron	Y		Estuarine but also found in freshwater
Calidris acuminata	sharp-tailed sandpiper		Y	
Calidris ferruginea	curlew sandpiper		Y	
Calidris melanotos	pectoral sandpiper		Y	

1 Riverine

2 Non-riverine

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Ceyx azureus	azure kingfisher	Y	Y	
Charadrius bicinctus	double-banded plover		Y	
Charadrius ruficapillus	red-capped plover	Y	Y	
Chenonetta jubata	Australian wood duck	Y	Y	
Chlidonias hybrida	whiskered tern	Y	Y	
Chlidonias leucopterus	white-winged black tern		Y	Also estuarine
Chroicocephalus novaehollandiae	silver gull	Y	Y	
Circus approximans	swamp harrier		Y	
Cygnus atratus	black swan	Y	Y	
Dendrocygna arcuata	wandering whistling-duck	Y	Y	
Dendrocygna eytoni	plumed whistling-duck	Y	Y	
Egretta garzetta	little egret	Y	Y	
Egretta novaehollandiae	white-faced heron	Y	Y	
Elseyornis melanops	black-fronted dotterel	Y	Y	
Ephippiorhynchus asiaticus	black-necked stork	Y	Y	
Erythrogonys cinctus	red-kneed dotterel	Y	Y	
Excalfactoria chinensis	king quail		Y	Similar habitat to ground parrot
Fulica atra	Eurasian coot	Y	Y	
Gallinago hardwickii	Latham's snipe	Y	Y	
Gallinula tenebrosa	dusky moorhen	Y	Y	
Gallirallus philippensis	buff-banded rail	Y	Y	
Gelochelidon nilotica	gull-billed tern	Y	Y	
Grus rubicunda	brolga	Y	Y	
Haliaeetus leucogaster	white-bellied sea-eagle	Y	Y	Also estuarine
Haliastur indus	brahminy kite	Y	Y	Estuarine but do come up the river. Occasionally freshwater
Haliastur sphenurus	whistling kite	Y	Y	Much more likely to see near water than away from
Himantopus himantopus	black-winged stilt	Y	Y	
Hydroprogne caspia	Caspian tern	Y	Y	
Irediparra gallinacea	comb-crested jacana	Y	Y	

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Ixobrychus dubius	Australian little bittern	Y	Y	Data deficient. Cryptic. Concerns raised in literature. Specific habitat requirements? Habitat affected in sub-coastal areas especially due to cattle and clearing for flood mitigation
Ixobrychus flavicollis	black bittern	Y	Y	
Lewinia pectoralis	Lewin's rail	Y	Y	
Limicola falcinellus	broad-billed sandpiper		Y	Also estuarine
Limosa limosa	black-tailed godwit		Y	Also estuarine
Lonchura castaneothorax	chestnut-breasted mannikin	Y	Y	Mostly near dams
Malacorhynchus membranaceus	pink-eared duck	Y	Y	
Megalurus gramineus	little grassbird	Y	Y	
Microcarbo melanoleucos	little pied cormorant	Y	Y	
Myiagra alecto	shining flycatcher	Y		
Nettapus coromandelianus	cotton pygmy-goose	Y	Y	
Nettapus pulchellus	green pygmy-goose	Y	Y	
Nycticorax caledonicus	nankeen night-heron	Y	Y	
Oxyura australis	blue-billed duck	Y	Y	Relisted under action plan by Steve Garnett as NT. Found in Lockyer lowlands and Beaudesert. Breeding pop.
Pandion cristatus	eastern osprey	Y	Y	Also estuarine
Pelecanus conspicillatus	Australian pelican	Y	Y	
Pezoporus wallicus	ground parrot		Y	Use model (essential habitat-core only) instead of records
Phalacrocorax carbo	great cormorant	Y	Y	
Phalacrocorax sulcirostris	little black cormorant	Y	Y	
Phalacrocorax varius	pied cormorant	Y	Y	
Platalea flavipes	yellow-billed spoonbill	Y	Y	
Platalea regia	royal spoonbill	Y	Y	
Plegadis falcinellus	glossy ibis		Y	
Podargus ocellatus plumiferus	plumed frogmouth	Y		
Podiceps cristatus	great crested grebe	Y	Y	
Poliocephalus poliocephalus	hoary-headed grebe	Y	Y	
Porphyrio porphyrio	purple swamphen	Y	Y	

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Porzana fluminea	Australian spotted crake	Y	Y	
Porzana pusilla	Baillon's crake	Y	Y	
Porzana tabuensis	spotless crake	Y	Y	
Recurvirostra novaehollandiae	red-necked avocet	Y	Y	
Rostratula australis	Australian painted snipe	Y	Y	
Stictonetta naevosa	freckled duck	Y	Y	
Stipiturus malachurus	southern emu-wren		Y	
Tachybaptus novaehollandiae	Australasian grebe	Y	Y	
Tadorna radjah	radjah shelduck	Y	Y	
Tadorna tadornoides	Australian shelduck	Y	Y	
Threskiornis molucca	Australian white ibis	Y	Y	
Threskiornis spinicollis	straw-necked ibis	Y	Y	
Tribonyx ventralis	black-tailed native-hen		Y	
Tringa glareola	wood sandpiper		Y	
Tringa nebularia	common greenshank		Y	Also estuarine
Tringa stagnatilis	marsh sandpiper		Y	Also estuarine
Turnix maculosus	red-backed button-quail		Y	Often occurs in wet heath
Tyto longimembris	eastern grass owl		Y	
Vanellus miles	masked lapwing		Y	

4.3.5 Mammal richness

Only 6 mammal taxa were considered by the panel to be aquatic dependent for this ACA (Table 14).

Table 14. Richness of native aquatic dependent mammals

This list was used to calculate the values for measure 3.1.7 in the AquaBAMM assessment.

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Hydromys chrysogaster	water rat	Y	Y	
Melomys burtoni	grassland melomys	Y	Y	
Myotis macropus	large-footed myotis	Y	Y	
Ornithorhynchus anatinus	platypus	Y	Y	Threatened by opera traps, water level changes impoundments and water releases
Pteropus poliocephalus	grey-headed flying-fox	Y	Y	Camps only, often associated with wetlands.
Xeromys myoides	water mouse	Y	Y	

1 Riverine

2 Non-riverine

4.3.6 Macroinvertebrate richness

The SEQ ACA is the first to examine aquatic dependent invertebrates in detail. Ninety-one taxa have been listed (Table 15). There was some discussion concerning the inclusion of whole families or sub-families within the list. Given the limits of current taxonomic resolution and that most data collected are to the higher classification level, the authors decided to include families. The only restriction was that the family listed be considered rare, sensitive to environmental change and/or likely to contain high endemicity within SEQ. Richness *per se* may not be important, e.g. the greatest number of taxa may occur at moderately disturbed site sites that would be considered of lower conservation value. Consequently it might be the richness of particular taxa that provides a more accurate indication of value. Where possible, individual species or genera were identified.

Table 15. Richness of native aquatic dependent invertebrate species

This list was used to calculate the values for measure 3.2.1 in the AquaBAMM assessment.

SCIENTIFIC NAME	COMMON NAME	FAMILY	HIGHER CLASS LEVEL	R[1]	NR[2]	COMMENTS
Rhizodrilus arthingtonae	freshwater worm	Naididae	Annelida - Oligochaeta		Y	Endemic to North Stradbroke Island; Brown Lake type locality
	hydrozoan family	Clavidae	Cnidaria - Hydrozoa	Y		
Cyclestheria hislopi	clam shrimp	Cyclestheriidae	Crustacea - Branchiopoda	Y	Y	Formerly family Conchostraca. *C. hislopi* only taxon in SEQ
Australatya striolata	riffle shrimp	Atyidae	Crustacea - Malacostraca	Y		
Caridina indistincta spp. complex	indistinct caridina complex	Atyidae	Crustacea - Malacostraca	Y	Y	Includes several taxa - Page et al 2005
Caridina nilotica		Atyidae	Crustacea - Malacostraca	Y	Y	
Paratya australiensis	freshwater shrimp	Atyidae	Crustacea - Malacostraca	Y	Y	
	amphipod family	Hyalidae	Crustacea - Malacostraca	Y		
Macrobrachium australiense	common Australian river prawn	Palaemonidae	Crustacea - Malacostraca	Y	Y	
Macrobrachium novaehollandiae	New Holland river prawn	Palaemonidae	Crustacea - Malacostraca	Y	Y	
Macrobrachium tolmerum	eastern river prawn	Palaemonidae	Crustacea - Malacostraca	Y		
	amphipod family	Paramelitidae	Crustacea - Malacostraca	Y		

1 Riverine

2 Non-riverine

SCIENTIFIC NAME	COMMON NAME	FAMILY	HIGHER CLASS LEVEL	R[1]	NR[2]	COMMENTS
Cherax cf. *cuspidatus* sp.		Parastacidae	Crustacea - Malacostraca		Y	
Cherax depressus		Parastacidae	Crustacea - Malacostraca		Y	
Cherax dispar	slender yabby	Parastacidae	Crustacea - Malacostraca		Y	Restricted distribution; loss/fragmentation of coastal habitat
Cherax punctatus	land yabby	Parastacidae	Crustacea - Malacostraca	Y	Y	
Cherax robustus	sand yabby	Parastacidae	Crustacea - Malacostraca		Y	Loss of coastal habitat (SEQ Fauna Panel 2007)
Euastacus binzayedi	freshwater crayfish	Parastacidae	Crustacea - Malacostraca	Y		Restricted to Lamington NP
Euastacus hystricosus	giant spiny crayfish	Parastacidae	Crustacea - Malacostraca	Y		Restricted distribution, Endangered in Coughran & Furse (2010)
Euastacus jagara	freshwater crayfish	Parastacidae	Crustacea - Malacostraca	Y		Endemic; Critically Endangered in Coughran & Furse (2010)
Euastacus maidae	freshwater crayfish	Parastacidae	Crustacea - Malacostraca	Y		Endemic; Critically Endangered in Coughran & Furse (2010)
Euastacus setosus	freshwater crayfish	Parastacidae	Crustacea - Malacostraca	Y		Endemic; Critically Endangered in Coughran & Furse (2010)
Euastacus sulcatus	freshwater crayfish	Parastacidae	Crustacea - Malacostraca	Y		Endemic; Vulnerable in Coughran & Furse (2010)
Euastacus urospinosus	rainforest crayfish	Parastacidae	Crustacea - Malacostraca	Y		Restricted distribution, Endangered in Coughran & Furse (2010) or Near Threatened in McCormack & van der Werf (2013)
Euastacus valentulus	freshwater crayfish	Parastacidae	Crustacea - Malacostraca	Y		Restricted distribution in SEQ
Tenuibranchiurus glypticus	swamp crayfish	Parastacidae	Crustacea - Malacostraca		Y	Very rare, known only from SEQ (greater Brisbane, Sunshine Coast) Wallum swamps. Listed as Endangered IUCN Red List (2014). Habitat loss (SEQ Expert Panel (2007)
	syncarid family	Psammaspididae	Crustacea - Malacostraca	Y		
Ovolara australis	riffle beetle	Elmidae	Insecta - Coleoptera	Y		Rare in SEQ; restricted to coastal NSW & SEQ (northernmost distribution)

SCIENTIFIC NAME	COMMON NAME	FAMILY	HIGHER CLASS LEVEL	R[1]	NR[2]	COMMENTS
	variegated mud-loving beetle family	Heteroceridae	Insecta - Coleoptera	Y	Y	Rare in SEQ
Hygrobia spp.	aquatic beetle	Hygrobiidae	Insecta - Coleoptera	Y	Y	Sole genus of family Hygrobiidae in Australia. Use all EHMP family records. Rare in SEQ
Sphaerius spp.	minute bog beetle	Sphaeriusidae [as Microsporidae]	Insecta - Coleoptera	Y		Sole genus of family Sphaeriusidae in Australia. Use all EHMP family records. Rare in SEQ
Byrrocryotus spp.	semi-aquatic beetle	Ptilodactylidae	Insecta - Coleoptera	Y	Y	Sole genus of family Ptilodactylidae in Australia. Use all EHMP family records. Rare in SEQ
Spercheus spp.	water beetle	Spercheidae	Insecta - Coleoptera	Y	Y	In intermittent streams. Family monogeneric. Use all EHMP family records. Rare in SEQ
	midge sub-family	Chironomidae: Aphroteniinae	Insecta - Diptera	Y		Rare sub-family in SEQ
	water snipe fly family	Athericidae	Insecta - Diptera	Y	Y	Rare in SEQ
Aphroteniella filicornis	non-biting midge	Chironomidae: Aphroteniinae	Insecta - Diptera	Y		Rare in SEQ, cool rainforest streams (southern fauna element) SEQ northernmost distribution. In need of conservation status in Qld
Aphroteniella tenuicornis	non-biting midge	Chironomidae: Aphroteniinae	Insecta - Diptera	Y		Rare in SEQ, cool rainforest streams (southern fauna element) recorded south of Brisbane only (Gold Coast hinterland); SEQ northernmost distribution
Podonomopsis evansi	non-biting midge	Chironomidae: Podonominae	Insecta - Diptera	Y		Rare in SEQ (seems to tolerate some eutrophication) shaded streams; SEQ northernmost distribution
	long-legged fly family	Dolichopodidae	Insecta - Diptera	Y	Y	Rare-common in SEQ
Austrosimulium mirabile	blackfly	Simuliidae	Insecta - Diptera	Y		Rare, very limited distribution, but then in good population densities, foothill streams
	hoverfly family	Syrphidae	Insecta - Diptera	Y	Y	Rare in SEQ. Locally common in suitable habitat - long-lasting shallow stagnant water

SCIENTIFIC NAME	COMMON NAME	FAMILY	HIGHER CLASS LEVEL	R[1]	NR[2]	COMMENTS
Mirawara purpurea	mayfly	Ameletopsidae	Insecta - Ephemeroptera	Y		Cool fast flowing headwaters, cobble - in SEQ in rainforest steams, wide-spread but in low numbers. In need of conservation status in Qld
Mirawara spp.	mayfly	Ameletopsidae	Insecta - Ephemeroptera	Y		Sole genus of family Ameletopsidae in Australia Use all EHMP family records. Rare in SEQ
Centroptilum new sp. 'lacey'	small minnow mayfly	Baetidae	Insecta - Ephemeroptera	Y		Rare
	mayfly family	Baetidae	Insecta - Ephemeroptera	Y		Several genera. Rare-common in SEQ
	mayfly family	Caenidae	Insecta - Ephemeroptera	Y	Y	Several genera. Rare-common in SEQ
Atalomicria new sp. 'MBR'	prong-gilled mayfly	Leptophlebiidae	Insecta - Ephemeroptera	Y		Rare, undescribed species - only known from SEQ so far
Austremerella picta	mayfly	Teloganodidae	Insecta - Ephemeroptera	Y		Rare in SEQ. Single taxon in Australia. Use all EHMP family records
	shore bug family	Saldidae	Insecta - Hemiptera	Y		Not aquatic but only found near water. Rare in SEQ
Telicota eurychlora	southern sedge darter	Hesperiidae	Insecta - Lepidoptera	Y	Y	Habitat loss - swamps & watercourses; Vulnerable in Sands & New (2002)
Argyreus hyperbius inconstans	Australian fritillary	Nymphalidae	Insecta - Lepidoptera		Y	
Junonia hedonia zelima	brown argus	Nymphalidae	Insecta - Lepidoptera		Y	Rare (SEQ Fauna Panel 2007). Habitat loss - melaleuca swamp/gully
Tisiphone abeona morrisi	varied swordgrass brown (north coast subsp.)	Nymphalidae	Insecta - Lepidoptera		Y	Threatened - loss of *Gahnia* wetlands; Critically Endangered in Sands & New (2002)
Ornithoptera richmondia	Richmond birdwing	Papilionidae	Insecta - Lepidoptera	Y		Food/breed source plant is riparian associated
Diphlebia spp.	azure damselfly	Diphlebiidae	Insecta - Odonata	Y		Sole genus of family Diphlebiidae in Australia. Use all EHMP family records. Rare-common in SEQ

SCIENTIFIC NAME	COMMON NAME	FAMILY	HIGHER CLASS LEVEL	R[1]	NR[2]	COMMENTS
Archaeophya adamsi	horned urfly	Gomphomacromiidae	Insecta - Odonata	Y		One of Australia's rarest dragonflies, known from a few locations in SEQ and around Sydney. Listed endangered in NSW. In need of conservation status in Qld
Austrolestes minjerriba	dune ringtail	Lestidae	Insecta - Odonata		Y	Very rare, confined to islands SEQ (Frazer, Nth Stradbroke, Moreton islands). Listed as Endangered IUCN Red List (2014). In need of conservation status in Qld
Orthetrum boumiera	brownwater skimmer	Libellulidae	Insecta - Odonata		Y	Confined to coastal dune lakes in SEQ and north-eastern NSW. In need of conservation status in Qld
Macromia tillyardi	Australian cruiser	Macromiidae	Insecta - Odonata	Y	Y	Family monogeneric. This only taxon in SEQ. Use all EHMP family records. Rare in SEQ
Austroargiolestes chrysoides	golden flatwing	Megapodagrioni-dae	Insecta - Odonata	Y		Rare, montane rainforest - restricted to SEQ, Moreton Bay Region southernmost distribution
Griseargiolestes albescens	coastal flatwing	Megapodagrioni-dae	Insecta - Odonata	Y	Y	Uncommon, wallum swamps to foothill streams, restricted to SEQ & north-east NSW. Restricted range - habitat loss - wallum swamp (SEQ Fauna Panel 2007)
Petalura litorea	coastal petaltail	Petaluridae	Insecta - Odonata		Y	Rare, confined to islands in SEQ & north NSW, wallum swamps, record 18-Mile Swamp Nth Stradbroke. Listed as Near Threatened (but stable) IUCN (2014). In need of conservation status in Qld
Acanthaeschna victoria	thylacine darner	Telephlebiidae	Insecta - Odonata	Y	Y	Very rare, confined to coastal SEQ & north NSW. Listed as Vulnerable IUCN Red List (2014). In need of conservation status in Qld. Larval habitat unknown, probably salt marshes

1 Riverine

2 Non-riverine

SCIENTIFIC NAME	COMMON NAME	FAMILY	HIGHER CLASS LEVEL	R[1]	NR[2]	COMMENTS
Telephlebia cyclops	northern evening darner	Telephlebiidae	Insecta - Odonata	Y		Rare, rainforest upland streams near waterfalls, habitat rare in SEQ; In need of conservation status in Qld
Telephlebia godeffroyi	eastern evening darner	Telephlebiidae	Insecta - Odonata	Y		In need of conservation status in Qld
Telephlebia tryoni	coastal evening darner	Telephlebiidae	Insecta - Odonata	Y		Restricted distribution. Semi-aquatic near intermittent streams. In need of conservation status in Qld
	basker dragonfly family	Urothemistidae	Insecta - Odonata	Y	Y	Rare in SEQ. Use all EHMP family records
Cosmioperla denise	stonefly	Eusteniidae	Insecta - Plecoptera	Y		Very rare, in SEQ restricted to fast flowing (cool) largely permanent upland forest streams, rocks. In need of conservation status in Qld
Antipodoecia turneri	caddisfly	Antipodoeciidae	Insecta - Trichoptera	Y		Sole taxon in family Antipodoeciidae. Use all EHMP family records. Rare in SEQ
Atriplectides spp.	caddisfly	Atriplectididae	Insecta - Trichoptera	Y		Sole genus of family Atriplectididae in Australia. Use all EHMP family records. Rare in SEQ
	caddisfly family	Calocidae	Insecta - Trichoptera	Y		Several genera. Rare in SEQ
Hyalopsyche disjuncta	caddisfly	Dipseudopsidae	Insecta - Trichoptera	Y		Sole representative of family Dipseudopsidae in Australia. Use all EHMP family records. Rare in SEQ
Agapetus spp.	caddisfly	Glossosomatidae	Insecta - Trichoptera	Y		Sole genus of family Glossosomatidae in Australia. Use all EHMP family records. Rare in SEQ
Helicopha queenslandensis	caddisfly	Helicophidae	Insecta - Trichoptera	Y		Rare [rareness of habitat in SEQ] montane, cool shaded streams, waterfilm over rock (hygropetric habitat) often associated with moss
	caddisfly family	Helicophidae	Insecta - Trichoptera	Y		Rare in SEQ
	caddisfly family	Hydrobiosidae	Insecta - Trichoptera	Y		Rare-common in SEQ

SCIENTIFIC NAME	COMMON NAME	FAMILY	HIGHER CLASS LEVEL	R[1]	NR[2]	COMMENTS
Orthotrichia new sp 'caboolture' [*O. aberrans*-group]	micro-caddisfly	Hydroptilidae	Insecta - Trichoptera	Y		Very rare; *O. aberrans*-group is the only parasitic caddisfly taxon; Australian endemic; undescribed sp. (adult not yet known), Only record Gregorys Ck, Caboolture R tributary
Triplexa villa	long-horned caddisfly	Leptoceridae	Insecta - Trichoptera	Y		Rare [rareness of habitat in SEQ] upland cool shaded streams, hygropetric and splash-zone
Westriplectes angelae	long-horned caddisfly	Leptoceridae	Insecta - Trichoptera		Y	Rarely recorded; larvae unknown and might be marine
Barynema australicum	caddisfly	Odontoceridae	Insecta - Trichoptera	Y		Rare (Moreton Bay Region northernmost distribution); fast flowing (cool) largely permanent upland forest streams, rocks & logs
	caddisfly family	Philopotamidae	Insecta - Trichoptera	Y		Rare-common in SEQ
	caddisfly family	Philorheithridae	Insecta - Trichoptera	Y		Rare-common in SEQ
	caddisfly family	Polycentropidae	Insecta - Trichoptera	Y		Rare-common in SEQ
Tasimia sp.	caddisfly	Tasimiidae	Insecta - Trichoptera	Y		Uncommon, cool upland streams, rainforest, boulders & cobbles
	caddisfly family	Tasimiidae	Insecta - Trichoptera	Y		Rare-common in SEQ
Cucumerunio novaehollandiae	Australian river mussel	Hydriidae	Mollusca - Bivalvia	Y		Endemic to the coastal rivers of NSW and QLD, from Hunter to Burnett Rivers. Decreasing pop - IUCN Red List (2014) as Data Deficient
Gabbia spp	freshwater snail	Bithyniidae	Mollusca - Gastropoda	Y		Sole genus of family Bithyniidae in Australia. Rare in SEQ
Fluvidona anodonta	North Pine River freshwater snail	Hydrobiidae	Mollusca - Gastropoda	Y		Endemic to SEQ (Pine River catchment); assumed endemic to Pine River catchment. Listed as Vulnerable IUCN Red List (2014). In need of conservation status in Qld
Jardinella new sp.1	mud snail	Hydrobiidae	Mollusca - Gastropoda	Y		Undescribed sp. new to science (W. Ponder Austrailian Museum Sydney)

SCIENTIFIC NAME	COMMON NAME	FAMILY	HIGHER CLASS LEVEL	R[1]	NR[2]	COMMENTS
	river snail family	Viviparidae	Mollusca - Gastropoda	Y	Y	Rare in SEQ
	flatworm family	Dalyelliidae	Platyhelminthes - Turbellaria	Y		Rare-common in SEQ

4.4 Exotic fauna

4.4.1 Fish

Fourteen alien fish taxa were listed for inclusion in measure 1.1.1 (Table 16). The panel decided that the records for five cichlid taxa, more typical of tropical climates, should not be used as they are unlikely to establish self-sustaining populations in SEQ. Despite this, the panel asked they be listed in the report so that authorities are aware such taxa are being released in the region and could become threats given climate warming. During report preparation two more cichlid taxa have been reported in the region (*Geophagus brasiliensis* pearl cichlid and *Amititlania nigrofasciata* convict cichlid).

Table 16. Alien fish species that impact on wetland values

This list was used to calculate the values for measure 1.1.1 in the AquaBAMM assessment.

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Aequidens pulcher	blue acara	Y	Y	Tropical species. List but do not include records
Amphilophus citrinellum	midas cichlid	Y	Y	Tropical species. List but do not include records
Amphilophus labiatus	red devil		Y	Tropical species. List but do not include records
Carassius auratus	goldfish	Y	Y	
Cichlasoma trimaculatum	three-spot cichlid	Y		Tropical species predominately. . List but do not include records
Cyprinus carpio	European carp	Y	Y	
Gambusia holbrooki	eastern gambusia	Y	Y	
Haplochromis burtoni	Burton's haplochromis	Y		Tropical species. List but do not include records
Misgurnus anguillicaudatus	oriental weatherloach	Y		
Oreochromis mossambicus	Mozambique tilapia	Y	Y	
Poecilia latipinna	sailfin molly	Y	Y	Very patchy
Poecilia reticulata	guppy	Y	Y	Very patchy
Xiphophorus helleri	swordtail	Y		
Xiphophorus maculatus	platy	Y		

1 Riverine

2 Non-riverine

4.4.2 Invertebrates

Among the alien invertebrates listed (Table 17), the panel recognised two snails from outside Australia and two native crayfish taxa translocated into SEQ from western and northern Queensland drainages.

Table 17. Alien invertebrate species that impact on wetland values

This list was used to calculate the values for measure 1.1.3 in the AquaBAMM assessment.

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Cherax destructor	inland yabby	Y	Y	Potential threat to indigenous *Euastacus* spp. (Davie 2007, Coughran et al 2009, McCormack 2014)
Cherax quadricarinatus	redclaw crayfish	Y	Y	Native sp. translocated for aquaculture - threat to local instream fauna including indigenous crustaceans (Davie 2007). In Moogerah & Somerset dams
Physella acuta	European physa (snail)	Y	Y	*Physa acuta* (still used in Australia) is an invalid synonym. Introduced. Origin uncertain - thought to be North American origin; now world-wide in running and standing freshwaters
Pomacea diffusa	spike-topped apple snail	Y	Y	Introduced. Origin South America. Detritus feeder; potentially severe threat (Potter 2007). Sightings in SEQ: Dec 2006 northside Brisbane (QM web-link), July 2009, Apr 2010 empty shells Little Burpengary Creek (Deception Bay)

1 Riverine

2 Non-riverine

4.4.3 Non-fish vertebrate pest species

Nine alien vertebrate taxa were listed (Table 18). The panel stressed that many of the taxa listed are more widespread within SEQ than indicated by the records available.

Table 18. Alien vertebrate species (other than fish) that impact on wetland values

This list was used to calculate the values for measure 1.1.4 in the AquaBAMM assessment.

SCIENTIFIC NAME	COMMON NAME	R[1]	NR[2]	COMMENTS
Anas platyrhynchos	northern mallard	Y	Y	Hybridises with Pacific black duck
Bos spp.	cattle spp.	Y	Y	Records do not reflect extent
Bos taurus	European cattle	Y	Y	Model would be ideal
Equus caballus	horse	Y	Y	Model would be ideal
Felis catus	cat	Y	Y	
Rhinella marina	cane toad	Y	Y	
Sus scrofa	pig	Y	Y	
Trachemys scripta elegans	red-eared slider		Y	
Vulpes vulpes	red fox	Y	Y	

1 Riverine

2 Non-riverine

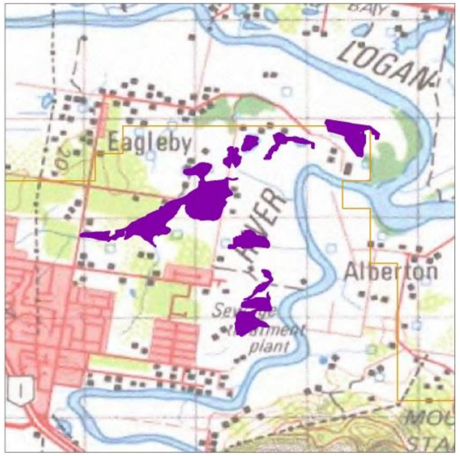
4.5 Special features

The panel identified several riverine and non-riverine special features in the Southeast Queensland region known to contain fauna values (Table 19). Where fauna special features were also considered to have additional values (e.g. flora, ecology), the special area was implemented as a wetland ecology special feature.

Each spatial unit that intersected with a particular ecosystem or feature in Table 19 was given a score equal to the conservation rating. Decisions are listed alphabetically by catchment. These features were intersected with the spatial units to identify the values for criterion 6 (Special features). All implemented special features were given a conservation rating of between 1 and 4 assigned by the panel. Decisions that were not able to be implemented due to a lack of readily available data or unconfirmed values, are indicated with '_not_implemented' in the decision implementation number column. Decisions that have 'to be implemented' in the implementation column are in the process of being implemented assuming available and suitable data and time. Where a single decision crosses a number of study areas, the decision has been duplicated for each study area. Decisions sorted by study area.

Table 19. Identified fauna special features and their values

Table sorted by decision number which equates to alphabetically by study area code then non-riverine/riverine.

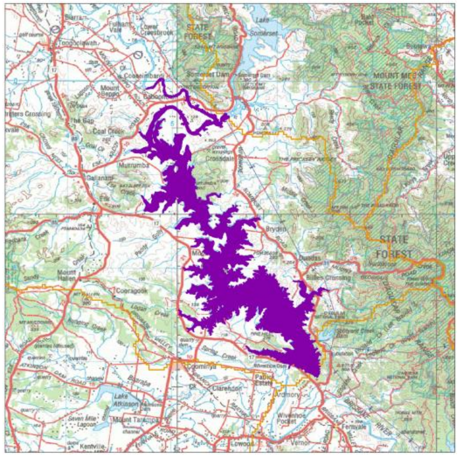
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
al_nr_fa_01	Eagleby complex wetlands		Albert		Y	Significant floodplain area and waterbird habitat used by freckled duck, Australasian shoveler, magpie goose (breeding), glossy ibis, migratory waders and red-necked avocet. Reed beds, grassland, mangrove and woodland around sewerage treatment plant provide habitat for 181 bird species. Lowland refugial wetland habitat (BPA seq_l_2).	5.1.4	4

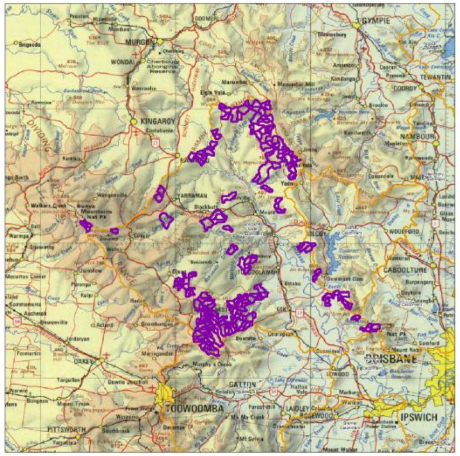
1 Riverine

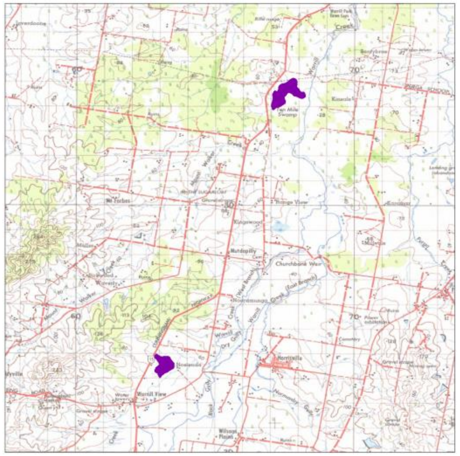
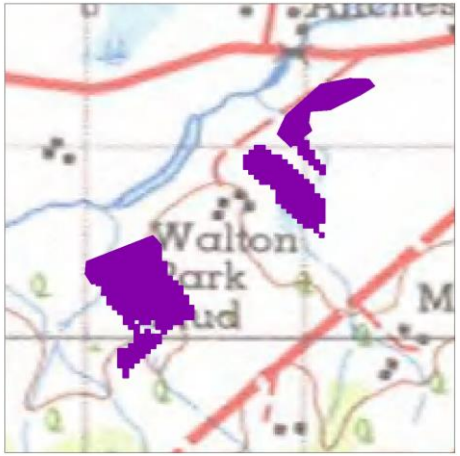
2 Non-riverine

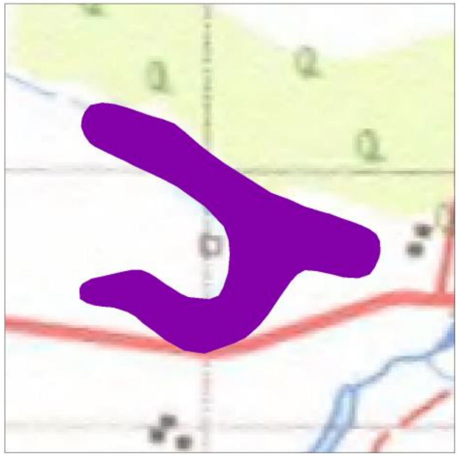
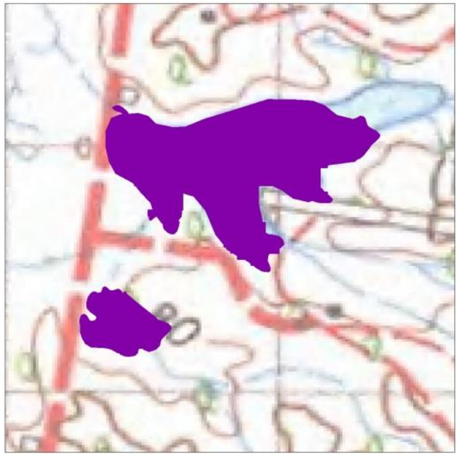
3 Number refers to the values from the generic CIM in Appendix B

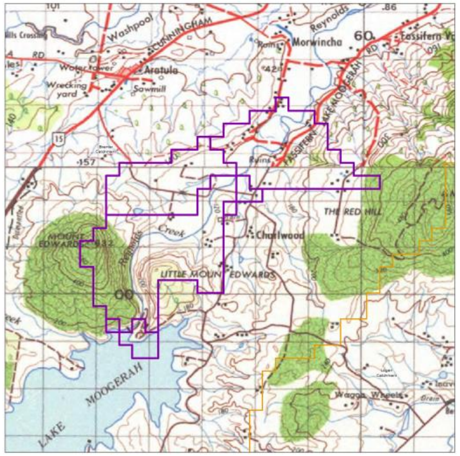
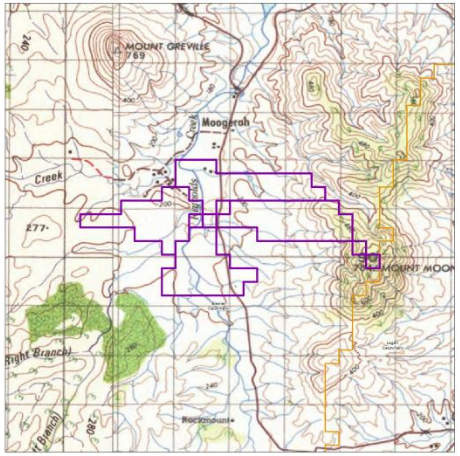
4 4 is the highest number

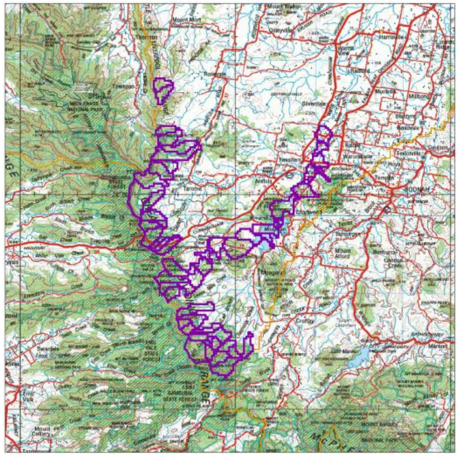
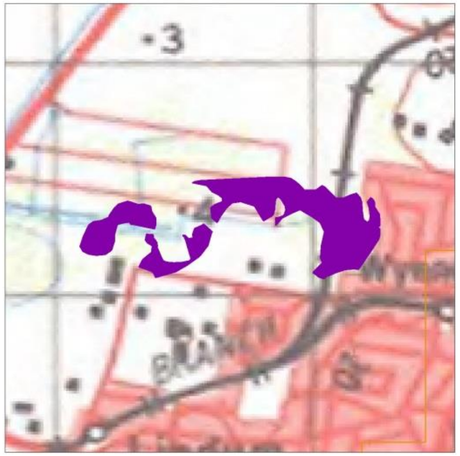
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
al_r_fa_01	Headwater areas supporting macro-invertebrate taxa		Albert	Y		Headwaters above the 300m contour and down into the mid sections of most streams in the basalt areas within the Scenic Rim subregion. Upland streams with steep gradients in undisturbed subcatchments, with good water quality, running over diverse substrates. High diversity of most macroinvertebrates e.g. crayfish, caddisflies and mayflies. Also stream-adapted frog fauna including a number of EVNT species. These fauna values correlate with elevated altitude, high rainfall, and intact vegetation.	6.3.1	4
bb_nr_fa_03	Wivenhoe Dam		Brisbane Upper		Y	Waterbird habitat - large flocks of Australian pelicans and cormorants. Does not have vegetation of other dams. Australian lungfish present.	5.1.4	4

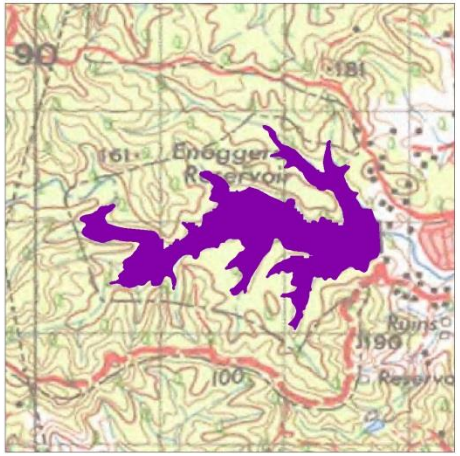
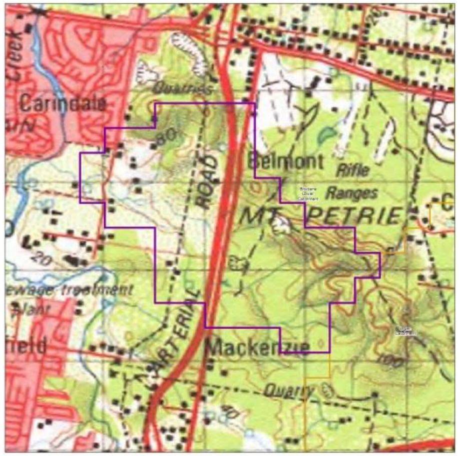
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bb_r_fa_01	Headwater areas supporting macro-invertebrate taxa		Brisbane Upper	Y		Headwaters above the 300m contour and down into the mid sections of most streams in the basalt areas within the Scenic Rim subregion. Upland streams with steep gradients in undisturbed subcatchments, with good water quality, running over diverse substrates. High diversity of most macroinvertebrates e.g. crayfish, caddisflies and mayflies. Also stream-adapted frog fauna including a number of EVNT species. These fauna values correlate with elevated altitude, high rainfall, and intact vegetation.	6.3.1	4
bi_nr_fa_01	Bribie Island		Bribie Island	Y	Y	Decision applies to all wetlands. All values as per Moreton Island except for fish. Macro-invertebrate fauna different to other islands. Includes wallum values. Ornate rainbowfish present. Only include mapped riverine network. Freshwater records of water mouse. Inland high tide roost for migratory waders (likely estuarine section of Dux Creek).	6.3.1	4 by itself. 3 if compared to other islands.

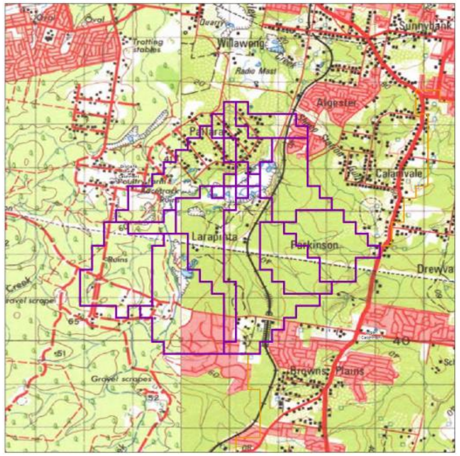
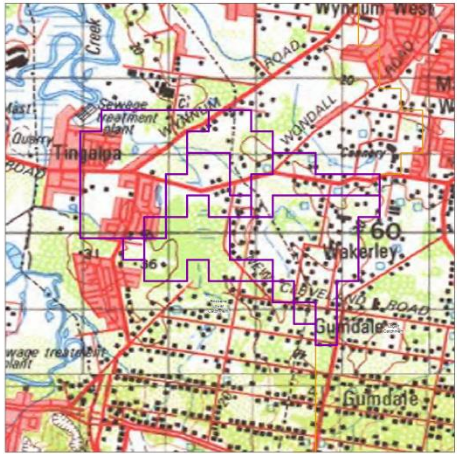
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
br_nr_fa_01	Aratula wetlands		Bremer		Y	Significant waterbird habitat.	5.1.4	4
br_nr_fa_02	Bremer Rd wetlands		Bremer		Y	Significant waterbird habitat - cotton pygmy-goose and Australian painted snipe.	5.1.4	3

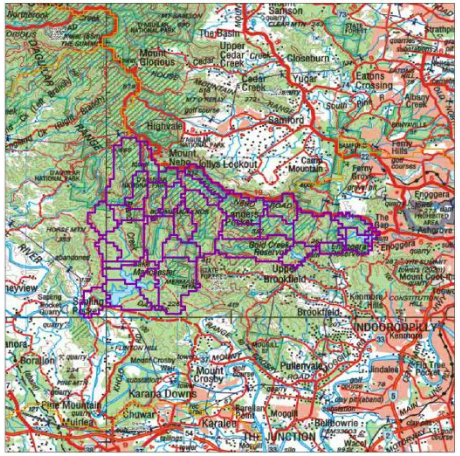
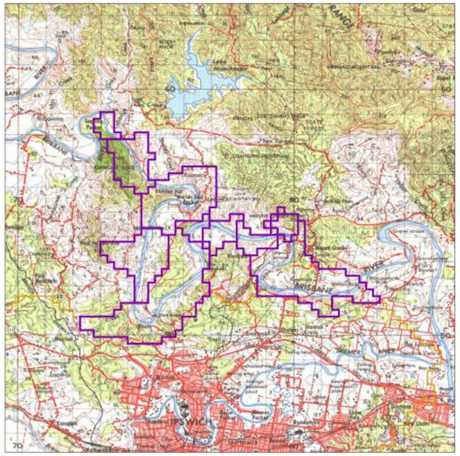
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
br_nr_fa_03	Nielsen Rd wetland		Bremer		Y	Frog habitat - diversity of species present including burrowing frogs. Also waterbird habitat including nesting black-necked stork. Habitat extends to non-remnant in the north.	5.1.4	3
br_nr_fa_04	Daly's Lagoon / Bayliss Lagoon		Bremer		Y	Waterbird habitat - freckled duck, Australasian Shoveler, cotton pygmy-goose, Australian little bittern, black bittern, Lewin's rail and Latham's snipe. Nesting site for black-necked stork.	5.1.4	4

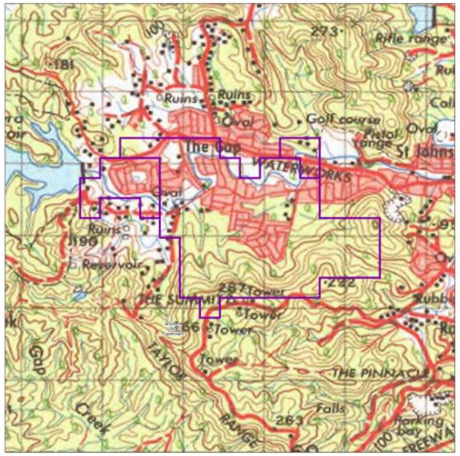
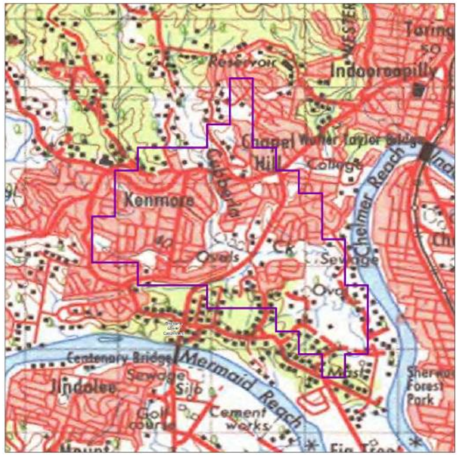
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
br_r_fa_01	Reynolds Creek below Moogerah Dam		Bremer	Y		Platypus habitat. Relatively intact riparian zone.	5.1.4	3
br_r_fa_02	Munchow crossing		Bremer	Y		Platypus habitat. Relatively intact riparian zone.	5.1.4	3

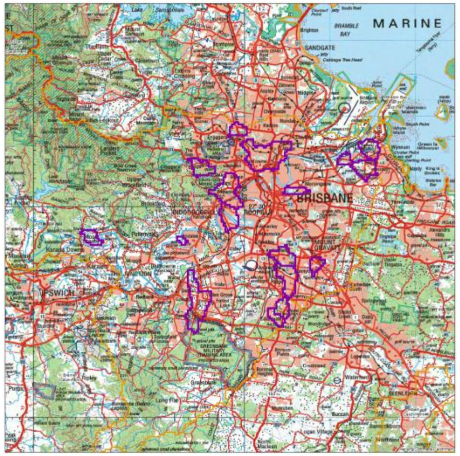
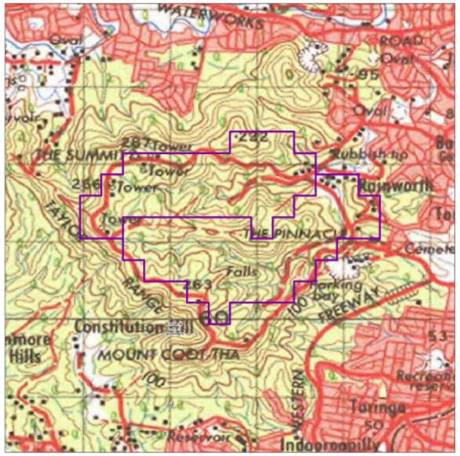
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
br_r_fa_03	Headwater areas supporting macro-invertebrate taxa		Bremer	Y		Headwaters above the 300m contour and down into the mid sections of most streams in the basalt areas within the Scenic Rim subregion. Upland streams with steep gradients in undisturbed subcatchments, with good water quality, running over diverse substrates. High diversity of most macroinvertebrates e.g. crayfish, caddisflies and mayflies. Also stream-adapted frog fauna including a number of EVNT species. These fauna values correlate with elevated altitude, high rainfall, and intact vegetation.	6.3.1	4
bs_nr_fa_01	Sandy Camp Road wetlands		Brisbane Lower		Y	Significant number and diversity of waterbirds including wandering whistling-duck, Australian darter, black bitten, Australlian little bitten, Baillon's crake and Australian painted snipe. Wetlands very threatened.	5.1.4	4

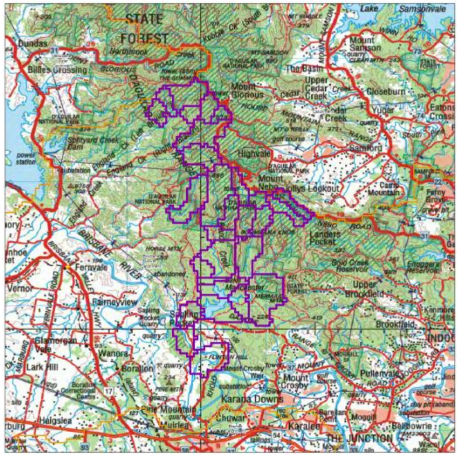
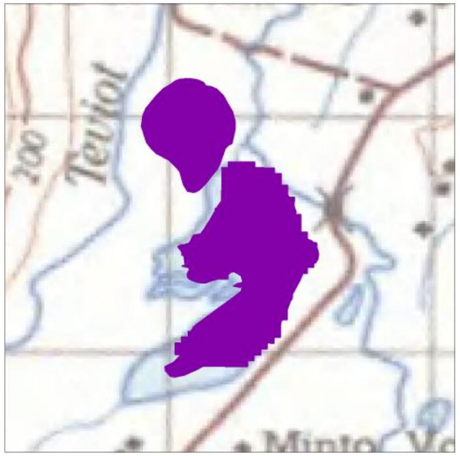
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_nr_fa_02	Enoggera Dam		Brisbane Lower		Y	159 bird species recorded on and around the lake including all three grebe species, ducks, cormorants, pale-vented bush-hen and Lewin's rail. Australian lungfish once present - unknown if still extant.	5.1.4	3
bs_r_fa_01	Base of Belmont Hills natural area (Spring Creek)		Brisbane Lower	Y		Biodiversity hot spot for fish e.g. Rhadinocentrus ornatus (Sun Fish/ Ornate Rainbow Fish), Mogurnda adspersa (Purple Spotted Gudgeon) and a few other gudgeons. Few exotic species. Dec: reep_bcc_2, WPU: BM-T4/010.	6.3.1	3

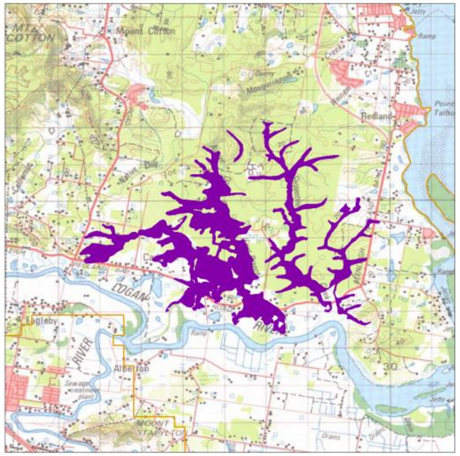
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_fa_02	Motorway Business Park Wetlands		Brisbane Lower	Y		Habitat for native riverine fish species including Craterocephalus marjoriae (Marjorie's Hardyhead). Dec: reep_bcc_2, WPU: OX/070	6.3.1	2
bs_r_fa_03	Dairy Swamp Triangle		Brisbane Lower	Y		Habitat for Locally Significant species Pseudechis porphyriacus (Red- bellied Black Snake). Melaleuca wetland. Habitat for up to 115 fauna species. Dec: reep_bcc_2, BM-T2/010	6.3.1	2

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_fa_04	Brisbane Forest Park frog habitat		Brisbane Lower	Y		Frog habitat for many rainforest species. Dec: reep_bcc_7 WPU: CL/010, E/070, G/030,	6.3.1	3
bs_r_fa_05	Colleges Crossing and upstream		Brisbane Lower	Y			6.3.1	3

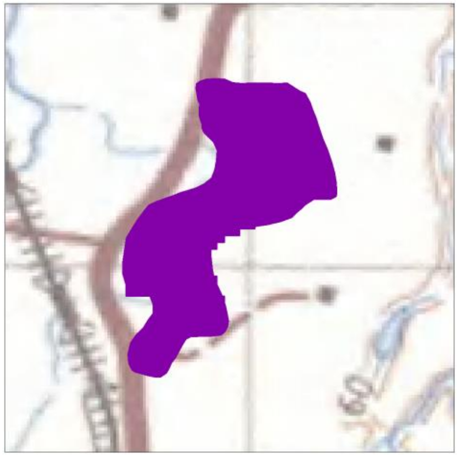
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_fa_06	Waltons Bridge Reserve- confluence of Fish Creek and Enoggera Creek, The Gap.		Brisbane Lower	Y		High biodiversity - fish and frog species. Dec: reep_bcc_7 WPU: E/050	6.3.1	3
bs_r_fa_07	Fig Tree Pocket		Brisbane Lower	Y		High biodiversity values. Dec: reep_bcc_7 WPU: CB/010	6.3.1	2

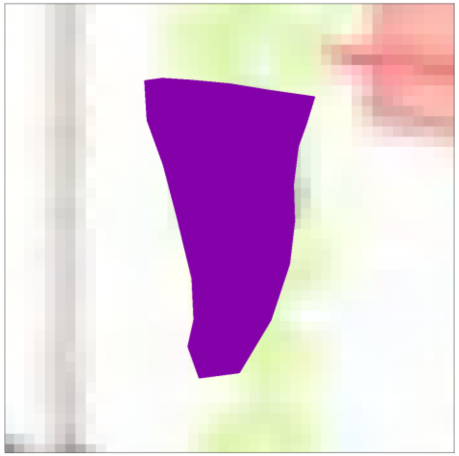
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_fa_09	Flying Fox camps		Brisbane Lower	Y		Significant numbers of flying foxes can congregate along riparian zones. Camps are identified as special habitat e.g. Cabbage Tree Creek, Indooroopilly Islands.	6.3.1	4
bs_r_fa_10	Mt Coot-tha Forest Park powerful owl habitat		Brisbane Lower	Y		Riparian habitat is important for nesting of Ninox strenua (powerful owl). Mt Coot-tha is a large tract of habitat in the Brisbane metropolitan area and is important because N. strenua requires a large home range.	6.3.1	3

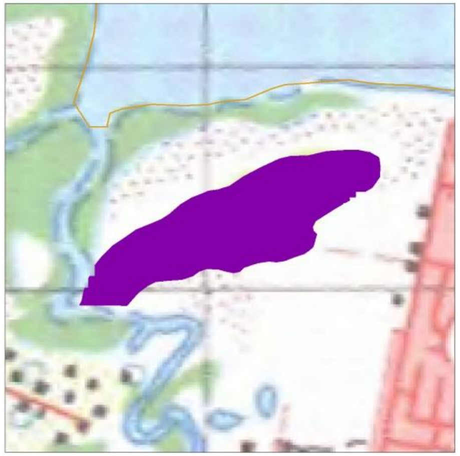
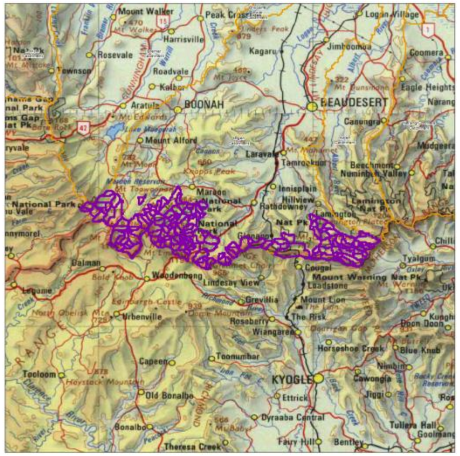
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_fa_11	Headwater areas supporting macro-invertebrate taxa		Brisbane Lower	Y		Headwaters above the 300m contour and down into the mid sections of most streams in the basalt areas within the Scenic Rim subregion. Upland streams with steep gradients in undisturbed subcatchments, with good water quality, running over diverse substrates. High diversity of most macroinvertebrates e.g. crayfish, caddisflies and mayflies. Also stream-adapted frog fauna including a number of EVNT species. These fauna values correlate with elevated altitude, high rainfall, and intact vegetation.	6.3.1	4
lg_nr_fa_01	Minto Crag Swamp		Logan		Y	Waterbird habitat. When water present used by high diversity of waterbirds including variety of ducks and black-necked stork.	5.1.4	4

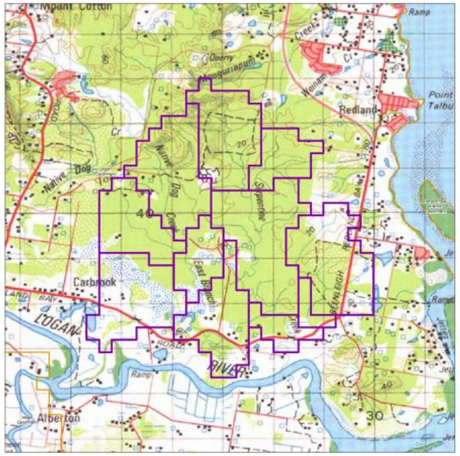
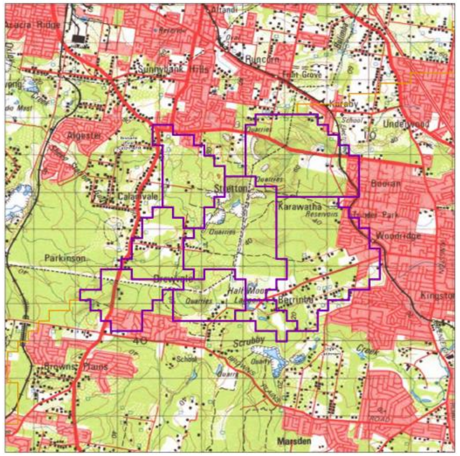
Decision number	**Special features (name)**	**Location**	**Study area**	**R**[1]	**NR**[2]	**Values**	**CIM**[3]	**Con. rating**[4]
lg_nr_fa_02	Eagleby complex wetlands		Logan		Y	Significant floodplain area. Possible ecology decision. Waterbird habitat used by freckled duck, Australasian shoveler, magpie goose (breeding), glossy ibis, migratory waders and red-necked avocet. Reed beds, grassland, mangrove and woodland around sewerage treatment plant provide habitat for 181 bird species. Lowland refugial wetland habitat (BPA seq_l_2).	5.1.4	4
lg_nr_fa_04	Serpentine Creek & Native Dog Creek East Branch		Logan		Y	Part of Carbrook Nationally Important Wetlands - drought refugia and swamps used by migratory waders (Blackman et al 1999), also part included in Moreton Bay Ramsar area. Good example of lowland stream in good ecological condition in southern SEQ and supports unique (low pH) ecosystem (Moffatt 2008). Threatened wallum froglet (*Crinia tinnula*) present.	6.3.1	3

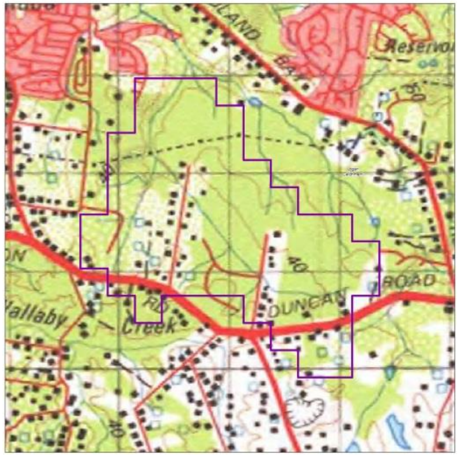
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
lg_nr_fa_05	Karawatha wetlands		Logan		Y	Nationally Important Wetland and part of the 56 km Flinders Karawatha Corridor. Includes perennial and intermittent creeks, seasonal and permanent waterholes, marshy areas, and perennial backwaters in 300ha. A significant area of subcoastal wallum with 13 vegetation communities with good connectivity. *Crinia tinnula* and *Litoria brevipalmata* among 23 frog species present. Fauna includes 3 turtle, 30 reptile, and 165 bird species - 6 listed in international conservation treaties. There are 34 mammal species including 16 bat species. The highest diversity of frog species in Brisbane including several EVNT species.	6.3.1	4
lg_nr_fa_06	Boonah water treatment plant		Logan		Y	Waterbird habitat. Unique waterbird assemblage.	5.1.4	3

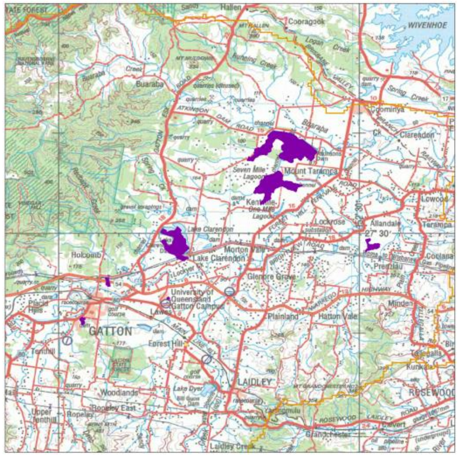
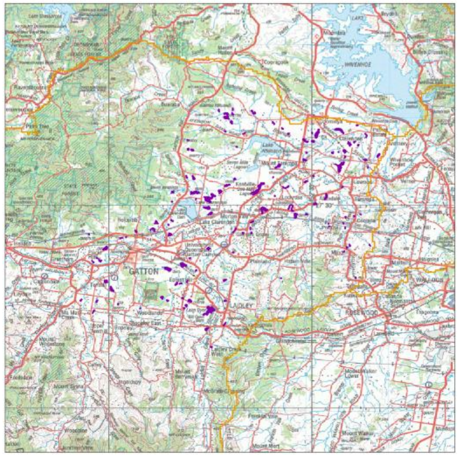
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
lg_nr_fa_07	Tamrookum Wetland		Logan		Y	Waterbird habitat. Ephemeral wetland with low reedbeds. 25 species of waterbird recorded including pink-eared duck, freckled duck, black-tailed native-hen, Australian painted snipe and Latham's snipe.	5.1.4	3
lg_nr_fa_08	Leslie Harrison Dam		Logan		Y	Waterbird habitat - variety of ducks, yellow-billed ibis, royal ibis, comb-crested jacana and Latham's snipe. Fish habitat. Forms part of a biodiveristy corridor and includes other fauna habitat values.	5.1.4	3

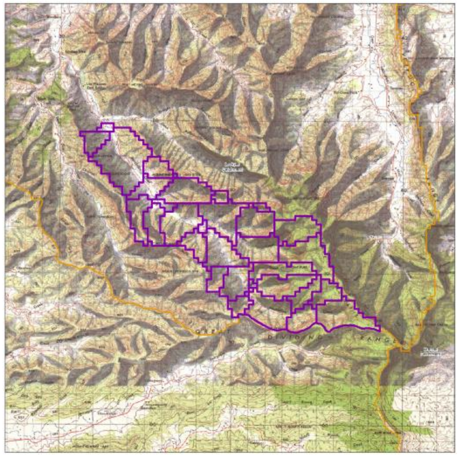
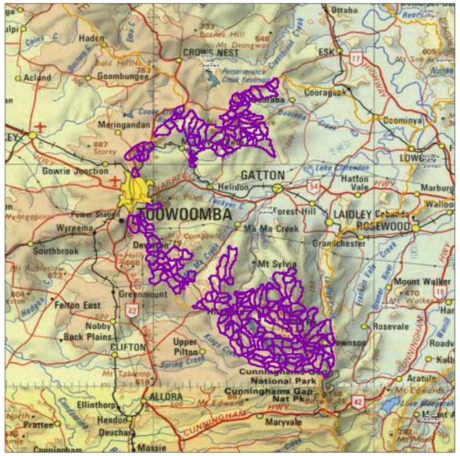
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
lg_nr_fa_09	Orchard Beach Wetland Weinam Creek (Mainland Redlands)		Logan		Y	Flying fox roosting site known to occur	6.3.1	3
lg_nr_fa_10	Crossley Drive Wetland (Mainland Redlands)		Logan		Y	Flying fox roosting site known to occur	6.3.1	2

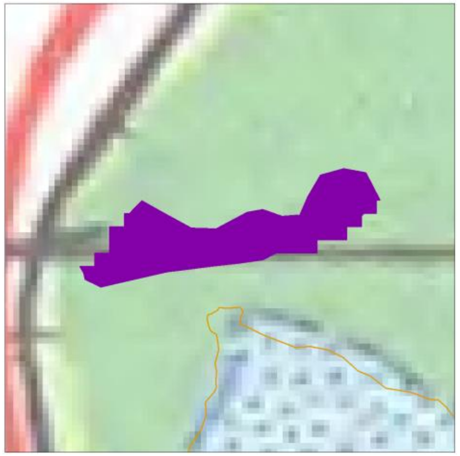
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
lg_nr_fa_11	Point Halloran Conservation Area (Mainand Redlands)		Logan		Y	Palustrine wetland surrounded by salt marsh providing wader habitat. Potential breeding ground for the endangered Illidge's Ant-Blue Butterfly and wader birds	5.1.4	3
lg_r_fa_01	Headwater areas supporting macro-invertebrate taxa		Logan	Y		Headwaters above the 300m contour and down into the mid sections of most streams in the basalt areas within the Scenic Rim subregion. Upland streams with steep gradients in undisturbed subcatchments, with good water quality, running over diverse substrates. High diversity of most macroinvertebrates e.g. crayfish, caddisflies and mayflies. Also stream-adapted frog fauna including a number of EVNT species. These fauna values correlate with elevated altitude, high rainfall, and intact vegetation.	6.3.1	4

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
lg_r_fa_02	Serpentine Creek & Native Dog Creek East Branch		Logan	Y		Part of Carbrook Nationally Important Wetlands - drought refugia and swamps used by migratory waders (Blackman etal 1999), also part included in Moreton Bay Ramsar area. Good example of lowland stream in good ecological condition in southern SEQ and supports unique (low pH) ecosystem (Moffatt 2008). One of the southernmost occurrences of Eucalyptus planchoniana, found in only a few locations in Qld. Aegiceras corniculatum (River mangrove) is dependent on tidal flow up the creek from the Logan River.	6.3.1	3
lg_r_fa_03	Karawatha wetlands		Logan	Y		Frog habitat (23 species) including Crinia tinnula & Litoria brevipalmata.	6.3.1	4

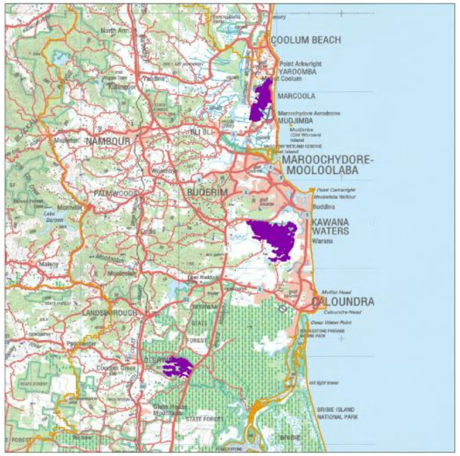
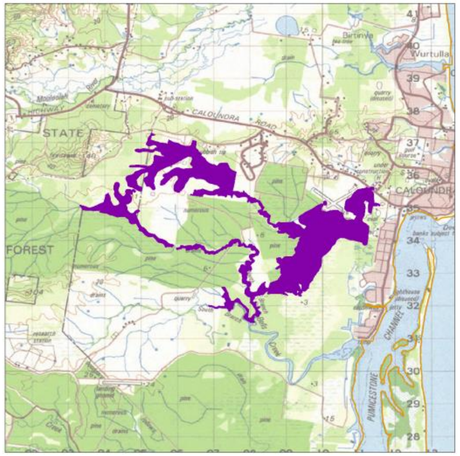
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
lg_r_fa_04	Flying Fox camps		Logan	Y		Significant numbers of flying foxes can congregate along riparian zones. Camps are identified as special habitat e.g. Cabbage Tree Creek, Indooroopilly Islands.	6.3.1	4
lg_r_fa_05	Coolnwynpin Creek		Logan	Y		Wallum froglet and ornate sunfish present	5.1.4	3

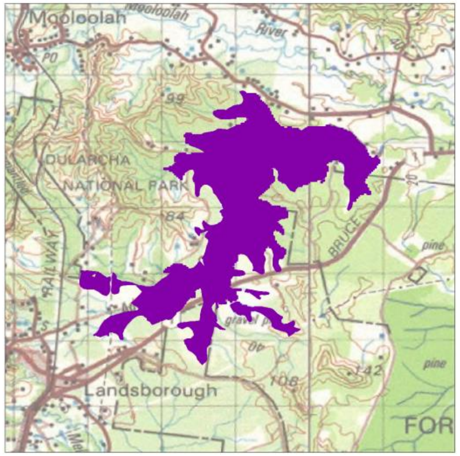
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
ly_nr_fa_01	Lower Lockyer Valley major wetlands		Lockyer		Y	Decision includes every major wetland in the lower Lockyer Valley. Remnants of floodplain. Lake Idley, Atkinson's Dam, Lake Clarendon, 7-Mile Swamp, Jahnke's lagoon, Lake Dyer (wader birds study group). Wetlands are large after heavy rain and include habitat for water birds like the cotton pygmy-goose, freckled duck, magpie goose, blue-billed duck (breeding) and plumed whistling-duck. A range of dry country frogs (15 species) are present. Other fauna includes grey snakes, blue winged kookaburras, certain Trichoptera (caddisflies) found only in the Lockyer Valley in SEQ. Breeding place for Australian painted snipe.	6.3.1	4
ly_nr_fa_02	Lower Lockyer Valley minor wetlands		Lockyer		Y	Smaller wetlands in lower Lockyer Valley. Remnants of floodplain. Wetlands are large after heavy rain and include habitat for water birds including the cotton pygmy-goose. A range of dry country frogs (15 species) are present. Other fauna includes grey snakes, blue winged kookaburras, certain Trichoptera (caddisflies) found only in the Lockyer Valley in SEQ. Breeding place for Australian painted snipe.	6.3.1	3

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
ly_r_fa_01								
ly_r_fa_02	Headwater areas supporting macro-invertebrate taxa		Lockyer	Y		Headwaters above the 300m contour and down into the mid sections of most streams in the basalt areas within the Scenic Rim subregion. Upland streams with steep gradients in undisturbed subcatchments, with good water quality, running over diverse substrates. High diversity of most macroinvertebrates e.g. crayfish, caddisflies and mayflies. Also stream-adapted frog fauna including a number of EVNT species. These fauna values correlate with elevated altitude, high rainfall, and intact vegetation.	6.3.1	4

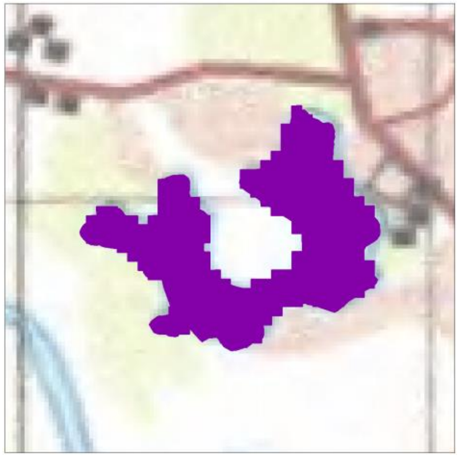
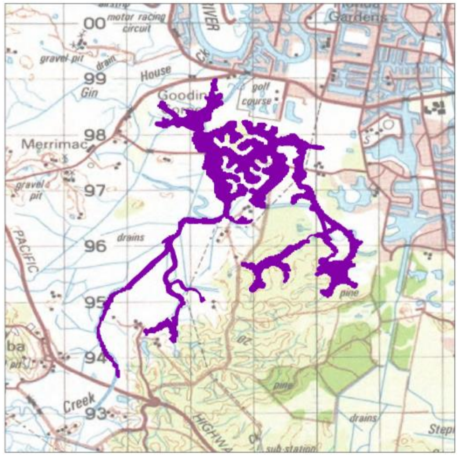
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
mb_nr_fa_01	Port of Brisbane lake		Moreton Bay Islands		Y	Significant range of waterbirds including the black swan and chestnut teal in large numbers. Migratory waders such as marsh, curlew and sharp-tailed sandpipers use the muddy margins.	6.3.1	3
mb_nr_fa_02	Paul Carter Wetlands, Maclaey Is (SMBI)		Moretoon Bay Islands		Y	Wader habitat	5.1.4	3

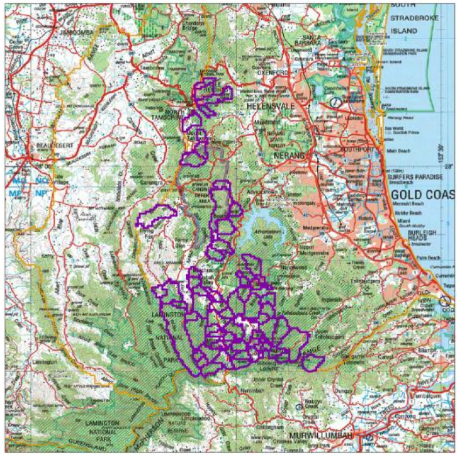
Decision number	**Special features (name)**	**Location**	**Study area**	**R[1]**	**NR[2]**	**Values**	**CIM[3]**	**Con. rating[4]**
mb_nr_fa_03	Melomys Wetland, Russell Is (SMBI)		Moreton Bay Islands		Y	Wader habitat	5.1.4	4
mb_nr_fa_04	Water Mouse Wetlands, Russell Island (SMBI)		Moreton Bay Islands		Y	Water mouse habitat	6.3.1	4

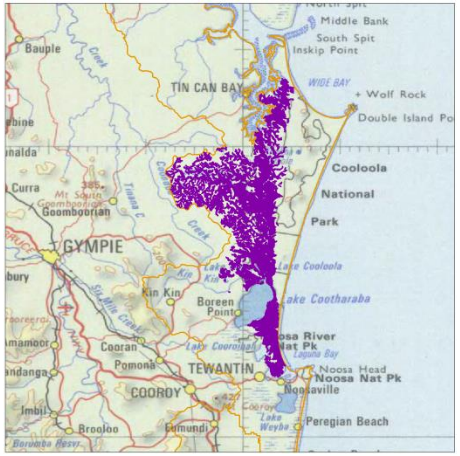
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
mc_nr_fa_02	Maroochy wallum aggregation		Maroochy		Y	Frog, invertebrate and some fish values. Decision covers a large wet wallum area. Best wallum remnant on the Sunshine Coast. Ground parrot present.	6.3.1	4
mc_nr_fa_03	Caloundra south wetlands		Maroochy		Y	Frog habitat. Threatened and priority species. Ex-plantation forestry.	6.3.1	3

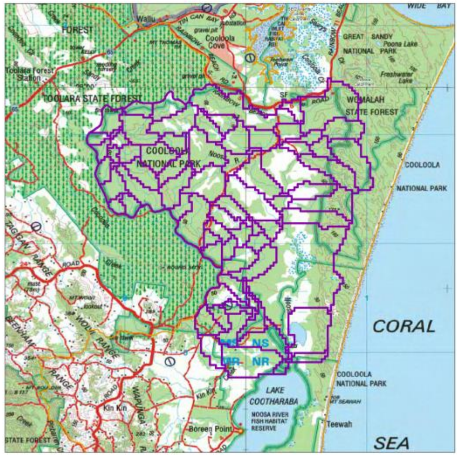
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
mc_nr_fa_04	Ewan Maddock Dam		Maroochy		Y	Waterbird habitat including Australian painted snipe, Latham's snipe, little grassbird and black-necked stork.	5.14	4
mc_r_fa_01	Headwater areas supporting macro-invertebrate taxa		Maroochy	Y		Headwaters above the 300m contour and down into the mid sections of most streams in the basalt areas within the Scenic Rim subregion. Upland streams with steep gradients in undisturbed subcatchments, with good water quality, running over diverse substrates. High diversity of most macroinvertebrates e.g. crayfish, caddisflies and mayflies. Also stream-adapted frog fauna including a number of EVNT species. These fauna values correlate with elevated altitude, high rainfall, and intact vegetation.	6.3.1	4

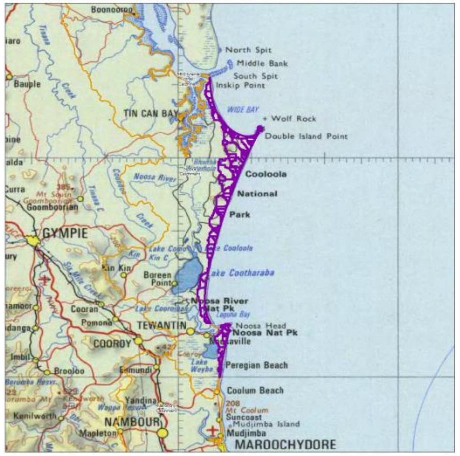
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
mt_nr_fa_01	Moreton Island palstrine and lacustrine wetlands		Moreton Island		Y	1 EVNT fish - *Nannoperca oxleyana* and 1 priority species - *Rhadinocentrus ornatus*. Multiple values: threatened acid frogs, priority shrimps and dragon flies present. Smallest crayfish in the world (*Tenuibranchiurus glypticus*). Similar geomorphology across islands. Wetlands near mine ponds are excluded. Similar values on Fraser and Stradbroke islands.	6.3.1	4
mt_r_fa_01	Moreton Island riverine wetlands		Moreton Island	Y		Mapped riverine network on the island. 1 EVNT fish - *Nannoperca oxleyana* and 1 priority species - *Rhadinocentrus ornatus*. Multiple values: threatened acid frogs, priority shrimps and dragon flies present. Smallest crayfish in the world (*Tenuibranchiurus glypticus*). Similar geomorphology on Fraser and Stradbroke islands.	6.3.1	4

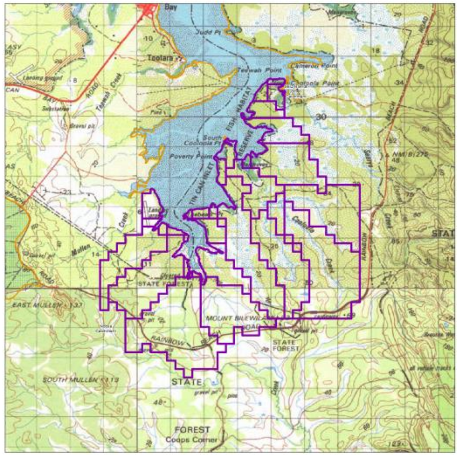
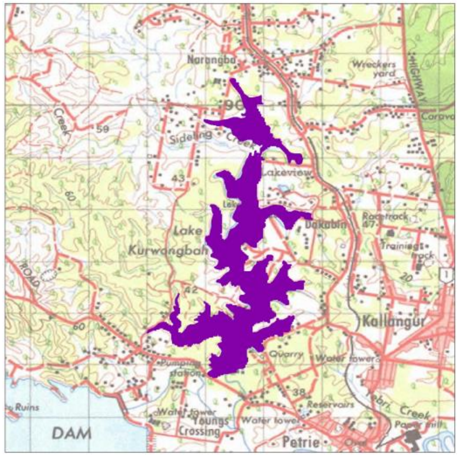
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
nc_nr_fa_01	Lake Hugh Muntz		Nerang Coomera		Y	Pure freshwater system with consistent water quality (excellent water quality compared to other H3 artificial wetlands). Artificial version of window lake. Fish and waterbird habitat. Occasional cyanobacterial blooms but much less frequent than in other artificial lakes.	5.1.4	3
nc_nr_fa_02	Robina lakes		Nerang Coomera		Y	Fish and important waterbird habitat. Stocked with bass. Difficult to maintain good water quality. Tidal influence. Contains *Salvinia* rafts.	5.1.4	2

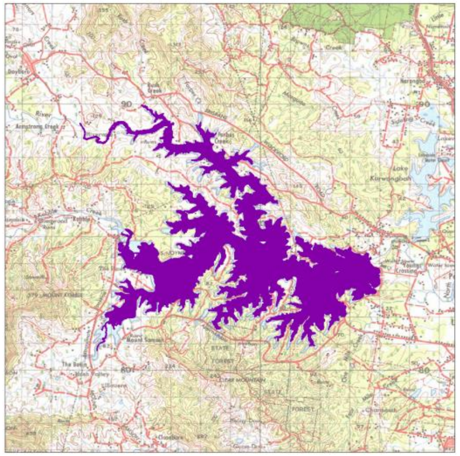
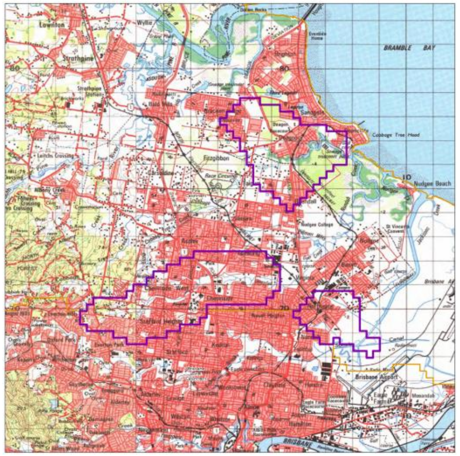
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
nc_r_fa_01	Headwater areas supporting macro-invertebrate taxa		Nerang Coomera	Y		Headwaters above the 300m contour and down into the mid sections of most streams in the basalt areas within the Scenic Rim subregion. Upland streams with steep gradients in undisturbed subcatchments, with good water quality, running over diverse substrates. High diversity of most macroinvertebrates e.g. crayfish, caddisflies and mayflies. Also stream-adapted frog fauna including a number of EVNT species. These fauna values correlate with elevated altitude, high rainfall, and intact vegetation.	6.3.1	4
nc_r_fa_03	Coomera River large platypus population		Nerang Coomera	Y		Large platypus population beside the gravel extraction area.	6.3.1	3

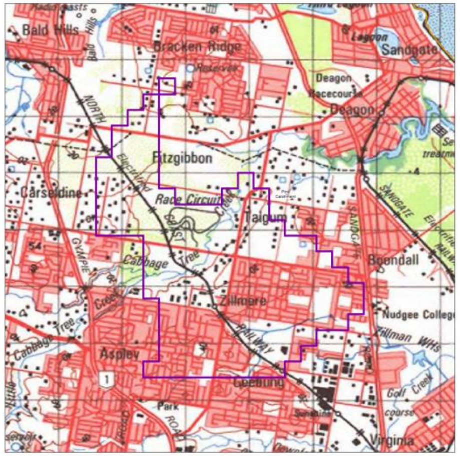
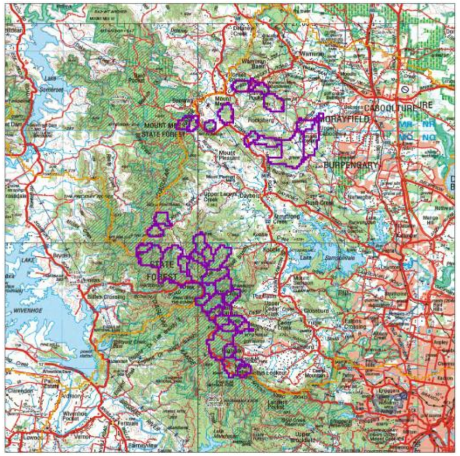
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
ns_nr_fa_01	Noosa river, Teewah Creek to Lake Cootharaba		Noosa		Y	Contains ground parrot, 2 EVNT fish, southern emu wren, acid frog species and water mouse. Macroinverbrate richness. Unique intact acidic water system running through wallum. Natural populations of Australian bass and jungle perch.	6.3.1	4
ns_nr_fa_02	Noosa National Park south of David Low Way		Noosa		Y	2 threatened fish species. Same values, same area as ns_r_fa_02.	6.3.1	3

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
ns_r_fa_01	Noosa River, Teewah creek to Lake Cootharaba		Noosa	Y		Contains ground parrot, 2 evnt fish, emu wrens, acid frogs, water mouse. Intact system. Macroinverbrate richness. EHMP report card, (See dm). Unique acidic water system running through wallum. Natural bass population. Jungle perch.	6.3.1	4
ns_r_fa_02	Noosa National Park south of David Low Way.		Noosa	Y		2 threatened fish species. N.B. Same area, same values as ns_nr_fa_02.	6.3.1	3

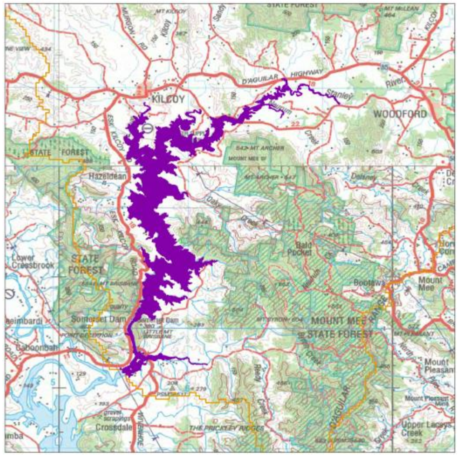
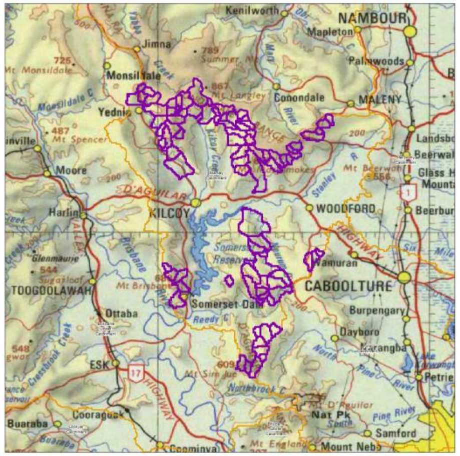
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
ns_r_fa_03	Noosa National Park, coastline between Inskip and Coolum Beach		Noosa	Y		Unique assemblages of macroinvertebrates in wallum systems. Fish habitat. Very few exotic pest species but system under threat. NB: Notes advise checking WBB perched lake descision.	6.3.1	4
ns_r_fa_04	Flying Fox camps		Noosa	Y		Wherever permanent and temporary flying fox camps occur the riparian zone vegetation is identified as special habitat. The panel noted that some roosts occurred within non-riverine wetlands. The majority of camps for these species are located along watercourses. It is thought that the riparian zone is favoured because of the higher humidity levels than the surrounding terrestrial areas and because the flying foxes may use the streams for navigation.	6.3.1	4

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
ns_r_fa_05	Honey blue-eye & Oxlyean pygmy-perch		Noosa	Y		Presence of two co-existing threatened fish (Honey blue-eye & Oxlyean pygmy-perch)	6.3.1	4
pn_nr_fa_01	Kurwongba dam		Pine		Y	Actively stocked with Australian bass, yellowbelly, Mary River cod, snubnose garfish and saratoga. Also contains redclaw yabby and tilapia. Infested with *Cabomba*.	5.1.4	3

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
pn_nr_fa_02	Samsonvale Dam		Pine		Y	Waterbird habitat including musk duck, great crested grebe, cotton pygmy-goose and Lewin's rail. Australian lungfish present.	5.1.4	4
pn_r_fa_01	Flying Fox camps		Pine	Y		Significant numbers of flying foxes can congregate along riparian zones. Camps are identified as special habitat e.g. Cabbage Tree Creek, Indooroopilly Islands.	6.3.1	4

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
pn_r_fa_02	Aspley State High School, Zillmere Rd, Aspley		Pine	Y		Large pool behind the school has a high diversity of native fish. Also much remnant bushland surrounds the site. Dec: reep_bcc_7 WPU: C/020	6.3.1	3
pn_r_fa_03	Headwater areas supporting macro-invertebrate taxa		Pine	Y		Headwaters above the 300m contour and down into the mid sections of most streams in the basalt areas within the Scenic Rim subregion. Upland streams with steep gradients in undisturbed subcatchments, with good water quality, running over diverse substrates. High diversity of most macroinvertebrates e.g. crayfish, caddisflies and mayflies. Also stream-adapted frog fauna including a number of EVNT species. These fauna values correlate with elevated altitude, high rainfall, and intact vegetation.	6.3.1	4

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
sb_nr_fa_01	North Stradbroke non-riverine wetlands		Stradbroke Islands		Y	One endangered fish species present. Dunelakes and swamps. Multiple values: threatened acid frogs, priority shrimps and dragon flies present. Smallest crayfish in the world. Similar geomorphology across islands. Only include mapped riverine network. Habitat of swamp daisy and *Eleocharis*, swamp orchids, *Saproscincus oriarus.* Large lakes have musk duck. Type locality for freshwater worm, damselfly and dragonfly.	6.3.1	4
sb_r_fa_01	North Stradbroke riverine systems		Stradbroke Islands	Y		One Endangered fish (*Nannoperca oxleyana*) present. Multiple values: threatened acid frogs, priority shrimps and dragon flies present. Smallest crayfish in the world (*Tenuibranchiurus glypticus*). Similar geomorphology on the other islands. Habitat of swamp daisy and *Eleocharis*, swamp orchids, *Saproscincus oriarus*. Large lakes have musk duck. Type locality for damselfly and dragonfly. Only include mapped riverine network.	6.3.1	4

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
sl_nr_fa_01	Somerset Dam		Stanley		Y	Waterbird habitat including large numbers of great crested grebe, great cormorant and Eurasian coot. Fish present include Australian bass, golden perch, silver perch, bony bream, eel-tailed catfish, spangled perch, Mary River cod, snubnose garfish, Australian lungfish and saratoga.	5.1.4	4
sl_r_fa_01	Headwater areas supporting macro-invertebrate taxa		Stanley	Y		Headwaters above the 300m contour and down into the mid sections of most streams in the basalt areas within the Scenic Rim subregion. Upland streams with steep gradients in undisturbed subcatchments, with good water quality, running over diverse substrates. High diversity of most macroinvertebrates e.g. crayfish, caddisflies and mayflies. Also stream-adapted frog fauna including a number of EVNT species. These fauna values correlate with elevated altitude, high rainfall, and intact vegetation.	6.3.1	4

5 Ecology

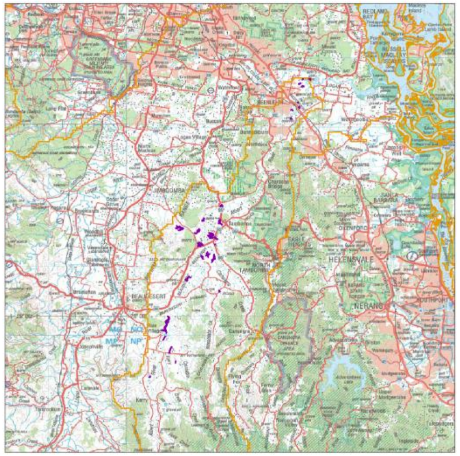
5.1 Special features

The panel identified several riverine and non-riverine special features in the Southeast Queensland region known to contain ecology values (Table 20).

Each spatial unit that intersected with a particular ecosystem or feature in Table 20 was given a score equal to the conservation rating. Decisions are listed alphabetically by catchment. These features were intersected with the spatial units to identify the values for criterion 6 (Special features). All implemented special features were given a conservation rating of between 1 and 4 assigned by the panel. Decisions that were not able to be implemented due to a lack of readily available data or unconfirmed values, are indicated with '_not_implemented' in the decision implementation number column. Decisions that have 'to be implemented' in the implementation column are in the process of being implemented assuming available and suitable data and time. Where a single decision crosses a number of study areas, the decision has been duplicated for each study area. Decisions sorted by study area.

Table 20. Identified ecology special features and their values

Table sorted by decision number which equates to alphabetically by study area code then non-riverine/riverine.

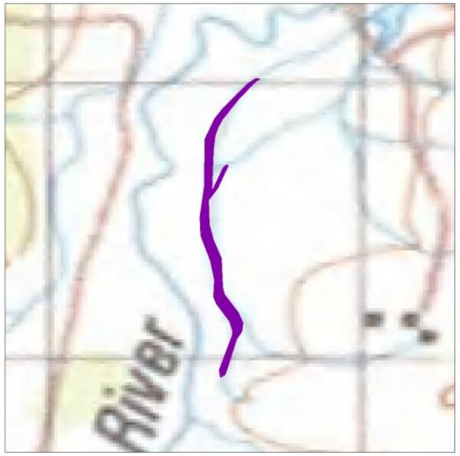
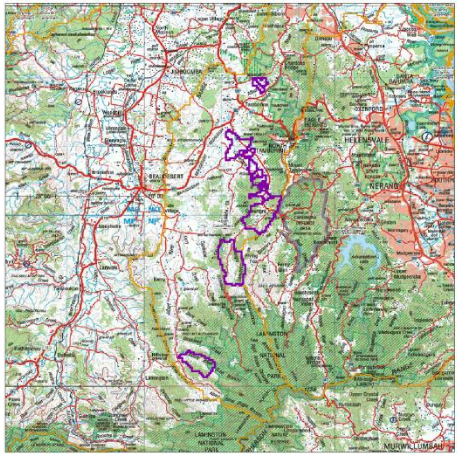
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
al_nr_ec_01	Ephemeral wetlands		Albert		Y	Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.	5.2.1, 6.3.1	4, 4

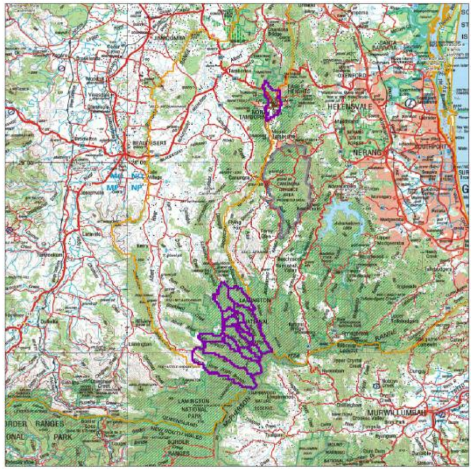
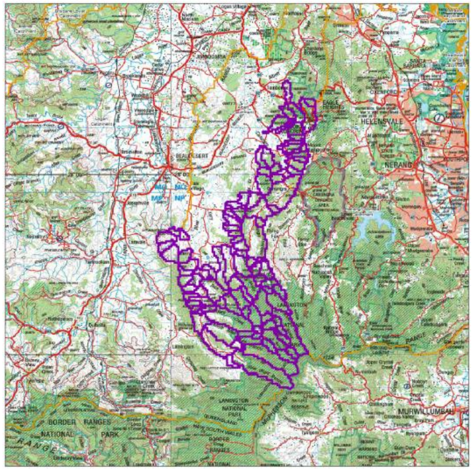
1 Riverine

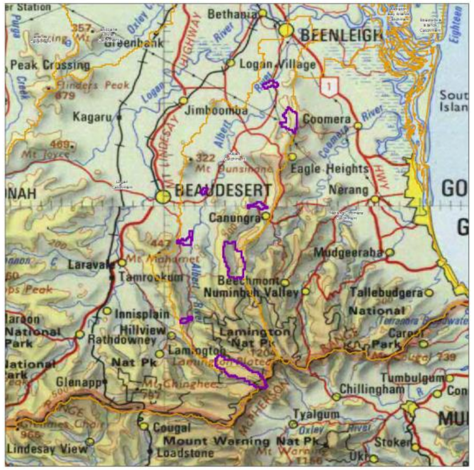
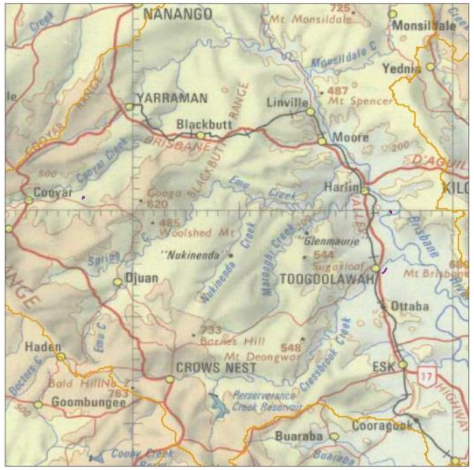
2 Non-riverine

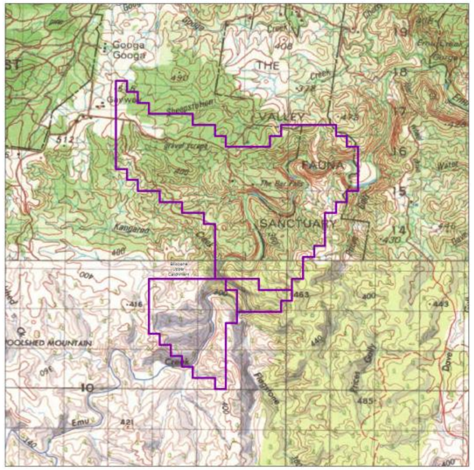
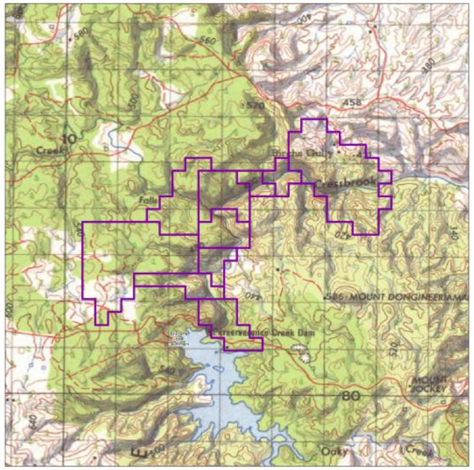
3 Number refers to the values from the generic CIM in Appendix B

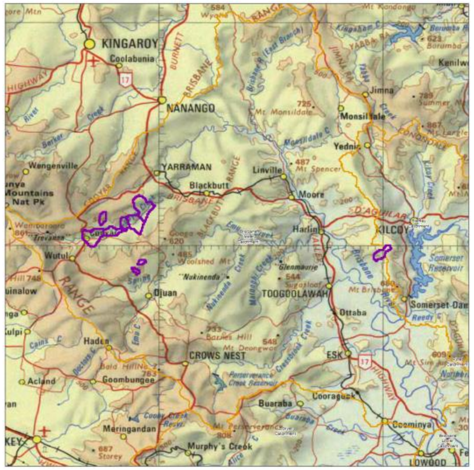
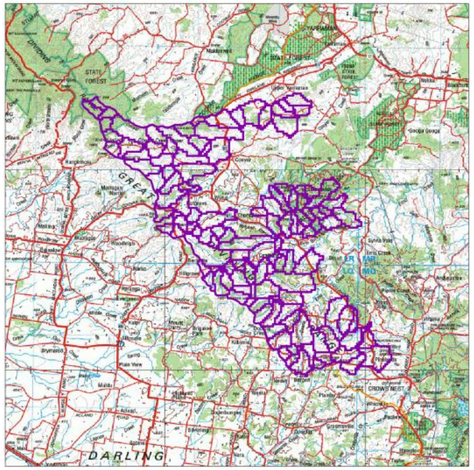
4 4 is the highest number

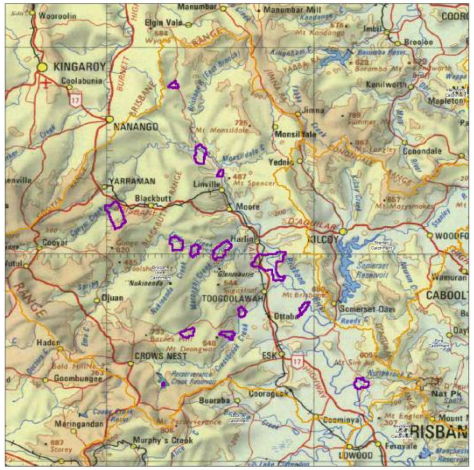
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
al_nr_ec_02	Oxbows		Albert		Y	Oxbow lakes RE 12.3.7c. Similar refugial values to RE 12.3.8 (possibly better as they are wetter for longer). Old palaeo-channels that have near permanent water and provide fish refuge in times of floods. Characterised by hollow bearing bluegums.	6.3.1	4
al_r_ec_01	Gallery rainforest		Albert	Y		Gallery rainforest RE 12.3.1 on alluvial plains. Highly fragmented and endangered vegetation community. Provides significant food input into waterways. Important habitat for macro-invertebrates and provides shade for the in-stream environment. Hydrologically important. Often too narrow to be mapped at 1:100 000 scale.	5.2.1, 6.3.1	4, 4

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
al_r_ec_02	Permanent flowing streams		Albert	Y		Permanent flowing streams fed by aquifers and rainfall - identified by Groundwater Dependent Ecosystem panel. Expression of water 600 years old on Mount Tamborine.	6.4.1	4
al_r_ec_03	Basaltic ground fed permanent refugia pools.		Albert	Y		Refugial value and ground water connectivity due to basalt aquifers in volcanic uplands. The Tertiary Basalt is an elite aquifer. Small permanent pools in the streams are maintained by spring-fed headwater systems. Steepness adds to uniqueness as it results in pools on shelves. Influence of the aquifers may extend downstream a minimum of 1 km in higher rainfall areas but can extend down to valley-bottom alluvium. In areas with less than 800 mm rainfall, the distance of influence is reduced e.g. as little as 100m away from the basalt outcrops. These streams are part of the Groundwater Dependent Ecosystem (GDE) mapping program. Pools in the northern basalt outcrops have eels and gudgeon.	6.4.1, 6.3.1	4, 4

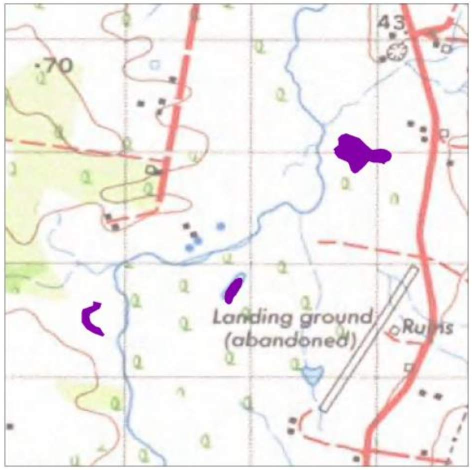
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
al_r_ec_04	High energy lotic systems		Albert	Y		Boulder to cobble bed stretches in stream beds providing pool and riffle environments. Provide diversity in substrate habitat and a highly oxygenated, self-cleaning system. Not all examples will have high ecological value due to other factors e.g. water quality. Activities that remove boulders and stones cause degradation.	6.1.1	3
bb_nr_ec_02	Ephemeral wetlands		Brisbane Upper		Y	Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland. Issue with the one overlapping Wivenhoe dam when levels are high.	5.2.1, 6.3.1	4, 4

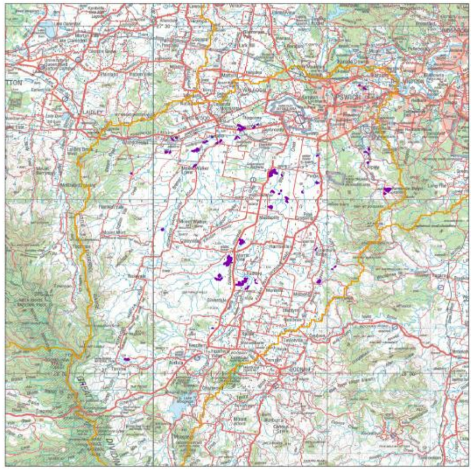
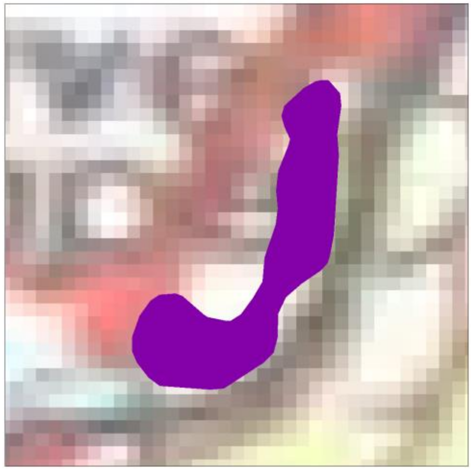
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bb_r_ec_01	Emu Creek Gorge		Brisbane Upper	Y		Highly variable system. Unique geomophology between the two dams, compared to upstream and downstream of them.	6.4.1	3
bb_r_ec_02	Crows Nest Gorge		Brisbane Upper	Y		Unique geomorphology and intact riparian zone between the dams - Lake Cressbrook and Perseverance Creek Dam. Unique geomophology compared to areas upstream and downstream of the dams. Some side gorges have higher biodiversity values than the main channel.	5.2.1, 6.3.1	4, 4

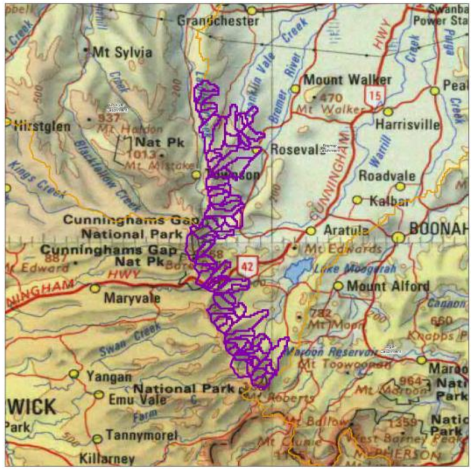
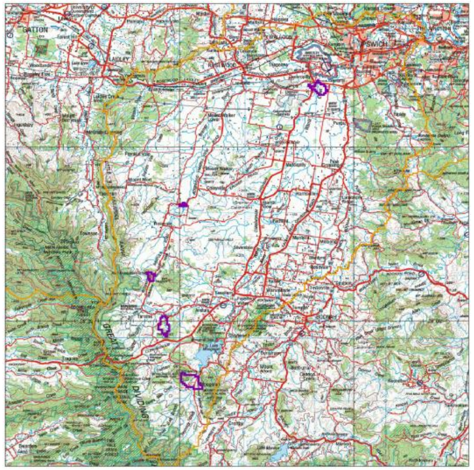
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bb_r_ec_03	Gallery rainforest		Brisbane Upper	Y		Gallery rainforest RE 12.3.1 on alluvial plains. Highly fragmented and endangered vegetation community. Provides significant food input. Important habitat for macro-invertebrates and provides shade for the in-stream environment. Hydrologically important. Often too narrow to be mapped at 1:100 000 scale.	5.2.1, 6.3.1	4, 4
bb_r_ec_04	Basaltic ground fed permanent refugia pools.		Brisbane Upper	Y		Refugial value and ground water connectivity due to basalt aquifers in volcanic uplands. The Tertiary Basalt is an elite aquifer. Small permanent pools in the streams are maintained by spring-fed headwater systems. Steepness adds to uniqueness as it results in pools on shelves. Influence of the aquifers may extend downstream a minimum of 1 km in higher rainfall areas but can extend down to valley-bottom alluvium. In areas with less than 800 mm rainfall, the distance of influence is reduced e.g. as little as 100m away from the basalt outcrops. These streams are part of the Groundwater Dependent Ecosystem (GDE) mapping program. Pools in the northern basalt outcrops have eels and gudgeon.	6.4.1, 6.3.1	4, 4

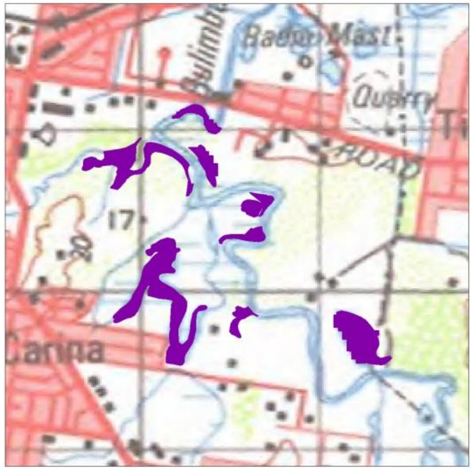
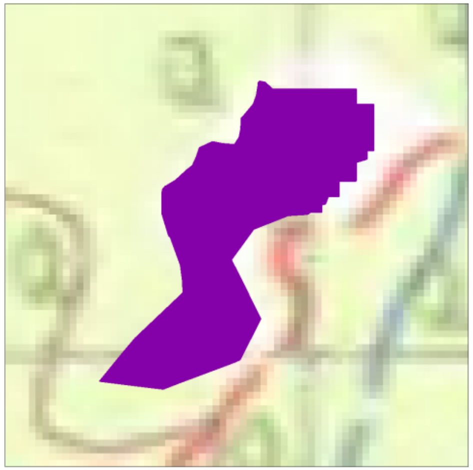
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bb_r_ec_05	High energy lotic systems		Brisbane Upper			Boulder to cobble bed stretches in stream beds providing pool and riffle environments. Provide diversity in substrate habitat and a highly oxygenated, self-cleaning system. Believed to be some examples downstream from Wivenhoe and Somerset dams and below other major infrastructure; regulated flow in these locations can result in enhanced biodiversity relative to natural state. Not all examples will have high ecological value due to other factors e.g. water quality. Activities that remove boulders and stones cause degradation.	6.1.1	3
bi_nr_ec_01	ICOLLS		Bribie Island		Y	Palustrine wetland - freshwater most of the time but occasionally estuarine when the sea breaks through dunes during storms/cyclones. Comprise a small proportion of the large contiguous swaths of nonriverine wetland that cover about half the island. Always associated with landzone 2. Particularly resilient system due to its high variability. Can have water quality issues.	6.4.1	4

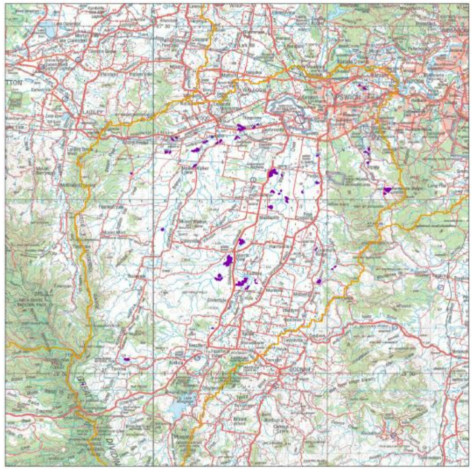
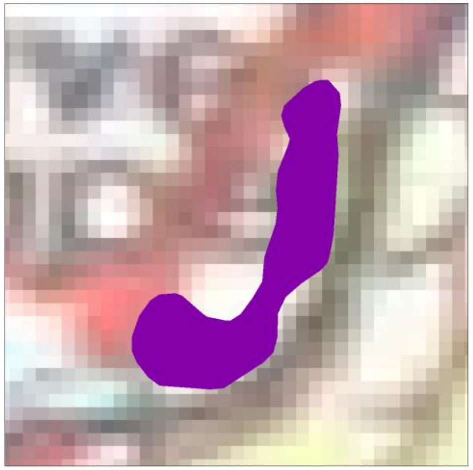
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bi_nr_ec_02	Groundwater Dependent Landzone 2		Bribie Island		Y	Coastal sand masses (Landzone 2) - wet heaths and Melaleuca wetlands are surface expression of the ground water. Below 50 metres elevation the trees have roots down to the water table. All lacustrine and palustrine wetlands in this area have a groundwater component that enhances their refugial values. One of the only systems in SEQ without serious impacts.	6.3.1	3
bi_nr_ec_03	Window lakes		Bribie Island		Y	Hydrologically connected to the wider regional aquifer. Mostly oligotrophic. Unique, old and stable systems with unique faunal assemblages. Occurs as a window into the water table on Quaternary coastal dunes and beaches. Low part of coastal landscape where water collects from both overland flow and infiltration from adjoining sand dunes. (BVG1M: 34a and BVG1M: 34c) represented by RE 12.2.15 and 12.2.15a	6.4.1, 6.1.1, 6.2.1	4,4,4

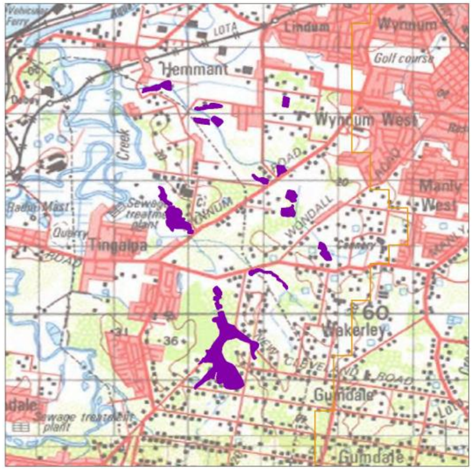
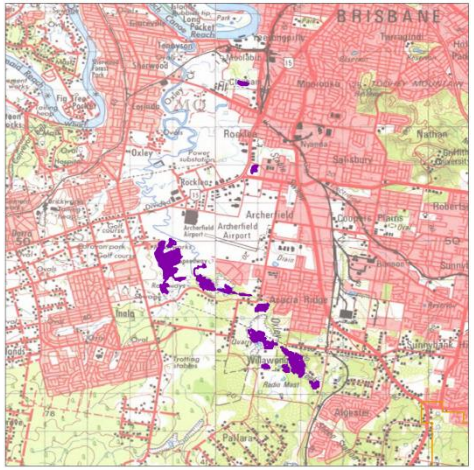
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
br_nr_ec_01	Oxbows		Bremer	Y		Oxbow lakes RE 12.3.7c. Similar refugial values to RE 12.3.8 (possibly better as they are wetter for longer). Old palaeo-channels that have near permanent water and provide fish refuge in times of floods. Characterised by hollow forming bluegums.	6.3.1	4
br_nr_ec_02	Purga wetlands		Bremer		Y	Melaleuca irbayana present (EPBC Act threatened ecological community), oxbow lakes, 10 to 15 semi-permanent and permanent pools. Diverse habitat of small wetlands. Not captured in the wetland mapping except for some small wetlands.	6.3.1	4

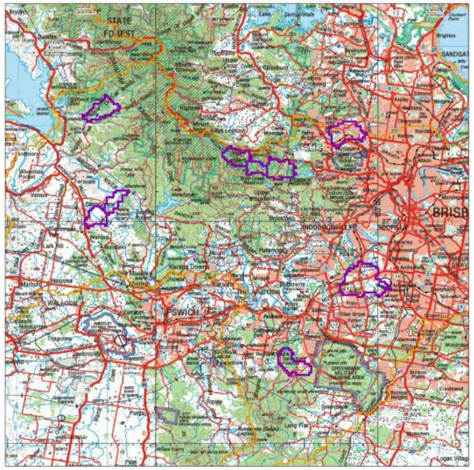
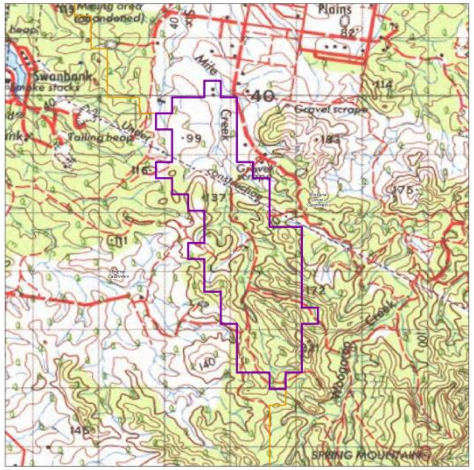
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
br_nr_ec_03	Ephemeral wetlands		Bremer		Y	Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.	5.2.1, 6.3.1	4, 4
br_nr_ec_04	Evelyn Dodd's Wetlands		Bremer		Y	Spring-fed wetlands just off Bundamba Creek. Degraded, heavily urbanised area but high refugium values for flora and fauna (wetland birds such as spoonbills). Macrophyte beds present.	6.3.1	3

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
br_r_ec_01	Basaltic ground fed permanent refugia pools.		Bremer	Y		Refugial value and ground water connectivity due to basalt aquifers in volcanic uplands. The Tertiary Basalt is an elite aquifer. Small permanent pools in the streams are maintained by spring-fed headwater systems. Steepness adds to uniqueness as it results in pools on shelves. Influence of the aquifers may extend downstream a minimum of 1 km in higher rainfall areas but can extend down to valley-bottom alluvium. In areas with less than 800 mm rainfall, the distance of influence is reduced e.g. as little as 100m away from the basalt outcrops. These streams are part of the Groundwater Dependent Ecosystem (GDE) mapping program. Pools in the northern basalt outcrops have eels and gudgeon.	6.4.1, 6.3.1	4, 4
br_r_ec_02	High energy lotic systems		Bremer	Y		Boulder to cobble bed stretches in stream beds providing pool and riffle environments. Provide diversity in substrate habitat and a highly oxygenated, self-cleaning system. Not all examples will have high ecological value due to other factors e.g. water quality. Activities that remove boulders and stones cause degradation.	6.1.1	3

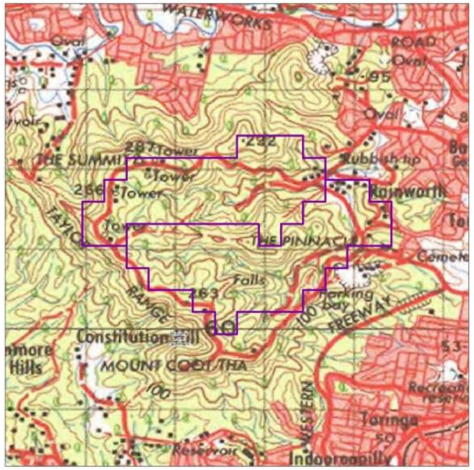
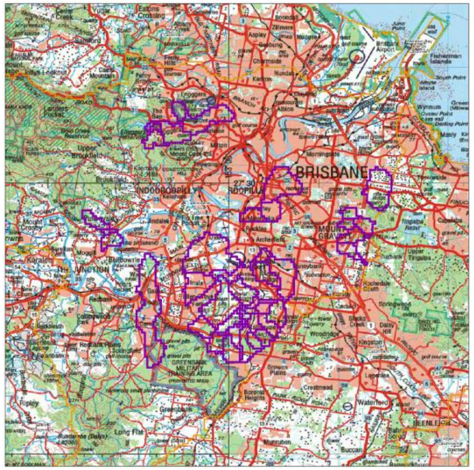
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_nr_ec_01	Minnippi Wetlands		Brisbane Lower		Y	Wet Melaleuca forest. Habitat for diverse range of waterbirds e.g. Baillon's and spotless crakes, Lewin's rail, comb-crested jacana and cotton pygmy-goose. Refugial value in a highly fragmented urbanised landscape.	6.3.1	3
bs_nr_ec_02	Greenbank Military Wetland		Brisbane Lower		Y	Wetlands in this area are in good condition as the vegetation surrounding them is largely intact. Refugial values. One particular wetland has high species richness.	6.3.1	4

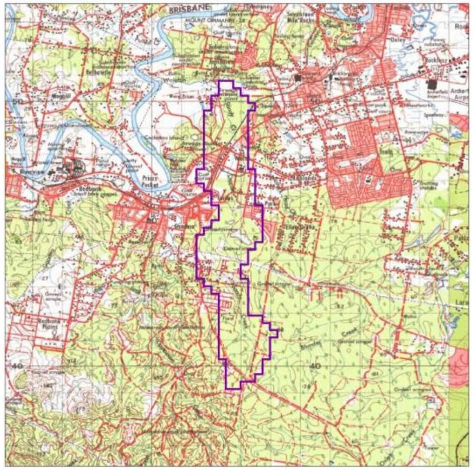
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_nr_ec_03	Ephemeral wetlands		Brisbane Lower		Y	Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.	5.2.1, 6.3.1	4,4
bs_nr_ec_04	Oxbows		Brisbane Lower		Y	Oxbow lakes RE 12.3.7c. Similar refugial values to RE 12.3.8 (possibly better as they are wetter for longer). Old palaeo-channels that have near permanent water and provide fish refuge in times of floods. Characterised by hollow forming bluegums.	6.3.1	4

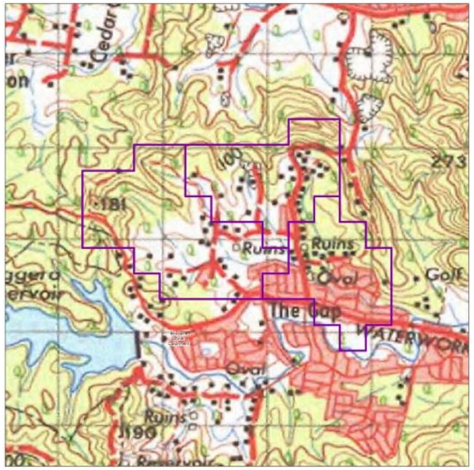
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_nr_ec_05	Ecologically Significant Melaleuca Wetlands		Brisbane Lower		Y	Nungubba Swamp, Tingalpa Wetland Reserve (Tinglapa and Hemmant Rd), Rocky Waterholes, Dairy Swamp Triangle, Bowhill Rd Freshwater Wetlands, Doolandella Boral Wetlands, Freshwater Wetland all reep_bcc_8	5.2.1	2
bs_nr_ec_06	Ecologically Significant Wetlands		Brisbane Lower		Y	Freshwater Wetlands (OX/040), Wetlands (OX/060) ,Beryl Roberts Park , Stable Swamp Creek (SS/070) , Rocky Water Holes Wetland (R/010), Pallara Parklands (OX/050), Marshall Rd Wetland (SS/020), Archerfield Wetlands reep_bcc_9	6.3.3	2
bs_nr_ec_07_not_implemented	Downstream of Pullenvale State School		Brisbane Lower		Y	Natural billabong with permanent water. (PL/020), reep_bcc_11. Too small to implement.	6.3.1	2

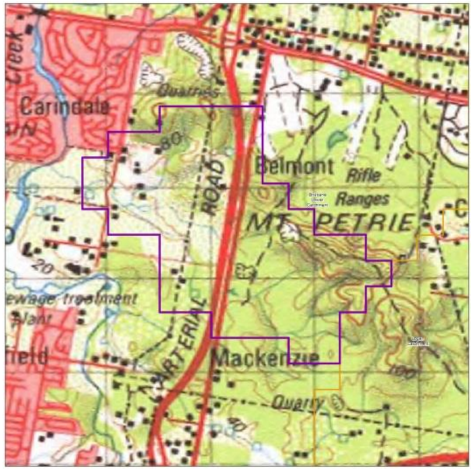
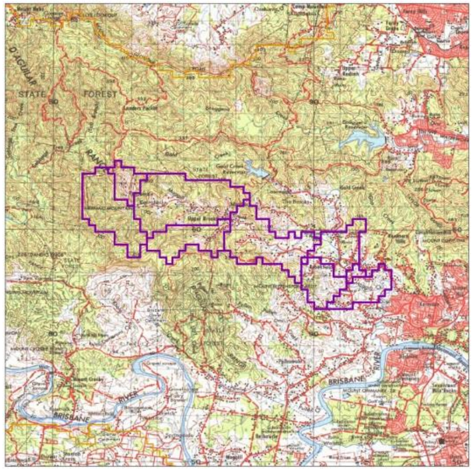
Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_ec_02	Gallery rainforest		Brisbane Lower	Y		Gallery rainforest RE 12.3.1 on alluvial plains. Highly fragmented and endangered vegetation community. Provides significant food input. Important habitat for macro-invertebrates and provides shade for the in-stream environment. Hydrologically important. Often too narrow to be mapped at 1:100 000 scale	5.2.1, 6.3.1	4,4
bs_r_ec_03	White Mountain spring fed pools		Brisbane Lower	Y		Small permanent pools on rocky outcrops. Drought refugia. Unique in the lower Brisbane catchment	6.3.1	3

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_ec_04	High energy lotic systems		Brisbane Lower	Y		Boulder to cobble bed stretches in stream beds providing pool and riffle environments. Provide diversity in substrate habitat and a highly oxygenated, self-cleaning system. Believed to be some examples downstream from Wivenhoe and Somerset dams and below other major infrastructure; regulated flow in these locations can result in enhanced biodiversity relative to natural state. Not all examples will have high ecological value due to other factors e.g. water quality. Activities that remove boulders and stones cause degradation	6.1.1	3
bs_r_ec_05	Section of Bulimba Creek		Brisbane Lower	Y		High diversity - few exotic fish, number of native fish. Mansfield conservation zone (in Wishart) – in good condition, lots of weeds but good riparian cover. Dec: reep_bcc_4, dec_04_feat_01, WPU BM/070	5.2.1	3

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_ec_06	Mt Coot-tha Forest Park waterfalls and headwaters		Brisbane Lower	Y		Simpson Falls and J.C. Slaughter Falls are two of the only remaining waterfalls in the Brisbane metropolitan area. Dec: reep_bcc_5a, WPU I/050. The headwaters of Ithaca Creek, maintained in natural state. Dec reep_bcc_9. v (BL/010) bs_r_fa_10	6.1.1, 6.3.3	3,3
bs_r_ec_07	Brisbane Deep pools for drought refuge		Brisbane Lower	Y		Deep pools for drought refuge	6.3.1	3

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_ec_08	Sandy Creek, Wacol (behind jail)		Brisbane Lower	Y		Regional Ecosystem 12.3.1 is there but not represented on mapping because of scale. RE (floodplain system) is unique in Brisbane. Naturally deeply incised creek, which may provide drought refuge and has no significant urban infrastructure. Dec: reep_bcc_6, WPU: SW/010	6.3.1	3
bs_r_ec_09	Sankeys Scrub, Whites Hill		Brisbane Lower	Y		Dry vine forest remnant. Important riparian flora and fauna habitat. Dec: reep_bcc_7, WPU: BM-T3/010	6.3.1	2

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_ec_10	Les Aitkinson Park, Stable Swamp and Stable Swamp Creek (Shellys Creek)		Brisbane Lower	Y		Freshwater spring (wetland, water source, drought refuge) with intact riparian vegetation (SS/040 and SS/050). reep_bcc_10	6.4.1	2
bs_r_ec_11	Fish Creek, The Gap		Brisbane Lower	Y		Spring fed creek system. reep_bcc_10. F/010	6.4.1	2

Decision number	Special features (name)	Location	Study area	R[1]	NR[2]	Values	CIM[3]	Con. rating[4]
bs_r_ec_12	Base of Belmont Hills natural area (Spring Ck)		Brisbane Lower	Y		Plunge pool and natural spring (potentially drought refuge). (BM-T4/010)	6.4.1	2
bs_r_ec_13	Moggill Creek (all WPU's)		Brisbane Lower	Y		Natural a hydrology regime with no major flow diversions. Contains refuge pools during drought which may be source populations for fish. Fish species present that are difficult to find elsewhere and high fish diversity. Rural values that are in contrast to urban areas of Brisbane therefore aquatic environment in relatively good condition. Relatively few crossings (culverts etc.) compared to urban creeks and not channellised to same extent as urban creeks. Good riparian vegetation. Potential platypus habitat. reep_bcc_11 (M/020, M/030, M/040,M/050)	6.3.1	3

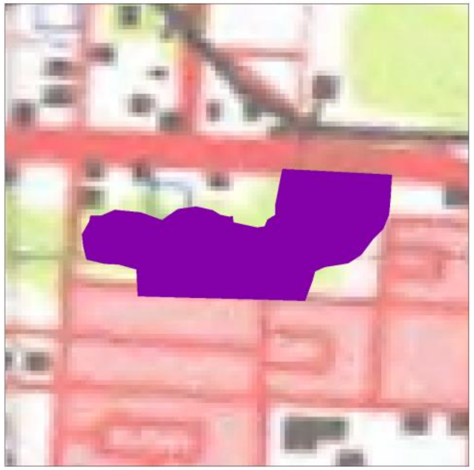
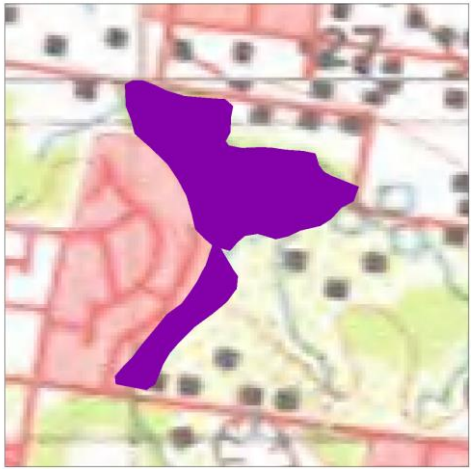
Decision number	**Special features (name)**	**Location**	**Study area**	**R[5]**	**NR[6]**	**Values**	**CIM[7]**	**Con. rating[8]**
ec_9_not_implemented	Melaleuca irbyana communities		Lockyer, Bremer, Logan, Brisbane Upper		Y	RE 12.9-10.11 (Melaleuca irbyana on sandstone ridges connected to groundwater) and 12.3.3c (M. irbyana on alluvium) mapped as a floodplain wetland. An endangered ecosystem and also habitat for many endangered species. Refugial values in the Lockyer Creek catchment. Suspected groundwater connectivity and unique soil features relating to moisture holding capacity. Very poorly studied but unique. Not implemented because the RE is not a wetland in the Qld wetland mapping.	6.3.1, 6.4.1	4, 4
lg_nr_ec_01	Groundwater Dependent Landzone 2		Logan		Y	Coastal sand masses (Landzone 2) - wet heaths and Melaleuca wetlands are surface expression of the ground water. Below 50 metres elevation the trees have roots down to the water table. All lacustrine and palustrine wetlands in this area have a groundwater component that enhances their refugial values. One of the only systems in SEQ without serious impacts.	6.4.1	3

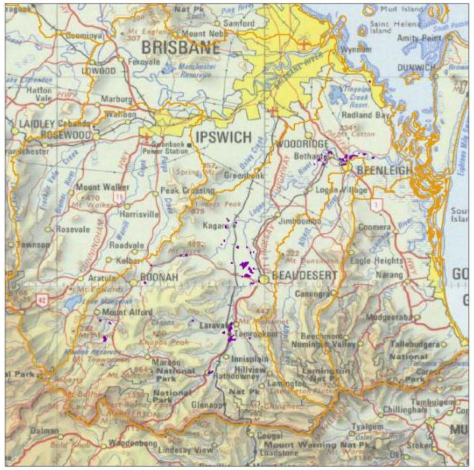
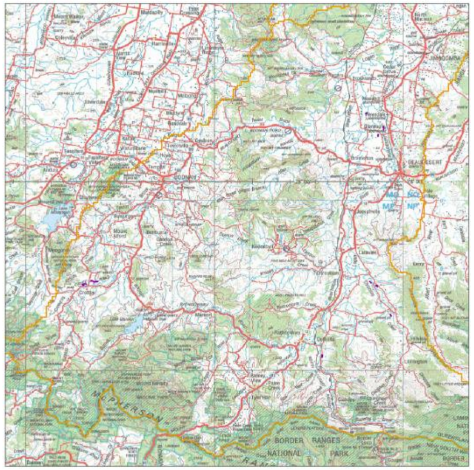
5 Riverine

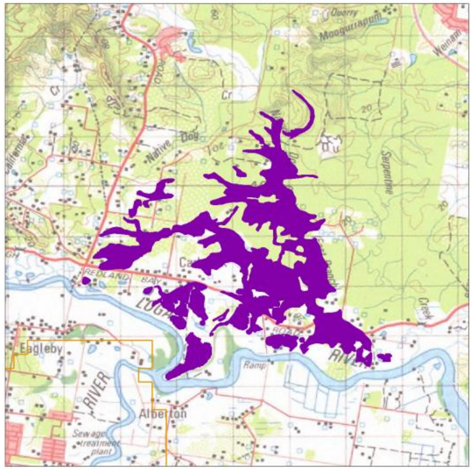
6 Non-riverine

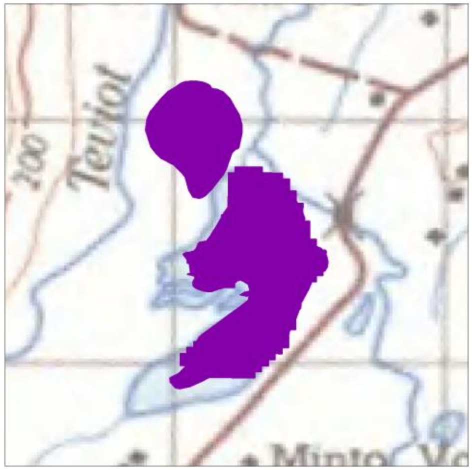
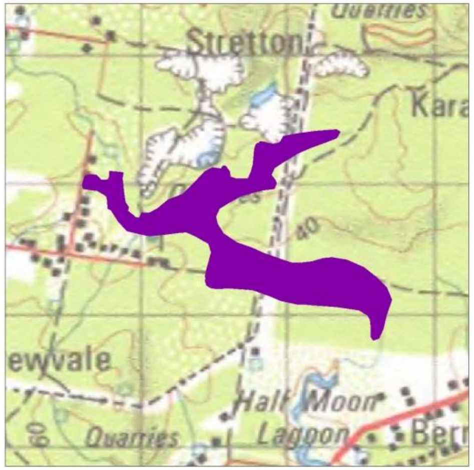
7 Number refers to the values from the generic CIM in Appendix B

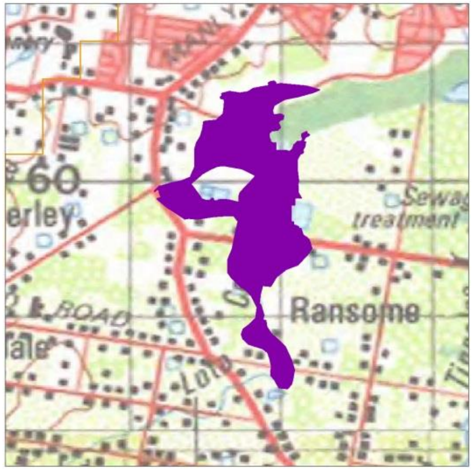
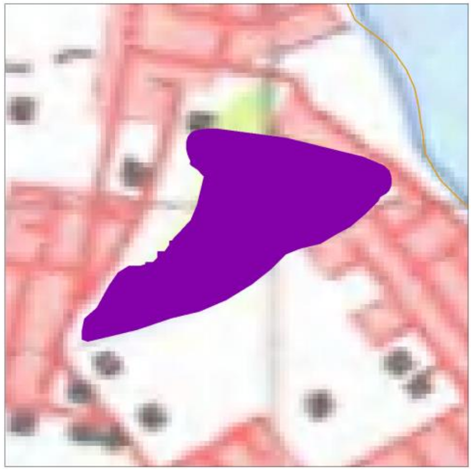
8 4 is the highest number

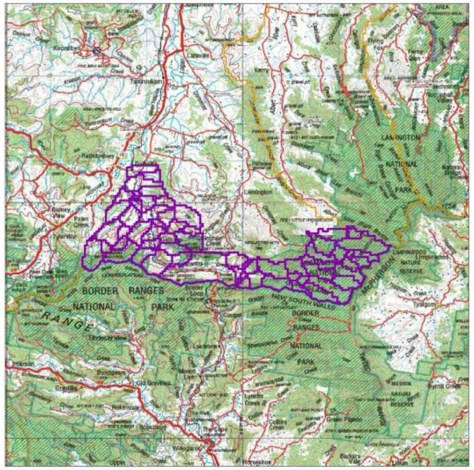
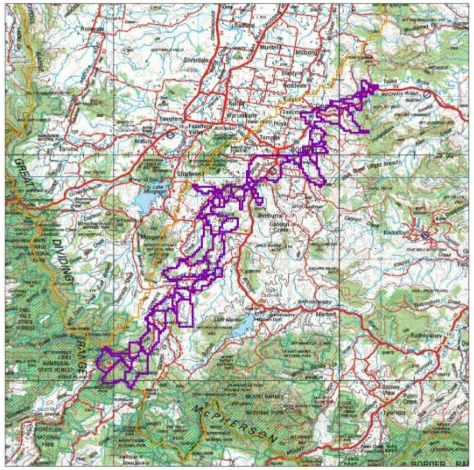
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
lg_nr_ec_02	Black swamp		Logan		Y	Flying fox camp - guano part of ecosystem energy system. Breeding habitat for cormorants and ibis. Some dieback issues in surrounding vegetation.	5.2.1, 5.1.4	3
lg_nr_ec_03	Tarradarrapin wetland		Logan		Y	Flying fox camp. Grey-headed flying-fox (EPBC Act listed species) camp records.	5.2.1	3

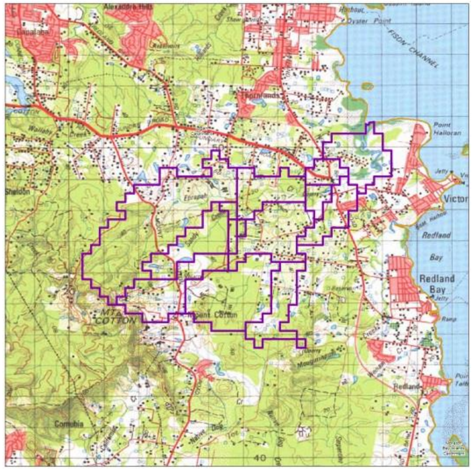
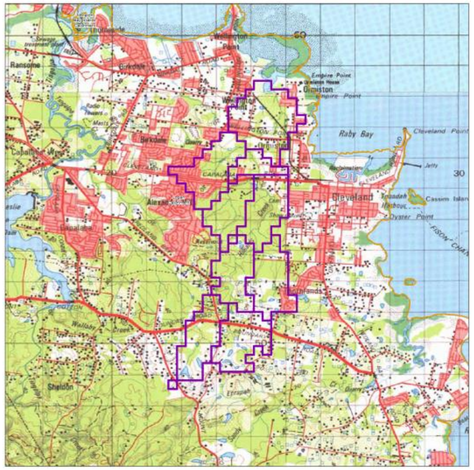
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
lg_nr_ec_04	Ephemeral wetlands		Logan		Y	Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.	5.2.1, 6.3.1	4,4
lg_nr_ec_07	Oxbows		Logan		Y	Oxbow lakes RE 12.3.7c. Similar refugial values to RE 12.3.8 (possibly better as they are wetter for longer). Old palaeo-channels that have near permanent water and provide fish refuge in times of floods. Characterised by hollow bearing bluegums.	6.3.1	4

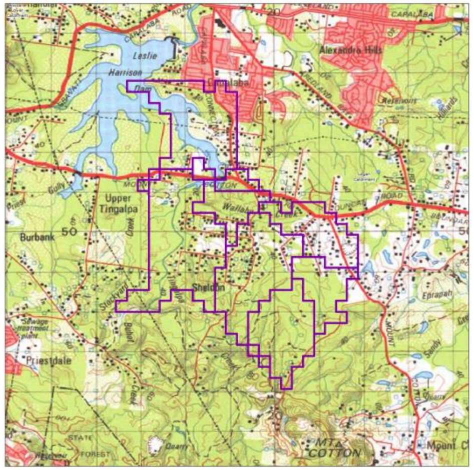
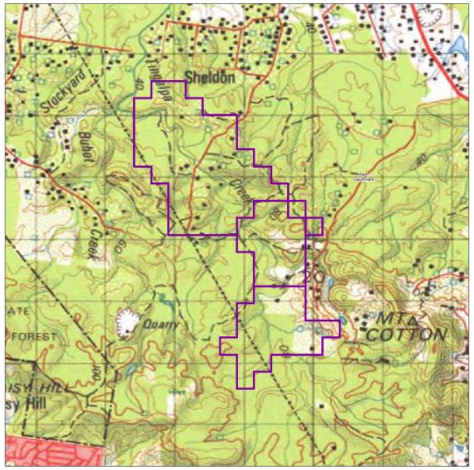
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
lg_nr_ec_08	Carbrook Venmans reserve		Logan		Y	Waterbird and frog habitat The wetlands have refugial values and are groundwater and overland flow connected. One of the largest remaining tracts of coastal paperbark forest between Noosa and the NSW border. Unusual association of *Eucalyptus microcorys* and *Eucalyptus racemosa* of local conservation significance. Several trees uncommon in SEQ including *Acacia perangusta, Glochidion sumatranum, Acronychia wilcoxiana, Eucalyptus robusta* x *tereticornis* natural hybrid. Fauna include *Ninox strenua, Ephippiorhynchus asiaticus* (black-necked stork), *Phascolarctos cinereus* (koala), *Tachyglossus aculeatus* (short beaked echidna), *Petaurus australis* (yellow-bellied glider), *Petaurus volans* (greater glider), *Macropus rufogriseus* (red-necked wallaby) and *Wallabia bicolor* (swamp wallaby). Venman's reserve is part of the Koala Bushland Coordinated Conservation Area. Protects the headwaters of Tingalpa Creek and its tributaries. See Blackman et al (1999) for more values. Macroinvertebrate data available from DSITI.	6.3.2	4

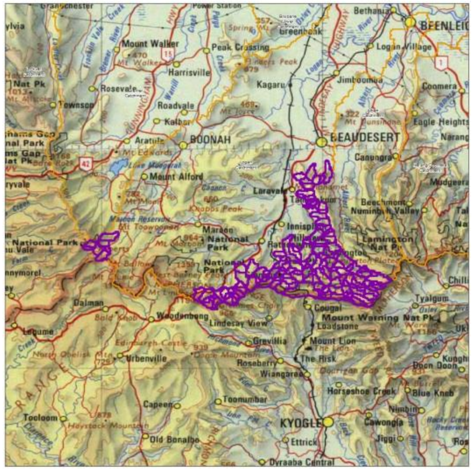
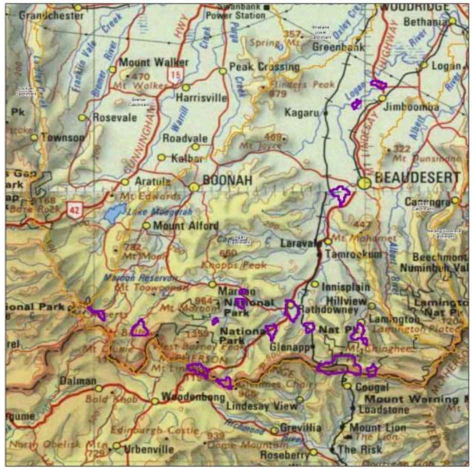
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
lg_nr_ec_09	Minto Swamp		Logan		Y	One of the largest swamps in the Scenic Rim. An ephemeral swamp and known habitat for waterbirds. Grazing pressures present but fairly resilient system. Values present in wetter times.	6.3.1	4
lg_nr_ec_10	Karawatha wetlands		Logan		Y	Melaleuca and mix of sedges. System of marshes, swamps, waterholes, lagoons and tributaries that is habitat for aquatic fauna - wet heath characteristics. 8 regional ecosystems within the wetland area, 2 Endangered, 5 Of Concern. Relatively large.	6.4.1	4

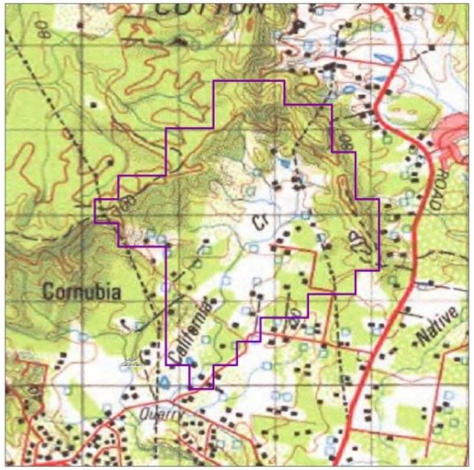
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
lg_nr_ec_11	Middle reaches of Lota Creek		Logan		Y	Ephemeral lowland waterholes - important drought refuge. Dec: reep_bcc_6 WPU: LT/020. Ephemeral waterhole surrounded by palustrine wetlands	6.3.1	3
lg_nr_ec_12	Egret Colony wetland (Mainland Redlands)		Logan		Y	Part of Moreton Bay Ramsar site. Flying fox roosting site known to occur. Phaius australis present.	6.3.1	3

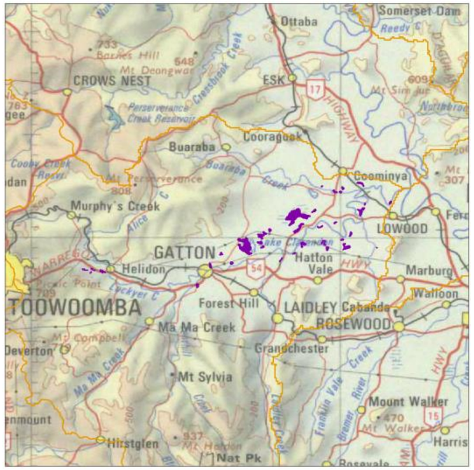
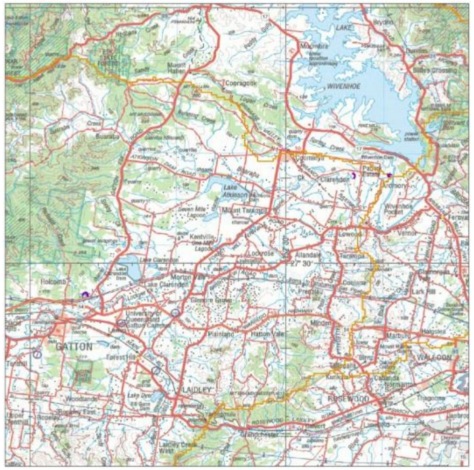
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
lg_r_ec_01	Running Creek and permanent flowing streams		Logan	Y		Only permanent flowing stream in Logan. Expression of water 600 years old on Mount Tamborine.	6.4.1	4
lg_r_ec_02	Teviot Brook		Logan	Y		Upper Teviot Brook above Wyaralong Dam. Interesting geology relating to Great Artesian Basin discharge/recharge areas. Unique hydrology, naturally saline. Unique invertebrates.	6.4.1, 6.3.1	3

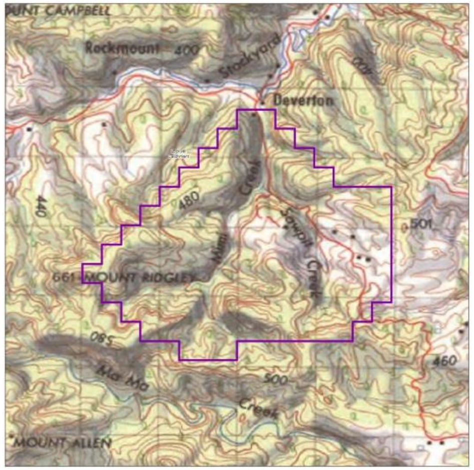
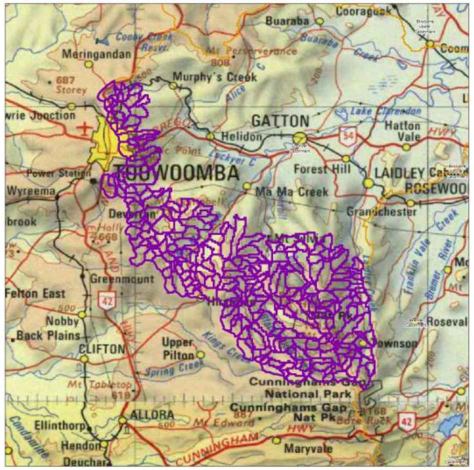
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
lg_r_ec_03	Eprapah Creek		Logan	Y		Decision captures freshwater and estuarine sections of the creek. Freshwater sections contain ornate rainbowfish (priority taxon) records. Vulnerable habitat. Good riparian cover.	5.2.1	3
lg_r_ec_04	Hilliards Creek		Logan	Y		Decision captures freshwater and estuarine sections of the creek. Upper, freshwater section is platypus habitat and site of ornate rainbowfish (priority taxon) records. Environmental flows impacted by sewage discharge. Good riparian cover.	5.2.1	3

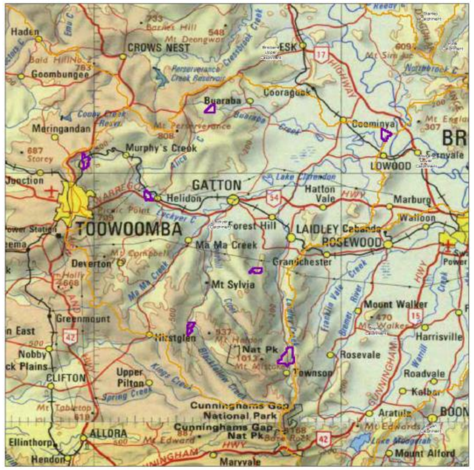
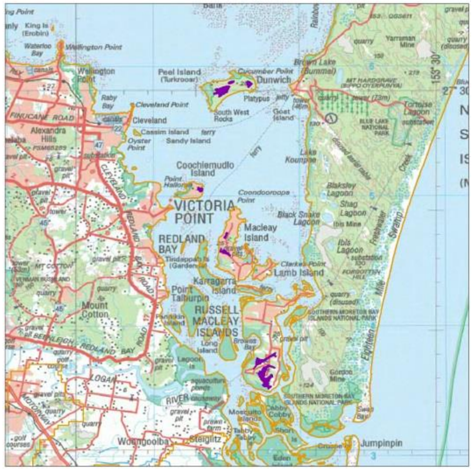
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
lg_r_ec_05	Upper Tingalpa Creek		Logan	Y		Ornate rainbowfish (priority taxon) records at this site. Also contains a section of original riparian rainforest.	5.2.1	4
lg_r_ec_06	Gallery Rainforest		Logan	Y		Gallery rainforest RE 12.3.1 on alluvial plains. Highly fragmented and endangered vegetation community. Provides significant food input. Important habitat for macro-invertebrates and provides shade for the in-stream environment. Hydrologically important. Often too narrow to be mapped at 1:100 000 scale.	5.2.1,6.3.1	4,4

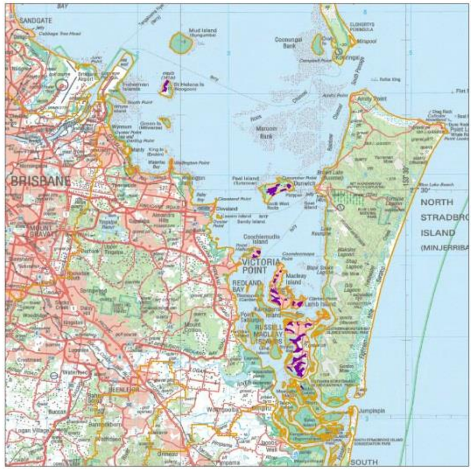
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
lg_r_ec_07	Basaltic ground fed permanent refugia pools		Logan	Y		Refugial value and ground water connectivity due to basalt aquifers in volcanic uplands. The Tertiary Basalt is an elite aquifer. Small permanent pools in the streams are maintained by spring-fed headwater systems. Steepness adds to uniqueness as it results in pools on shelves. Influence of the aquifers may extend downstream a minimum of 1 km in higher rainfall areas but can extend down to valley-bottom alluvium. In areas with less than 800 mm rainfall, the distance of influence is reduced e.g. as little as 100m away from the basalt outcrops. These streams are part of the Groundwater Dependent Ecosystem (GDE) mapping program. Pools in the northern basalt outcrops have eels and gudgeon.	6.4.1, 6.3.1	4,4
lg_r_ec_08	High energy lotic systems		Logan	Y		Boulder to cobble bed stretches in stream beds providing pool and riffle environments. Provide diversity in substrate habitat and a highly oxygenated, self-cleaning system. Believed to be some examples downstream from Wivenhoe and Somerset dams and below other major infrastructure; regulated flow in these locations can result in enhanced biodiversity relative to natural state. Not all examples will have high ecological value due to other factors e.g. water quality. Activities that remove boulders and stones cause degradation.	6.1.1	3

Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
lg_r_ec_09	Brisbane Deep pools for drought refuge		Logan	Y		Deep pools for drought refuge.	6.3.1	3
lg_r_ec_10	California Creek		Logan	Y		R.E. 12.3.11 Of Concern	6.3.1	2

Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
ly_nr_ec_01	Ephemeral wetlands		Lockyer		Y	Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.	5.2.1, 6.3.1	4,4
ly_nr_ec_02	Oxbows		Lockyer		Y	Oxbow lakes RE 12.3.7c. Similar refugial values to RE 12.3.8 (possibly better as they are wetter for longer). Old palaeo-channels that have near permanent water and provide fish refuge in times of floods. Characterised by hollow forming bluegums.	6.3.1	4

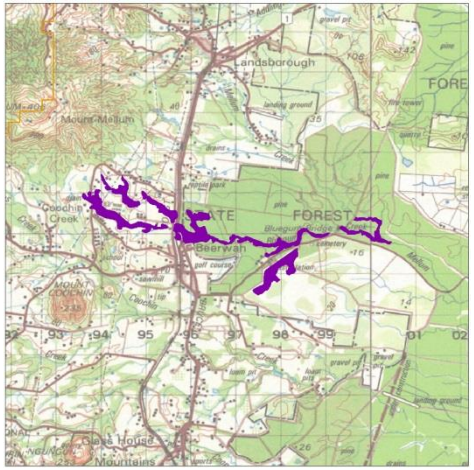
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
ly_r_ec_01	Gallery rainforest		Lockyer	Y		Gallery rainforest RE 12.3.1 on alluvial plains. Highly fragmented and endangered vegetation community. Provides significant food input. Important habitat for macro-invertebrates and provides shade for the in-stream environment. Hydrologically important. Often too narrow to be mapped at 1:100 000 scale.	5.2.1,6.3.1	4,4
ly_r_ec_02	Basaltic ground fed permanent refugia pools.		Lockyer	Y		Refugial value and ground water connectivity due to basalt aquifers in volcanic uplands. The Tertiary Basalt is an elite aquifer. Small permanent pools in the streams are maintained by spring-fed headwater systems. Steepness adds to uniqueness as it results in pools on shelves. Influence of the aquifers may extend downstream a minimum of 1 km in higher rainfall areas but can extend down to valley-bottom alluvium. In areas with less than 800 mm rainfall, the distance of influence is reduced e.g. as little as 100m away from the basalt outcrops. These streams are part of the Groundwater Dependent Ecosystem (GDE) mapping program. Pools in the northern basalt outcrops have eels and gudgeon.	6.4.1, 6.3.1	4

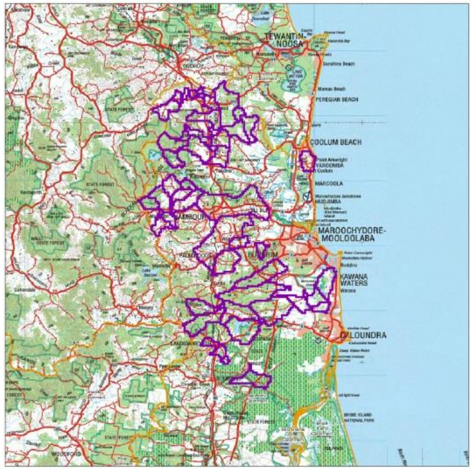
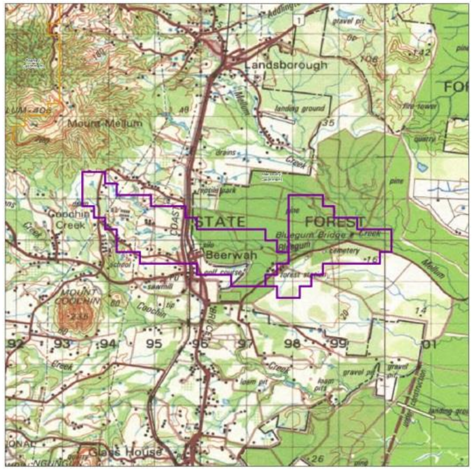
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
ly_r_ec_03	High energy lotic systems		Lockyer	Y		Boulder to cobble bed stretches in stream beds providing pool and riffle environments. Provide diversity in substrate habitat and a highly oxygenated, self-cleaning system. Believed to be some examples downstream from Wivenhoe and Somerset dams and below other major infrastructure; regulated flow in these locations can result in enhanced biodiversity relative to natural state. Not all examples will have high ecological value due to other factors e.g. water quality. Activities that remove boulders and stones cause degradation.	6.1.1	3
mb_nr_ec_01	Groundwater Dependent Landzone 2		Moreton Bay islands		Y	Coastal sand masses (Landzone 2) - wet heaths and Melaleuca wetlands are surface expression of the ground water. Below 50 metres elevation the trees have roots down to the water table. All lacustrine and palustrine wetlands in this area have a groundwater component that enhances their refugial status. One of the only systems in SEQ without serious impacts.	6.4.1	3

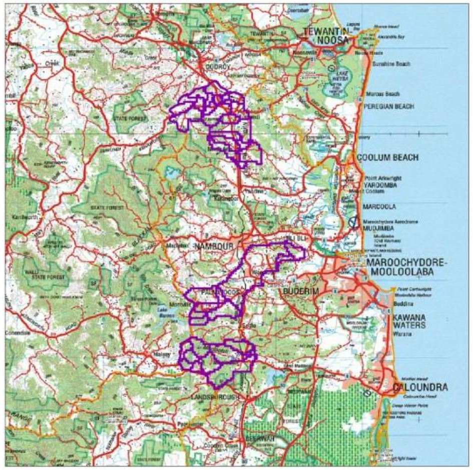
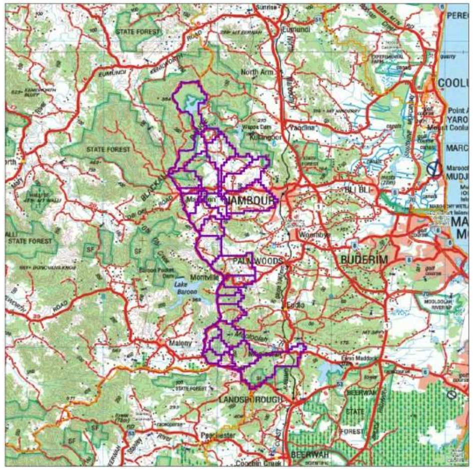
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
mb_nr_ec_02	Melaleuca swamps on small islands		Moreton Bay islands		Y	Very isolated and intact systems supported by freshwater lenses sitting on top of underlying saline groundwater.	6.4.1	4
mb_nr_ec_03	Window lakes		Moreton Bay islands		Y	Hydrologically connected to the wider regional aquifer. Mostly oligotrophic. Unique, old and stable systems with unique faunal assemblages. Occurs as a window into the water table on Quaternary coastal dunes and beaches. Low part of coastal landscape where water collects from both overland flow and infiltration from adjoining sand dunes. (BVG1M: 34a and BVG1M: 34c) represented by RE 12.2.15 and 12.2.15a	6.4.1, 6.1.1, 6.2.1	4,4,4

Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
mb_nr_ec_04	Tim Shea's Wetlands, Macleay Is (SMBI)		Moreton Bay islands		Y	Swamp with Baumea spp, Juncas spp and Lepronia articulata. R.E. 12.3.5 Of Concern. Glossy Black Cockatoo, Short beaked Echidna Wetland of Regional Significance.	6.3.1	3
mb_nr_ec_05	Whistling Kite and turtle swamp Swamp wetlands, Russell Is (SMBI) Also known as Minjerribah Conservation Area Wetland, Russell Is (SMBI)		Moreton Bay islands		Y	The wetland is currently in a relatively pristine condition. Rare, vulnerable and endangered species and ecosystems are considered threatened due to their vulnerability to anthropogenic and other impacts. Blandfordia grandiflora, Halloragis exaltata, Olearia hygropilla, False Water Rat, Glossy Black Cockatoo, Phaius australis,Medium conservation priority for EHP frog habitat	6.3.1	4

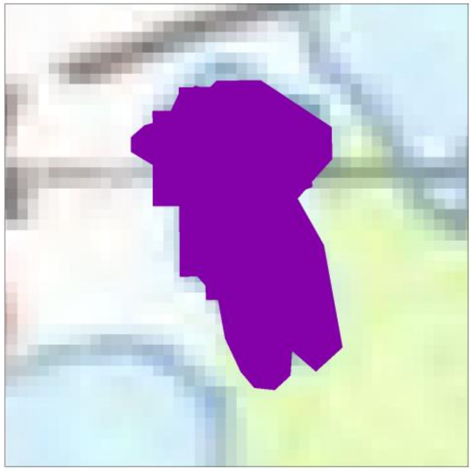
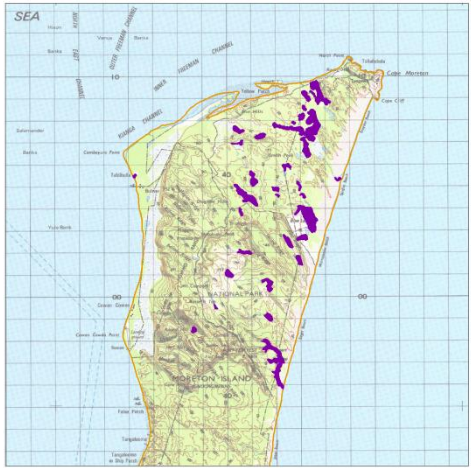
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
mc_nr_ec_01	Groundwater Dependent Landzone 2		Maroochy		Y	Coastal sand masses (Landzone 2) - wet heaths and Melaleuca wetlands are surface expression of the ground water. Below 50 metres elevation the trees have roots down to the water table. All lacustrine and palustrine wetlands in this area have a groundwater component that enhances their refugial status. One of the only systems in SEQ without serious impacts.	6.4.1	3
mc_nr_ec_02	Ephemeral wetlands		Maroochy		Y	Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.	5.2.1, 6.3.1	4,4

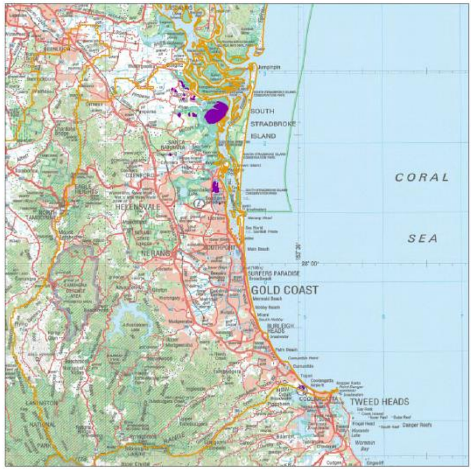
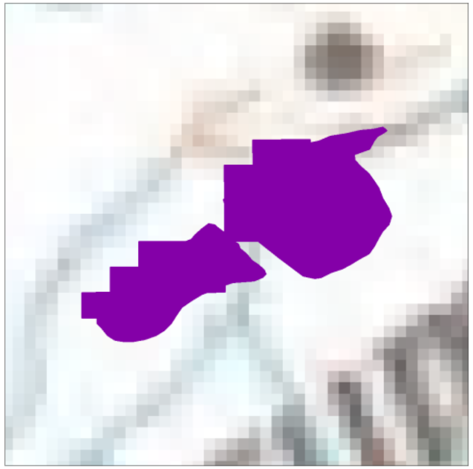
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
mc_nr_ec_03	Bluegum Creek (Beerwah SF)		Maroochy		Y	Hydrology and water quality good condition. Acidic water - wallum habitat. Supports fish species. 180 bird species recorded. "The Upper Pumicestone Coastal Plain wetlands are significant because they contain some of the last remnants of wallum and intertidal wetland from the once extensive wetlands of the northern Caboolture plain. These remnants are good representatives because they have been conserved from development and for research. The area hosts a very large number of wildlife species, including migratory species, and provides refuge habitat for wildlife. "	6.3.1	3
mc_nr_ec_04	Window Lakes		Maroochy		Y	Hydrologically connected to the wider regional aquifer. Mostly oligotrophic. Unique, old and stable systems with unique faunal assemblages. Occurs as a window into the water table on Quaternary coastal dunes and beaches. Low part of coastal landscape where water collects from both overland flow and infiltration from adjoining sand dunes. (BVG1M: 34a and BVG1M: 34c) represented by RE 12.2.15 and 12.2.15a	6.4.1, 6.1.1, 6.2.1	4,4,4

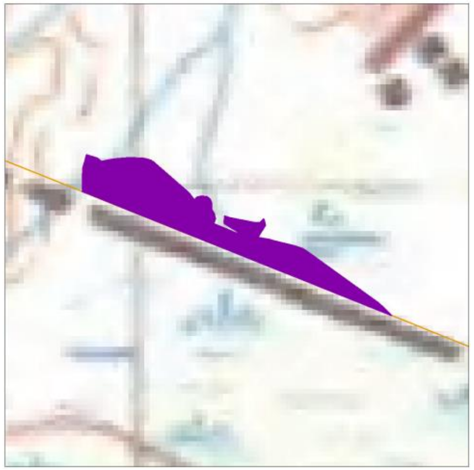
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
mc_r_ec_01	Gallery rainforest		Maroochy	Y		Gallery rainforest RE 12.3.1 on alluvial plains. Highly fragmented and endangered vegetation community. Provides significant food input. Important habitat for macro-invertebrates and provides shade for the in-stream environment. Hydrologically important. Often too narrow to be mapped at 1:100 000 scale.	5.2.1,6.3.1	4,4
mc_r_ec_02	Blue Gum Creek		Maroochy	Y		Hydrology and water quality in good condition. Acidic water and Wallum habitat. Supports fish species.	6.3.1	3

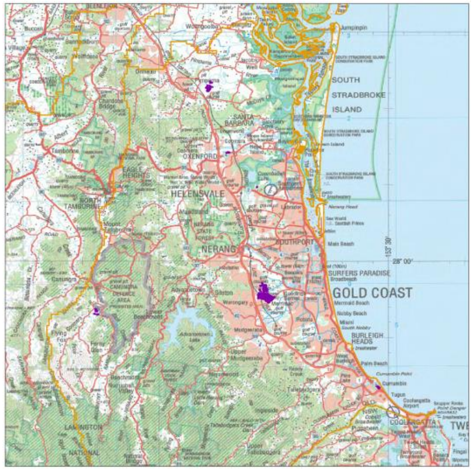
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
mc_r_ec_03	Low gradient sandy riparian systems		Maroochy	Y		Low gradient sandy systems with intact riparian vegetation/gallery rainforest dominated by ferns and bryophytes. Provides shade for aquatic ecosystem. Good quality water. High fertility soils. Hydrological values as well.	6.3.1,6.4.1	4,4
mc_r_ec_04	Headwaters of Maroochy River		Maroochy	Y		Refugial value and ground water connectivity due to basalt aquifers in volcanic uplands. The Tertiary Basalt is an elite aquifer. Small permanent pools in the streams are maintained by spring-fed headwater systems. Steepness adds to uniqueness as it results in pools on shelves. Influence of the aquifers may extend downstream a minimum of 1 km in higher rainfall areas but can extend down to valley-bottom alluvium. In areas with less than 800 mm rainfall, the distance of influence is reduced e.g. as little as 100m away from the basalt outcrops. These streams are part of the Groundwater Dependent Ecosystem (GDE) mapping program. Pools in the northern basalt outcrops have eels and gudgeon.	6.4.1, 6.3.1	4

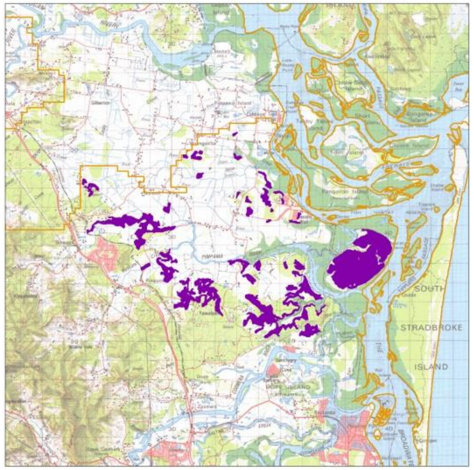
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
mc_r_ec_05	High energy lotic systems		Maroochy	Y		Boulder to cobble bed stretches in stream beds providing pool and riffle environments. Provide diversity in substrate habitat and a highly oxygenated, self-cleaning system. Not all examples will have high ecological value due to other factors e.g. water quality. Activities that remove boulders and stones cause degradation.	6.1.1	3
mt_nr_ec_01	Groundwater dependent Landzone 2		Moreton Island		Y	Coastal sand masses (Landzone 2) - wet heaths and Melaleuca wetlands are surface expression of the ground water. Below 50 metres elevation the trees have roots down to the water table. All lacustrine and palustrine wetlands in this area have a groundwater component that enhances their refugial status. One of the only systems in SEQ without serious impacts.	6.4.1	3

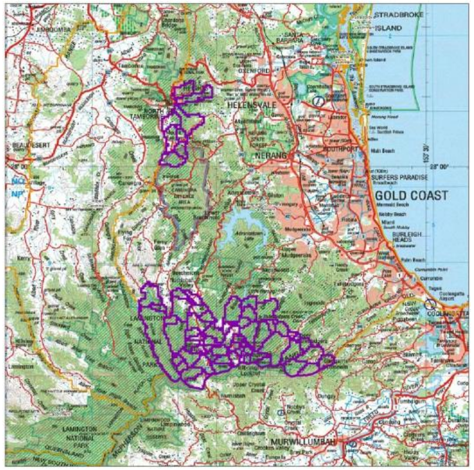
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
mt_nr_ec_02	Ephemeral wetlands		Moreton Island		Y	Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.	5.2.1, 6.3.1	4,4
mt_nr_ec_03	Sandmass window lakes		Moreton Island		Y	Hydrologically connected to the wider regional aquifer. Mostly oligotrophic. Unique, old and stable systems with unique faunal assemblages. Occur as a window into the water table on Quaternary coastal dunes and beaches. Low part of coastal landscape where water collects from both overland flow and infiltration from adjoining sand dunes. (BVG1M: 34a and BVG1M: 34c) represented by RE 12.2.15 and 12.2.15a	6.4.1, 6.1.1, 6.2.1	4,4,4

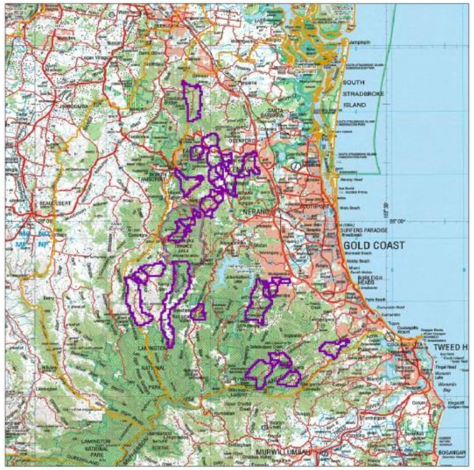
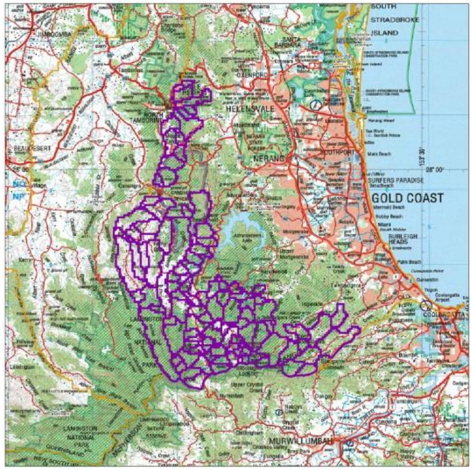
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
nc_nr_ec_01	Groundwater Dependent Landzone 2		Nerang Coomera		Y	Coastal sand masses (Landzone 2) - wet heaths and Melaleuca wetlands are surface expression of the ground water. Below 50 metres elevation the trees have roots down to the water table. All lacustrine and palustrine wetlands in this area have a groundwater component that enhances their refugial status. One of the only systems in SEQ without serious impacts.	6.4.1	3
nc_nr_ec_04	Lagoon next to Aqua Promenade in Currumbin Valley		Nerang Coomera		Y	This area forms part of the high-flow bypass for the channel and helps maintain stream stability. Longneck Turtle and water bird habitat. Also *Nymphoides indica* present. *Salvinia* blooms occur occasionally - *Cyrtobagous salviniae* weevils being used as biological control.	6.3.1	3

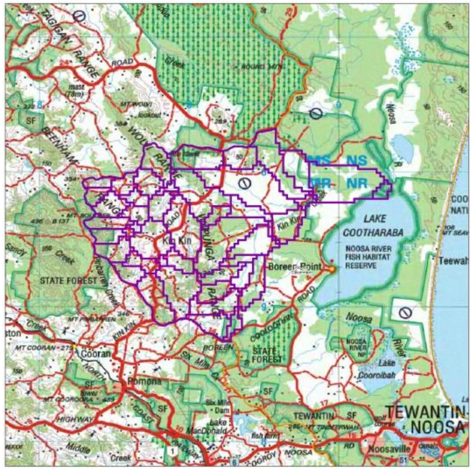
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
nc_nr_ec_05	Coolangatta airport wallum patch		Nerang Coomera		Y	Part of large wallum swamp influenced by the M1 motorway.Tiny remnants of an old system. Part of larger complex of diverse wallum swamp. Last vestige of original habitat before construction of the M1.	6.3.3	4
nc_nr_ec_06	Flat Rock Creek, ponded area in Currumbin Wildlife Sanctuary		Nerang Coomera		Y	An Intermittently Closed and Open Lakes and Lagoons (ICOLL) system that forms part of a coastal creek that opens and closes. Water quality varies - better when open. Partially regulated flow. Freshwater system until connected. It is water bird habitat and periodically important as a fish nursery.	5.1.4	3

Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
nc_nr_ec_07	Ephemeral wetlands		Nerang Coomera		Y	Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.	5.2.1, 6.3.1	4,4
nc_nr_ec_08	Pine Ridge Conservation Park		Nerang Coomera		Y	Last large tract of wet heath left on the Gold Coast. Highly threatened, but still largely intact. Highly diverse. Likely habitat for threatened species. Typical trough and ridge paterning. Surrounded by forests.	5.2.1, 6.3.1	4,4

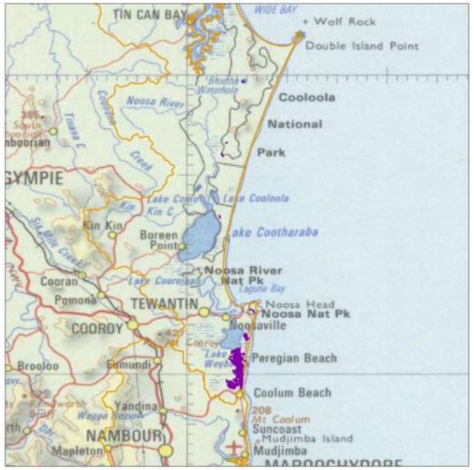
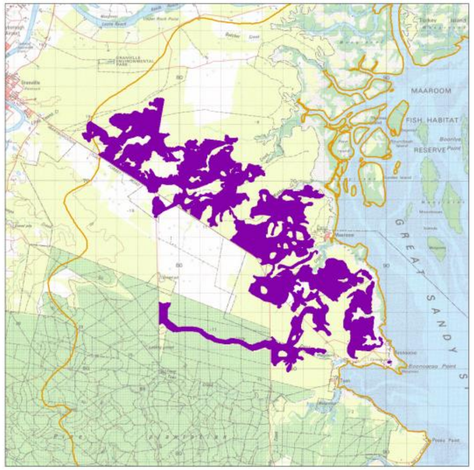
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
nc_nr_ec_09	Pimpama River Conservation Area		Nerang Coomera		Y	Periodically inundated paperbark swamp forest - REs 12.2.7 and 12.3.5. Same values as nc_nr_fl_02. Subject to climate change as topographic factors. Part of a mostly forested corridor between the Moreton Bay Islands and the GC hinterland, important for seasonal altitudinal migration of birds between the hill ranges and the coast. Also part of several local-scale wildlife corridors running north-south and the Pimpama River Main Channel ecological corridor, and the Coomera Corridor, which run east-west. Habitat for threatened glossy black cockatoo and koala. Vegetation communities include mangrove forest and shrubland, saltmarsh and marine flats, coastal sedgebeds, Casuarina glauca and Melaleuca quinquenervia open forest; 10 REs are represented, two Of Concern. Protects 11 plants of regional significance.	5.2.1, 6.3.1	3,3
nc_nr_ec_10	Window Lakes		Nerang Coomera		Y	Hydrologically connected to the wider regional aquifer. Mostly oligotrophic. Unique, old and stable systems with unique faunal assemblages. Occurs as a window into the water table on Quaternary coastal dunes and beaches. Low part of coastal landscape where water collects from both overland flow and infiltration from adjoining sand dunes. (BVG1M: 34a and BVG1M: 34c) represented by RE 12.2.15 and 12.2.15a	6.4.1, 6.1.1, 6.2.1	4,4,4

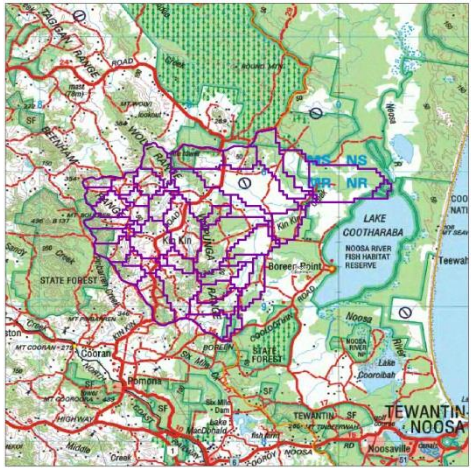
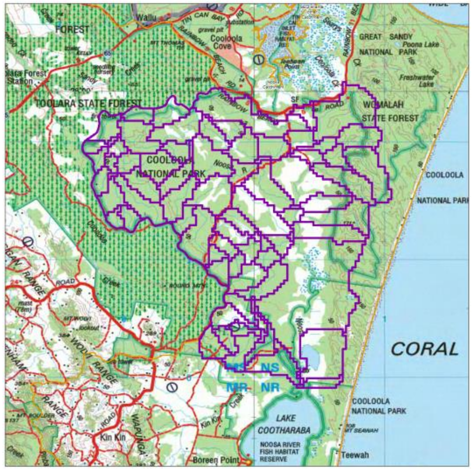
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
nc_r_ec_02	Permanent flowing streams		Nerang Coomera	Y		Permanent flowing streams fed by aquifers and rainfall - identified by GDE panel. Expression of water 600 years old on Mount Tamborine - Grant Periott has a report. Justification for keeping this separate from nc_r_ec_05 is needed.	6.4.1	4
nc_r_ec_03	Unregulated undisturbed creeks.		Nerang Coomera	Y		Coomera River is relatively undisturbed (has a weir in the lower reaches and possible small barrier near Canungra). Picked up under previous headwater decision. Other relatively undisturbed rivers include Currumbin Creek. Flow unregulated. Values also picked up in C1 and C7.	6.4.1	3

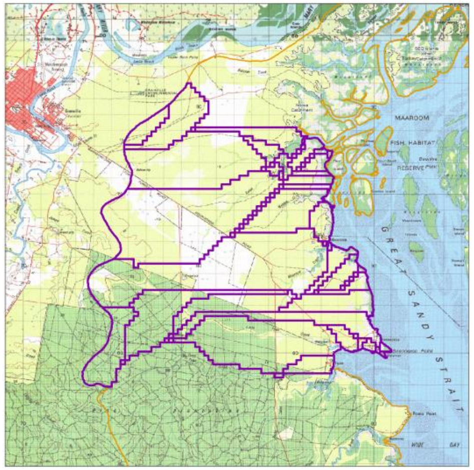
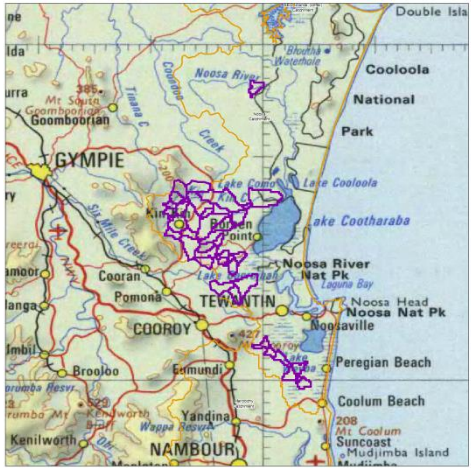
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
nc_r_ec_04	Gallery Rainforest		Nerang Coomera	Y		Gallery rainforest RE 12.3.1 on alluvial plains. Highly fragmented and endangered vegetation community. Provides significant food input. Important habitat for macro-invertebrates and provides shade for the in-stream environment. Hydrologically important. Often too narrow to be mapped at 1:100 000 scale.	5.2.1,6.3.1	4,4
nc_r_ec_05	Basaltic ground fed permanent refugia pools.		Nerang Coomera	Y		Refugial value and ground water connectivity due to basalt aquifers in volcanic uplands. The Tertiary Basalt is an elite aquifer. Small permanent pools in the streams are maintained by spring-fed headwater systems. Steepness adds to uniqueness as it results in pools on shelves. Influence of the aquifers may extend downstream a minimum of 1 km in higher rainfall areas but can extend down to valley-bottom alluvium. In areas with less than 800 mm rainfall, the distance of influence is reduced e.g. as little as 100m away from the basalt outcrops. These streams are part of the Groundwater Dependent Ecosystem (GDE) mapping program. Pools in the northern basalt outcrops have eels and gudgeon.	6.4.1, 6.3.1	4,4

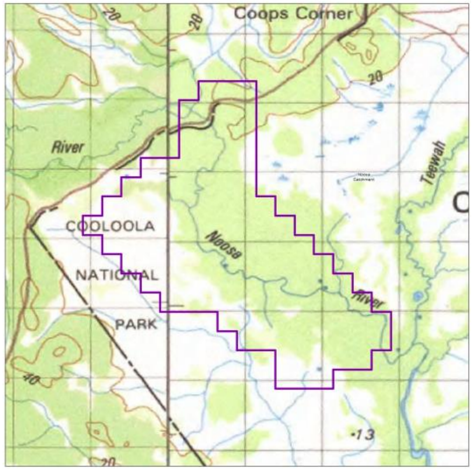
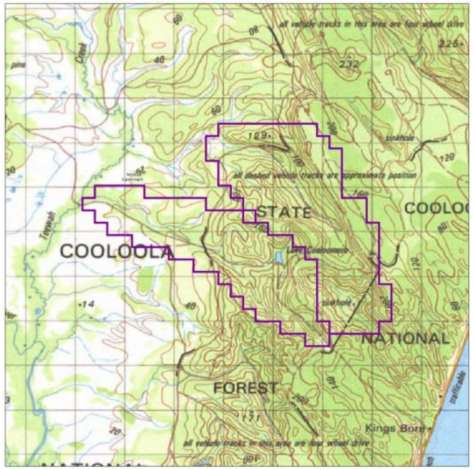
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
nc_r_ec_06	High energy lotic systems		Nerang Coomera	Y		Boulder to cobble bed stretches in stream beds providing pool and riffle environments. Provide diversity in substrate habitat and a highly oxygenated, self-cleaning system. Not all examples will have high ecological value due to other factors e.g. water quality. Activities that remove boulders and stones cause degradation.	6.1.1	3
ns_nr_ec_01	Patterned fens		Noosa		Y	RE 12.2.15g Internationally significant sedge-dominated palustrine wetlands in coastal sand masses fed by groundwater. Special hydrological processes - upwelling groundwater makes it unique and distinct from the surrounding wet heath. Normally only found in alpine areas. Some fens are better defined than others, which may be related to age - some areas up to 20,000 years old. Older fens may be more resilient and have survived changes in sea level. Systems move with changing sea level, so around more developed areas they will be more susceptible to climate change impacts. High natural condition. First-rate paleoecology archive. Values from ns_nr_fl_01. The only subtropical example of patterned fens. Floristic structure unique. Habitat for threatened fauna.	6.1.1,6.3.1, 5.2.1	4,4,4

Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
ns_nr_ec_02	Groundwater dependent Landzone 2		Noosa		Y	Coastal sand masses (Landzone 2) - wet heaths and Melaleuca wetlands are surface expression of the ground water. Below 50 metres elevation the trees have roots down to the water table. All lacustrine and palustrine wetlands in this area have a groundwater component that enhances their refugial status. One of the only systems in SEQ without serious impacts.	6.4.1	3
ns_nr_ec_03	Perched lakes		Noosa		Y	Groundwater dependent wetlands but hydrologically separated from the wider regional aquifer. Unique faunal assemblages. Paleoecology archive based on Stradbroke Island research. Unique that there are so many systems that are up to 20000 years old.	6.4.1, 6.1.1, 6.2.1	4,4,4

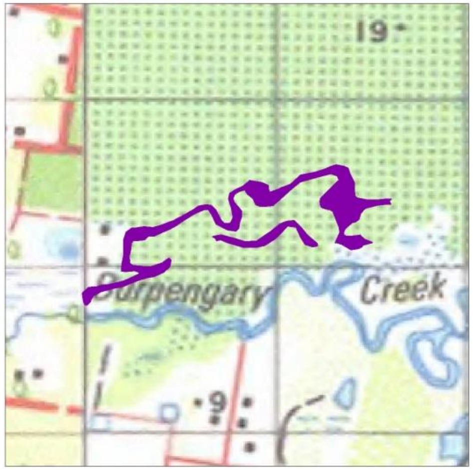
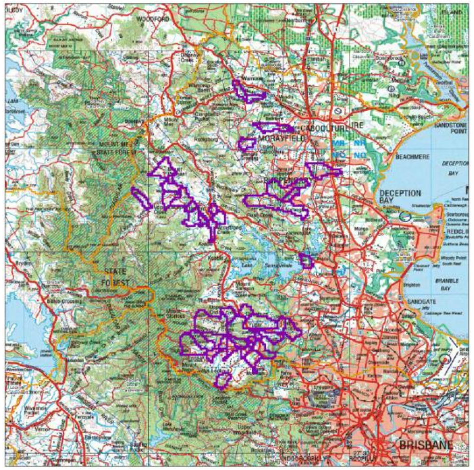
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
ns_nr_ec_04	Window lakes		Noosa		Y	Hydrologically connected to the wider regional aquifer. Mostly oligotrophic. Unique, old and stable systems with unique faunal assemblages. Occurs as a window into the water table on Quaternary coastal dunes and beaches. Low part of coastal landscape where water collects from both overland flow and infiltration from adjoining sand dunes. (BVG1M: 34a and BVG1M: 34c) represented by RE 12.2.15 and 12.2.15a	6.4.1, 6.1.1, 6.2.1	4,4,4
ns_nr_ec_05	Ephemeral wetlands		Noosa		Y	Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.	5.2.1, 6.3.1	4,4

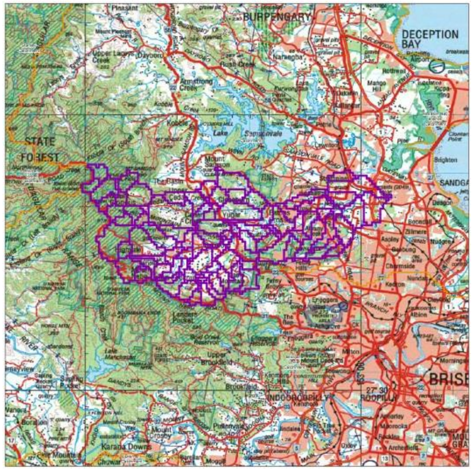
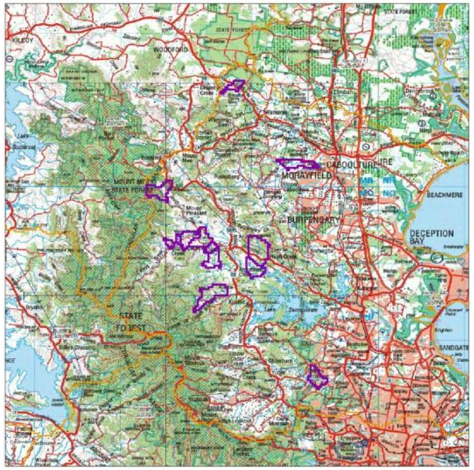
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
ns_r_ec_01	Kin Kin Creek		Noosa	Y		Tributary of the Noosa River and retains some naturalness values but is disturbed. High priority area for restoration.	6.3.3	2
ns_r_ec_02	Teewah Creek and upper Noosa River		Noosa	Y		Intact hydrology north of Lake Cootharaba. Acidic, tannin stained water (dystrophic) systems fed through Pleistocene dunes. Intact system, few weeds, no in-stream infrastructure. Unique geomorphic processes, very high water quality and fauna diversity (EHMP data) Contains ground parrot , 2 EVNT fish, emu wrens, acid frogs, water mouse. High macroinverbrate richness (EHMP data). Unique acidic water system running through wallum. Natural bass population and jungle perch.	6.1.1, 6.2.1, 6.4.1, 6.3.1	4,4,4,4

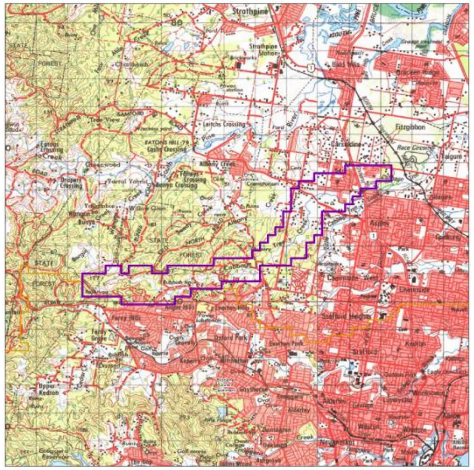
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
ns_r_ec_03	Poona National Park and Kauri Creek		Noosa	Y		Deeply weathered surface (Landzone 5) that is unique in the coastal lowland areas. Water draining out of it feeds alluvial aquifers. Reasonable refugial values for creeks. Groundwater connection - Poona, Tuan and Little Tuan creeks. Better values in Poona National Park and Kauri Creek. Areas of intact riparian vegetation are very significant, but mostly forestry plantations through this area.	6.4.1	3
ns_r_ec_04	Gallery Rainforest		Noosa	Y		Gallery rainforest RE 12.3.1 on alluvial plains. Highly fragmented and endangered vegetation community. Provides significant food input. Important habitat for macro-invertebrates and provides shade for the in-stream environment. Hydrologically important. Often too narrow to be mapped at 1:100 000 scale.	5.2.1,6.3.1	4,4

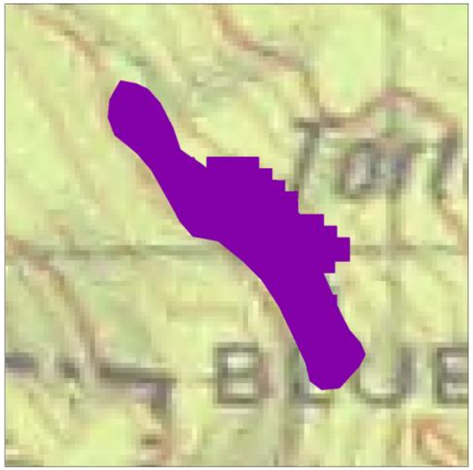
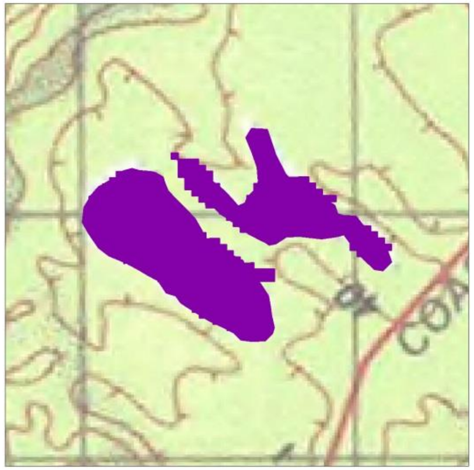
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
ns_r_ec_05	High energy lotic systems		Noosa	Y		Boulder to cobble bed stretches in stream beds providing pool and riffle environments. Provide diversity in substrate habitat and a highly oxygenated, self-cleaning system. Not all examples will have high ecological value due to other factors e.g. water quality. Activities that remove boulders and stones cause degradation.	6.1.1	3
ns_r_ec_07	Harry's Gulch		Noosa	Y		Main source of water for Teewah Creek and the upper Noosa River. It is a groundwater fed system discharging from dunes to the east.	6.4.1	4

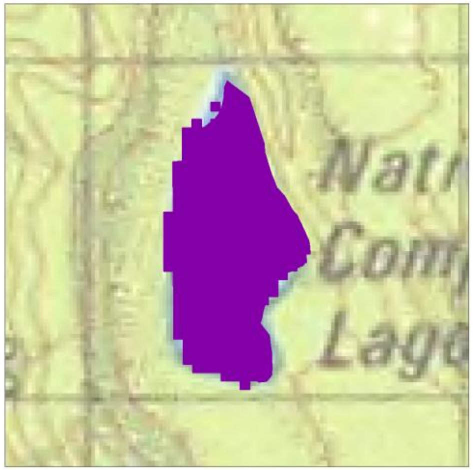
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
pn_nr_ec_01	Groundwater Dependent Landzone 2		Pine		Y	Coastal sand masses (Landzone 2) - wet heaths and Melaleuca wetlands are surface expression of the ground water. Below 50 metres elevation the trees have roots down to the water table. All lacustrine and palustrine wetlands in this area have a groundwater component that enhances their refugial status. One of the only systems in SEQ without serious impacts.	6.4.1	3
pn_nr_ec_02	Ephemeral wetlands		Pine		Y	Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.	5.2.1, 6.3.1	4,4

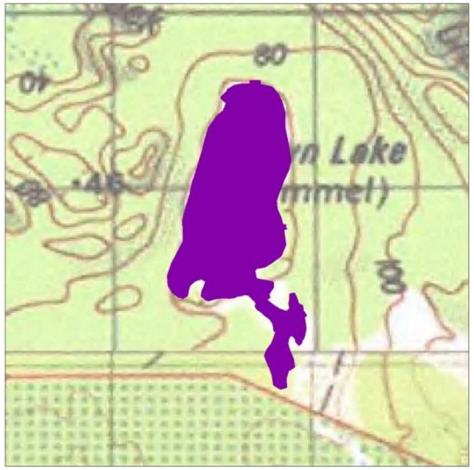
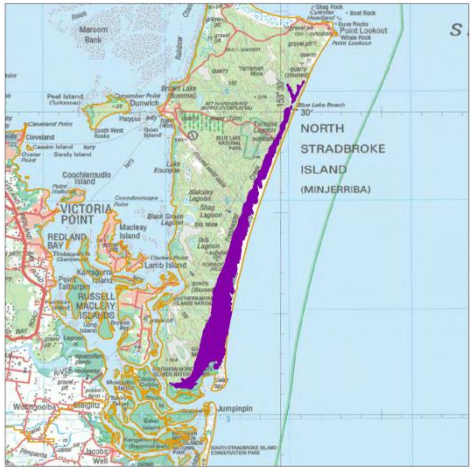
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
pn_nr_ec_03	Oxbows		Pine		Y	Oxbow lakes RE 12.3.7c. Similar refugial values to RE 12.3.8 (possibly better as they are wetter for longer). Old palaeo-channels that have near permanent water and provide fish refuge in times of floods. Characterised by hollow forming bluegums.	6.3.1	4
pn_r_ec_01	Gallery rainforest		Pine	Y		Gallery rainforest RE 12.3.1 on alluvial plains. Highly fragmented and endangered vegetation community. Provides significant food input. Important habitat for macro-invertebrates and provides shade for the in-stream environment. Hydrologically important. Often too narrow to be mapped at 1:100 000 scale.	5.2.1,6.3.1	4,4

Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
pn_r_ec_02	South Pine River		Pine	Y		Hydrologically natural compared to the North Pine River (EHMP high rating). May extend to the rest of the headwaters.	6.4.1, 6.2.1	3,3
pn_r_ec_03	High energy lotic systems		Pine	Y		Boulder to cobble bed stretches in stream beds providing pool and riffle environments. Provide diversity in substrate habitat and a highly oxygenated, self-cleaning system. Not all examples will have high ecological value due to other factors e.g. water quality. Activities that remove boulders and stones cause degradation.	6.1.1	3

Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
pn_r_ec_04	Cabbage Tree Creek		Pine	Y		Stable bed and banks. Dec: reep_bcc_5 WPU: C/030 , C/040, C/050	6.1.1	2
sb_nr_ec_01	Blue Lake		Stradbroke Islands		Y	Evidence of stable water quality over the past 7,000 yrs. Lake is 13 metres deep with very clear water allowing sedges to grow on the bottom. Unique to eastern Australia. Fish present include Oxleyan pygmy perch, *Rhadinocentrus*, eels, catfish and also gambusia. *Eleocharis* present. Natural barrage into 18 Mile Swamp.	6.4.1; 6.3.1, 8.2.5	4

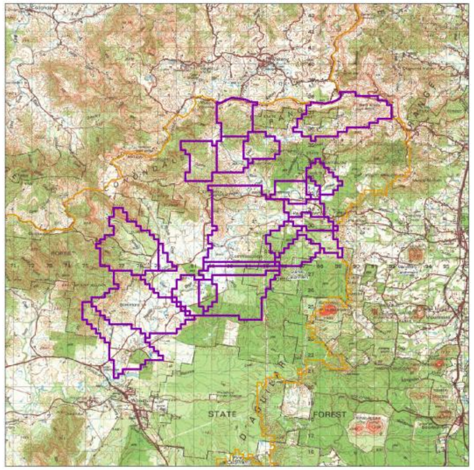
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
sb_nr_ec_02	Tortoise Lagoon		Stradbroke Islands		Y	Palaeo-ecological values: 35,000 year continuous record. Unique geomorphology.	6.1.1	4
sb_nr_ec_03	Welsby system		Stradbroke Islands		Y	Welsby sytem currently 26,000 year records. Evidence of extinct species.	6.4.1	4

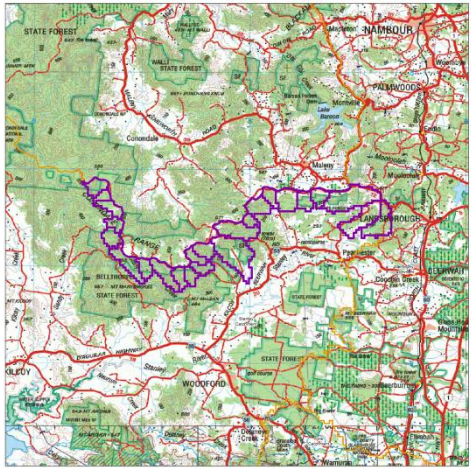
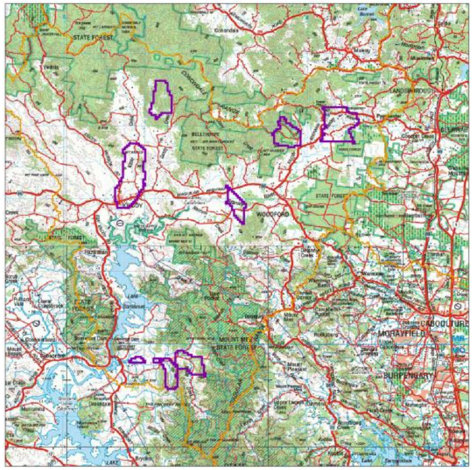
Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
sb_nr_ec_04	Native Companion Lagoon		Stradbroke Islands		Y	45,000 year records. Record of dust.	6.1.1	4
sb_nr_ec_05	Myora Springs		Stradbroke Islands		Y	Only patch of rainforest on the islands. Also 800 year palaeo-ecological record. Pollen records show it was Melaleuca swamp. Rainforest then followed. Extends across the road over to the west. Not currently mapped.	6.1.1, 6.3.1	4

Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
sb_nr_ec_06	Brown Lake		Stradbroke Islands		Y	North-south orientation is unusual. Tail of swamp land to the south. Biggest natural perched lake on the islands - actually a perched sphagnum bog. Depth 8-9 meters. Type locality of freshwater worm, dragonfly and damselfly. Now has gambusia. Originally no fish. Radiocarbon date 43,000 yrs (Patrick pers. comm).	6.1.1, 6.4.1, 6.3.1	4
sb_nr_ec_07	18 Mile Swamp		Stradbroke Islands		Y	Unique geomorphology. Largest wetland of its type in SEQ. Best representation of RE 12.2.15. Saline area at southern end. Mangroves have progressively moved south over 1,000yrs.	8.2.5, 6.1.1	4

Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
sb_nr_ec_08	Groundwater Dependent Landzone 2		Stradbroke Islands		Y	Coastal sand masses (Landzone 2) - wet heaths and Melaleuca wetlands are surface expression of the ground water. Below 50 metres elevation the trees have roots down to the water table. All lacustrine and palustrine wetlands in this area have a groundwater component that enhances their refugial status. One of the only systems in SEQ without serious impacts.	6.4.1	3
sb_nr_ec_09	Window lakes		Stradbroke Islands		Y	Hydrologically connected to the wider regional aquifer. Mostly oligotrophic. Unique, old and stable systems with unique faunal assemblages. Occurs as a window into the water table on Quaternary coastal dunes and beaches. Low part of coastal landscape where water collects from both overland flow and infiltration from adjoining sand dunes. (BVG1M: 34a and BVG1M: 34c) represented by RE 12.2.15 and 12.2.15a	6.4.1, 6.1.1, 6.2.1	4,4,4

Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
si_nr_ec_01	Melaleuca swamps on small islands		Misc. other islands		Y	Very isolated and intact systems supported by freshwater lenses sitting on top of underlying saline groundwater. Include on Moreton Bay Islands if they exist.	6.4.1	4
sl_nr_ec_01	Ephemeral wetlands		Stanley		Y	Ephemeral wetlands RE 12.3.8. Regardless of condition (e.g. grazing, weeds), these wetlands have important refugial values in highly degraded landscapes. Unique wetland type. Distinctive RE type. Most mapped as their own wetland.	5.2.1, 6.3.1	4,4

Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
sl_nr_ec_02	Oxbows		Stanley		Y	Oxbow lakes RE 12.3.7c. Similar refugial values to RE 12.3.8 (possibly better as they are wetter for longer). Old palaeo-channels that have near permanent water and provide fish refuge in times of floods. Characterised by hollow forming bluegums.	6.3.1	4
sl_r_ec_01	Gallery Rainforest		Stanley	Y		Gallery rainforest RE 12.3.1 on alluvial plains. Highly fragmented and endangered vegetation community. Provides significant food input. Important habitat for macro-invertebrates and provides shade for the in-stream environment. Hydrologically important. Often too narrow to be mapped at 1:100 000 scale.	5.2.1,6.3.1	4,4

Decision number	Special features (name)	Location	Study area	R[5]	NR[6]	Values	CIM[7]	Con. rating[8]
sl_r_ec_02	Headwaters of Stanley River		Stanley	Y		Refugial value and ground water connectivity due to basalt aquifers in volcanic uplands. The Tertiary Basalt is an elite aquifer. Small permanent pools in the streams are maintained by spring-fed headwater systems. Steepness adds to uniqueness as it results in pools on shelves. Influence of the aquifers may extend downstream a minimum of 1 km in higher rainfall areas but can extend down to valley-bottom alluvium. In areas with less than 800 mm rainfall, the distance of influence is reduced e.g. as little as 100m away from the basalt outcrops. These streams are part of the Groundwater Dependent Ecosystem (GDE) mapping program. Pools in the northern basalt outcrops have eels and gudgeon.	6.4.1,6.3.1	4
sl_r_ec_03	High energy lotic systems		Stanley	Y		Boulder to cobble bed stretches in stream beds providing pool and riffle environments. Provide diversity in substrate habitat and a highly oxygenated, self-cleaning system. Believed to be some examples downstream from Wivenhoe and Somerset dams and below other major infrastructure; regulated flow in these locations can result in enhanced biodiversity relative to natural state. Not all examples will have high ecological value due to other factors e.g. water quality. Activities that remove boulders and stones cause degradation.	6.1.1	3

5.2 Connectivity

The panel members were asked to develop and/or identify a set of principles that could be applied to determine relative connectivity scores of non-riverine and riverine spatial units within the Southeast Queensland region.

5.2.1 Importance of connectivity

There was broad agreement by the panel that the concept of connectivity is important, and it is directly or indirectly linked to most facets of aquatic ecology, geomorphology and water quality. The scientific literature reviewed for the AquaBAMM program reflects this view. The ecological value of a particular reach of river is directly linked in quantity and quality to the movement both up and downstream (and between adjoining terrestrial lands) of resources such as water, sediment and debris and recruitment and distribution of species (Cullen 2003).

An inherent connectivity (or lack of connectivity in drier periods) is a significant feature of fresh waters. In arid-zone systems, and floodplains, the irregular flow regime and sporadic connectivity underpins the conservation of the instream and floodplain wetland biota such as the invertebrate assemblages (Sheldon et al 2002). Similarly, this relationship is evident for maintaining the health and productivity of end-of-river estuarine systems (Cullen 2003).

A largely unknown and unseen linkage occurs within the hyporheic zone between surface waters and groundwater ecosystems sustaining many endemic or relictual invertebrate fauna (Boulton et al 2003).

5.2.2 Applying principles for measuring connectivity

The practicalities of measuring connectivity in a riverine environment are complex making general principles difficult to develop and implement. Connectivity in its broadest meaning incorporates hydrological processes (quantity and quality, temporal and spatial variability), organism dispersal (barriers) and disturbances from natural conditions. Connectivity can be bi-directional movements within a stream (e.g., fish passage), uni-directional contribution to a downstream spatial unit or special area, or lateral connectivity to floodplain wetlands or groundwater ecosystems. These aspects of connectivity combine to provide a matrix of competing and differing values from an ecological conservation viewpoint.

5.2.3 Fish passage (riverine) - measure 7.1.2

The negative effects of pest species were discussed at the SEQ ecology panel in relation to the current fish passage model previously used in other ACAs. The panels also discussed the effects of isolation and gene flow. Some fish populations require isolation to maintain discreet populations as opposed to a connected aquatic system. There was comment that the current ACA model is too simplistic and doesn’t account for every scenario of species or connectivity. While the ACA team acknowledges that there are exceptions to the general model, most species require connectivity where this has been artificially removed (instream barriers).

The panel discussions provided robust commentary on the connectivity of fish passage. However, the panel agreed to use the current model with the possibility of it being modified by fish pest records or expert opinion for some catchments.

The principles for the fish passage connectivity rating (measure 7.1.2) developed by the riverine ecology expert panel from the Burnett River Aquatic Conservation Assessment (Clayton et al 2006) assumes that barriers lower in the catchment have more impact on total fish movements then those in upper reaches of the catchment. There is also recognition that each barrier can be rated according to its relative level of fish passage. The steps outlined below are used to calculate a connectivity score for each spatial unit.

Two items of spatial data are used as inputs for this measure; Geoscience Australia geofabric units (attributed with Strahler stream order) and the Queensland Government Waterways for Waterway Barrier Works, a publicly downloadable GIS layer that shows all waterways within Queensland in which barrier works are regulated by the Fisheries Act (1994) and the Sustainable Planning Act (2009). The latter is attributed with a Fish Passage Rating (FPR), which indicates the risk of adverse impact on fish movement from in-stream barriers.

Step 1: Geofabric units (already attributed with Strahler stream order) are attributed with whichever Waterway Barrier Works (WWBW) FPR is represented by the greatest length of WWBW watercourse with that rating, within each unit. Each spatial unit was also attributed to indicating whether or not there is a point feature in the NRM 1:100,000 weirs dams & barrages with in it. This was used to modify the ascribed FPR; FPR is set to zero in any geofabric unit that contains a mapped weir, dam or barrage.

Step 2: An Intrinsic Connectivity Score (ICS) for each stream segment is derived from the geofabric units' Strahler stream order using the re-classification system shown in Table 21.

Table 21. The Intrinsic Connectivity Score for streams

Stream order	Intrinsic connectivity score
1	1
2 and 3	2
4	3
>= 5	4

Step 3: Conservation Rating is derived from the combination of ICS and FPR according to Table 22.

For example, the ICS for a river segment having a stream order of six would be four, and if a barrier exists on this river reach, its FPR score would be zero; resulting in an overall Conservation Rating of 1 (under measure 7.1.2) for the spatial unit.

Rules for calculating the connectivity score:

- the ICS cannot be lower than one
- a spatial unit's ICS pertains to the highest stream order present in the unit
- where there is no barrier within a spatial unit, the ICS for the highest stream order is used as the ICS.

Table 22. Calculation matrix for the Conservation Rating (7.1.2)

	Fish passage rating (FPR)				
Intrinsic connectivity Score (ICS)	**0 Barrier present**	**1 Poor**	**2 Moderate**	**3 Good**	**4 No barrier Present**
1 (Low)	1	1	1	1	1
2 (Medium)	1	1	1	1	2
3 (High)	1	1	1	2	3
4 (Very high)	1	1	2	3	4

These Conservation Ratings were used as the score for fish passage connectivity for the AquaBAMM measure 7.1.2.

5.2.4 Connectivity between riverine and non-riverine wetlands - measure 7.3.1

Lateral connectivity between the aquatic riverine system and adjacent ecosystems was recognised by the panel as an important value. The panel members deliberated on several models or methods to assess the level of lateral connectivity between the riverine and non-riverine wetlands. The practicalities of measuring connectivity between wetlands are complex making general principles difficult to develop and implement.

The panel discussed the difficulty in differentiating between those wetlands that have more value in contributing to riverine connectivity. In relation to measure 7.3.1 (the contribution of the spatial unit to the maintenance of floodplain and wetland ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6) it was suggested to assign floodplain wetlands a higher connectivity value than those that are not a floodplain wetland. This could be implemented using floodplain information contained within current wetland mapping.

Riverine subsections that contain a non-riverine wetland with a value of four for measures 6.3.2 (Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.) and 6.3.3 (Ecologically significant wetlands identified through expert opinion and/or documented study) were identified. Where the subsecton intersected with flood plain vegetation from the QLD Wetland Mapping (version 3) or intersected a mapping 250k drainage line, that subsection will be assigned a connectivity value of four for measure 7.3.1.

5.2.5 Connectivity between freshwater wetlands and estuarine wetlands - measure 7.5.1

Connectivity between freshwater wetlands (riverine and non-riverine) and estuarine ecosystems was also recognised by the panel as being important. The panel members discussed several methods for assessing the lateral connectivity of freshwater and estuarine wetlands and agreed that anything that is connected hydrologically and/or biologically to estuarine areas should be given a higher connectivity rating.

Panel discussions were focussed around the effects of existing barrages in the estuarine zones along the SEQ coastline. Many of these barrages have been in existence for many decades now. There was acknowledgement that these barrages are barriers to fish passage. However, if these barrages were to be removed from the system there would be adverse impacts due to water quality and hydrological changes. That is, freshwater ecosystems above the barrage are established in what was once the estuary and these would be negatively affected in the removal of a barrage. Two case studies were used to demonstrate the issues:

- The Pimpama Barrage has limited fish passage but at the same time prevents pollution entering the lower estuary. Removal would improve fish passage but create a water quality issue.
- The Currumbin Tidal Barrage functions as bed control structure and removing it would change the local hydrology.

The panel noted that any model needs to be situation dependent. The panel discussed the use of stream order and distance from the mouth of the estuary as potential attributes for calculating this measure. Proximity of a barrier to the estuary was considered to be the primary factor for consideration. It was suggested to integrate catchment size and Adopted Middle Thread Distance (AMTD) to determine distance for threshold calculations.

Even though some experts considered the current measure calculation model too simplistic, it was decided to implement the current model from the WBB using stream order.

The panel agreed that riverine systems without a barrage should score higher than those systems with a barrage. As part of measure 7.5.1 (The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6), riverine spatial units containing estuarine wetlands without a barrage were scored a four, with the next spatial units upstream also scoring a four until the stream order changed. Each progressive drop in stream order subsequent to this dropped the score progressively by one. Scoring continued upstream and stopped when a barrage occurred.

The panel suggested that wherever there is an estuarine mapped wetland including water bodies and regional ecosystems, without a barrage within a spatial unit, the non-riverine wetlands are assigned a score of four within that subsection. The non-riverine wetlands within the next upstream spatial unit are then assigned a three, then a two, then a one. If the upstream spatial units contained a barrage then the scoring stopped. Additionally, where a spatial unit included an estuarine wetland and a barrage, the non-riverine wetlands within that spatial unit would score a two and the next subsection upstream would score a one. Again, if the upstream spatial units contained a barrage then the scoring stopped. Highly modified and artificial wetlands were excluded from this scoring system as it was determined that the connectivity in these systems had been severely altered and did not play a positive role in the maintenance of estuarine wetland values.

In addition to these models, another area for applying scores to freshwater wetlands was considered. The connectivity between freshwater wetlands in the coastal dune systems overlaying coffee rock (i.e., landzone 2) were identified as significant in maintaining some mangroves and seagrass beds. This connection occurs along the coast line and estuaries within the SEQ region. A model was suggested to implement C7 in the non-riverine ACAs based on a buffer of the coastline (yet to be determined). Any wetland identified in this buffer (landzone 2 <50m altitude) would be given a value in 7.5.1. This would be applied to all study areas along the coast. This model is to be trailed in the SEQ ACA but may not be implemented upon review.

5.2.6 Connectivity between freshwater wetlands and groundwater - measure 7.2.1

The Queensland Wetlands program is gathering data relating to groundwater dependent ecosystems (GDE) connectivity for the SEQ region. This program is expected to provide data on GDE flows and connectivity between wetland elements. However, this data is unavailable for implementation at this time. When they become available they will be incorporated into a revised SEQ ACA product.

The panel agreed to use the current models applied in the WBB ACA.

Connectivity between freshwater wetlands (riverine and non-riverine) and groundwater was recognised by the SEQ panel as being important. The panel members discussed several methods for assessing the connectivity of freshwater and groundwater systems and agreed that anything that is connected hydrologically and/or biologically to groundwater areas should be given a higher connectivity rating.

For subsections with a rating of four for measure 6.4.1 (Presence of distinct, unique or special hydrological regimes e.g. Spring fed stream, ephemeral stream, boggomoss), the next subsection upstream scored a four, the next subsection upstream a two, and the next subsection upstream a one. If a subsection had been nominated by the wetland ecology panel as having a value for measure 7.2.1 (The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values identified through criteria 5 and/or 6.), then the next subsection upstream scored a four, the next a three, then two and then one. The subsection with a value for measure 7.2.1 did not receive a connectivity value itself, only those subsections upstream. This was implemented for both riverine and non-riverine assessments.

In addition the panel demonstrated aspects of a new hydrology information system to characterise hydrological processes within ecoregions (e.g. sub-basins within sub-bioregions) to support wetland management. The approach was supported by a state-wide data base that is accessible through the EHP WetlandInfo web facility. The intention was to release the information freely to support the appropriate selection of satellite imagery to characterise flood significance by rating against historical records; and to characterise hydrological processes and conditions relevant to wetland filling, including seasonality (within year variation). The method achieves this by attributing time series rainfall, runoff, stream flow and height information by reference and benchmark information, which reveals the variation (emergent hydrological regimes) in water supplies within year (for dry, median and wet reference regimes) and between year for a regime.

It was suggested that this rich suite of statistics be used to identify catchment areas with different levels of water stress. Some aquatic stressors become apparent when flows are reduced or stopped and aquatic biological products and human pressures result in an increasing number and magnitude of impacts, such as a reduction in oxygen levels. Aquatic weeds are used to provide an example of stress outcomes (e.g. in some pools in the Mary River) because aquatic weeds often have a competitive advantage when flows are reduced and pressures increase.

In areas where stream systems are characterised by losses to ground water and or water extraction, it was suggested that permanent wetlands and pools may provide vital refugia and connectivity for wildlife. This information and data was not used for this ACA, however at a future date the hydrological characterisation tools may link to the ACA process, providing information to improve the scoring of the importance of wetland inundation processes and inundation permanence. The method is also expected to be used to profile wetland inundation processes, which will inform assessments of wetland aquatic connectivity. The outcomes from these future projects may be used to inform the ACA connectivity assessment and scoring process in the future.

The method uses simple statistics and is evidence based, so that the relationships between hydrological statistics and wetland processes are associative and not determined (mathematically predictable). Models that determine stream flows and potential floodplain wetland filling quantities include the Integrated Quality Quantity Model (IQQM), which is used by EHP to determine in-stream environmental flows to regulate reservoir releases. Deterministic models are unable to characterise the wetland filling processes for many wetland types and locations across Queensland, and this is why the presented evidence based approach is required. The sub-basins and mapping used by the method is concordant with EHP attribution, so standard period of record stream flow information obtained from EHP or the Bureau of Meteorology can be compared with the evidence based approach for comparable areas.

5.2.7 Connectivity of special features - measures 7.1.1 and 7.2.1

The panel members were also asked to develop principles for scoring connectivity for special features such as waterfalls, macrophyte beds, significant instream habitats, and other areas or features identified through expert opinion. This question primarily relates to uni-directional connectivity, i.e. quantity or quality of flow to a downstream special feature.

The principles for assessing connectivity values for special features (measures 7.1.1 and 7.2.1) developed by the riverine ecology expert panel from the Burnett River Aquatic Conservation Assessment (Clayton et al 2006) were tabled at the panel workshop. The panel considered implementing the “Model 4 Inverse exponential scoring of spatial units upstream” method for the Southeast Queensland region. This model is presented below.

5.2.7.1 Inverse exponential scoring of spatial units upstream.

This model uses the spatial units rather than a distance to determine how they are scored. Every contributing spatial unit above a particular special feature was logarithmically scored with the spatial units immediately upstream of a special feature being scored a four, the next adjoining upstream spatial units received a score of two and the remainder above a special feature were scored a one. The spatial unit having the special feature located within it would not receive a score because it was already scored in criterion 6. Where a spatial unit had more than one calculation (i.e. overlapping scores), the maximum value was incorporated.

This model better reflects the importance of spatial units immediately above a special feature by applying a logarithmic threshold to scoring. It is also an efficient and practical application of a complex issue. A disadvantage of this model is that it treats all special features (e.g. macrophyte bed, geomorphological feature, hydrological feature) equally where there may be reasons to differentiate between them. Also, this model can result in some variation of the real distances upstream of a special feature being scored.

While the panel endorsed using the inverse exponential scoring model for Southeast Queensland, a variation was recommended to reflect the importance of connectivity to a special feature within the immediate subsection. The panel recommended applying a score of four to the geofabric units upstream within the subsection containing the special feature, and then a decreasing score by one as the subsections move further from the special feature subsection (e.g. 4, 3, 2, and 1). As the intent of this measure is to assign connectivity values to the subsections that are connected to the special feature, the measure was implemented to assign connectivity values to only those subsections that ‘connect to’ the special feature subsection, not the special feature subsection itself. The decrease in score by one as the subsection changes is a variation to the standard method (e.g. 4, 2, and 1) and has been implemented for Southeast Queensland.

Therefore, for measure 7.1.1, (The contribution, (upstream or downstream), of the spatial unit to the maintenance of significant species or populations, including those features identified through criteria 5 and/ or 6),. For measures 5.1.4 (Habitat for significant numbers of waterbirds) ,6.3.1 (Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose), or 6.3.2 (Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.) , had their associated riverine spatial unit (geofabric), given a score of 4, with all upstream geofabric units within the subsection also given a score of 4, All spatial units within the next subsection upstream was assigned a three; the next upstream subsection a two and the next upstream spatsubsection a one.

For measure 7.2.1, (The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through Criteria 5 and/or 6 (e.g. karst, cave streams, artesian springs), Non-riverine wetlands identified as having a score of 4 under measures 6.4.1 (presence of distinct, unique or special hydrological regimes (eg. spring fed stream, ephemeral stream, boggomoss), had their associated riverine spatial unit (geofabric), given a score of 4, with all upstream geofabric units within the subsection also given a score of 4, All spatial units within the next subsection upstream was assigned a three; the next upstream subsection a two and the next upstream spatsubsection a one.

5.3 Stratification

Study area stratification for application to relevant measures of AquaBAMM is a user decision and is not mandatory for a successful assessment. However, AquaBAMM makes provision for data to be stratified in any user-defined way that is determined to be ecologically appropriate. Stratification mitigates the effects of data averaging across large study areas, and is particularly important where ecological diversity and complexity is high. An example where stratification may be appropriate is fish diversity where fewer species inhabit the upland zone compared to lowland floodplains. For measure datasets where there is an equal probability of scoring across a range of values throughout the study area, stratification is unwarranted. To date, the use of strata in completed ACAs has been based on elevation (e.g. 150 m (ASL) for coastal flowing catchments and 400 m ASL for catchments west of the Great Dividing Range in the Murray-Darling Basin) or bioregional boundaries.

Stratification was considered by the Southeast Queensland expert panels. The panels decided that stratification was not required for this study area.

5.4 Weighting of measures

The panel members that attended the three SEQ expert panel workshops were asked to weight the measures within each indicator. Measures were to be weighted according to their importance to an indicator and based on the following rules:

- at least one measure within each indicator must be weighted 10 which is the highest weighting
- the other measures within each indicator were weighted compared to the weighting of 10 assigned in the first step
- It was okay to have different measures with the same weight (i.e. all measures could be weighted 10)
- some indicators only had one measure and had already been given a weighting of 10.
- measures shouldn’t be weighted down because of the quality or lack of data for that measure.

Due to a lack of responses, the weighting of measures from the Wide Bay-Burnett ACA were used. Wide Bay-Burnett was chosen as it is broadly similar to SEQ in terms of values and threats, ecologically contiguous and within the same bioregion. Where the same measure was used in both the WBB and SEQ ACA, the same weights were used. For new measures, team members assessed the WBB range of weights within that indicator and made an informed decision about the weight to be used in SEQ. Solitary measures within an indicator were given the standard weight of 10.

In the Wide Bay-Burnett ACA, the individual weights were averaged and reviewed with particular attention to averages having a high variance. In order to improve the statistical reliability of the final weights it was decided to average the weights across the entire Wide Bay-Burnett region, rather than average the weights for each study area/catchment.

The final weights for each measure were then applied in the AquaBAMM assessment (Table 23 and Table 24). The measure number in Table 23 and Table 24 relates to the hierarchical approach of the AquaBAMM method. The first number refers to a criterion and the second number to an indicator within a criterion followed by the individual measure number.

There are a number of different methods for eliciting expert information, however many of these can become very complicated and time intensive. The benefits of refining the weights through a more detailed method were considered minimal. The result from the approach adopted at the workshop was considered by the AquaBAMM development team to accurately reflect the expert panel's decisions.

Table 23. The average weights for each non-riverine measure

Maximum score is 10.

Criteria and Indicators	Measures		Weight
1 Naturalness Aquatic			
1.1 Exotic flora/fauna	1.1.1	Presence of 'alien' fish species within the wetland	9
	1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	9.9
	1.1.3	Presence of exotic invertebrate fauna within the wetland	8.3
	1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	8.7
1.3 Habitat features modification	1.3.7	% area of remnant wetland relative to preclear extent for each spatial unit	10
1.4 Hydrological modification	1.4.5	Hydrological disturbance/modification of the wetland (e.g. as determined through EPA wetland mapping and classification)	10
2 Naturalness Catchment			
2.1 Exotic flora/fauna	2.1.1	Presence of exotic terrestrial plants in the assessment unit	10
2.2 Riparian disturbance	2.2.5	% area of remnant vegetation relative to preclear extent within buffered non-riverine wetland: 500m buffer for wetlands >= 8Ha, 200m buffer for smaller wetlands	10
2.3 Catchment disturbance	2.3.1	% "agricultural" land-use area (i.e. cropping and horticulture)	9
	2.3.2	% "grazing" land-use area	8.9
	2.3.3	% "vegetation" land-use area (i.e. native veg + regrowth)	9.1
	2.3.4	% "settlement" land-use area (i.e. towns, cities, etc)	9.8
2.4 Flow modification	2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	10
3 Diversity and Richness			
3.1 Species	3.1.2	Richness of native fish	9.5
	3.1.3	Richness of native aquatic dependent reptiles	9.5
	3.1.4	Richness of native waterbirds	9.3
	3.1.5	Richness of native aquatic plants	9.6
	3.1.6	Richness of native amphibians (non-riverine wetland breeders)	9.6
	3.1.7	Richness of native aquatic dependent mammals	9.1

Criteria and Indicators	Measures		Weight
3 Diversity and Richness cont.			
3.2 Communities/ assemblages	3.2.1	Richness of macroinvertebrate taxa	10
3.3 Habitat	3.3.2	Richness of wetland types within the local catchment (e.g. SOR sub-section)	8.9
	3.3.3	Richness of wetland types within the sub-catchment	9.3
4 Threatened Species and Ecosystems			
4.1 Species	4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species – NCAct, EPBCAct	9.9
	4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species - NCAct, EPBCAct	9.9
4.2 Communities/ assemblages	4.2.1	Conservation status of wetland Regional Ecosystems – Herbarium biodiversity status, NCAct, EPBCAct	10
5 Priority Species and Ecosystems			
5.1 Species	5.1.1	Presence of aquatic ecosystem dependent 'priority' fauna species (expert panel list/discussion or other lists such as ASFB, WWF, etc)	9.8
	5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	9.8
	5.1.3	Habitat for, or presence of, migratory species (Expert Panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention)	9.3
	5.1.4	Habitat for significant numbers of waterbirds	8.8
5.2 Ecosystems	5.2.1	Presence of 'priority' aquatic ecosystem	10
6 Special Features			
6.1 Geomorphic features	6.1.1	Presence of distinct, unique or special geomorphic features	10
6.2 Ecological processes	6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	10
6.3 Habitat	6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	9.5
	6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.	9.6
	6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	9.4
6.4 Hydrological	6.4.1	Presence of distinct, unique or special hydrological regimes (eg. Spring fed stream, ephemeral stream, boggomoss)	10

Criteria and Indicators	Measures		Weight
7 Connectivity			
7.2 Groundwater dependent ecosystems	7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6 (e.g., karsts, cave streams, artesian springs)	10
7.3 Floodplain and wetland ecosystems	7.3.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist, with floodplains, rivers, groundwater, etc.	10
7.5 Estuarine and marine ecosystems	7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6	10
8 Representativeness			
8.1 Wetland protection	8.1.1	The percent area of each wetland type within Protected Areas.	9.6
	8.1.2	The percent area of each wetland type within a coastal/estuarine area subject to the Fisheries Act, Coastal Management Act or Marine Parks Act.	9.2
8.2 Wetland uniqueness	8.2.1	The relative abundance of the wetland management group to which the wetland type belongs within the catchment or study area (management groups ranked least common to most common)	9.7
	8.2.2	The relative abundance of the wetland management group to which the wetland type belongs within the subcatchment or estuarine/marine zone (management groups ranked least common to most common)	9.5
	8.2.3	The size of each wetland type relative to others of its management group within the catchment or study area	8.8
	8.2.4	The size of each wetland type relative to others of its type within a subcatchment (or estuarine zone)	8.5
	8.2.5	Wetland type representative of the study area – identified by expert opinion	8.6
	8.2.6	The size of each wetland type relative to others of its type within the catchment or study area	8.8

Table 24. The average weights for each riverine measure

Maximum score is 10.

Criteria and Indicators	Measures		Weight
1 Naturalness Aquatic			
1.1 Exotic flora/fauna	1.1.1	Presence of 'alien' fish species within the wetland	9.3
	1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	9.8
	1.1.3	Presence of exotic invertebrate fauna within the wetland	8.3
	1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	8.5
1.3 Habitat features modification	1.3.4	Presence/absence of dams/weirs within the wetland	9.3
	1.3.5	Inundation by dams/weirs (% of waterway length within the wetland)	9.6
	1.3.7	% area of remnant wetland relative to preclear extent for each spatial unit	9
	1.3.8	Presence of dredging/extraction (including for navigation) and channel modification within the wetland	8.6
2 Naturalness Catchment			
2.1 Exotic flora/fauna	2.1.1	Presence of exotic terrestrial plants in the assessment unit	10
2.2 Riparian disturbance	2.2.1	% area remnant vegetation relative to preclear extent within buffered riverine wetland or watercourses	9.8
	2.2.2	Total number of REs relative to preclear number of REs within buffered riverine wetland or watercourses	7.8
	2.2.9	Percentage tree cover within the waterway corridor	9.0
2.3 Catchment disturbance	2.3.1	% "agricultural" land-use area (i.e. cropping and horticulture)	8.9
	2.3.2	% "grazing" land-use area	8.6
	2.3.3	% "vegetation" land-use area (i.e. native veg + regrowth)	8.9
	2.3.4	% "settlement" land-use area (i.e. towns, cities, etc)	9.5
2.4 Flow Modifications	2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	10
3 Diversity and Richness			
3.1 Species	3.1.1	Richness of native amphibians (riverine wetland breeders)	9.5
	3.1.2	Richness of native fish	9.8
	3.1.3	Richness of native aquatic dependent reptiles	9.4
	3.1.4	Richness of native waterbirds	9.3
	3.1.5	Richness of native aquatic plants	9.7
	3.1.7	Richness of native aquatic dependent mammals	9.1

Criteria and Indicators	Measures		Weight
3.2 Communities/ assemblages	3.2.1	Richness of macroinvertebrate taxa	9.8
	3.2.2	Richness of REs along riverine wetlands or watercourses within a specified buffer distance	8.8
3.3 Habitat	3.3.2	Richness of wetland types within the local catchment (e.g. SOR sub-section)	8.8
	3.3.3	Richness of wetland types within the sub-catchment	9.3
4 Threatened Species and Ecosystems			
4.1 Species	4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species – NCAct, EPBCAct	9.9
	4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species - NCAct, EPBCAct	9.9
4.2 Communities/ assemblages	4.2.1	Conservation status of wetland Regional Ecosystems – Herbarium biodiversity status, NCAct, EPBCAct	10
5 Priority Species and Ecosystems			
5.1 Species	5.1.1	Presence of aquatic ecosystem dependent 'priority' fauna species (expert panel list/discussion or other lists such as ASFB, WWF, etc)	9.8
	5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	9.8
	5.1.3	Habitat for, or presence of, migratory species (Expert Panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention)	9.4
	5.1.4	Habitat for significant numbers of waterbirds	8.9
5.2 Ecosystems	5.2.1	Presence of 'priority' aquatic ecosystem	10
6 Special Features			
6.1 Geomorphic features	6.1.1	Presence of distinct, unique or special geomorphic features	10
6.2 Ecological processes	6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	10
6.3 Habitat	6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	9.6
	6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.	9.6
	6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	9.4
6.4 Hydrological	6.4.1	Presence of distinct, unique or special hydrological regimes (eg. Spring fed stream, ephemeral stream, boggomoss)	10

Criteria and Indicators	Measures		Weight
7 Connectivity			
7.1 Significant species or populations	7.1.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of significant species or populations, including those features identified through criteria 5 and/ or 6	9.4
	7.1.2	Migratory or routine 'passage' of fish and other fully aquatic species (upstream, lateral or downstream movement) within the spatial unit	9.6
7.2 Groundwater dependent ecosystems	7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6 (e.g., karsts, cave streams, artesian springs)	10
7.3 Floodplain and wetland ecosystems	7.3.1	The contribution of the spatial unit to the maintenance of floodplain and wetland ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6	10
7.5 Estuarine and marine ecosystems	7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6	10

5.5 Ranking of indicators

The panel members that attended each SEQ expert panel workshop were asked to rank the indicators within each criterion. Indicators were to be ranked according to their importance to a criterion and based on the following rules:

- at least one indicator within each criterion must be ranked one which is the highest ranking
- the other indicators were ranked within each criterion relative to the ranking of one assigned in the first step
- it was okay to have different indicators with the same ranking (i.e. all indicators may be ranked one)
- indicator should not be ranked down because of the quality or lack of data for that indicator.

Due to a lack of responses, the ranking of indicators from the Wide Bay-Burnett ACA were used. Wide Bay-Burnett was chosen as it is broadly similar to SEQ in terms of values and threats, ecologically contiguous and within the same bioregion. Where the same indicator was used in both the WBB and SEQ ACA, the same ranks were used. For new indicators, team members assessed the WBB range of ranks within that criterion and made an informed decision about the rank to be used in SEQ.

In the Wide Bay-Burnett ACA, the individual rankings were averaged and reviewed with particular attention to averages having a high variance. In order to improve the statistical reliability of the final rankings it was decided to average the ranks across the entire Wide Bay-Burnett region, rather than average the ranks for each study area/catchment.

The final ranks for each indicator were then applied in the AquaBAMM assessment (Table 25 and Table 26).

Table 25. The average rank for each non-riverine indicator

Maximum rank is one.

Criteria	Indicator	Rank
1 Naturalness Aquatic		
1.1	Exotic flora / fauna	2
1.3	Habitat features modification	2
1.4	Hydrological modification	1
2 Naturalness Catchment		
2.1	Exotic flora / fauna	2
2.2	Riparian disturbance	1
2.3	Catchment disturbance	2
2.4	Flow modification	1
3 Diversity and Richness		
3.1	Species	1
3.2	Communities / assemblages	1
3.3	Habitat	1
4 Threatened Species and Ecosystems		
4.1	Species	1
4.2	Communities / assemblages	2
5 Priority Species and Ecosystems		
5.1	Species	1
5.2	Communities / assemblages	1
6 Special Features		
6.1	Geomorphic features	3
6.2	Ecological processes	2
6.3	Habitat	2
6.4	Hydrological	1
7 Connectivity		
7.2	Groundwater dependent ecosystems	2
7.3	Floodplain and wetland ecosystems	1
7.5	Estuarine and marine ecosystems	1

Criteria	Indicator	Rank
8 Representativeness		
8.1	Wetland protection	1
8.2	Wetland uniqueness	1

Table 26. The average rank for each riverine indicator

Maximum rank is one.

Criteria	Indicator	Rank
1 Naturalness Aquatic		
1.1	Exotic flora / fauna	2
1.3	Habitat features modification	1
2 Naturalness Catchment		
2.1	Exotic flora / fauna	3
2.2	Riparian disturbance	2
2.3	Catchment disturbance	2
2.4	Flow modification	1
3 Diversity and Richness		
3.1	Species	1
3.2	Communities / assemblages	1
3.3	Habitat	1
4 Threatened Species and Ecosystems		
4.1	Species	1
4.2	Communities / assemblages	1
5 Priority Species and Ecosystems		
5.1	Species	1
5.2	Communities / assemblages	1
6 Special Features		
6.1	Geomorphic features	2
6.2	Ecological processes	2
6.3	Habitat	2
6.4	Hydrological	1
7 Connectivity		
7.1	Significant species or populations	2
7.2	Groundwater dependent ecosystems	3
7.3	Floodplain and wetland ecosystems	1
7.5	Estuarine and marine ecosystems	2

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7 Acronyms and abbreviations

Acronym	Definition
ACA	Aquatic Conservation Assessment
ASL	above sea level
BPA	Biodiversity Planning Assessment
CAMBA	China-Australia Migratory Birds Agreement
CMS	Convention of Migratory Species of Wild Animals (also known as the Bonn Convention)
DIWA	Directory of Important Wetlands Australia
DSITI	Department of Science, Information Technology and Innovation
EHP	Department of Environment and Heritage Protection
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
GIS	Geographic Information System
HEV	High ecological value (under a water quality improvement plan)
JAMBA	Japan–Australia Migratory Birds Agreement
MRCCC	Mary River Catchment Coordinating Committee
NC Act	Nature Conservation Act 1992
NPSR	Department of National Parks, Sport and Racing
QPWS	Queensland Parks and Wildlife Service
Ramsar	Ramsar Convention on Wetlands
RE	Regional ecosystem
ROKAMBA	Republic of Korea–Australia Migratory Bird Agreement
SEQ	Southeast Queensland
SOR	State of the Rivers

8 Appendix A - terms of reference

8.1 Aquatic flora expert panel

The Aquatic Flora Expert Panel is established to provide expert advice on the aquatic floristic values of the riverine and non-riverine wetlands in Southeast Queensland. The panel membership will consist of professionals with expertise relating to aquatic flora and riparian flora and floristic communities.

The advice provided by the expert panel at the workshop will be compiled into written and electronic form, which the Department of Environment and Heritage Protection will use in the Aquatic Conservation Assessment (ACA). The ACA will assist in assigning aquatic ecological and conservation values to the riverine and non-riverine wetlands of Southeast Queensland.

The tasks to be undertaken by the panel include, but without limitation, the following:

- Review relevant existing spatial data (species point records) and available information (reports etc.);
- Provide advice on aquatic dependent endangered, vulnerable or near-threatened flora species habitat and localities;
- Provide advice on aquatic dependent priority flora species habitat and localities;
- Identify priority ecosystems or areas important for significant floral communities or species;
- Provide advice on aquatic dependent exotic flora species localities and abundance;
- Weight measures relative to their importance for an indicator, and
- Rank indicators relative to their importance for a criterion.

8.2 Aquatic fauna expert panel

The Aquatic Fauna Expert Panel is established to provide expert advice on the aquatic fauna values of the riverine and non-riverine wetlands in Southeast Queensland. The panel membership will consist of professionals with expertise relating to aquatic fauna values.

The advice provided by the expert panel at the workshop will be compiled into written and electronic form, which the Department of Environment and Heritage Protection will use in the Aquatic Conservation Assessment (ACA). The ACA will assist in assigning aquatic ecological and conservation values to the riverine and non-riverine wetlands in Southeast Queensland.

The tasks to be undertaken by the panel include, but without limitation, the following:

- Review relevant existing spatial data (species point records) and available information (reports etc.);
- Provide advice on aquatic dependent rare or threatened fauna species habitat and localities;
- Provide advice on aquatic dependent priority fauna species habitat and localities;
- Identify priority ecosystems or areas important for significant faunal communities or species;
- Provide advice on aquatic dependent exotic fauna species localities and abundance;
- Weight measures relative to their importance for an indicator, and
- Rank indicators relative to their importance for a criterion.

8.3 Aquatic ecology expert panel

The Aquatic Ecology Expert Panel is established to provide expert advice based on experience and demonstrated scientific theory on natural geological or geo-morphological and hydrological processes, and issues of connectivity between aquatic systems within the waterways in Southeast Queensland. The panel membership will consist of professionals in fields of expertise relating to water quality, wetland health assessment, geomorphology, fish passage and hydrological processes.

The advice provided by the expert panel at the workshop will be compiled into written and electronic form, which the Department of Environment and Heritage Protection will use in the Aquatic Conservation Assessment (ACA). The ACA will assist in assigning aquatic ecological and conservation values to the riverine and non-riverine wetlands of Southeast Queensland.

The tasks to be undertaken by the panel include, but without limitation, the following:

- Identify areas of significant geomorphological, ecological or hydrological processes (Special Features);
- Provide advice on biodiversity ‘hot-spots’ or areas of particular significance for aquatic species or communities;
- Establish principles for applying the connectivity criterion in the study area;
- Weight measures relative to their importance for an indicator, and
- Rank indicators relative to their importance for a criterion.

9 Appendix B - Criteria, indicators and measures for the Southeast Queensland region

Criteria and Indicators	Measures		Riverine	Non-riverine
1 Naturalness Aquatic				
1.1 Exotic flora/fauna	1.1.1	Presence of ‘alien' fish species within the wetland	Y	Y
	1.1.2	Presence of exotic aquatic and semi-aquatic plants within the wetland	Y	Y
	1.1.3	Presence of exotic invertebrate fauna within the wetland		Y
	1.1.4	Presence of feral/exotic vertebrate fauna (other than fish) within the wetland	Y	Y
1.3 Habitat features modification	1.3.4	Presence/absence of dams/weirs within the wetland	Y	
	1.3.5	Inundation by dams/weirs (% of waterway length within the wetland)	Y	
	1.3.7	% area of remnant wetland relative to preclear extent for each spatial unit	Y	Y
	1.3.8	Presence of dredging/extraction (including for navigation) and channel modification within the wetland		
1.4 Hydrological modification	1.4.5	Hydrological disturbance/modification of the wetland (e.g. as determined through EHP wetland mapping and classification)		Y
2 Naturalness catchment				
2.1 Exotic flora/fauna	2.1.1	Presence of exotic terrestrial plants in the assessment unit	Y	Y
2.2 Riparian disturbance	2.2.1	% area remnant vegetation relative to preclear extent within buffered riverine wetland or watercourses	Y	
	2.2.2	Total number of REs relative to preclear number of REs within buffered riverine wetland or watercourses	Y	
	2.2.5	% area of remnant vegetation relative to pre-clear extent within buffered non-riverine wetland: 500m buffer for wetlands >= 8Ha, 200m buffer for smaller wetlands		Y
	2.2.9	Percentage tree cover within the waterway corridor	Y	
2.3 Catchment disturbance	2.3.1	% "agricultural" land-use area (i.e. cropping and horticulture)	Y	Y
	2.3.2	% "grazing" land-use area	Y	Y
	2.3.3	% "vegetation" land-use area (i.e. native veg + regrowth)	Y	Y
	2.3.4	% "settlement" land-use area (i.e. towns, cities, etc)	Y	Y
2.4 Flow Modifications	2.4.1	Farm storage (overland flow harvesting, floodplain ring tanks, gully dams) calculated by surface area	Y	Y

Criteria and Indicators	Measures		Riverine	Non-riverine
3 Diversity and richness				
3.1 Species	3.1.1	Richness of native amphibians (riverine wetland breeders)	Y	
	3.1.2	Richness of native fish	Y	Y
	3.1.3	Richness of native aquatic dependent reptiles	Y	Y
	3.1.4	Richness of native waterbirds	Y	Y
	3.1.5	Richness of native aquatic plants	Y	Y
	3.1.6	Richness of native amphibians (non-riverine wetland breeders)		Y
	3.1.7	Richness of native aquatic dependent mammals	Y	Y
3.2 Communities/ assemblages	3.2.1	Richness of macroinvertebrate taxa	Y	Y
	3.2.2	Richness of REs along riverine wetlands or watercourses within a specified buffer distance	Y	
3.3 Habitat	3.3.2	Richness of wetland types within the local catchment (e.g. SOR sub-section)	Y	Y
	3.3.3	Richness of wetland types within the sub-catchment	Y	Y
4 Threatened species and ecosystems				
4.1 Species	4.1.1	Presence of rare or threatened aquatic ecosystem dependent fauna species – NCAct, EPBCAct	Y	Y
	4.1.2	Presence of rare or threatened aquatic ecosystem dependent flora species - NCAct, EPBCAct	Y	Y
4.2 Communities/ assemblages	4.2.1	Conservation status of wetland Regional Ecosystems – Herbarium biodiversity status, NCAct, EPBCAct	Y	Y
5 Priority species and ecosystems				
5.1 Species	5.1.1	Presence of aquatic ecosystem dependent 'priority' fauna species (expert panel list/discussion or other lists such as ASFB, WWF, etc)	Y	Y
	5.1.2	Presence of aquatic ecosystem dependent 'priority' flora species	Y	Y
	5.1.3	Habitat for, or presence of, migratory species (Expert Panel list/discussion and/or JAMBA / CAMBA agreement lists and/or Bonn Convention)	Y	Y
	5.1.4	Habitat for significant numbers of waterbirds	Y	Y
5.2 Ecosystems	5.2.1	Presence of 'priority' aquatic ecosystem	Y	Y
6 Special features				
6.1 Geomorphic features	6.1.1	Presence of distinct, unique or special geomorphic features	Y	Y
6.2 Ecological processes	6.2.1	Presence of (or requirement for) distinct, unique or special ecological processes	Y	Y

Criteria and Indicators	Measures		Riverine	Non-riverine
6.3 Habitat	6.3.1	Presence of distinct, unique or special habitat (including habitat that functions as refugia or other critical purpose)	Y	Y
	6.3.2	Significant wetlands identified by an accepted method such as Ramsar, Australian Directory of Important Wetlands, Regional Coastal Management Planning, World Heritage Areas, etc.	Y	Y
	6.3.3	Ecologically significant wetlands identified through expert opinion and/or documented study	Y	Y
6.4 Hydrological	6.4.1	Presence of distinct, unique or special hydrological regimes (eg. Spring fed stream, ephemeral stream, boggomoss)	Y	Y
7 Connectivity				
7.1 Significant species or populations	7.1.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of significant species or populations, including those features identified through criteria 5 and/ or 6	Y	
	7.1.2	Migratory or routine 'passage' of fish and other fully aquatic species (upstream, lateral or downstream movement) within the spatial unit	Y	
7.2 Groundwater dependent ecosystems	7.2.1	The contribution (upstream or downstream) of the spatial unit to the maintenance of groundwater ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6 (e.g., karsts, cave streams, artesian springs)	Y	Y
7.3 Floodplain and wetland ecosystems	7.3.1	The contribution of the spatial unit to the maintenance of floodplain and wetland ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6	Y	
	7.3.2	Extent to which the wetland retains critical ecological and hydrological connectivity, where it should exist, with floodplains, rivers, groundwater, etc.		Y
7.5 Estuarine and marine ecosystems	7.5.1	The contribution of the spatial unit to the maintenance of estuarine and marine ecosystems with significant biodiversity values, including those features identified through criteria 5 and/or 6		

Criteria and Indicators	Measures		Riverine	Non-riverine
8 Representativeness				
8.1 Wetland protection	8.1.1	The percent area of each wetland type within Protected Areas.		Y
	8.1.2	The percent area of each wetland type within a coastal/estuarine area subject to the Fisheries Act, Coastal Management Act or Marine Parks Act.		Y
8.2 Wetland uniqueness	8.2.1	The relative abundance of the wetland management group to which the wetland type belongs within the catchment or study area (management groups ranked least common to most common)		Y
	8.2.2	The relative abundance of the wetland management group to which the wetland type belongs within the sub-catchment or estuarine/marine zone (management groups ranked least common to most common)		Y
	8.2.3	The size of each wetland type relative to others of its management group within the catchment or study area		Y
	8.2.4	The size of each wetland type relative to others of its type within a sub-catchment (or estuarine zone)		Y
	8.2.5	Wetland type representative of the study area – identified by expert opinion		Y
	8.2.6	The size of each wetland type relative to others of its type within the catchment or study area		Y