Chapter **8**

Queensland Agricultural Land Audit

Mackay, Isaac and Whitsunday

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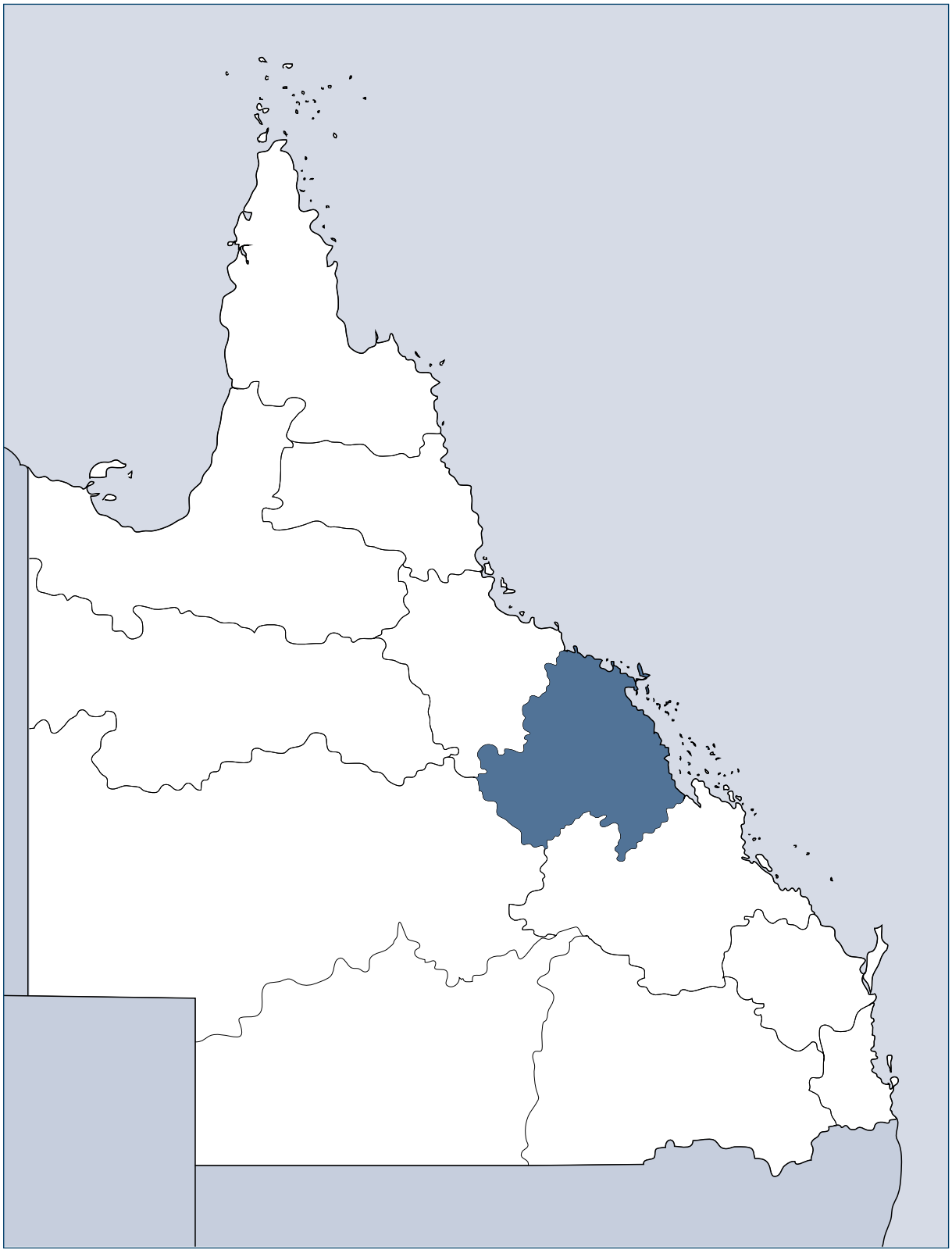

8.1.1 Economic profile

The Mackay, Isaac and Whitsunday region is located on the east coast of Queensland from St Lawrence in the south to Gumlu in the north and runs westwards over the range to the Belyando River. It comprises the three local government areas of Isaac Regional Council, Mackay Regional Council and Whitsunday Regional Council. It has a total area of 89 629 km^2, or 5.1 per cent of the total area of the state (see Map 8.1).

The main agricultural industries for this region are sugarcane and cattle. Other important industries are timber, grain (in the western area of the region), production horticulture (on the coast) and seafood.

The value of agricultural production in the region was $891 million in 2010–11, which was 9.3 per cent of Queensland's total value of agricultural production. In 2010–11 the major agricultural commodities in the region were cropping (valued at $324 million, including sugarcane at $233 million, cereals at $54 million and cotton at $15 million), livestock products and slaughtering (valued at $336 million) and horticulture (valued at $232 million, including vegetables at $208 million and fruit at $13 million).

The region has a long-established sugarcane industry with extensive, integrated transport facilities, established markets and five milling facilities. Mount McLaren has a grain depot and there are grain storages at Capella and Emerald (outside of the region).

A large-scale beef processing plant operates in Mackay. Horticulture value-adding and packaging processing facilities located in Bowen complement the area's strong production horticulture focus.

The key centres for provision of agricultural and service facilities are Mackay, Proserpine, Sarina, Clermont and Bowen–Gumlu. Mackay is a point of export for some boxed beef and sugar as well as a point of supply for inputs such as oil and fertiliser. Proserpine, Mackay and Sarina are important centres for the sugarcane industry.

The region is divided by the ranges, which separate the wetter coastal strip from the drier western areas, creating some limitations for transport. As a result, centres outside of the region are also used for access to services. People in the western part of the region may access services from Emerald, Charters Towers or Rockhampton. Those on the coastal strip south from Mackay tend to use Mackay and Rockhampton, and those north of Mackay may go to Proserpine, Bowen or Townsville.

As at 30 June 2011, the estimated population of the Mackay, Isaac and Whitsunday region was 179 093 people, or 3.9 per cent of the state's population. The population is projected to increase to 279 818 people over the next 20 years, which is a growth of approximately 56 per cent. Most of this growth is expected to occur in coastal settlements between Airlie Beach and Sarina and in settlements of the Bowen Basin mining area. The main industries in the region are mining, agriculture and tourism.

The population represents a slightly younger demographic than the state's averages. The median age for 2 of the 3 regional council areas was lower than the state median age of 36.2 years, with the lowest median age of 31.5 years in the Isaac Regional Council area.

The unemployment rate for the Mackay, Isaac and Whitsunday region for the June quarter 2012 was 3.7 per cent, compared with 5.5 per cent for Queensland. The Isaac region had a significantly lower unemployment rate of 1.1 per cent.[1]

At the time of the 2011 census, mining was the largest industry of employment for the region, with 14.3 per cent of the region's employed labour force engaged in this industry. The Isaac Regional Council area has a significantly higher proportion of the population employed in the mining sector (39.5 per cent). Agriculture, in contrast, represented just 4.9 per cent of the employment for the Mackay, Isaac and Whitsunday region.

1 Australian Bureau of Statistics 2012, Queensland regional profiles (generated 5 December 2012), Office of Economic and Statistical Research, Queensland Treasury and Trade, ‹http://statistics.oesr.qld.gov.au/qld-regional-profiles›.

However, of businesses registered in the region in 2008–09, agriculture represented the largest number at 21.6 per cent. This was closely followed by construction at 18.3 per cent. The Mackay, Isaac and Whitsunday region accounts for 7.15 per cent of the total businesses registered in the agriculture, forestry and fishing industries for the state.

Technical and trade-based roles dominate employment in the region at 20.4 per cent of employed residents. Workers were evenly spread through managers (11.1 per cent), professionals (12.2 per cent), labourers (12.0 per cent), machinery operators and drivers (15.0 per cent) and clerical job roles (12.1 per cent). [2]

Land values across the region vary according to the productivity of the land (see Table 8.1). All agricultural land-use types have seen significant market value increases for the period from 2001 to 2012, ranging from 36 to 456 per cent.

In 2012 the highest land value was for the irrigated sugarcane land of the Mackay Regional Council at $18 000 per hectare, which is the highest price for that land type in the state (Table 8.1). The irrigation is largely supplementary irrigation to rain-fed sugarcane crops; there is virtually no full irrigation of sugarcane in the Mackay, Isaac and Whitsunday region. Similarly, the dryland cane land in Mackay Regional Council and the cane land in the Whitsunday Regional Council have been at the high end of prices for the state at $17 000 and $15 000 per hectare respectively. The grazing land in the Whitsunday Regional Council has seen a relatively high market value increase over the past 10 years compared with other land types because of its relatively low starting base. After 2001, the boost in the value of cattle meant that the price per beast area generally doubled; the 2006 peak in the cattle market has subsequently dropped, but is reflected in the value of grazing land for this period. In the period from 2001 to 2007, most property sales would have been between graziers, but more recently there has been a disconnect between the value of the land and its production levels. This is due to either mining companies purchasing grazing properties or properties being purchased by developers seeking land for urban, tourism and industrial expansion, as they are able to pay higher prices for grazing land, particularly in the coastal zone (i.e. coastal grazing areas). For example, in the Isaac Regional Council area in 2011 and 2012, a mining company purchased grazing properties in the Valkyrie district estimated to represent the production of 20 000 head of cattle. Along the coastal zone, urban expansion and demand for lifestyle blocks are influencing market values for agricultural land.

Table 8.1 The change in land values for the Mackay, Isaac and Whitsunday region

Local authority	Land type	Market valuation ($/ha)			Percentage change 2001–12	State market valuations range 2012 ($/ha)
		Pre-boom 2001	Boom (market peak) 2007	Post-boom 2012		
Mackay Regional Council	Cane (irrigated)	12 000	15 000	18 000	+50	13 000 to 18 000
	Cane (dryland)	10 000	13 000	17 000	+70	7 100 to 17 000
	Coastal grazing	1 000	2 250	2 250	+125	2 250
	Remnant forest	150	400	350	+133	35 to 8 500
Isaac Regional Council	Mixed scrub and forest	500	1 200	1 000	+100	1 000
	Coastal grazing	1 000	2 250	2 250	+125	2 250
	Mixed arable downs	800	1 500	1 500	+88	1 500
Whitsunday Regional Council	Grazing	45	275	250	+456	20 to 25 000
	Agriculture	11 000	14 000	15 000	+36	15 000
	Cane	11 000	14 000	15 000	+36	15 000
	Aquaculture	4 000	8 000	7 000	+75	7 000 to 50 000
	Remnant forest	8	40	35	+338	35 to 8 500

Source: Data provided by Department of Natural Resources and Mines, State Valuation Service, July 2012

2 Australian Bureau of Statistics 2012, Queensland regional profiles (generated 5 December 2012), Office of Economic and Statistical Research, Queensland Treasury and Trade, ‹http://statistics.oesr.qld.gov.au/qld-regional-profiles›.

8.1.2 Strengths, weaknesses, opportunities and threats

Key regional issues

- There is a significant amount of good-quality agricultural land and a favourable climate, including high rainfall along the coast, which sustains a rich mixture of agricultural produce.
- The region has good water resources and well-developed water infrastructure for irrigation along the coast.
- There is infrastructure to support the agricultural activities in the region, including transport, processing, grain-storage and water infrastructure.
- Sugarcane production areas are being impacted by infiltration of sea water into freshwater aquifers and by urban and industrial expansion.
- Market conditions are the main factors limiting agricultural expansion in the western areas; infrastructure (such as transport) is also significant.

A range of socio-economic and environmental characteristics make the Mackay, Isaac and Whitsunday region a significant agricultural area for Queensland. However, growth of agricultural industries in the region faces significant challenges. Outlined below are the strengths (existing factors that favour agricultural production), weaknesses (unfavourable conditions that hamper the success of agricultural production), opportunities (actions that could be taken to enhance future agricultural production) and threats (issues that could negatively impact on agricultural production), which provide a snapshot of some of the key factors impacting on the potential for agricultural growth in the region.

Strengths

The strengths of the region include the following:

- The region has a mix of sugarcane, grazing, horticulture, broadacre cropping, intensive livestock and aquaculture industries and is supported by the favourable climate and soils.
- Large areas of high-quality grazing land occur in areas west of the range on agricultural land class A country, and these receive much lower rainfall than the coast.
- The region is close to markets in south-eastern Queensland and Asia, and has market windows for horticultural crops including mangoes, lychees and longans for Asia and the domestic markets. Tropical fruit harvests begin in the Northern Territory and move south, finishing in northern New South Wales 4–5 months later; the region is well placed to supply crops in the middle of this period.
- There is a good supply of existing and potential water resources for current and future agriculture. (See Section 8.1.4 for more information on water resources.)
- The region has established infrastructure to support the key industries (e.g. railways, roads, cargo ports, sugar mills and a sugar refinery, meatworks, silos and water infrastructure). The multinational beef processors within the region offer plant that is available to process certified organic beef.

Weaknesses

The weaknesses of the region include the following:

- Key biosecurity issues for agricultural production include
  - invasive plants and animals—for example, locusts, giant rat's tail grass, feral pigs and lantana
  - insect pests of plants—for example, fruit flies, fungal leaf spots and banana pests
  - animal pests and diseases—for example, bovine Johne's disease, botulism and internal parasites.
- Due to the production of a small number of minimally processed commodities, the local agricultural economy is largely export driven. This dependency results in significant exposure to world commodity price movements, competition and changes in export markets, and a potential economic pattern of boom and bust.

- Infrastructure funding and provision lags behind demand in the key areas of transport, water and power. Strong competition for access to transport infrastructure and water from mining and urban expansion is increasing input costs and limiting expansion of agriculture.
- The current road transport infrastructure limits agricultural expansion due to a range of issues including mass-limited watercourse crossings and steep gradients on the Eton Range crossing, declining road conditions and increasing transport times. (See Section 8.1.5 for more details.)
- Access to both skilled and unskilled labour is a problem for the sugarcane, horticultural and grazing sectors. Limited access to social infrastructure (affordable housing and other services) exacerbates this issue. In addition, access to support services (e.g. tyres and machinery servicing), particularly in western areas, can be difficult and expensive.
- Unreliable and inadequate telecommunications across the region, including a lack of mobile phone coverage in significant areas, is a constraint to running a modern agricultural business and limits agricultural development.
- Extension services for the grain and beef industries are usually based outside the region.

Opportunities

The opportunities for expanded agricultural production in the region include the following:

- The Water for Bowen project conducted by SunWater proposed to divert up to 60 000 ML of water from the Burdekin system. Although withdrawn by SunWater due to lack of financial viability, the project would have offered the potential to more than double the irrigated agricultural production area in the Bowen district.
- Similarly, the Connors River Dam and Pipelines Project proposed by SunWater primarily for coalmining and communities in the Bowen and Galilee basins has been withdrawn, but may have offered extra water for agriculture.
- There is opportunity to expand aquaculture, particularly in the Guthalungra–Bowen area.
- Improvements to transport infrastructure—including enhancing port facilities, developing interchange nodes and improving the Peak Downs Highway and other major roads—will enable faster and more efficient transport of agricultural produce and inputs. A multi-cargo port facility at Mackay would attract container ships on a weekly basis to transport commodities such as grains and frozen beef. Also, incoming inputs would benefit this region and the Central Queensland region.
- The potential multi-modal transport opportunities provided by new mine rail corridors and ports should be investigated to ensure that infrastructure is not exclusively focused on coal.

Threats

The threats to agricultural production in the region include the following:

- Sugarcane production areas in coastal areas have been impacted by infiltration of sea water into freshwater aquifers and by urban and industrial expansion around Mackay. Urban expansion also affects infrastructure supporting agricultural production. These impacts need to be managed and planned for together to avoid further loss of land that is currently used for sugarcane production.
- The cost of developing water storage and supply infrastructure is high and many agricultural producers may struggle to afford water from the proposed sources. For example, the expansion of sugarcane west of Proserpine will be limited by access to an affordable irrigation water supply.
- There is resistance to plantation forestry from some local governments and some sectors of the sugarcane industry due to perceived competition for land.
- Mining operations in the Bowen Basin are currently expanding into high-productivity grazing land north-west and south-east of Dysart and along the Isaac River, and this will affect production levels and have flow-on impacts to supply chains. These soils are also suited to cropping, so it also threatens future expansion of cropping in the affected areas.
- The significant expansion of mining infrastructure (including rail and road corridors across high-productivity grazing and cropping areas) reduces production and affects agricultural operations, access to stock routes and stream/water flows.

8.1.3 Climate

The Mackay, Isaac and Whitsunday region has an average daily temperature range of 16.3–28.9 °C and on average receives 817 mm of rainfall each year. Rainfall is variable between coastal and inland communities. Inland near Moranbah averages approximately 500 mm annual rainfall compared to 1600 mm in Mackay. Dry and wet seasons are more varied along the coastal communities, with rainfall in the wet season being three to four times that in the dry season. Inland, the rainfall during the wet season is double that received in dry season.

The Pioneer River basin has a catchment area of about 1500 km^2 between the Fitzroy and Burdekin rivers. Very high rainfall on the Clarke and Connors ranges causes very fast stream rises in Blacks and Cattle creeks, which feed into the Pioneer River. Water from heavy rainfall in the upper catchment reaches Mackay within 10 hours.

The trends of increasing temperatures since 1910 are likely to continue, with the average annual temperature for the region expected to be 0.9 °C warmer by 2030. Evaporation is also likely to increase (by 7–15 per cent) and extreme events are more likely, with an increase in both prolonged dry periods and floods. Increases in temperature, evaporation and prolonged dry periods will affect water supplies and agricultural production.

8.1.4 Water resources

The Mackay, Isaac and Whitsunday region straddles several water resource planning areas and includes coastal areas for which there are no water resource plans. The water resource plans provide water for urban use, agriculture, industry, tourism and ecological outcomes. The Pioneer Valley and Whitsunday water resource plan areas are wholly within the Mackay, Isaac and Whitsunday region, but the region also includes upper catchments in the south of the Burdekin and the north of the Fitzroy water resource plan areas. The very western edge of the region sits in the Cooper Creek water resource plan area.

Water allocations for agriculture (see Map 8.2) are categorised as either supplemented (i.e. stored in major infrastructure like Teemburra Dam, west of Mackay, for later delivery and use) or unsupplemented (i.e. taken from natural flows as the opportunity presents). Water sourced from supplemented schemes is generally associated with a greater reliability of supply and access. Unsupplemented water is accessed directly from stream or overland flow and is generally taken on an opportunistic basis and applied directly to crops or stored in on-farm infrastructure for later use.

The Pioneer Valley water resource plan includes surface water and groundwater. Supplemented water and groundwater in this plan area are fully allocated and much of the agricultural use of the water is for irrigated sugarcane. There is a 14 000 ML annual volumetric limit of unsupplemented surface water (available during high flows) in some of the smaller catchments, including Sandy Creek.

Supplemented water is sourced from Teemburra and Kinchant dams as well as three weirs along the Pioneer River. The Eton Water Supply Scheme provides 62 563 ML of water over 499 supplemented water allocations and the Pioneer River Water Management Area provides 78 110 ML over 352 supplemented water allocations. While these two schemes are 100 per cent allocated, water trading is allowed, so farmers may either buy or sell water for irrigation.

Groundwater resources in the Pioneer Valley water resource plan are fully developed and allocated with 536 groundwater entitlements in the Pioneer Groundwater Management Area. Seawater intrusion occurs in the coastal areas around Mackay and groundwater extraction needs to be managed carefully to avoid further seawater intrusion through over-extraction. Recycled water from the Mackay Sewerage Scheme may also be available for crop irrigation.

Further north, the Peter Faust Dam in the Whitsunday water resource plan provides water for irrigated agriculture, mainly sugarcane around Proserpine. The plan also provides for the taking of overland flow water without a licence for stock or domestic purposes and through small storages of up to 20 ML capacity. There is 28 500 ML of general reserve water in the southern sub-catchments, which may be accessed for agricultural use.

The relevant areas in the Burdekin Basin water resource plan include a large part of the Suttor River and Mistake Creek catchments, the Bowen and Broken rivers and part of the lower Burdekin Water Management Area. A large part of this area supports grazing, dryland cropping and small areas of irrigated cropping. There is an unallocated general reserve of 130 000 ML in the southern part of the plan area, which is largely used for grazing, but has small pockets of land that are suitable for broadacre cropping, growing forage crops or growing grain for use in feedlots. There is also 50 000 ML of unsupplemented, unallocated water available in the lower Burdekin. Overland flow is regulated and landholders with works greater than 250 ML must hold a licence. There are tradable water allocations in the Burdekin Basin water resource plan area.

The Bowen Broken Water Supply Scheme includes a nominal volume of 8744 ML of supplemented water. The agricultural uses of this water include sugarcane and horticulture around Bowen. Plans for the future raising of the Burdekin Falls Dam, which would add 150 000 ML in supplemented water, could lead to more unallocated water for agriculture in the future.

The part of the Fitzroy Basin water resource plan relevant to the Mackay, Isaac and Whitsunday region includes the Isaac River (above Tartrus Weir) and the Connors River. The area is used mainly for grazing, but there are some areas of dryland and irrigated cropping. Irrigators in this sub-catchment area capture overland flow water. The water is used mostly for stock watering and to irrigate fodder crops or grain for use in feedlots. The plan also allows water to be captured in storages of up to 50 ML for stock or domestic purposes. There is 12 000 ML in the Isaac, Connors, lower Mackenzie and lower Fitzroy catchments, so only a portion of that is available in the Isaac and Connors rivers.

Strong growth in Central Queensland, driven by coalmining and associated development, has led to increased demand for water. The Connors–Isaac sub-catchment has opportunities for water harvesting but there is high risk associated with any development of irrigation infrastructure on a floodplain that is highly susceptible to flooding. SunWater announced that the Connors River Dam and Pipelines Project would not proceed at this time. It was to provide water primarily for Central Queensland's coalmining and the towns of Nebo and Moranbah, but potentially also for agriculture.[3] The high rainfall at the head of the Fitzroy and Burdekin rivers and coastal streams, and the location of various proposed dam sites, could enable future irrigation activities.

While water assets are considered a strength for the region, water in many areas is currently fully allocated. Nevertheless, this competition for water is driving improved water-use efficiency and the use of water for higher value crops. The lack of a water resource plan for some of the coastal catchments can mean that water is managed and licensed in a more ad hoc way and there are emerging groundwater issues.

8.1.5 Infrastructure

The region has established infrastructure to support the key agricultural industries, including rail and sugarcane tramways, roads and highways, ports, sugar mills and a sugar refinery, meatworks, silos and water infrastructure (see Map 8.3).

Mackay provides financial and technical services for much of the region, although enterprises in the south tend to use services provided in Rockhampton. North-western areas of the region access services from Mackay, Charters Towers or Townsville. Mackay and Proserpine are the main service centres for the sugarcane industry.

The cargo port at Mackay is the primary point of export for sugar and for imports of oil and fertiliser. There are five sugar mills in the region—one at Proserpine, three in Mackay and one in Sarina. Horticultural products are packed in Bowen or Gumlu and sent to domestic markets in Brisbane, primarily by road transport. A small amount of boxed beef is exported from the cargo port at Mackay, but most beef is exported from Brisbane.

3 SunWater 2012, 'SunWater discontinues work on Connors River Dam and Pipelines Project', SunWater, viewed 12 October 2012, ‹http://www.sunwater.com.au/about-sunwater/media-room/latest-news/latest-news/2012/sunwater-discontinues-work-on-connors-river-dam-and-pipelines-project›.

The Mount McLaren grain depot on the railway between Clermont and Moranbah can hold 230 000 tonnes of grain and has sufficient segregations to handle a range of commodities for rail transport to the cargo port at Mackay or road transport. Although it is designed to enable transport by rail, there are now fewer available options for grain. Rail is primarily focused on transporting coal, so the majority of grain is now transported by road. The port facilities in Mackay are not suited to storing large quantities of grain, as it is shipped in by road, creating a bottleneck at the port for grain export. Therefore, grain from the region is exported from Gladstone. Developing a multi-cargo port facility in Mackay and improving access to rail transport would allow the Mount McLaren grain depot to be fully used. It would also benefit the Central Highlands cropping region through improved supply chains.

There are sugarcane tramway networks connecting sugarcane growing areas with sugar mills along the coastal areas. Sugarcane outside of these tramway areas, for example in the Blue Mountain area, is transported by road to the tramway network or directly to sugar mills. There are no plans to expand the tramway network and it could shrink as road transport to mills increases and tramway networks become uneconomical to maintain. However, a short amount of additional rail network could link the Proserpine, Mackay and Sarina mill areas, providing more options for growers and mills. This would also support potential new sugarcane growing areas between Proserpine and Mackay and increase the attractiveness of mill amalgamation. However, it would require some expensive crossings over the Bruce Highway.

Bulk sugar from the Plane Creek mill at Sarina was previously transported by rail to port in Mackay, but strong competition for access to rail transport has made it cheaper for the mill to transport sugar by road.

A sugar refinery adjacent to the Racecourse mill in Mackay produces food-grade sugar, which is value-adding over raw sugar for export purposes. The Plane Creek mill also has an ethanol refinery that can produce up to 60 ML of ethanol per year.

Increasing demands on hard infrastructure (e.g. roads, rail) and soft infrastructure (e.g. health and education facilities) as a result of mining growth in the region is affecting agricultural development and regional communities. For example, provision of infrastructure such as water, sewerage, power and affordable housing lags behind demand. Lack of affordable housing reduces the appeal of the area for agricultural (and support) workers. There is also a need for more services including child care, youth facilities and public transport. The wide geographic spread of the population increases the cost of providing services and infrastructure.

The road network in the region is relied upon for transporting agricultural products. However, it is also used by other industries, including mining and tourism. Traffic on the Peak Downs Highway is growing, affecting road conditions and contributing to an increase in travel times and a potential increase in conflict between vehicles.[4] The reliance on road transport in the region can result in problems in wet weather, when the roads become impassable or are susceptible to damage.

Between Nebo and Mackay, the Peak Downs Highway crosses the Eton Range and has steep grades and bridges with weight restrictions (e.g. at Vines Creek). It is not suitable for road trains, which are the most efficient road transport for the movement of cattle, and road trains need to be decoupled at the top of the range. Cattle from the western parts of the region are often sent to the abattoir at Rockhampton, partly due to difficulties associated with the range crossing. The highway is no longer adequate for the current transport needs and it constrains expansion of agricultural industries in the region.

Approval of coal port expansions at Abbot Point, Hay Point, Dalrymple Bay and Dudgeon Point will put extra pressure on the Bruce and Peak Downs highways.

4 Department of Local Government and Planning 2012, *Mackay, Isaac and Whitsunday regional plan*, State of Queensland.

8.1.6 Vegetation

The region has an extensive variety of soils and vegetation, including coastal wetlands, rainforests, tea-tree plains, eucalypt forests and woodlands, open downs, brigalow/gidgee, box, ironbark, lancewoods and alluvial plains. These support a range of cattle enterprise types, cropping, horticulture and forestry.

Some of these vegetation communities have been extensively cleared for agricultural production in the past. These include coastal rainforest and tea-tree plains for sugarcane, highland rainforest for dairy farming and brigalow for grazing and cropping. In the 1960s, extensive areas of brigalow were cleared as part of the Brigalow Development Scheme, a joint Queensland and Commonwealth scheme designed to award brigalow land by ballot, provide no-interest loans for clearing and other property developments and build significant infrastructure to support agricultural development in the Brigalow Belt.

Some areas of land in the region are restricted from clearing under the *Vegetation Management Act 1999* (see Map 8.4). About 3.9 million hectares (43.3 per cent of the region) may be cleared, has been cleared or is naturally open, and 0.3 million hectares (3.5 per cent of the region) requires further verification or approval before clearing. Nearly 4.8 million hectares (53 per cent of the region) cannot be cleared.

Areas of national park and state forest across the region total nearly 0.5 million hectares (5.5 per cent of the region). These areas are excluded from the audit analyses.

Amendments to the *Vegetation Management Act 1999* (tabled in Parliament in March 2013) will remove constraints on clearing high-value regrowth vegetation on freehold land across the state, and create opportunities to clear vegetation for high-value agriculture. The audit mapping will be updated in the future to reflect these amendments when the laws come into force.

8.2 Current and potential agricultural land use

Current land use in the Mackay, Isaac and Whitsunday region is presented in Map 8.5. Based on the current datasets, 89.8 per cent of the region's land area is used for agriculture, with the vast majority used for grazing (85.3 per cent of the region's land). The region is important for sugarcane, with nearly 30 per cent of the land area in Queensland under sugarcane occurring in this region. It is also an important horticulture producing area, as it includes 18.2 per cent of Queensland's annual horticulture producing land (see Table 8.2).

Table 8.2 presents the current and potential areas for the range of agricultural land-use categories investigated by the audit. The total potential land-use area exceeds 100 per cent as some areas may be suitable for more than one agricultural land-use category. The forestry area includes land that is used for forestry and other purposes (e.g. grazing and forestry together).

Along the coastal strip there is sugarcane, horticulture (primarily vegetables, mangoes, bananas, lychees and amenity horticulture) and grazing (see Map 8.5). Extensive cropping, primarily sorghum in summer and legumes or wheat in winter, occurs in the western areas around Clermont and Dysart and around the junction of the Isaac and Connors rivers.

Table 8.2 Current and potential land area

Queensland Land Use Mapping Program (2009)	Current land use			Potential land use*	
	Area (ha)	Percentage of region	Percentage of ALUC† that occurs in region	Area (ha)	Percentage of region
Broadacre cropping	225 269	2.52	6.35	862 354	9.62
Sugarcane	168 105	1.88	29.74	633 042	7.06
Perennial horticulture	1 534	0.02	1.75	746 113	8.32
Annual horticulture	8 580	0.10	18.19	1 582 905	17.66
Grazing	7 642 642	85.28	5.17	8 325 098	92.88
Sown pastures	2 389 488	26.66	14.90	2 271 052	25.34
Intensive livestock	226	0.00	0.60	2 137 164	23.84
Aquaculture	778	0.00	0.01	23 931	0.27
Other land use (non-agricultural land uses and also may include some forestry)	914 201	10.20	5.20		
Total	**8 961 335**	**100.00**			
Forestry‡ (see Section 8.2.2)					
Managed in silvopastoral systems (mixed native or plantation forestry and grazing)	3 648 593	40.71	1.90		

Note: Refer to Sections 8.2.2 (under 'Forestry') and 8.3 ('Data confidence') for a further explanation regarding the forestry datasets and methodology used.

* Potential areas include where the majority of current production occurs as well as where production could potentially occur. Refer to Section 8.3 ('Data confidence').

† Agricultural land-use category.

‡ Forestry includes land, irrespective of tenure, that has been established as forestry (native or plantation), but can also be used for other purposes such as grazing. Current plantation forestry locations are developed from data from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), HQPlantations Pty Ltd and Forest Enterprises Australia Holdings. Current native forestry is based on data from the Department of Agriculture, Fisheries and Forestry (Queensland) and the Department of Environment and Heritage Protection. See Section 8.2.2 (under 'Forestry') for further information about forestry data.

In the Isaac, Connors and Belyando catchments, grain crops are grown opportunistically, and are used in local cattle feedlots rather than transported to the coast, due in part to lower quality roads in those areas. Grain in the western areas is loaded onto rail or road at the Mount McLaren grain depot near Clermont, or transported by road south through grain storages at Emerald, Capella and Comet.

Forestry occurs across the region, with state forests west of Clermont and along the coastal ranges. Forestry plantations occur along the coast, but damage from disease and cyclones has generally led to a conversion of forestry plantations into sugarcane or grazing land uses. In total, forestry activities, particularly native forestry mixed with grazing, occur on almost 40 per cent of the land area in the region, although most of this land is primarily used for grazing.

Some of the inland areas with good-quality soils have the potential to grow grain on a regular basis if water is available at a competitive price.

Aquaculture currently occurs on 778 hectares in several locations along the coastal areas of the region (see Map 8.11).

When sugar prices are high, sugarcane growing areas tend to expand. Recent high prices and urbanisation along the coast are pushing sugarcane production inland in the areas south of Mackay. Sugarcane now grows at Blue Mountain, despite the high freight costs compared with those for areas close to the mills.

8.2.1 Important agricultural areas

In the Mackay, Isaac and Whitsunday region, three areas have been identified as important agricultural areas.

An important agricultural area is an area that has all the requirements for agriculture to be successful and sustainable, is part of a critical mass of land with similar characteristics and is strategically significant to the region or the state. Map 8.6 shows the general location of the important agricultural areas for the Mackay, Isaac and Whitsunday region.

Bowen

The Bowen area north to Gumlu (see Map 8.6) has an established horticulture industry that fills seasonal windows for particular commodities. It provides the region's total crop for many vegetables and 99 per cent of the region's mangoes. In 2010–11, total vegetable production was worth $207.5 million and the mango crop was worth $11.3 million. In that year, the area grew 58 per cent of Queensland's capsicums, 41 per cent of the state's beans, 38 per cent of tomatoes, 28 per cent of sweet corn, 20 per cent of mangoes and 17 per cent of melons.

The region produces mangoes in December–January, which follows the season for mangoes from the Northern Territory and Kimberleys and comes before the season for southern Queensland and northern New South Wales. Likewise, tomatoes are produced in winter, which complements the spring and autumn production around Bundaberg and Childers and the summer production on the Granite Belt, ensuring continuity of supply of tomatoes throughout the year from different regions in Queensland.

There is infrastructure to support horticulture in the area. Horticulture is irrigated from the Bowen Broken Water Supply Scheme and from groundwater. The Bruce Highway runs through the Bowen area and horticultural produce is transported by road to Brisbane or Townsville to be sold fresh in the domestic market. There are also niche processing facilities in the region that process some of the region's tomatoes, mangoes and other produce, bringing in tomatoes from other regions when Bowen's tomatoes are out of season.

The area has a ready labour supply including locals, backpackers and grey nomads.

There is potential for expansion if markets are favourable and if irrigation water is available from a project such as the proposed raising of the Burdekin Falls Dam wall and the Bowen–Broken water pipeline.

The area also has the potential for aquaculture to expand, as indicated on Map 8.11. There are several existing aquaculture sites on the Don River and further south on the Gregory River.

East coast

The coastal area between Proserpine and Clairview (see Map 8.6) is important for sugarcane as well as being a high pasture-growth area and having intensive livestock sites. It also has potential for horticulture and plantation forestry.

The Mackay, Isaac and Whitsunday region's east coast area grows 26 per cent of Queensland's sugarcane. The climatic conditions and good soils suit sugarcane, producing high sugarcane yields with high sugar content.

The area has established sugarcane tramway networks, port facilities for exporting and five sugar mills. There is a sugar refinery that produces food-grade sugar and an ethanol plant that can produce up to 60 ML of ethanol per year. Some mills are establishing facilities to produce other bioproducts (such as furfural) and to use bagasse for cogeneration of electricity. The current mill infrastructure has capacity to process additional sugarcane if there is some expansion of sugarcane production in the area.

Irrigation water is available in the Pioneer Valley from the Teemburra and Kinchant dams and from groundwater. The Peter Faust Dam provides irrigation water for the sugarcane growing areas around Proserpine. While groundwater is fully allocated and most of the surface water is allocated, water trading is available in these areas.

The east coast area has very high pasture-growth rates (over 7500 kg/ha/yr on some soils) and is suitable for a range of cattle enterprises, including dairy farming and growing and finishing beef cattle. The highest liveweight gains in the area are on alluvial plains and coastal rainforest and are 180–200 kg/head/yr at a stocking rate of 1 adult equivalent per 0.8 hectares. These stocking rates can be doubled (1 adult equivalent per 0.4 hectares) if the pastures are fertilised. The area is also suited to sown pastures and most finishing of cattle occurs on sown pastures.

There is an increasing tendency to grow legume crops in rotation with sugarcane to improve soil health and sugarcane production. The area has potential for feedlots and could source some feed material locally or from grain growing areas in the south of the region.

The area also has potential for annual and perennial horticulture and for plantation forestry, particularly softwood timber plantations, which have a low risk of damage due to cyclones and pests.

The east coast area has many towns and the larger centre, Mackay. The area is a popular tourist destination, offering both long-term and seasonal labour.

The Golden Mile

The Golden Mile is an area of high-quality soils interspersed with a mosaic of various land types. The brigalow and alluvial plains east of Dysart and along the Isaac, Conners and Mackenzie rivers (see Map 8.6) provide areas of very high quality grazing and cropping country with capacity for further expansion into cropping and horticulture if water and transport are available.

Cattle growth rates are very high, with liveweight gains of up to 250 kg/head/yr. The area supports a range of beef cattle enterprises and is particularly suited to fattening beef cattle, which are increasingly sourced from northern areas of Queensland including the Gulf. It is an important component of the beef supply chain with grazing on native pastures, fodder cropping and sown pastures and opportunistic feedlotting. Feedlots use locally grown grain from this area or from around Clermont and Emerald to finish cattle to a targeted market. The area is also close to saleyards and meat processing facilities at Rockhampton and Mackay.

East of Dysart, there are significant areas of cropping when rainfall conditions are suitable. These areas sit within a larger area of land suitable for cropping that extends towards the junction of the Mackenzie and Nogoa rivers (see Map 8.7). The area around the junction of the Isaac and Connors rivers has a history of cropping, including cereals, potatoes and peanuts. Pockets of higher fertility soil are also cropped opportunistically for grain or fodder and there are a number of feedlots in the area. There are relatively few areas that are constrained by the *Vegetation Management Act 1999* (see Map 8.4).

The area is also suitable for cropping and horticulture (see Maps 8.7, 8.9 and 8.10), but horticulture in particular would need a reliable water supply. The area has a low unemployment rate (1.1 per cent for the Isaac local government area) and labour and skills shortage would be a problem if cropping or horticulture were to be considered. Improved social infrastructure in nearby towns (including affordable housing) would improve the attractiveness of the area for workers. Having more sealed roads in the area and providing three-phase power would assist in realising the potential of the area. Access to cost-effective transport also needs to be considered, although there are cotton gins and a grain storage facility near Emerald and a major grain storage facility at Mount McLaren, northeast of Clermont.

8.2.2 Industry profiles

Broadacre cropping

Current

Broadacre cropping makes up 2.5 per cent of the Mackay, Isaac and Whitsunday region and the region contains 6.4 per cent of broadacre cropping land in Queensland. The audit has identified that just under 10 per cent of the region is suitable for cropping, but there are constraints including limited access to water and high cost of transport to market.

There are two major cropping zones—along the coastal areas for irrigated cropping and north of Clermont for dryland cropping (see Map 8.7). The crops grown in the region include sorghum, wheat, cotton, legumes (chick peas and mung beans), fodder crops and maize. Mung beans are increasing in importance in the region. There is a small amount of barley grown near Nebo in winter.

While most of the current irrigated broadacre cropping in Mackay, Isaac and Whitsunday occurs within the areas identified as having potential for such crops, there are a scattered number of small sites where irrigated crops are currently being grown outside of the identified potential areas. These operations use localised water-harvesting facilities established by individual enterprises to irrigate small areas. The irrigation areas north of Clermont use a localised water resource such as natural lagoons or ring tanks for irrigation. Along the Mackenzie River there is limited cropping within the floodplain due to the flood risk, but crops tend to be grown in the higher areas, away from the river. The soils along the Mackenzie River are very good for cropping.

North of Clermont there is a large area of current dryland cropping that sits outside the biophysical potential (see Map 8.7). The area is outside the climatic criteria of annual rainfall greater than 450 mm for 7 out of 10 years. The soils in that area are heavy clay soils that are able to store very high levels of moisture, so that some crops may be grown without requiring in-crop rainfall. These areas are cropped when soil moisture and climatic conditions are suitable and farmers vary crops and the time of planting accordingly. These adaptive operations in the region are managing the highly variable rainfall through opportunistic cropping. This area is used to grow a mixture of crops including chick peas, sorghum, wheat, mung beans and maize.

Most cotton grown in the region is opportunistic dryland cotton, primarily east of Dysart. There is some irrigated cotton along the Mackenzie River, in the very south of the region. Cotton is transported by road to cotton gins at Emerald. The distance to a cotton gin will affect the profitability of a cotton crop, but currently it is economical to grow cotton within 200 km of a gin. Gins tend to be located where irrigated cotton is grown, due to the greater reliability of cotton for the gin. Limited availability of water is a greater restriction to the amount of cotton grown in the region than distance to the gins at Emerald.

Grain is stored on-farm or transported to the large grain storage facility at Mount McLaren or silos at Capella, Emerald or Comet. Grain from Mount McLaren goes to the Mackay or Gladstone ports and grain from the other locations is sent to the port at Gladstone.

In 2011, the value of sorghum was $30 million, which was 11.9 per cent of the state's sorghum crop. Wheat in the region was worth $20.1 million (5.3 per cent of the state's wheat crop), cotton was worth $14.6 million (1.9 per cent of the state's cotton crop) and legumes were worth $10.1 million (11 per cent of the state's legume crop).

Potential

The total area that could be suitable for broadacre cropping in the Mackay, Isaac and Whitsunday region is 862 354 hectares (9.6 per cent of the region); however, only 2.5 per cent of the region is currently used for broadacre cropping. The vast majority of the potential cropping area (71 per cent) is currently used for grazing, while 16 per cent is currently used for sugarcane. The potential broadacre cropping areas are scattered throughout the eastern half of the region.

Although Map 8.7 seems to show significant unrealised potential for broadacre cropping, this is generally constrained by limited access to water, highly variable rainfall, competing land use, insufficient labour and limited access to transport. All of the water resource plan areas have unallocated water, and many of the potential areas not currently cropped occur along watercourses (e.g. the Mackenzie, Isaac and Broken rivers) that fall into these water resource plan areas. However, access to and reliability of water sources depends on the catchment and, in unsupplemented areas, producers need to have water-harvesting infrastructure on their property. In supplemented areas and where water trading is permitted, producers are competing on price with other users such as mining operations. Water infrastructure such as the Connors River Dam and the Bowen–Broken pipeline are currently on hold, but having them completed would not necessarily make water available to farmers, as they would still be competing with other water users.

Opportunistic dryland cropping is more difficult in the northern areas. Potential broadacre cropping areas west of Collinsville will likely only be viable along the river with localised water harvesting. The coastal areas of the region are humid and receive high rainfall, making them unsuitable for many broadacre crops. Sorghum can be grown along the coast.

Socio-economic factors affecting what is produced in a particular area include skills shortages, access to affordable housing and other services and the history of the enterprise. Currently debt levels in rural businesses are high and this could affect the decision or ability to invest in new infrastructure to change the enterprise mix (e.g. establish broadacre cropping). The unemployment rate in the Mackay, Isaac and Whitsunday region is much lower than in Queensland as a whole (3.7 per cent compared with 5.5 per cent for Queensland) and labour and skills shortages are an issue for agriculture in the region.

Access to transport and cost of transport can affect the return for particular commodities. Infrastructure on the property, whether it be related to the running of the property (such as for water harvesting, machinery storage or grain storage) or to service other industries (such as new rail infrastructure to support mining), can also reduce the amount of land available for cropping and impede access to areas on the property.

Sugarcane

Current

Sugarcane is grown on 168 105 hectares in the Mackay, Isaac and Whitsunday region; this is just under 2 per cent of the region (Table 8.2). However, it represents 30 per cent of the sugarcane growing area in Queensland. Sugarcane is grown in the high-rainfall coastal areas from Proserpine to Clairview. Because of these favourable climatic conditions, high sugarcane yields and high sugar content are obtained. Sugarcane crops in the region may be irrigated or non-irrigated. Irrigation enables much better yield prediction and forward marketing of sugar. Legumes such as chick peas and mung beans are grown in rotation with sugarcane to help improve soil health and reduce sugarcane pathogens.

Sugarcane is transported primarily via the sugarcane tramways network to one of the five sugar mills in the region. There is one mill at Proserpine, three in the Mackay area and one in Sarina. Road transport is used for transporting sugarcane from outside the tramway network, including the Blue Mountain and Carmilla areas.

Sugarcane grown in region in 2011 was worth $240 million and was 26.3 per cent of Queensland's total sugarcane crop.

The sugarcane growing area in the region has declined by around 20 per cent since its peak in 2002. The area of land growing sugarcane is related to the price of sugar relative to input costs such as water and transport. Some sugarcane areas have been converted to forestry or grazing. Seawater intrusion into freshwater aquifers has also impacted the narrow strip of coastal sugarcane producing land east of the Bruce Highway between Sarina and Mackay.

Expansion of urban and peri-urban areas around Mackay and Sarina has also meant a reduction in the area of sugarcane grown in that area. Smaller blocks are also relatively more expensive to harvest, and much larger blocks are needed to establish sugarcane growing enterprises.

Sugarcane production has diversified in recent times so that, in addition to sugar products, the region produces ethanol and other fermentation products and could produce furfural (plant resins) in the future. The Proserpine mill has a furfural plant adjacent to the mill but it is not yet operational. The Queensland University of Technology's Mackay Renewable Biocommodities Pilot Plant is a unique pilot research and development facility adjacent to the Racecourse mill. A 37 MW cogeneration plant is currently being built at the Racecourse mill and is due to be commissioned early in 2013. Using bagasse as its feedstock, it will meet all the energy needs of the mill and put excess power into the grid, supplying approximately 30 per cent of Mackay's electricity needs.

Potential

The area of biophysical potential shown in Map 8.8 is much greater than the area currently under sugarcane. The current area under sugarcane sits within the potential area, but 7.1 per cent of the region (633 042 hectares) has been identified as suitable for growing sugarcane (Table 8.2). Most of the potential area (72 per cent) is currently used for grazing; a further 4 per cent is currently broadacre cropping and 1.1 per cent is currently horticulture.

In areas west of the range it is currently uneconomical to grow sugarcane because of limited access to water, the high cost of transport to a mill, frost risk and the slower growth rate due to the cooler night-time conditions.

In the northern part of the region, the main constraints to expansion of sugarcane are high transport and water costs. In the southern areas, the main constraint is limited access to water.

Sugarcane in the Mackay and Sarina areas could expand west into cleared grazing land to compensate for losses to urbanisation and saltwater intrusion, but expansion is constrained by limited transport and access to water. Expansion could occur around Proserpine, but will be constrained by limited access to water in the areas to the west and south-west of Proserpine.

Higher sugar prices could drive an expansion of sugarcane growing areas. Demand for sugar has increased with growing wealth in parts of Asia. In addition, with some overseas sugarcane producers diverting production to ethanol rather than sugar production, the world supply of sugar could decrease and, as a result, the demand for Australian sugar could increase.

If sugarcane production were to increase in the region, some of the expansion in milling requirements could be met by existing mills, but if larger areas were put under sugarcane, additional milling infrastructure may be required.

Horticulture

Current

Perennial horticulture occurs on 1534 hectares or 0.02 per cent of the Mackay, Isaac and Whitsunday region, in pockets along the coast. Mangoes are grown primarily around Bowen, Gumlu and Bloomsbury. Other perennial horticulture crops in the region include lychees (around Bowen, Proserpine, Mackay and Sarina), bananas (Bowen and north of Mackay), pineapples (Bowen, Sarina and Koumala), macadamias (Bowen and Eton), lemon myrtle (Proserpine), coffee (Proserpine) and limes (Bowen).

Annual horticulture occurs on 8580 hectares or 0.1 per cent of the Mackay, Isaac and Whitsunday region (mainly in the Bowen through to Gumlu area) but represents 18 per cent of the total annual horticulture production area in Queensland (Table 8.2). The region produces 58 per cent of Queensland's capsicum crop, 38 per cent of the state's field-grown tomatoes and 41 per cent of the state's beans.

Horticulture produce from the region goes to the domestic fresh markets, with 75 per cent being transported by road (the Bruce Highway) to Brisbane, and 25 per cent to Townsville. Some lychees are exported. Produce is mostly packed on-farm, but there are some packing facilities for vegetables in Gumlu and one in Mackay for bananas. Local produce is also sold at local farmers markets. Growers in the region are investigating alternative markets, including off-coast islands and niche processing avenues.

There are already processing facilities in the region that provide for niche markets; for example, a food processing plant at Bowen supplies frozen capsicums and chillies to restaurant and food services. There are also tomato and mango processing facilities in Bowen. The tomato processing facilities use tomatoes from Bowen, Bundaberg and Victoria in their respective seasons. The markets for horticultural crops continually change and processing facilities need to be able to adjust the foods processed according to market demand.

In 2010–11, the region produced $11 million of mangoes, which represents 20 per cent of Queensland's mango crop. The value of annual horticulture commodities in the region includes tomatoes ($86.2 million), capsicums ($48.6 million), beans ($39.1 million), sweet corn ($10.1 million), melons ($9.4 million) and other vegetables ($12 million, including squash, chillies, zucchinis and eggplant).

Lifestyle horticulture (including cut flowers, nurseries and turf farms) generated $11.7 million for the region in 2010–11 and these industries are growing in importance.

Horticultural crops in the region face strong competition from other regions (including Tully for bananas and Bundaberg for tomatoes) that have ideal climatic conditions for particular crops and critical mass for cost-effective transport and processing. However, Bowen provides fruit and vegetables in a different seasonal window to these and other areas, which helps to overcome these transport costs. Processing facilities such as canneries require a consistent supply of specific commodities all year, together with cost-effective transport and a ready labour market. These larger processing facilities are based around Brisbane.

Potential

In the Mackay, Isaac and Whitsunday region, 8.3 per cent of land (746 113 hectares) is suitable for perennial horticulture and 17.7 per cent (1 582 905 hectares) is suitable for annual horticulture (Table 8.2). Currently horticulture covers a much smaller area than the biophysical potential area identified by the audit (Maps 8.9 and 8.10), but there are market and socio-economic factors that limit horticultural production, as discussed below. Most of the potential area is currently used for grazing (75 per cent) and sugarcane (21 per cent). A further 1.5 per cent is currently broadacre cropping and 2 per cent is other uses.

Some horticultural crops (including vegetables, macadamias and lychees) are currently expanding. There are value-adding opportunities for the region, including semi-dried tomatoes, frozen purees and corn cobettes. There is also potential for hydroponics and protected cropping, depending on the energy costs.

Horticulture crops have very specific climatic requirements and expansion depends on the new area having those specific needs. Case study 6.1 provides an example of climate requirements for bananas. Lychees are sensitive to the impacts of cyclones. Areas in the region south of Proserpine are too humid for many horticultural crops and much of the inland area is affected by low temperatures and/or frosts during winter.

Access to water for irrigation is particularly important for horticulture. Water for horticulture in the region comes primarily from farm dams (water harvesting), supplemented bores and rainfall. The development of the Bowen–Broken pipeline would provide more irrigation water for the horticulture industry around Bowen, but growers would need to compete with other users for the water.

Many socio-economic factors affect the viability of horticulture in a particular region; these include the existence of profitable markets, the value of the Australian dollar (for exports), access to labour, the cost and ease of transport, access to and the cost of water and the cost of land. Maps 8.9 and 8.10 show the 50 km radius from each town with a population of 2000 or more to indicate areas with reasonable access to labour. However, the towns need to be able to supply affordable accommodation and other services to attract and retain the labour. Most horticulture operations in the region, particularly around Proserpine and further north, employ backpackers for picking and packing. Large operations also employ permanent agronomists. Labour and transport become more problematic further west, with fewer roads and larger distances to population centres. In contrast, some coastal horticultural areas are under pressure from urban expansion.

Intensive livestock

Current

Intensive livestock production currently occurs on 226 hectares of land in the Mackay, Isaac and Whitsunday region (less than 0.01 per cent of the region). Feedlots occur primarily in the south of the region; however, in line with feedlot management, they tend to be located close to grain supplies and areas of cropping potential. This allows for lower cost of production (due to easy access to feed grains) as well as the ability to spread effluent across cropping soil.

Feedlots on Map 8.11 that appear to be a long way from cropping zones may hold licences and run opportunistically when cattle prices and/or grain prices are suitable. They may have some areas of soil suitable for cropping and be running the feedlot when climate conditions and soil moisture support a crop. Feedlots on the range would need to cart in grain from other areas.

A number of smaller on-farm feedlots (of less than 50 head) not marked on Map 8.11 operate when market conditions and/or the price of grain are favourable. Some feedlots are located close to abattoirs, but need to cart in grain.

Cattle from feedlots close to Mackay will likely be sent to the abattoir at Bakers Creek, south of Mackay, but the range crossing on the Peak Downs Highway is not suitable for the more cost-effective road trains, so most western feedlots send cattle to abattoirs in Rockhampton and Brisbane. The choice of destination depends on which market is paying the best at the time. Larger processors have abattoirs in two or more locations and can nominate an abattoir based on the need to fill market orders.

Branded beef are either processed in small slaughterhouses on-farm or sent as a separate consignment to abattoirs. These are generally exported to overseas markets such as Taiwan and Japan.

There are a couple of piggeries near Koumala and a local abattoir processes these pigs. In 2010–11, the total value of pigs, poultry, eggs and milk in the region was $4.2 million, which is a small fraction of the Queensland total.

There are egg producers near Bowen and Mirani. The total value of egg production in the region in 2010–11 was $1.2 million. The dairy industry in the Mackay area was worth $2.1 million in 2010–11.

There are a number of aquaculture sites along the coast, with concentrations around Gregory River, Ilbilbie, Pioneer Valley and Don River. Barramundi, prawns, crabs, redclaw and other fish are produced in the region. Aquaculture sites cover 778 hectares in the region and the total value of the region's production in 2010–11 was $8 million.[5]

Potential

The potential areas for intensive livestock production are marked in Map 8.11. Over 2 million hectares (23.8 per cent of the region) have been identified as suitable for intensive livestock production (feedlots, piggeries and poultry). Areas suitable for aquaculture sites occur on nearly 24 000 hectares (0.3 per cent of the region) in coastal areas (see Map 8.11).

Expansion opportunities for intensive livestock in the region are in the areas close to grain or where fodder and grain can be grown using irrigation. Transport of grain and cattle in some parts of the region can be a limiting factor, but feedlots provide a market opportunity for grain crops that would otherwise have high transport costs in taking grain to more distant markets.

Feedlots require additional labour and there is currently very low unemployment in the region and a shortage of suitable labour. Accommodation is generally provided on-farm, so access to affordable housing in towns is not usually a constraint to labour for feedlot enterprises.

Constraints to expansion of piggeries include urban expansion, poor access to grain, limited access to water, and heat and humidity (which affect feed conversion rates and economic return).

For poultry production, heat in the region is a limiting factor and the cost of cooling sheds can be prohibitive. Also restrictive are the costs of carting grain for feed. There is some potential in southern and western areas, which are cooler and close to grain. Previously in an industry promotion, one chicken-meat processor offered to build a hatchery on farms and supply the pullets to grow out for 8 weeks. The processor provided transport for the chickens and training. In return, the farmer provided the land and cash support.

Potential aquaculture areas are close to the coast (see Map 8.11) and cover nearly 24 000 hectares or 0.3 per cent of the region. Aquaculture sites require access to cost-effective water to manage high salinity levels (from evaporation) and access to three-phase power. Due to their proximity to the Great Barrier Reef, potential enterprises need to demonstrate that they can manage off-site impacts.

Grazing

Current

Cattle are grazed across more than 7.6 million hectares (85 per cent) of the Mackay, Isaac and Whitsunday region (Table 8.2). Pasture production (and liveweight gains) vary markedly across the region, with pasture growth rates in excess of 7500 kg/ha/yr in some coastal areas and inland riparian areas. Even in areas where soils are poorer, if 800–1000 mm average annual rainfall occurs, high pasture-growth rates (above 1500 kg/ha/yr) result. However, these figures decline quickly if the pasture is grazed too heavily, and the poorer country does not recover well from overgrazing. Overgrazing in areas with black cracking clay soils can lead to invasion of parthenium weed.

In cleared brigalow areas, pastures are sown primarily to buffel. These and other pastures are sometimes oversown with legumes. Map 8.14 shows areas in the region that are suitable for sowing pastures using mechanical methods. The map also includes areas that have previously been sown (e.g. following clearing). Nearly 2.4 million hectares (26.7 per cent of the region) is currently under sown pastures (see Table 8.2).

5 Wingfield, M 2012, *Ross Lobegeiger report to farmers: aquaculture production survey 2010–11*, Department of Agriculture, Fisheries and Forestry, Queensland, ‹http://www.daff.qld.gov.au/documents/Fisheries_Aquaculture/Report-to-farmers-10-11.pdf›.

Some forested grazing areas are also used for native forestry and managed as silvopastoral systems, which combine grazing and forestry in a mutually beneficial way (see 'Forestry', on the following page).

The highest liveweight gains in coastal areas, on alluvial plains and in coastal rainforest are 180–200 kg/head/yr at a stocking rate of 1 adult equivalent per 0.8 hectares. These stocking rates can be doubled (1 adult equivalent per 0.4 hectares) if the pastures are fertilised. The highest liveweight gains in the hinterland areas are 200–250 kg/head/yr at a stocking rate of 1 adult equivalent per 2 hectares.

In the brigalow areas, the cost of controlling invasive regrowth can affect the profitability of grazing. Improved knowledge about techniques and requirements under the *Vegetation Management Act 1999* could reduce the costs associated with regrowth control in brigalow and hardwood forest areas.

The main production systems include breeding and finishing cattle to meet the specifications for the Japanese export market on brigalow country, breeding and selling weaners in central coastal areas (with finishing on sown pasture systems), and large-scale breeding and mixed store/finishing systems (including live export) in the hinterland and on the northern spear-grass pastures.

Cattle are bred to meet both meat quality market specifications and to cope with the climatic conditions (such as regular long periods of dry conditions) as well as both external and internal parasites. During the 1980s and 1990s, there was a rapid improvement in the beef herd to meet these standards.

Cattle ready for slaughter are sent to Mackay, Rockhampton or Brisbane. There are two or three road trains taking cattle from Clermont to Brisbane for slaughter each week. Some from the northern parts of the region may be sent to Townsville. The choice of processor depends in part on the prices being paid by the abattoirs.

The value of cattle sold for slaughter in 2010–11 in the Mackay, Isaac and Whitsunday region was $300 million; nearly $212 million of that came from the Isaac local government area. This equates to nearly 10 per cent of the total cattle slaughter in Queensland.

Map 8.12 shows the areas growing different amounts of pasture, assuming all the land is in condition B. In reality the land condition varies across the region, with some in condition A (best possible condition) and some much more degraded. Maps 8.12 and 8.13 demonstrate the difference that land condition can make to productivity and carrying capacity. Map 8.13 shows the higher productivity expected when the land is all in the best possible condition.

Potential

The potential area for grazing in the Mackay, Isaac and Whitsunday region is 8.32 million hectares or 93 per cent of the region (Table 8.2). However, the most significant opportunity for growth in the industry is not from expanding the area, but from improving land condition and herd management. Beef cattle productivity can be improved through good pasture management, using appropriate stocking rates, introducing perennial legumes into existing pastures, and enhanced herd and business management. Although this opportunity applies statewide, the potential gains are particularly high in this region because of its inherent quality for grazing. There has been significant investment by the Queensland and Commonwealth governments and Meat and Livestock Australia in improved land and debt management.

There is a high level of debt in the beef industry in the region[6], preventing investment in improvements that could raise productivity. The price of land does not reflect the returns from grazing. Prices have increased due to a combination of mining and investment by large companies. This is making investment in the cattle industry difficult, particularly when combined with the current high Australian dollar. This often leads to the decision to carry too many cattle for the country. However, some enterprises that have been bought by mining companies are able to lease back part of their properties, and in some cases almost all of their properties. The price paid for the land enables the producer to continue to operate with no debt or much lower debt.

Mining and gas companies also provide off-farm employment opportunities and income, which reduces seasonal and market risks and allows land parcels to be stocked in a way that maximises production and minimises land degradation.

There are market-specific opportunities, for example grass-fed 'branded' beef. There are opportunities for organic beef production in the west, but ticks need to be treated in the coastal areas, preventing access to organic markets. Ticks can also be managed through breeding higher levels of *Bos indicus*, but this changes the meat quality. While large supermarket chains tend to have specific marbling requirements that need feedlot finishing, they are moving to include grass-fed options for consumers.

Providing access to additional water may not increase production, except if it could be used to grow grain or other fodder crops. There would need to be the skills and desire to grow grain. Additional cropping requires investment in machinery, silos, harvesters and water.

Other constraints to growth include the extremely variable climate, competition for transport and limited transport infrastructure. Rail is the most efficient transport and can deliver cattle directly to abattoirs, but it requires a certain number of cattle and competition is high, particularly with Aurizon reducing the amount of agricultural products being transported. There is also a lack of rail sidings for loading on the railways in the region.

Opportunities exist for increased grazing and timber production in some native forested grazing areas where commercial timber species naturally occur; these silvopastoral systems are described more fully under 'Forestry' below. Managing trees through thinning and harvesting (to reduce competition between trees, allowing the remaining trees to grow larger and more quickly) also reduces competition on pastures, resulting in increased grazing production.

Forestry

Current

The Mackay, Isaac and Whitsunday region currently produces less than 5 per cent of Queensland's native hardwood forestry production and less than 1 per cent of plantation softwood forestry production for the Queensland timber processing industry. Forestry production predominately comes from timber resource areas (native and plantation) on state-owned lands under the *Forestry Act 1959*, native forest practice notification areas on private (freehold) land under the *Vegetation Management Act 1999*[7] and plantation forestry on private land. Almost all of this land is also grazed and generally managed as silvopastoral systems—production systems that combine forestry and grazing in a mutually beneficial way.

6 Cranston, M 2012, 'Cattleman's beef with banks', *Australian Financial Review*, 1 December 2012, viewed 5 December 2012, ‹http://www.afr.com/p/national/cattlemen_beef_with_banks_irqQofOi39xLWH845S7rjM›; QRAA 2012, *Rural debt survey 2011*, State of Queensland, viewed 5 December 2012, ‹http://www.qraa.qld.gov.au/index.php?option=com_content&view=article&id=335&Itemid=239›.

7 Under the *Vegetation Management Act 1999*, 'forest practice' includes felling and removing trees for commercial gain. A landholder who conducts a native forest practice on remnant vegetation must do so according to the *Code applying to a native forest practice on freehold land* and must give formal notice of the location through a 'Notice of forest practice' form.

Hardwood native forestry in the Mackay, Isaac and Whitsunday region produces a number of forest products including sawlogs, poles, bridging girders, fencing timbers and craftwood for a broad range of appearance, construction and mining timber processing purposes. Hardwood fencing timbers are an important resource for grazing and other agricultural land uses. Native forestry currently occurs across the region, generally on land that is also used for grazing (Map 8.15). The key commercial native forestry tree species in the Mackay, Isaac and Whitsunday region include spotted gum, Queensland blue gum and ironbark, plus a broad range of other suitable hardwood species.

On state-owned land, the denotation of a management unit (MUID)[8] on the lot on plan indicates commercial native forestry or quarry material interest, but the actual native forest production area is generally restricted to the forested area within the parcel. So although there are currently timber interests based on MUIDs on almost 3.5 million hectares, which is 39.0 per cent of the region (see Table 8.3), this figure is not the actual area of native forestry production on state land. Harvesting of these MUIDs is scheduled on a routine basis in conjunction with the current state timber supply commitments and market demand. On private land, (freehold) forest practice notifications (managing, felling and removal of native trees for commercial purposes) cover 147 254 hectares (1.6 per cent of the region). The actual area of production is generally restricted to the forested areas within those areas (see Table 8.3).

Plantation forestry (softwood and hardwood) produces a number of forest products including sawlogs, round timbers and pulpwood for a broad range of appearance and construction timber processing purposes. Plantation forestry occurs on less than 1000 hectares in the region. In the 2000s (up to 2009) there was more than 10 000 hectares of hardwood 'pulpwood' plantation in the region, but due to infestation of the pest *Kirramyces* spp., which rapidly killed or severely stunted the plantations, plus damage from Tropical Cyclone Ului, the land use has changed or is in the process of being converted to sugarcane or grazing. The remaining areas of previous hardwood 'pulpwood' plantation that are being converted to sugarcane or grazing are mapped as 'fallow' (see Map 8.16).

The region's existing plantation area includes a small to medium softwood plantation (exotic pine and native hoop pine) at Cathu, between Mackay and Proserpine, and a series of small single-species and mixed-species plantations scattered through the higher rainfall areas (see Map 8.16). The small plantation forestry areas are generally unmapped.

Softwood plantation forestry areas cover just under 800 hectares and have a denser tree canopy. They are generally only combined with grazing for the first 5 years of a crop rotation (until tree canopy closure). The softwood plantation tree species are exotic pine varieties that perform well across a range of soils, particularly less-fertile soils that for 7 out of 10 years receive annual average rainfall of greater than 800 mm, and native hoop pine, which performs well on the more fertile soils that receive an annual average rainfall of greater than 700 mm for 7 out of 10 years (see Map 8.16).

Most of the softwood plantations were established by the Queensland Government for sawlog production from the 1960s to the 1990s and hardwood from the 2000s. The plantations on state-owned land were licensed and those on freehold land were sold to private interests in 2010 by the Queensland Government as part of the sale of the Queensland Government's plantation assets to private interests.

Hardwood plantations are small and unmapped and, although they do not register in Table 8.3, they collectively cover approximately 200 hectares. They are generally managed as silvopastoral systems. Hardwood plantation forestry tree species are mostly spotted gum, with a number of other species used in small single-species and mixed-species plantations across the region (see Map 8.16).

The Mackay, Isaac and Whitsunday region supports a number of small processing facilities within or just outside the region (see Map 8.15). Most process native hardwood timber and some also process exotic pine plantation softwood and native hoop pine plantation softwood. Commercial haul distances can be 400 km or more, and increase with product value, providing native forestry producers a number of current market options.

8 MUID—management unit inventory data.

Potential

There is potential for increased forestry production in the region from native hardwood plus softwood and hardwood plantation resources. However, for plantation forestry, the risk of cyclone damage (and for some hardwood species the risk of pest/disease damage) will need to be carefully considered in light of recent experience in the region. Increased forestry production would provide further resources for existing timber processing facilities within and near to the region once increased supply comes onstream.

Forestry production is currently operating in some of the potential areas and in others potential production is yet to be realised. While the native forestry mapping is reasonably accurate, it is primarily based on the regional ecosystem mapping data used for the *Vegetation Management Act 1999*, and so there are some identified inaccuracies.

The areas identified for potential native forestry expansion in the Mackay, Isaac and Whitsunday region are considerable—high potential 1.4 million hectares, medium potential 0.8 million hectares and low potential 1.6 million hectares (15.6, 9.3 and 18.4 per cent of the region's area; see Map 8.15 and Table 8.3). There are opportunities to increase native forestry production on the mapped potential areas on a long-term basis while having minimal impacts on the other pastoral land uses by creating silvopastoral systems.

The areas identified for potential plantation forestry expansion in the region are generally limited to the higher rainfall areas—hardwood 404 176 hectares and softwood 667 574 hectares (4.5 and 7.4 per cent of the region's area; see Map 8.16 and Table 8.3). The current land uses in the areas identified for hardwood are primarily grazing (54 per cent) and sugarcane (39 per cent). The existing land uses in the areas identified for softwood are primarily grazing (61 per cent) and sugarcane (25 per cent); 8 per cent is used for other purposes.

Exotic pine and spotted gum (hardwood) varieties are considered the best options for expansion, given the results of trials in the region. Hardwood plantation forestry expansion can be integrated into the existing grazing landscape, particularly with spotted gum and similar tree varieties, and can be managed as silvopastoral systems.

Further plantation forestry development would be most productive in areas with good rainfall (in the areas mapped as potential) and those with productive growth rates for plantation exotic pine softwood and spotted gum hardwood species (in the areas mapped as potential). Also suitable are areas with relatively affordable land prices and potential access to a range of existing timber processing facilities, domestic markets (Mackay, Rockhampton and Townsville) and port facilities (Mackay). However, the region has a medium to high risk of severe cyclone damage, and for some hardwood species a medium risk of pest/disease damage.

Most existing timber processors in the region have some capacity to expand production if increased log timber comes onstream. Demand for native hardwood forest products is high, and for exotic and native softwood plantation forest products is medium to high. Demand for forest products is forecast to remain strong in the medium to long term.

Overall, the region currently has a relatively small forestry production output. However, there is some opportunity for forestry production growth in native hardwood forestry plus hardwood and softwood plantation forestry, which in turn will support growth in the down-stream timber processing sector.

Table 8.3 Current and potential land area for forestry

Forestry[†]	Current land use			Potential land use[*]	
	Area (ha)	Percentage of region	Percentage of ALUC[‡] that occurs in region	Area (ha)	Percentage of region
Plantation forestry (ABARES, HQPlantations, FEA Holdings)					
Hardwood	0	0.00	0.00	404 176	4.51
Softwood	783	0.01	0.38	667 574	7.45
Mixed species (softwood and hardwood)	0	0.00	0.00	366 526	4.09
Fallow (where plantation not currently planted to trees)	5 185	0.06	29.63		
Total	**5 968**	**0.07**			
Native forestry					
State-owned land timber interests (area based on entire lot on plan; forestry restricted to forested area within that)	3 495 372[§]	39.00	3.54		
Private land (native forest practice notifications)	147 254	1.64	4.56		
High potential				1 393 863	15.55
Medium potential				833 703	9.30
Low potential				1 645 107	18.35
Total	**3 642 626**	**40.64**		**3 872 673**	**43.20**

[*] Potential areas include where the majority of current production occurs as well as where production could potentially occur. Refer to Section 8.3 ('Data confidence').

[†] Forestry includes land, irrespective of tenure, that has been established as forestry (native or plantation), but can also be used for other purposes such as grazing. Current plantation forestry locations are developed from data from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), HQPlantations Pty Ltd and Forest Enterprises Australia Holdings (FEA Holdings). Current native forestry is based on data from the Department of Agriculture, Fisheries and Forestry (Queensland) and the Department of Environment and Heritage Protection. 'High potential' = higher value commercial timber species of suitable height for sawlog production. 'Medium potential' = commercial species but trees not of sufficient height for sawlog production or no height information available. 'Low potential' = areas with tree cover but not commercially viable species or may include timber species suitable for forest products other than sawlogs.

[‡] Agricultural land-use category.

[§] MUIDs (management unit inventory data) over leasehold land and reserves generally cover the entire lot on plan, though the actual native forest production area is restricted to the forested area within the lot on plan. Therefore, this figure does not represent the actual area of production.

8.3 Data confidence

The data confidence map (Map 8.17) indicates that the agricultural land class dataset that was used as the basis for most of the maps developed for the Mackay, Isaac and Whitsunday region was considered a mixture of 'high', 'medium' and 'low' confidence levels.

The confidence levels indicate how well the line work, soil data and soil quality information provided match reality. They are determined by how spatially accurate the lines around different soil types are on the map, how much information was available for soil data, how soil quality information was collected, what was collected and the skill of those collecting the information.

Most of the current land-use information used in the audit has been obtained through the Queensland Land Use Mapping Program (QLUMP), which is dated 2009 for this region. Land use is determined through available databases, satellite imagery and aerial photographs. As there are difficulties with differentiating land uses using imagery, local expert knowledge and some field surveys have been conducted to verify the data.[9]

The current locations of intensive animal production facilities are derived from data from the Intensive Livestock Environmental Regulation Unit, within the Department of Agriculture, Fisheries and Forestry (Queensland). The area for intensive land use is based on QLUMP data. The location of egg production is based on the Safe Food Production Queensland egg register as at October 2012.

Current plantation forestry locations are developed from data from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), HQPlantations Pty Ltd and Forest Enterprises Australia Holdings (FEA Holdings).

Apart from forestry and intensive livestock (where more up-to-date and specific datasets are available), QLUMP data represents the best available dataset for the other land uses and was used in the identification of current areas of agricultural production.

The QLUMP forestry data is based on state forest boundaries and some plantation forest information is also included. However, there is also native forestry on private land and other state land (for which state government information is available). There are also more accurate and up-to-date plantation forestry datasets available from ABARES, HQPlantations and FEA Holdings. Therefore, the forestry analysis (which is based on non-QLUMP datasets) is presented in Table 8.3.

As there will be differences between the current Intensive Livestock Environmental Regulation Unit data, forestry information and the QLUMP dataset, the current land-use information based on QLUMP data does not represent exact and current figures for land area (as it is 2009 data), but relative areas between the different land-use types.

Intensive animal operations represent a relatively small agricultural footprint. Therefore, differences in datasets for intensive livestock are not likely to significantly impact on the relative proportions of other land uses.

Grazing can be a mixed land use; therefore, the difference between the total area for forestry from QLUMP data and that derived from the other datasets will largely occur in areas where grazing and forestry are occurring on the same land.

When determining the potential for each of the different land uses, a number of assumptions had to be made (as a result of issues such as uncertainties in the mapping). The net result of these assumptions is that the area figures contained in Table 8.2 overestimate the true potential area for each agricultural land-use category.

9 The methods QLUMP apply to mapping land use are described in full in the ABARES handbook *Guidelines for land use mapping in Australia: principals, procedure and definitions* (4th edition), available at ‹http://adl.brs.gov.au/data/warehouse/pe_abares99001806/GuidelinesLandUseMappingLowRes2011.pdf›.

8.4 Sources of information

8.4.1 Bibliography

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8.4.2 Further studies

Pre-amalgamation shire handbooks

- Pioneer Shire (1971)
- Sarina Shire (1971)
- Mirani Shire (1971)

Studies

The references marked with an * are available to view (or download) from the Department of Environment and Heritage Protection electronic library at www.ehp.qld.gov.au (click on the 'Library catalogue' link).

Use the search function and the title of the reference to access the relevant documents in PDF format.

Note: Some of these documents are very large (up to 50 MB).

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Abstract: This is an agricultural capability map of the Bowen–Broken rivers region, a part of the Burdeken River watershed.

Department of Environment and Heritage Protection 2012, *Desert uplands strategic land resource assessment*, CD, State of Queensland, ‹http://www.derm.qld.gov.au/services_resources/item_details.php?item_id=34991›.

Abstract: 4135 field sites from five different sources have been used to collate the vast amount of information contained in this database. In total, 48 map sheets at a scale of 1:100 000, 79 land system information sheets, 335 land unit information sheets, 3218 site information sheets and 524 individual property maps have been prepared, all of which can be viewed or printed from the ACCESS database and used in conjunction with this GIS. The desert uplands strategic land resource ACCESS database can be accessed and viewed at a variety of scales, thereby providing a versatile tool with general information at a bioregional level through to detailed information at a property level.

Department of Science, Information Technology, Innovation and the Arts 2009, *Burdekin NRM region landuse*, State of Queensland, ‹http://qspatial.information.qld.gov.au/geoportal/catalog/search/resource/details.page?uuid=%7BE4D57922-D65F-40AD-8138-5391CD299CAE%7D›.

Abstract: This dataset is a digital land-use map of part of the Great Barrier Reef catchment in Queensland. It encompasses the Burdekin Natural Resource Management region. As nearly as possible, it shows land use in 2009. The dataset is a product of the Queensland Land Use Mapping Program (QLUMP) and was produced by the Department of Environment and Resource Management. It was prepared as part of a land-use change and updated land-use mapping for the Great Barrier Reef catchment funded by the Queensland Government Reef Protection Package. The dataset comprises an ESRI vector geodatabase at a nominal scale of 1:50 000. The layer is a polygon dataset with each class having attributes describing land use. Land use is classified according to the Australian Land Use and Management Classification (ALUMC) Version 7, May 2010.

***Department of Science, Information Technology, Innovation and the Arts 2012, *Land use summary 1999–2009: Mackay–Whitsunday NRM region*, State of Queensland, 20 pp.**

Abstract: This document includes land use, vegetation mapping and clearing of land in the Mackay region.

***Grounds, S, Denham, R & Witte, C 2007, *Land use change mapping from 1999 to 2004 for the Plane Creek catchment*, Department of Natural Resources and Water, Queensland, 23 pp.**

Abstract: The Plane Creek catchment is 260 189 hectares in area and is located in the north of the Central Queensland coast. The area extends from southern Mackay in the north to south of Carmila, where it adjoins the Fitzroy catchment. Annual rainfall in the Mackay, Isaac and Whitsunday region ranges from 1000 mm in inland areas to 3000 mm in elevated sections of the coastal ranges, and Mackay's average annual rainfall is 1585 mm. The catchment is managed for many land-use types, with grazing and sugarcane being dominant.

***Gunn, RH 1967, 'Lands of the Nogoa–Belyando area, Queensland', CSIRO, *Land Research Series*, no. 18, 198 pp.**

Abstract: This reference contains pasture, vegetation, geological and soils data and mapping of the survey area.

***Hardy, SM 1998, *Soils and land suitability of the Kelsey Creek area, North Queensland*, Department of Natural Resources and Mines, Queensland, project report DNRQ980080, 42 pp.**

Abstract: The Kelsey Creek survey area is the third survey area of the Proserpine Integrated Land Use Study. Forty-two soils were identified within the Kelsey Creek survey area, which covers 24 550 hectares. The land resource survey of this area has delineated 179 unique mapping areas. The electronic version contains full text in PDF form.

***Holz, GK & Shields, PG 1985, *Mackay sugar cane land suitability study*, Department of Primary Industries, Queensland, QV85001, 131 pp.**

Abstract: The land resources of approximately 290 000 hectares in the Mackay area are mapped and described. The resources of the area are discussed in terms of climate, geology, topography, hydrology, vegetation, soils and land degradation. Complete morphological and analytical data for these profiles is presented. Soil chemical and physical characteristics are discussed in detail. Land degradation and soil erosion are also highlighted. The electronic version has the Mackay suitability for sugarcane map, the Mackay assigned cane land map, the Mackay soils map, the full text of the report (in PDF), and the Mackay land use and land suitability map.

***Rowland, T et al. 2006, *Land use change mapping from 1999 to 2004 for the Fitzroy River catchment*, Department of Natural Resources and Water, Queensland, 18 pp.**

Abstract: The Fitzroy River catchment is approximately 14.26 million hectares in area and stretches from the Carnarvon Gorge National Park in the west to Rockhampton on the Central Queensland coast. It is the largest river basin on the Queensland east coast and contains the regional centres of Rockhampton, Emerald, Biloela and Taroom. The catchment is dominated by savannah woodlands and grasslands, with livestock grazing the primary land use. Production forestry, cropping and national parks comprise the next major uses, and extensive mining areas are also present in the catchment area. Cereals and cotton are the major crops grown.

***Shields, PG, Chamberlain, HJ & Booth, NJ 1993, *Soils and agricultural use in the Kilcummin area, Central Queensland*, Department of Primary Industries, Queensland, QV91001, 185 pp.**

Abstract: A detailed land resource survey and land suitability assessment was undertaken for the Kilcummin area. This project consists of digital data, two reports and two published maps. The electronic version has the full text of the report (in PDF).

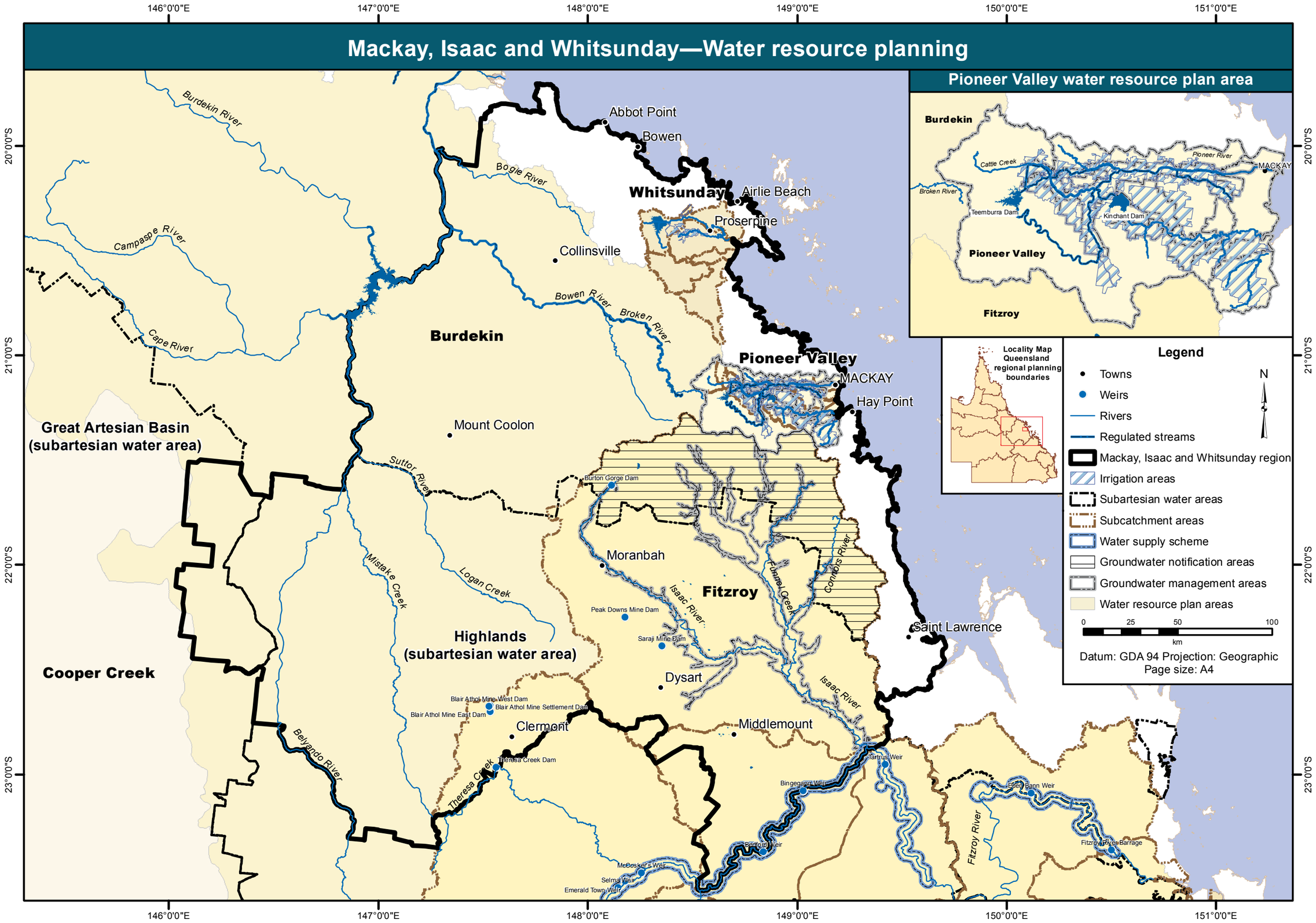
***Van den Berg, D, Grounds, S & Denham, R 2007, *Land use change mapping from 1999 to 2004 for the Pioneer River catchment*, Department of Natural Resources and Water, 19 pp.**

Abstract: The Pioneer River catchment is approximately 163 546 hectares in area and is located in the upper central Queensland coast. The area extends from Mackay in the east to Eungella National Park in the west. Annual rainfall in the Mackay, Isaac and Whitsunday region ranges from 1000 mm in inland areas to 3000 mm in elevated sections of the coastal ranges, and Mackay's average annual rainfall is 1585 mm. The catchment is managed for many land-use types, with grazing, production forestry and sugarcane being dominant.

Map 8.2 Water resources

This map provides an overview of current water resources and water infrastructure.

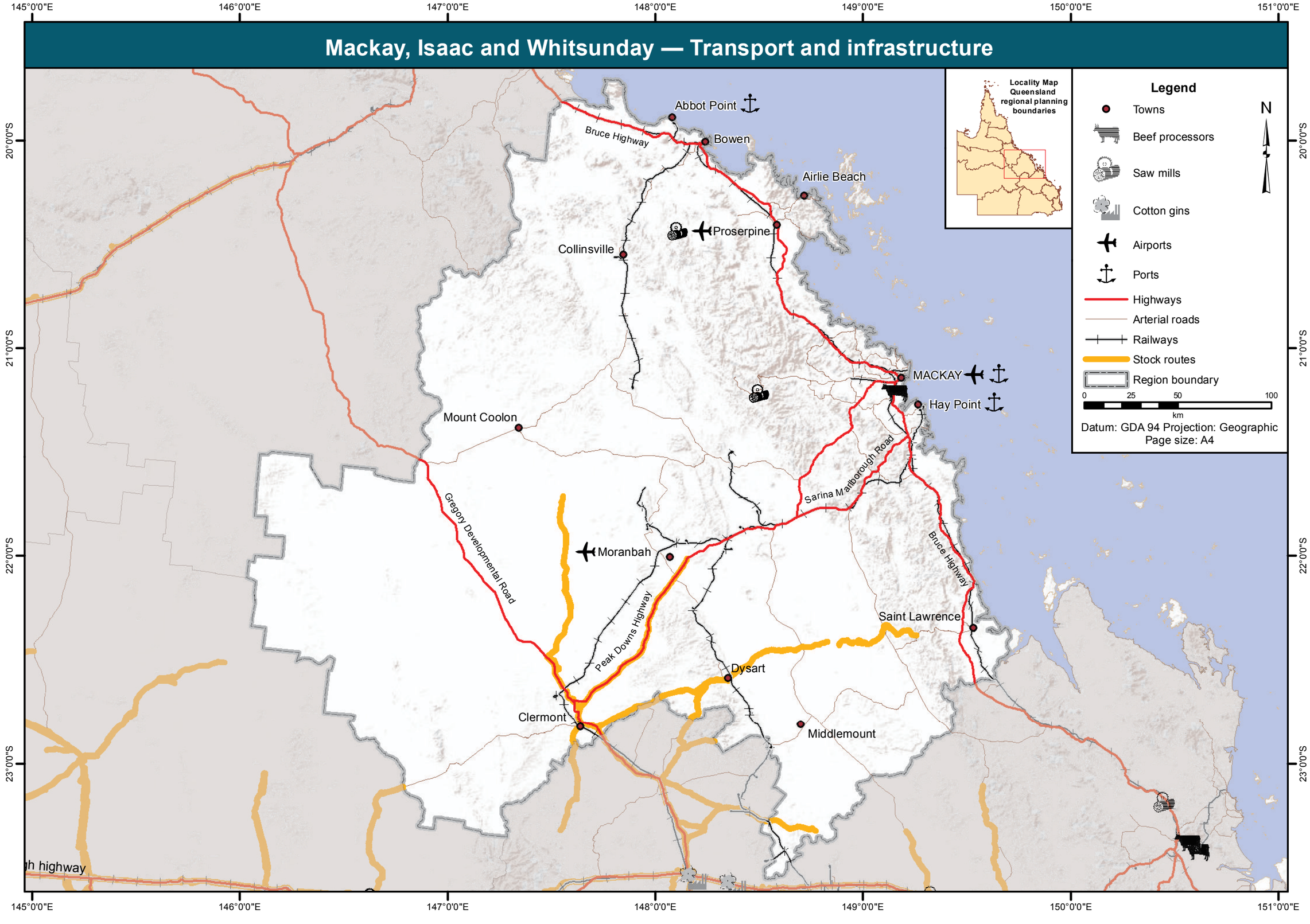
Mackay, Isaac and Whitsunday—Water resource planning



Map 8.3 Infrastructure

This map shows key infrastructure components, major agricultural processing plants and natural features relevant to current and future agricultural development within the region.

Mackay, Isaac and Whitsunday — Transport and infrastructure



Map 8.4 Vegetation management

This map shows land where, based on currently available information, agricultural use is potentially impacted by the provisions of the *Vegetation Management Act 1999* or associated Regulations protecting native vegetation. It has been compiled from information available to the audit at 28 September 2012 and reflects the legislative and policy regime in place at that time. The map shows areas where no clearing is permitted and areas where clearing requires further verification.

'Clearing requires further verification' can be split into two categories. Category A is where clearing for agriculture purposes may be constrained to varying levels under the Vegetation Management Act. These areas need further verification on the ground, depending on the types of activities taking place. Land that is category A has been denoted:

- high-value regrowth

or

- Schedule 4 Grassland regional ecosystem—homogeneous or heterogeneous polygons

or

- Schedule 5 Grasslands—heterogeneous polygons.

Category B indicates land for which regional ecosystems have not been reliably mapped. This land may or may not contain areas of regional ecosystems where clearing for agricultural purposes is constrained under the Vegetation Management Act. This land requires regional ecosystem mapping before its status can be confirmed. Land that is in this category has been denoted remnant vegetation on the 'remnant map' as per the description on the Department of Environment and Heritage Protection website at www.ehp.qld.gov.au (search 'remnant vegetation').

'No clearing permitted' identifies land for which clearing for agriculture purposes is constrained under the Vegetation Management Act. This land has been denoted:

- remnant vegetation other than Schedule 4 Grasslands on the regional ecosystem map

and

- category A or B on a PMAV.

Mackay, Isaac and Whitsunday Restrictions on clearing based on the Vegetation Management Act (1999)

Uncoloured areas within region are already cleared or have no restrictions to clearing

Legend

- No clearing permitted
- Clearing requires further verification
- National parks and state forests
- Region boundary
- Roads
- Rivers
- Towns

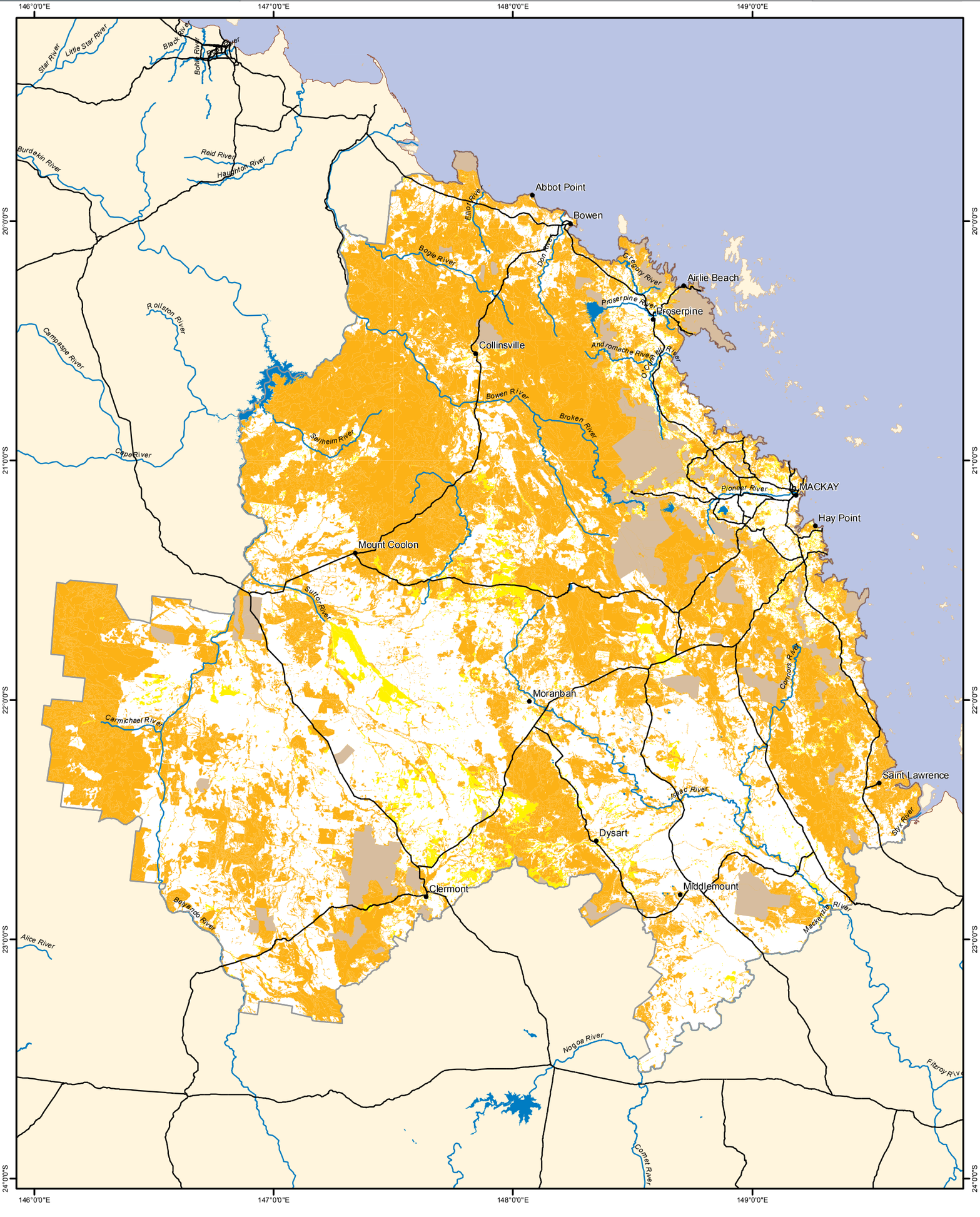
N

1:1,600,000

0 10 20 40 60 80
km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.5 Current land use

This map shows the extent and distribution of land used for each of the agricultural land-use classes adopted by the audit. It has been produced mainly using data collected by QLUMP. QLUMP mapping has been generated using a combination of satellite image interpretation and ground validation. Its nominal scale is 1:100 000 and for this region it is current as at 2009. Visit www.derm.qld.gov.au (search 'QLUMP') for further information about QLUMP. Forestry plantations are mapped using data provided by ABARES and HQPlantations and state forest boundaries have been extracted from the Queensland Government tenure spatial layer.

Mackay, Isaac and Whitsunday Current land use based on QLUMP data (2009) and other data sources for forestry (see explanatory notes)

Legend

- Current forestry plantations
- State forests
- Annual horticulture
- Perennial horticulture
- Cropping
- Irrigated cropping
- Grazing
- Intensive animal production
- Sugarcane
- Other land use
- Defence
- Nature conservation
- Mining
- Water
- Region boundary
- Roads
- Rivers
- Towns

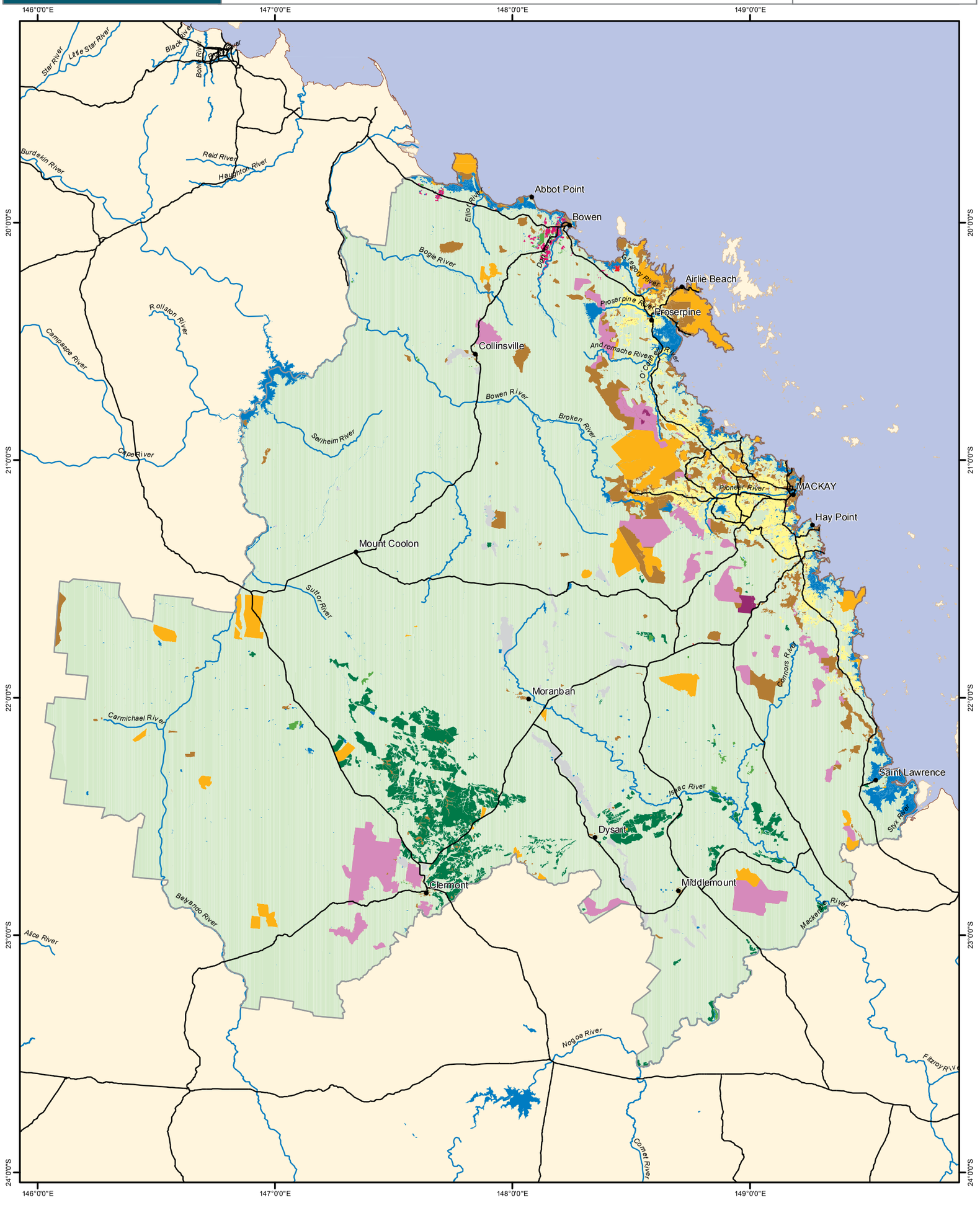
N

1:1,600,000

0 5 10 20 30 40
km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.6 Important agricultural areas

This map shows the important agricultural areas identified by the audit within this region. An area is identified by the audit as being important for agriculture if it has all the requirements for agriculture to be successful and sustainable, is part of a critical mass of land with similar characteristics and is strategically significant to the region or the state. The areas shown on this map have been identified by the audit on the basis of advice from regional and industry experts and from synthesis of maps and information on current and potential use of land for the range of agricultural land uses considered by the audit. The information used to derive this map varies in its spatial accuracy and resolution. In recognition of these limitations, the information has been generalised for use in strategic decision-making at the regional level. It is indicative only of broad areas within which land important for agriculture is located. More detailed investigation to map the spatial extent and location of important land would be required before the information is suitable for finer scale decision-making such as in statutory land-use planning.

Mackay, Isaac and Whitsunday Important agricultural land areas

Legend

- Bowen
- East Coast
- The Golden Mile area
- Central Highlands (see Central Queensland chapter)
- Areas excluded from potential (see explanatory notes)
- Region boundary
- Roads
- Rivers
- Towns

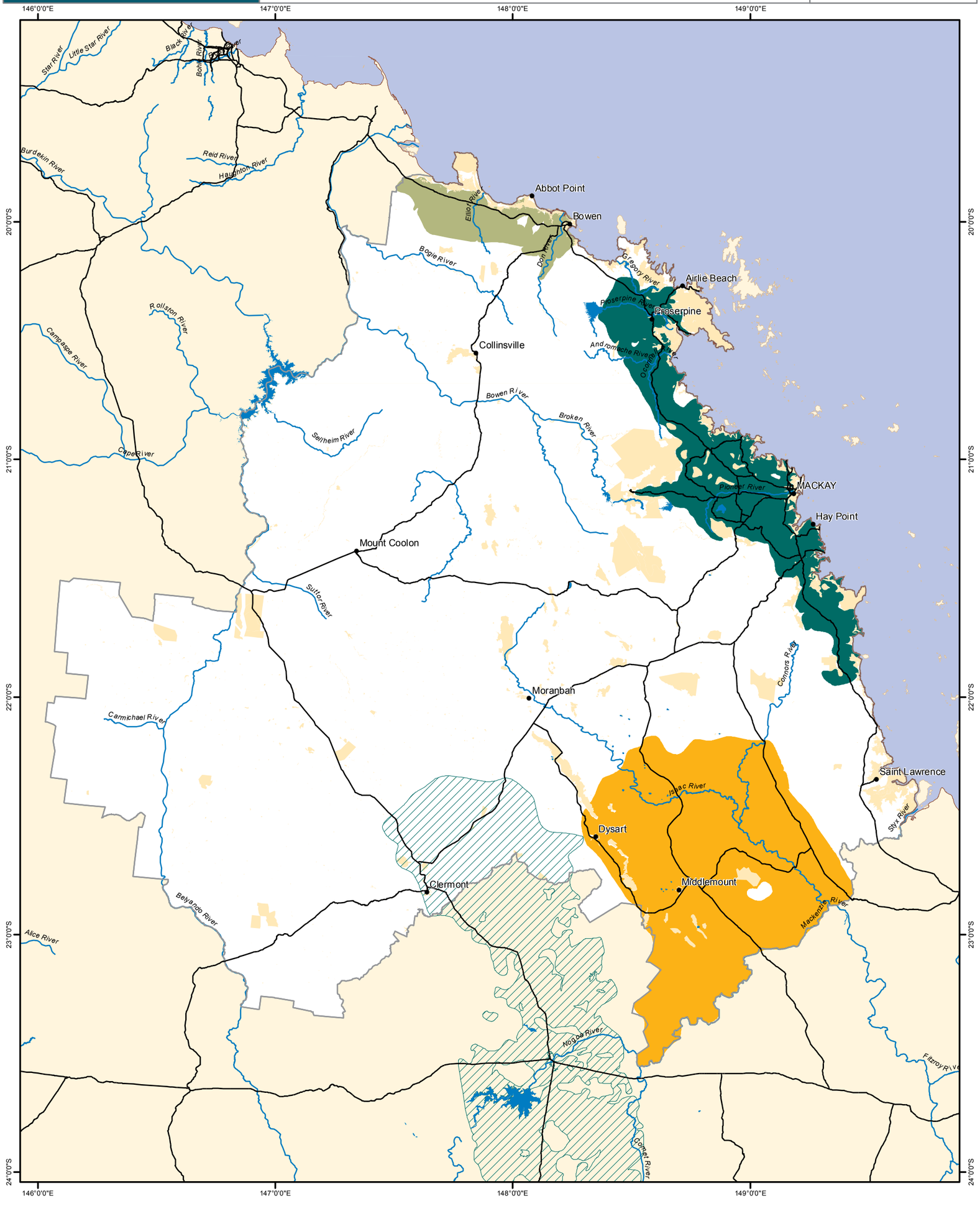
N

1:1,600,000

0 10 20 40 60 80
km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.7 Broadacre cropping

This map shows land identified by the audit as currently being used for the agricultural land-use category 'broadacre cropping' (rain-fed or irrigated). It also shows land identified as not currently used for broadacre cropping but having potential to be used for this purpose. Land shown as currently being used for broadacre cropping has been identified on the basis that it was mapped by QLUMP as secondary class 'cropping' or 'irrigated cropping'.

Land shown as having potential for broadacre cropping:

a) **includes** land of agricultural land class (ALC) A with slope less than 8 per cent and mean annual rainfall greater than 450 mm for 7 out of 10 years

b) **excludes** land that is urban, intensive use (such as mining), national park, state forest, managed by the Department of Defence or permanently under water.

In identifying this land, the audit **did not consider** a range of business factors (such as markets, pre-existing land uses and competing potential land uses) that are important influences on management decisions made by producers who drive land use.

It should not be assumed from this study that all (or any particular portion of) land identified as having potential to be used for broadacre cropping should or will be converted to that use. Land potential has been identified by the audit using a limited number of criteria for which mapping is readily available. Also, the extent to which the potential identified on this map is realised (or realisable) is strongly influenced by constraints that have not been included as criteria in the mapping, for example the availability of water for irrigation (see Map 8.2). See Section 8.1 for further constraints.

Mackay, Isaac and Whitsunday Biophysical potential for broadacre cropping and current broadacre cropping

Potential based on ALC 'A', slope <8%, rainfall >450mm 7 in 10 years

Legend

- Potential cropping
- Current cropping
- Current irrigated cropping
- Areas excluded from potential (see explanatory notes)
- Region boundary
- Cotton gins
- Roads
- Rivers
- Towns

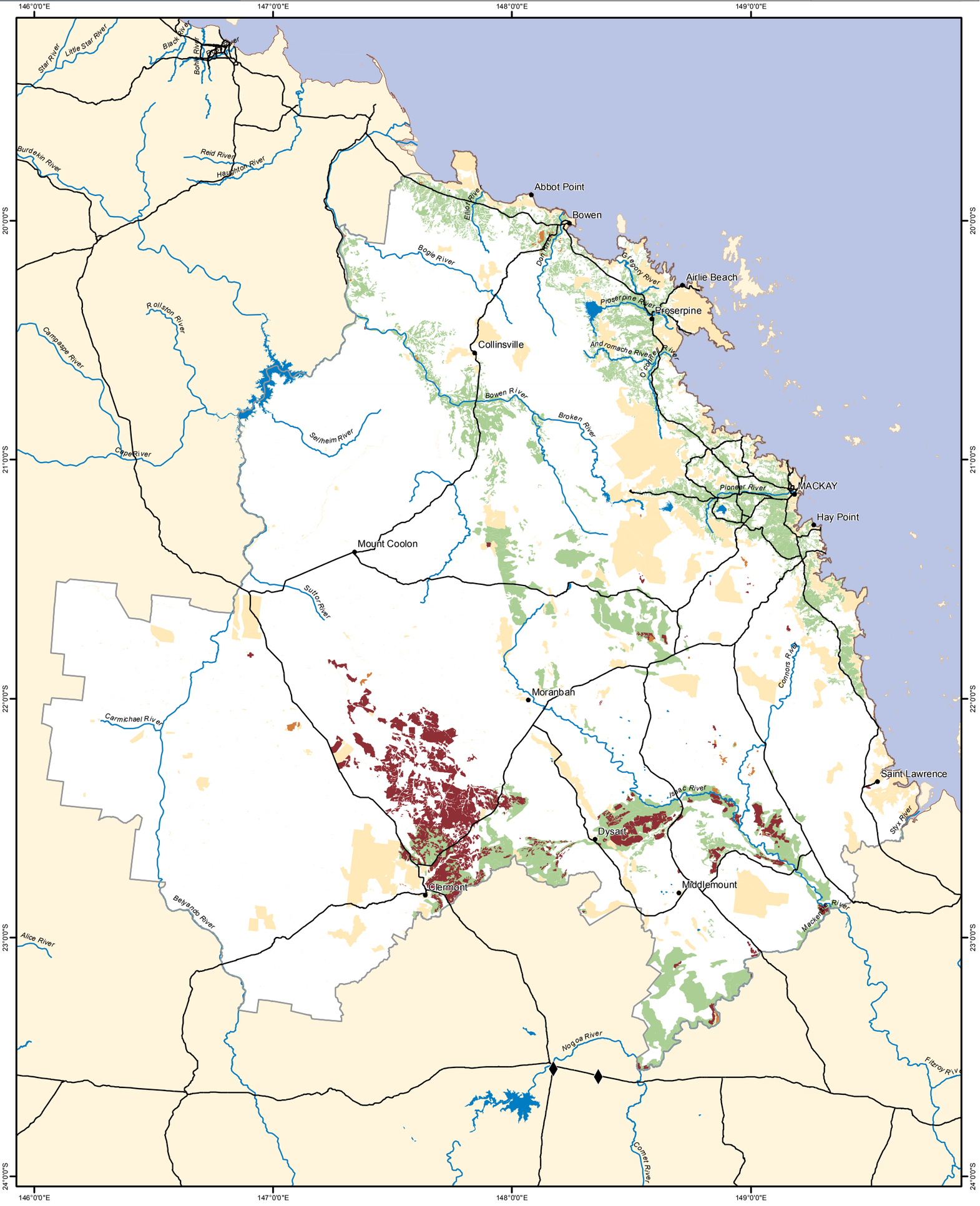
N

1:1,600,000

0 10 20 40 60 80
km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.8 Sugarcane

This map shows land identified as not currently used for sugarcane cultivation but having potential to be used for this purpose. Land shown as currently being used for sugarcane cultivation has been identified on the basis that it was mapped by QLUMP as tertiary class 'sugarcane'.

Land shown as having potential for sugarcane cultivation:

a) **includes** land of agricultural land class A and class B with slope less than 5 per cent and fewer than 55 days per year with a minimum temperature of 9 °C or less

b) **excludes** land that is urban, intensive use (such as mining), national park, state forest, managed by the Department of Defence or permanently under water.

In identifying this land, the audit **did not consider** a range of business factors (such as markets, pre-existing land uses and competing potential land uses) that are important influences on management decisions made by producers who drive land use. These factors and how farmers respond to them are highly variable across space and through time. It was not possible to measure the effects of these factors with any confidence within the time and resources available to the audit.

Access to a sugar mill is an important consideration in determining the potential for land to be used for growing sugarcane. The locations of current mills are shown on the map for information.

It should not be assumed from this study that all (or any particular portion of) land identified as having potential to be used for sugarcane cultivation should or will be converted to that use. Land potential has been identified by the audit using a limited number of criteria for which mapping is readily available. Also, the extent to which the potential identified on this map is realised (or realisable) is strongly influenced by constraints that have not been included as criteria in the mapping, for example the availability of water for irrigation (see Map 8.2). See Section 8.1 for further constraints.

Mackay, Isaac and Whitsunday Biophysical potential for sugarcane and current sugarcane

Potential based on ALC 'A' and 'B', slope <5%, <55 days per year where minimum temperature ≤9˚C

Legend

- Potential sugarcane
- Current sugarcane production
- Areas excluded from potential (see explanatory notes)
- Region boundary
- Sugar mills
- Sugarcane rail
- Roads
- Rivers
- Towns

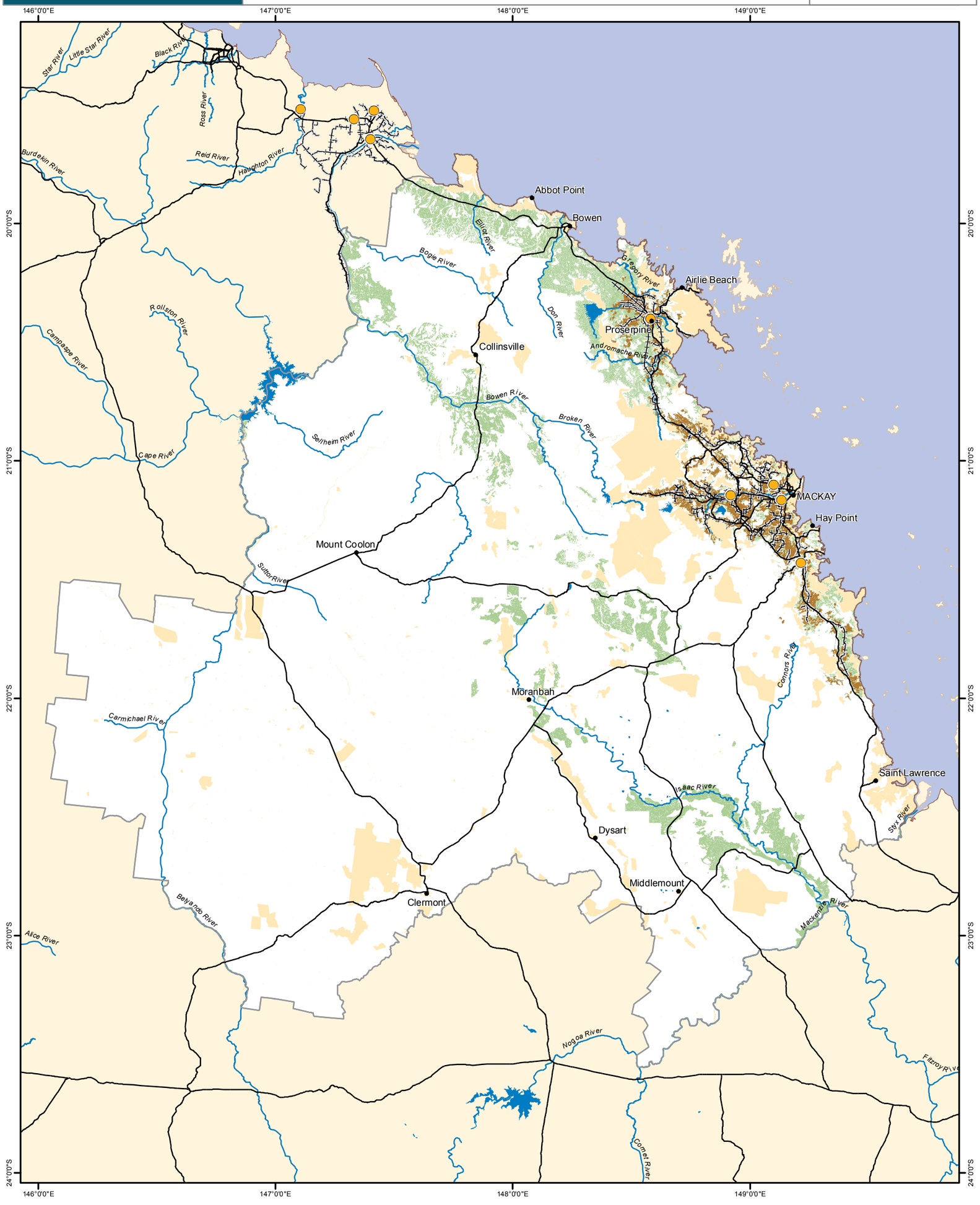
N

1:1,600,000

0 10 20 40 60 80
km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.9 Annual horticulture

This map shows land identified by the audit as currently being used for the agricultural land-use category 'annual horticulture'. It also shows land identified as not currently used for annual horticulture but having potential to be used for this purpose. Land shown as currently being used for annual horticulture has been identified on the basis that it was mapped by QLUMP as 'seasonal horticulture', 'irrigated seasonal horticulture' or 'intensive horticulture'.

Land shown as having potential for annual horticulture:

a) **includes** land of agricultural land class A and class B with slope less than 8 per cent and April to October rainfall less than 500 mm

b) **excludes** land that is urban, intensive use (such as mining), national park, state forest, managed by the Department of Defence or permanently under water.

In identifying this land, the audit **did not consider** a range of business factors (such as markets, pre-existing land uses and competing potential land uses) that are important influences on management decisions made by producers who drive land use. These factors and how farmers respond to them are highly variable across space and through time. It was not possible to measure the effects of these factors with any confidence within the time and resources available to the audit.

Also, the audit **did not consider** temperature or flood risk. Temperature is a major determinant of suitability of land for horticulture. It affects whether a crop can grow and its performance. However, due to the large range of different horticultural crops grown in Queensland and the widely variable temperature requirements for these crops, it is not possible to determine meaningful criteria for temperature for the category 'annual horticulture'. Flood risk is similarly difficult to map. Reliable data on flood frequency and severity currently exists for comparatively few parts of the state and the extent to which agricultural land use and management are affected by flooding varies greatly from farmer to farmer depending on their individual circumstances and perceptions.

Availability of labour, especially during harvest season, is an important consideration in selecting suitable land for many forms of annual horticulture. To reflect this, areas that are within 50 km of a centre with a population of 2000 or more are highlighted on the map. However, labour is not always a critical factor (e.g. for crops that are mechanically harvested) and the size and proximity of the nearest population centre is not always the best surrogate for labour force availability (e.g. many horticultural businesses make extensive use of itinerant seasonal workers or backpackers).

It should not be assumed from this study that all (or any particular portion of) land identified as having potential to be used for annual horticulture should or will be converted to that use. Land potential has been identified by the audit using a limited number of criteria for which mapping is readily available. Also, the extent to which the potential identified on this map is realised (or realisable) is strongly influenced by constraints that have not been included as criteria in the mapping, for example the availability of water for irrigation (see Map 8.2). See Section 8.1 for further constraints.

Mackay, Isaac and Whitsunday Biophysical potential for annual horticulture and current annual horticulture

Potential based on ALC 'A' and 'B', slope <8%, April - October rainfall <500mm

Legend

- Potential annual horticulture
- Current annual horticulture (not to scale)
- Areas excluded from potential (see explanatory notes)
- Region boundary
- 50km from a population >2000
- Roads
- Rivers
- Towns

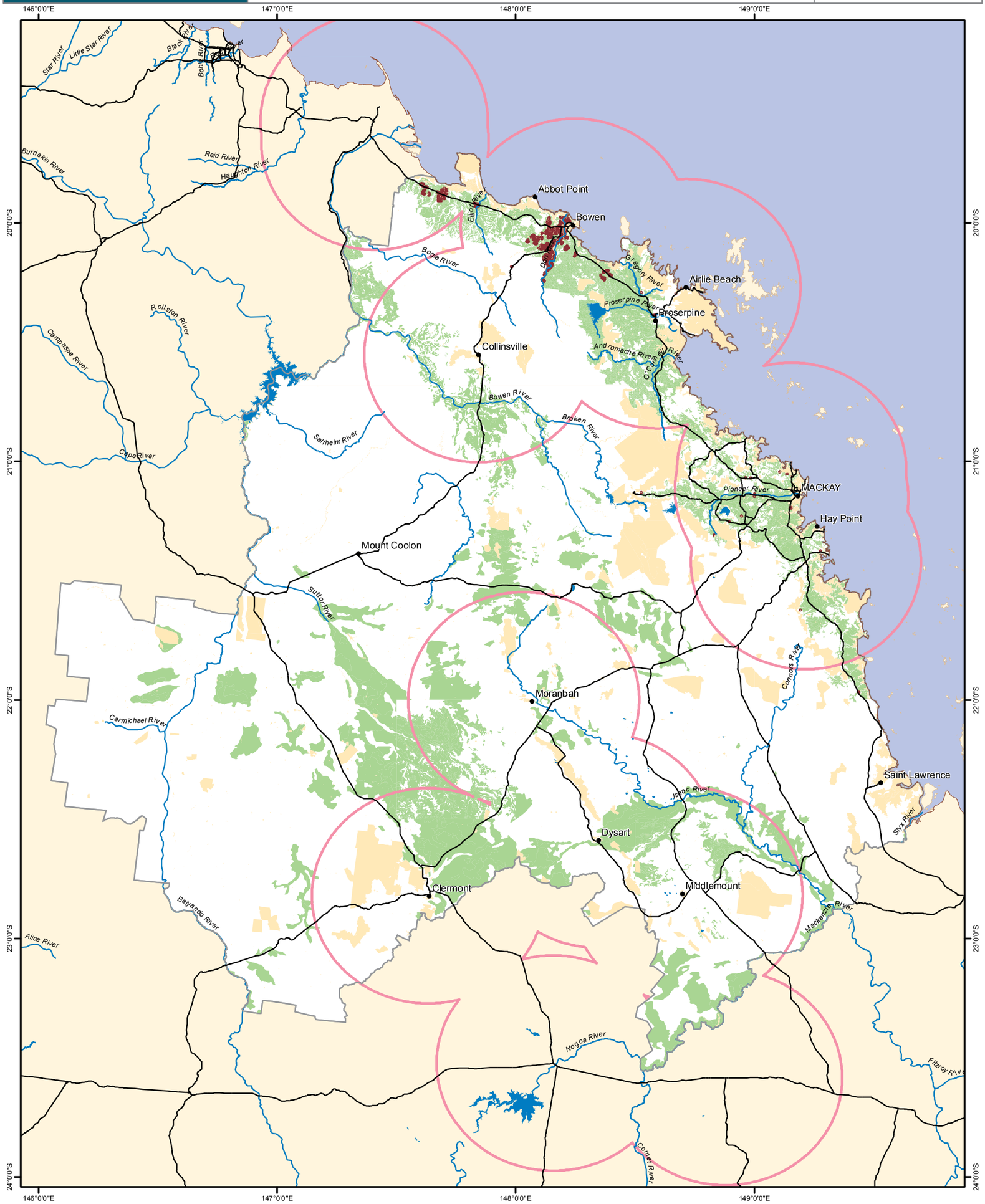
N

1:1,600,000

0 10 20 40 60 80 km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.10 Perennial horticulture

This map shows land identified by the audit as currently being used for the agricultural land-use category 'perennial horticulture' (rain-fed or irrigated). It also shows land identified as not currently used for perennial horticulture but having potential to be used for that purpose. Land shown as currently being used for perennial horticulture has been identified on the basis that it was mapped by QLUMP as 'perennial horticulture' or 'irrigated perennial horticulture'.

Land shown as having potential for perennial horticulture:

a) **includes** land of agricultural land class A and class B with slope less than 15 per cent and April to October rainfall less than 500 mm

b) **excludes** land that is urban, intensive use (such as mining), national park, state forest, managed by the Department of Defence or permanently under water and land that has cracking clay soils.

In identifying this land, the audit **did not consider** a range of business factors (such as markets, pre-existing land uses and competing potential land uses) that are important influences on management decisions made by producers who drive land use These factors and how farmers respond to them are highly variable across space and through time. It was not possible to measure the effects of these factors with any confidence within the time and resources available to the audit.

Also, the audit **did not consider** temperature or flood risk. Temperature is a major determinant of suitability of land for horticulture. It affects whether a crop can grow and its performance. However, due to the large range of different horticultural crops grown in Queensland and the widely variable temperature requirements for these crops, it is not possible to determine meaningful criteria for temperature for the category 'perennial horticulture'. In addition, the inability to map microclimates at the appropriate scale means that temperature cannot be included in the criteria. Flood risk is similarly difficult to map. Reliable data on flood frequency and severity currently exists for comparatively few parts of the state and the extent to which agricultural land use and management are affected by flooding varies greatly from farmer to farmer depending on their individual circumstances and perceptions.

Availability of labour, especially during harvest season, is an important consideration in selecting suitable land for many forms of perennial horticulture. To reflect this, areas that are within 50 km of a centre with a population of 2000 or more are highlighted on the map. However, labour is not always a critical factor (e.g. for crops that are mechanically harvested) and the size and proximity of the nearest population centre is not always the best surrogate for labour force availability (e.g. many horticultural businesses make extensive use of itinerant seasonal workers or backpackers).

It should not be assumed from this study that all (or any particular portion of) land identified as having potential to be used for perennial horticulture will be converted to that use. Land potential has been identified by the audit using a limited number of criteria for which mapping is readily available. Also, the extent to which the potential identified on this map is realised (or realisable) is strongly influenced by constraints that have not been included as criteria in the mapping, for example the availability of water for irrigation (see Map 8.2). See Section 8.1 for further constraints.

Mackay, Isaac and Whitsunday Biophysical potential for perennial horticulture and current perennial horticulture

Potential based on ALC 'A' and 'B',
slope <15%,
April - October rainfall <500mm,
no cracking clays

Legend

- Potential perennial horticulture
- Current perennial horticulture (not to scale)
- Areas excluded from potential (see explanatory notes)
- Region boundary
- 50km from a population >2000
- Towns
- Roads
- Rivers

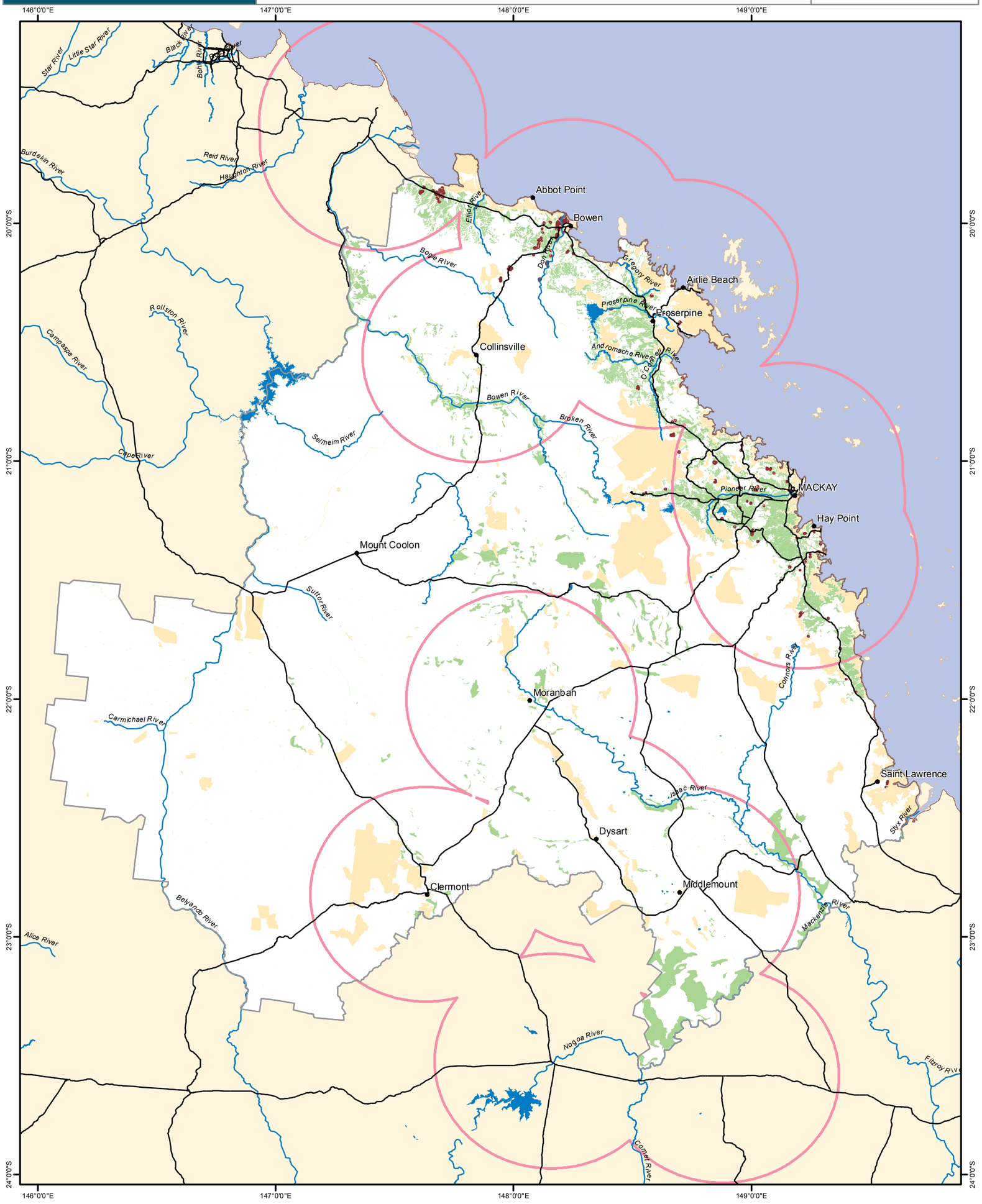
N

1:1,600,000

0 10 20 40 60 80
km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.11 Intensive livestock

This map shows land identified by the audit as currently being used for the agricultural land-use category 'intensive animal industries' (feedlot cattle and pigs). It also shows land identified as not currently being used for intensive animal industries but having potential to be used for that purpose. Land shown as currently being used for intensive animal industries has been identified on the basis that it is listed in the database of the Department of Agriculture, Fisheries and Forestry (Queensland) Intensive Livestock Environmental Regulation Unit. Cattle feedlots are only included where they have a capacity greater than 150 head. Individual intensive animal enterprises are smaller in area than enterprises involved in other agricultural land-use categories and most intensive animal enterprises would not be visible when represented to scale on audit maps. Because of this, the spatial extent of each current intensive animal enterprise is not shown; instead, each enterprise is mapped using a symbol centred on the centroid of the property.

Major beef abattoirs are shown on the map for information. Their locations have not been used in the analysis to identify land with potential for intensive beef industries as the location of many other smaller-scale abattoirs or country butchers that process animals was not available and therefore it could not be determined where access to processing was a constraint on potential intensive animal production.

Land shown as having potential for intensive animal industries:

a) **includes** land of agricultural land class A and class B (and class C1 where it is within 10 km of current cropping) with slope less than or equal to 8 per cent

b) **excludes** land that is urban, intensive use (such as mining), national park, state forest, managed by the Department of Defence or permanently under water.

In identifying this land, the audit **did not consider** a range of business factors (such as markets, pre-existing land uses and competing potential land uses) that are important influences on management decisions made by producers who drive land use. These factors and how farmers respond to them are highly variable across space and through time. It was not possible to measure the effects of these factors with any confidence within the time and resources available to the audit.

It should not be assumed from this study that all (or any particular portion of) land identified as having potential to be used for intensive animal industries should or will be converted to that use. Land potential has been identified by the audit using a limited number of criteria for which mapping is readily available. Also, the extent to which the potential identified on this map is realised (or realisable) is strongly influenced by constraints that have not been included as criteria in the mapping, for example the availability of water (see Map 8.2) and natural resource regulations such as those for vegetation management.

Aquaculture—current and potential

This map shows land identified by the audit as currently being used for the agricultural land-use category 'aquaculture'. It also shows land identified as not currently used for aquaculture but having potential to be used for that purpose. Land shown as currently being used for aquaculture has been identified on the basis that it was mapped by QLUMP as the tertiary class 'aquaculture'. Individual aquaculture enterprises are smaller in area than enterprises involved in other agricultural land-use categories and most aquaculture enterprises would not be visible when represented to scale on audit maps. Because of this, the spatial extent of each current aquaculture enterprise is not shown; instead, each enterprise is mapped using a symbol centred on the centroid of the property.

Land shown as having potential for aquaculture:

a) **includes** land that is within 2 km of an estuarine water source, is above the highest astronomical tide and has an elevation less than 10 m, slope less than 5 per cent and clay content greater than 20 per cent

b) **excludes** land that is urban, intensive use (such as mining), national park, state forest, managed by the Department of Defence, permanently under water, fish habitat area, of high ecological significance or mapped as containing acid sulfate soils.

In identifying this land, the audit **did not consider** a range of business factors (such as markets, pre-existing land uses and competing potential land uses) that are important influences on management decisions made by producers who drive land use. These factors and how farmers respond to them are highly variable across space and through time. It was not possible to measure the effects of these factors with any confidence within the time and resources available to the audit.

The map also shows areas where there are vulnerable groundwater systems. Contamination of groundwater systems is an important consideration in selecting sites for aquaculture enterprises. However, mapping of groundwater vulnerability in Queensland is relatively coarse and a range of measures can be used to mitigate this risk. Therefore the occurrence of vulnerable groundwater is not included in the criteria for mapping potential for aquaculture but is shown on the map for information.

It should not be assumed from this study that all (or any particular portion of) land identified as having potential to be used for aquaculture should or will be converted to that use. Land potential has been identified by the audit using a limited number of criteria for which mapping is readily available. Also, the extent to which the potential identified on this map is realised (or realisable) is strongly influenced by constraints that have not been included as criteria in the mapping, for example the availability of water for irrigation (see Map 8.2). See Section 8.1 for further constraints.

Mackay, Isaac and Whitsunday Biophysical potential for cattle feedlots, piggeries and marine aquaculture and current intensive animal production and aquaculture

Feedlots and piggeries potential: 'A' + 'B' class land + 'C1' class land within 10km of current cropping, slope ≤8%

Marine aquaculture potential: within 2km of estuarine water source, above HAT, <10m elevation, soil >20% clay content

Legend

- Potential feedlot and piggeries area
- Beef processors
- Current cattle feedlots (over 150 head)
- Egg processors
- Current egg producers
- Current piggeries
- Current aquaculture sites
- Potential marine aquaculture area
- Areas excluded from potential (see explanatory notes)
- Region boundary
- Roads
- Rivers
- Towns

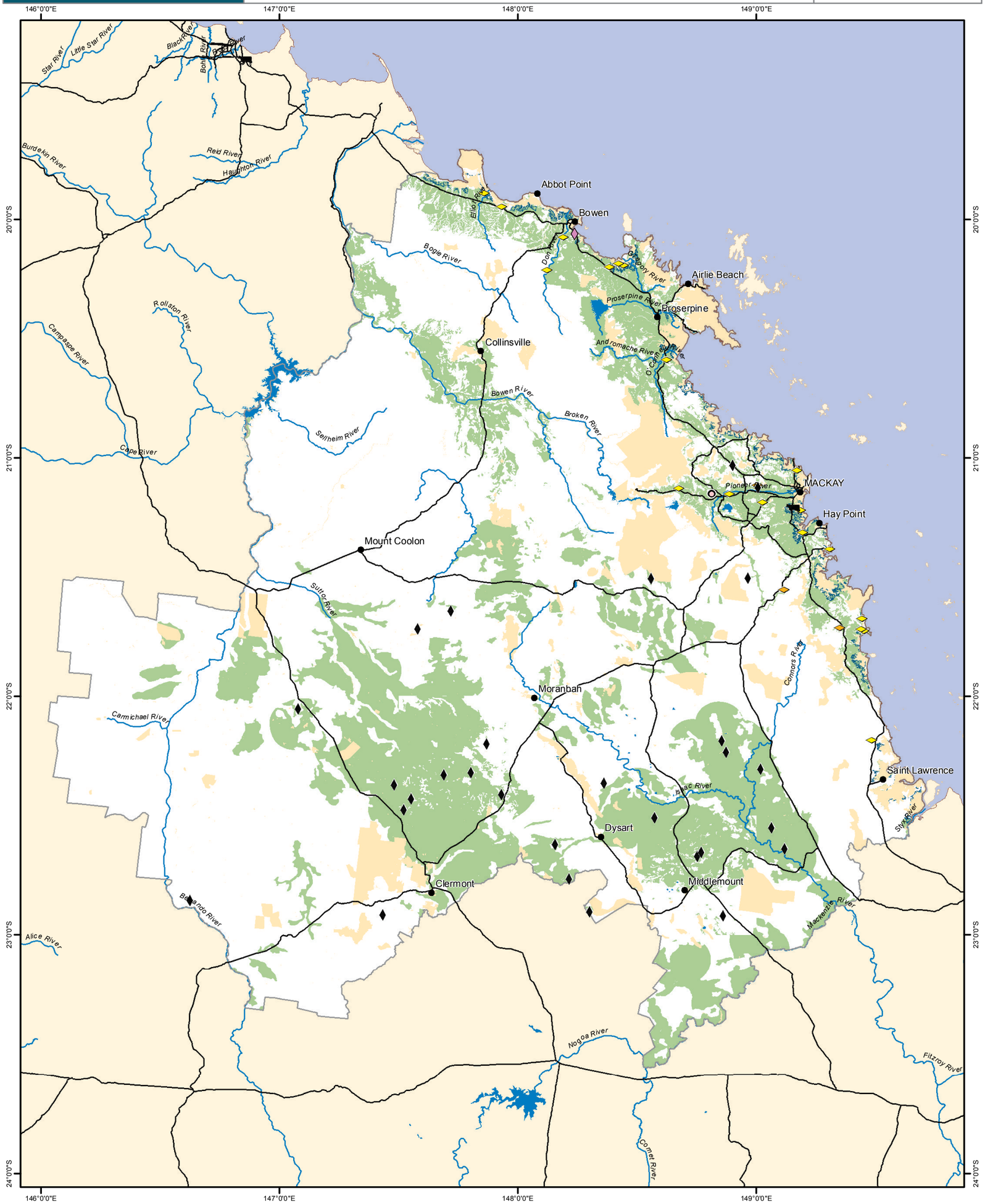
N

1:1,600,000

0 10 20 40 60 80
km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.12 Current pasture production (land condition B)

This map shows the current pasture biomass production that was modelled by the audit. For the purpose of this modelling, the land was assumed to be in fair condition (grazing land management (GLM) class B).

Current modelled pasture biomass production of land:

a) is **calculated** using the GRASP model of pasture biomass production (www.longpaddock.qld.gov.au—search 'GRASP') parameterised for each GLM land type (http://futurebeef.com.au) and discounted according to the amount of existing tree basal area on the land (as mapped by SLATS) and with pasture condition set to B (http://futurebeef.com.au)

b) **excludes** production from land that is urban, intensive use (such as mining), national park, managed by the Department of Defence or permanently under water.

In modelling this production, the audit **did not consider** a range of business factors (such as markets, pre-existing land uses or competing potential land uses) that are important influences on management decisions made by producers who drive land use. These factors and how farmers respond to them are highly variable across space and through time. It was not possible to measure the effects of these factors with any confidence within the time and resources available to the audit.

It should not be assumed from this study that the current modelled pasture biomass production of all land (or any particular portion of land) will be achieved. Land potential has been identified by the audit using a limited number of criteria for which mapping is readily available. Also, the extent to which the potential identified on this map is realised (or realisable) is strongly influenced by natural resource regulations such as those for vegetation management.

Mackay, Isaac and Whitsunday Current yearly pasture production (long term average)

GRASP model, modified by tree basal area and land condition (B)

Legend

Yearly pasture production (long term average)
(Dry matter yearly growth in kg/ha)

- High >3500
- Medium 1500-3500
- Low <1500

- Areas excluded from potential (see explanatory notes)
- Region boundary
- Roads
- Rivers
- Towns

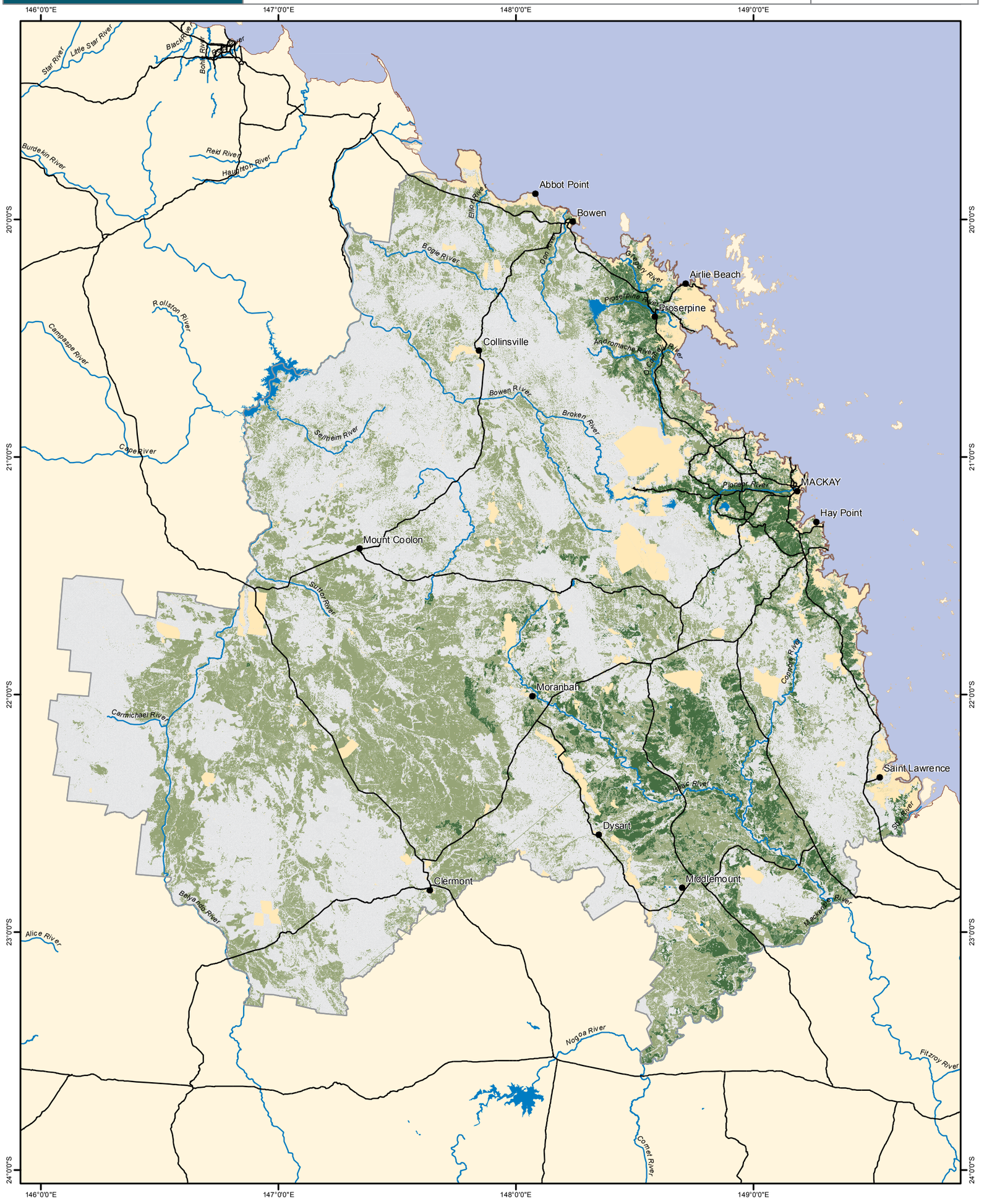
N

1:1,600,000

0 10 20 40 60 80
km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.13 Potential pasture production (land condition A)

This map shows the potential pasture biomass production that was modelled by the audit. For the purpose of this modelling, the land was assumed to be in good condition (GLM class A).

Potential modelled pasture biomass production of land:

a) is **calculated** using the GRASP model of pasture biomass production (www.longpaddock.qld.gov.au—search 'GRASP') paramaterised for each GLM land type (http://futurebeef.com.au) and discounted according to the amount of existing tree basal area on the land (as mapped by SLATS) and with pasture condition set to A (http://futurebeef.com.au)

b) **excludes** production from land that is urban, intensive use (such as mining), national park, managed by the Department of Defence or permanently under water.

In modelling this production, the audit **did not consider** a range of business factors (such as markets, pre-existing land uses and competing potential land uses) that are important influences on management decisions made by producers who drive land use. These factors and how farmers respond to them are highly variable across space and through time. It was not possible to measure the effects of these factors with any confidence within the time and resources available to the audit.

It should not be assumed from this study that the potential modelled pasture biomass production of all land (or any particular portion of land) will be achieved. Land potential has been identified by the audit using a limited number of criteria for which mapping is readily available. Also, the extent to which the potential identified on this map is realised (or realisable) is strongly influenced by natural resource regulations such as vegetation management.

Mackay, Isaac and Whitsunday Potential yearly pasture production (long term average)

GRASP model, modified by tree basal area and land condition (A)

Legend

Yearly pasture production (long term average)
(Dry matter yearly growth in kg/ha)

- High >3500
- Medium 1500-3500
- Low <1500

- Areas excluded from potential (see explanatory notes)
- Region boundary
- Roads
- Rivers
- Towns

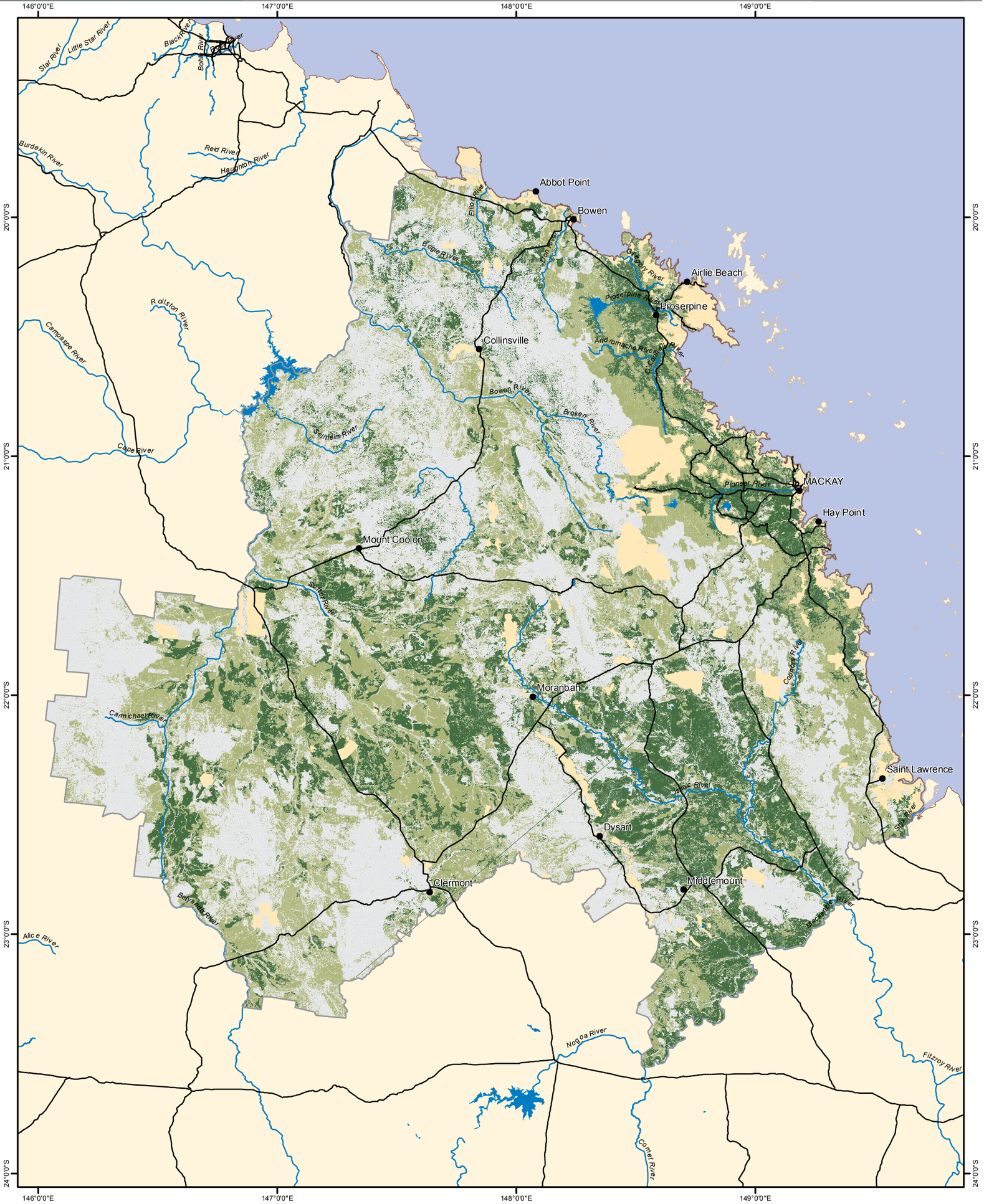
N

1:1,600,000

0 10 20 40 60 80
km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.14 Sown pastures

This map shows land identified by the audit as currently sown to pasture grasses. It also shows land identified as not currently sown to pasture grasses but having potential to be used for that purpose. For the purpose of the audit, sowing of pastures is considered to be the deliberate introduction of pasture grass varieties and species. It includes distribution of pasture grass seed preceded by cultivation or other management actions (such as fire) to create conditions conducive to successful establishment of the introduced grasses. It does not include naturalised introduction of exotic grasses without deliberate management or the supplementation of native grass pastures with introduced legumes. It is not possible with the data and tools available to the audit to map the occurrence of these supplemented pastures.

Land shown as currently sown to pasture has been identified using the approach outlined by Peck et al. (2010). This is land that currently has no (or very little) tree cover, has a mean annual rainfall greater than 500 mm and is of a GLM land type (http://futurebeef.com.au) that is considered to be suitable for pasture improvement. Land that is urban, intensive use (such as mining), national park, managed by the Department of Defence, permanently under water or currently cropped is **excluded**.

Land shown as having potential to be used for sown pastures:

a) **includes** land of a GLM land type that is considered to be suitable for establishing and maintaining sown pasture but currently has trees on it
b) **excludes** land that is urban, intensive use (such as mining), national park, managed by the Department of Defence or permanently under water.

In identifying this land, the audit **did not consider** a range of business factors (such as markets, pre-existing land uses or competing potential land uses) that are important influences on management decisions made by producers who drive land use. These factors and how farmers respond to them are highly variable across space and through time. It was not possible to measure the effects of these factors with any confidence within the time and resources available to the audit.

It should not be assumed from this study that all (or any particular portion of) land identified as having potential to support improved pastures will or should be converted to that use. Land potential has been identified by the audit using a limited number of criteria for which mapping is readily available. Also, the extent to which the potential identified on this map is realised (or realisable) is strongly influenced by constraints that have not been included as criteria in the mapping, for example natural resource regulations relating to vegetation management.

Mackay, Isaac and Whitsunday Areas suitable for sown grass species and areas predicted to have sown grass species established

Legend

- Sown grasses present in a significant density
- Potential for broadscale introduction of sown grass species
- Low potential for broadscale introduction of sown grass species
- Areas excluded from potential (see explanatory notes)
- Region boundary
- Roads
- Rivers
- Towns

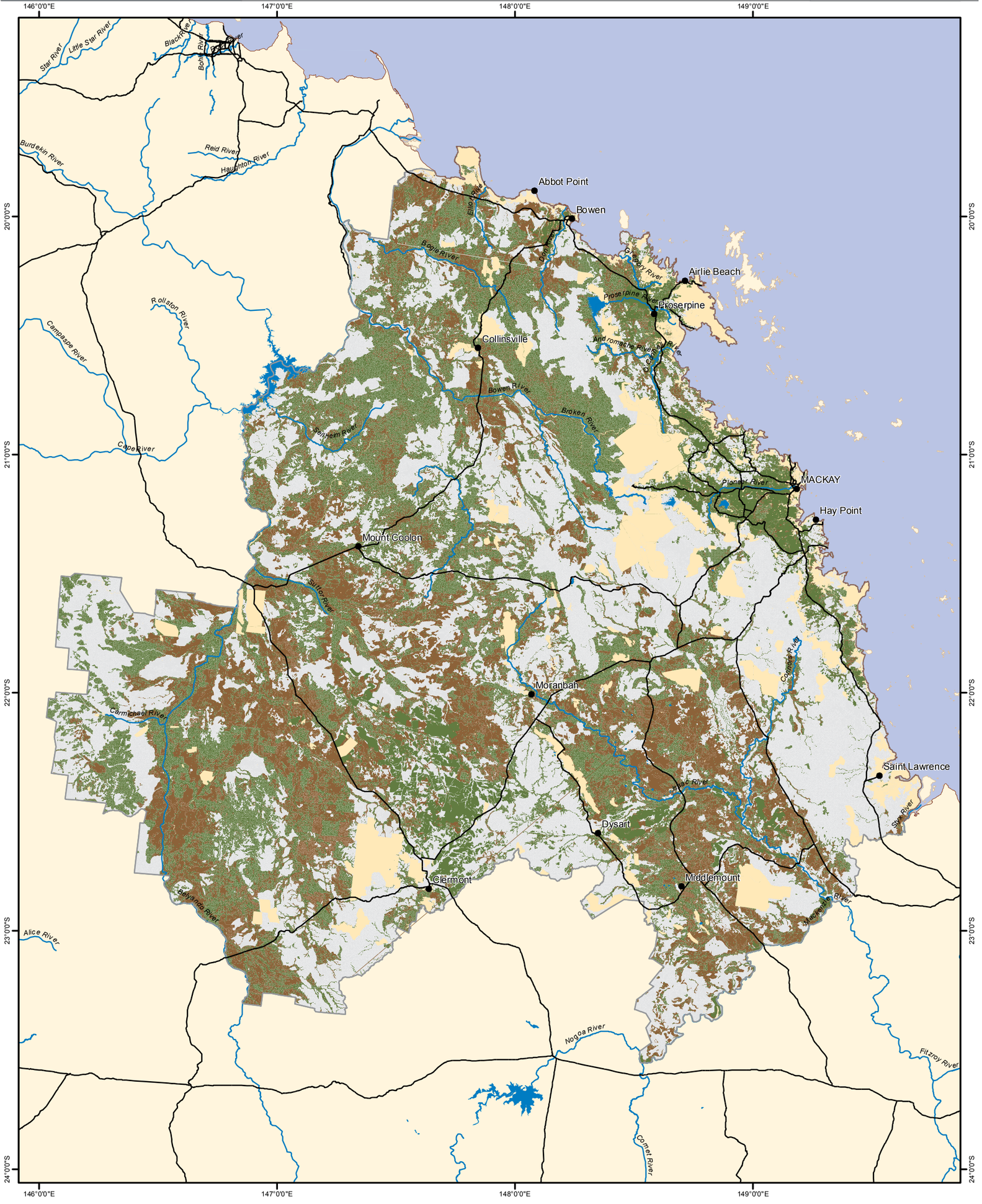
N

1:1,600,000

0 10 20 40 60 80
km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.15 Native forestry

This map shows land identified by the audit as currently being used for production of sawlogs and/or other timber products from native forestry. This land has been identified on the basis that it is either freehold land that is covered by a forest practice notification under the *Vegetation Management Act 1999* or is state-owned land over which the Queensland Government has a timber interest (as indicated by it being covered by a Department of Agriculture, Fisheries and Forestry (Queensland) Forestry Division MUID).

The map also shows land identified as not currently being used for production of sawlogs and/or other timber products from native forestry but having potential to be used for that purpose.

For land to be rated by the audit as having potential for sawlog as well as non-sawlog timber production, it must also be a regional ecosystem that contains species (as listed in the REDD description) known to produce commercial sawlogs. For land to be listed as high potential for sawlog production, the canopy top height for that regional ecosystem must also exceed the threshold determined by the audit as indicating high-productivity site conditions for production of sawlogs of that type.

Land shown as having potential for native forestry:

a) **includes** land that is mapped as currently having a woody vegetation canopy of greater than 15 per cent (SLATS foliage projective cover)
b) **excludes** land that is cleared of forest, urban, intensive use (such as mining), national park, managed by the Department of Defence or permanently under water.

In identifying this land, the audit **did not consider** a range of business factors (such as markets, pre-existing land uses and competing potential land uses) that are important influences on management decisions made by producers who drive land use. These factors and how farmers respond to them are highly variable across space and through time. It was not possible to measure the effects of these factors with any confidence within the time and resources available to the audit.

Access to processing facilities can also be a major consideration in determining the potential for land to be used for native forestry. However, it was not possible in this analysis to determine with any confidence what the critical threshold distances are. Therefore, while the locations of existing sawmills are shown on the map as a general guide to those interested in considering this factor, distance from sawmills has not been included in the analysis.

It should not be assumed from this study that all (or any particular portion of) land identified as having potential to be used for native forestry should or will be converted to that use. Land potential has been identified by the audit using a limited number of criteria for which mapping is readily available. Also, the extent to which the potential identified on this map is realised (or realisable) is strongly influenced by natural resource regulations such as those for vegetation management.

Mackay, Isaac and Whitsunday Biophysical potential for native forestry and current native forestry

Potential based on commercial tree species, tree height, FPC >15%

Legend

- High potential for sawlog and non-sawlog products
- Potential for sawlog and non-sawlog timber products
- Potential for non-sawlog timber products only
- Forest practice notifications on private land (Vegetation Management Act 1999)
- State owned land timber interests (Forestry Act 1959)
- Areas excluded from potential (see explanatory notes)
- Region boundary
- Saw mills for native timber (within 100km of region)
- Roads
- Rivers
- Towns

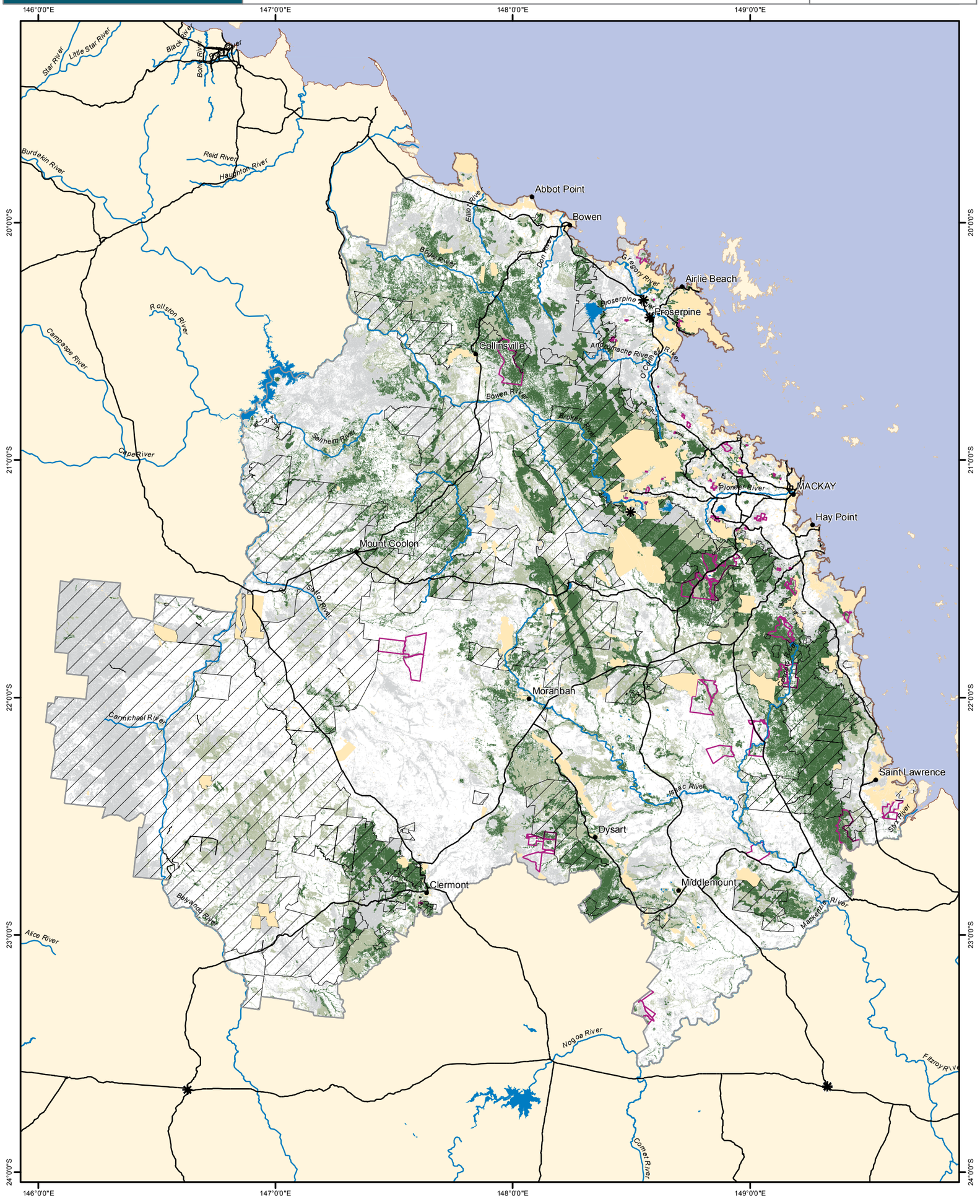
N

1:1,600,000

0 10 20 40 60 80 km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.16 Plantation forestry

This map shows the land identified by the audit as currently being used for the agricultural land-use category 'plantation forestry'. It also shows land identified as not currently used for plantation forestry but having potential to be used for this purpose. Land shown as currently being used for plantation forestry has been identified from mapping provided by HQPlantations, ABARES and FEA Holdings. Areas represented in this mapping have been classified as either hardwood or softwood by experts with local knowledge.

Land shown as having potential for plantation forestry:

a) **includes** land of agricultural land class A, class B and class C1 (as well as class C2 and class C3 for softwoods) that has slope less than 25 per cent and rainfall greater than 700 mm (or 800 mm for softwood) for 7 out of 10 years

b) **excludes** land that is urban, intensive use (such as mining), national park, managed by the Department of Defence or permanently under water as well as land that has cracking clay soils.

In identifying this land, the audit **did not consider** a range of business factors (such as markets, pre-existing land uses and competing potential land uses) that are important influences on management decisions made by producers who drive land use. These factors and how farmers respond to them are highly variable across space and through time. It was not possible to measure the effects of these factors with any confidence within the time and resources available to the audit.

Access to processing facilities can also be a major consideration in determining the potential for land to be used for plantation forestry. However, it was not possible in this analysis to determine with any confidence what the critical threshold distances are. Therefore, while the locations of existing sawmills that predominantly process plantation timber are shown on the map as a general guide to those interested in considering this factor, distance from sawmills has not been included in the analysis.

It should not be assumed from this study that all (or any particular portion of) land identified as having potential to be used for plantation forestry should or will be converted to that use. Land potential has been identified by the audit using a limited number of criteria for which mapping is readily available. Also, the extent to which the potential identified on this map is realised (or realisable) is strongly influenced by constraints that have not been included as criteria in the mapping, for example the availability of water for irrigation (see Map 8.2). See Section 8.1 for further constraints.

Mackay, Isaac and Whitsunday Biophysical potential for rainfed plantation forestry and current plantation forestry

Hardwood potential based on ALC 'A', 'B' and 'C1', slope <25%, rainfall >700mm 7 in 10 years, no cracking clays
Softwood potential based on ALC 'A', 'B' and 'C', slope <25%, rainfall >800mm 7 in 10 years, no cracking clays

Legend

- Potential softwood plantations
- Potential hardwood plantations
- Current fallow
- Current hardwood
- Current mixed species
- Current softwood
- Areas excluded from potential (see explanatory notes)
- Region boundary
- Sawmills for plantation timber
- Roads
- Rivers
- Towns

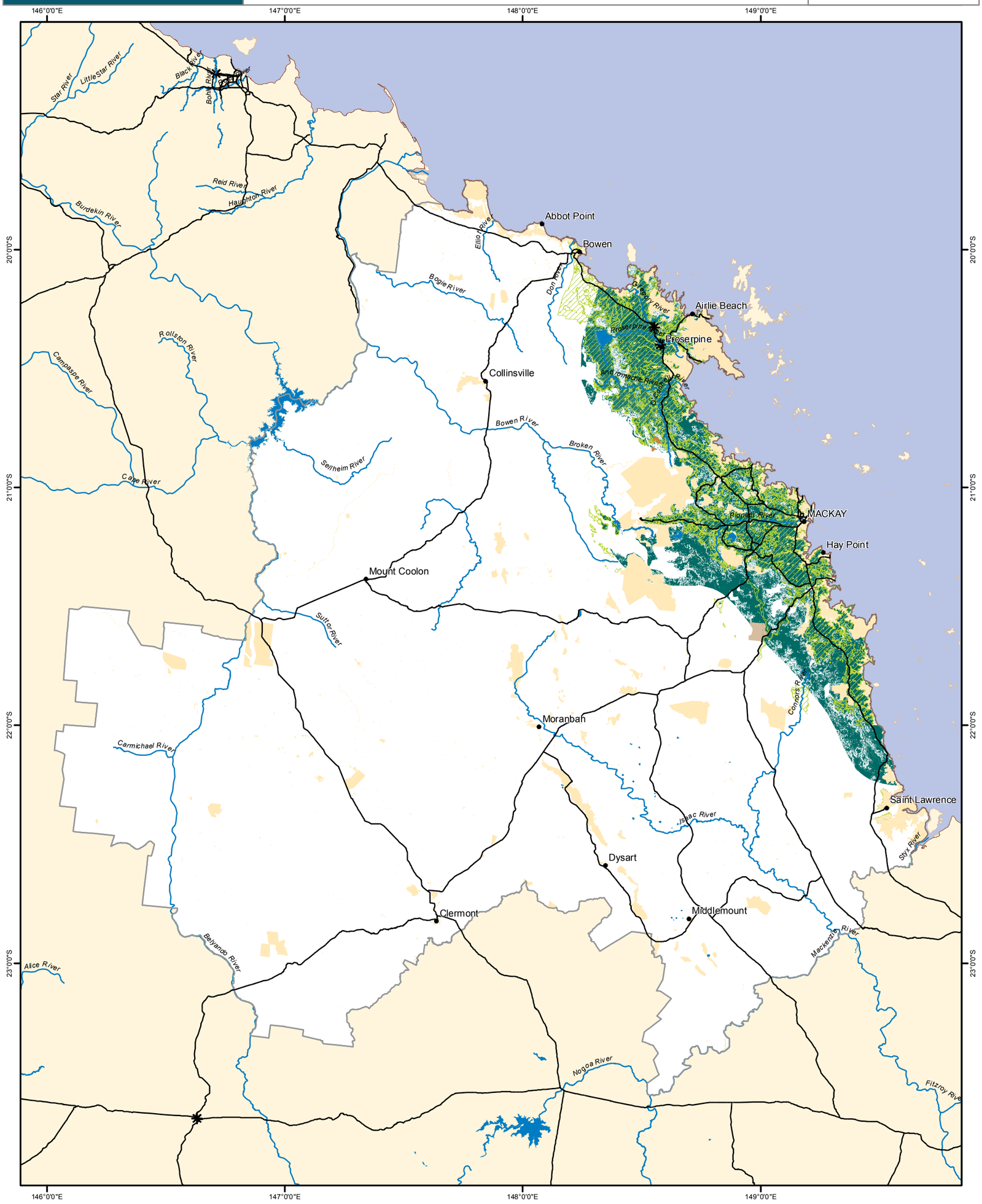
N

1:1,600,000

0 10 20 40 60 80
km

Datum: GDA 94 Projection: Geographic
Page size: A3

Locality Map
Queensland regional planning boundaries



Map 8.17 Data confidence in soil mapping

This map shows the variation in the relative confidence in the audit's mapping of land-use potential across the region. Land-use potential maps have been generated by the audit by combining a number of different datasets. The level of confidence in the final product is determined by the most limiting of the datasets used. This is generally the agricultural land class mapping, which was derived from a number of different land resource studies, each covering different parts of Queensland often at differing scales of resolution and with different standards of information reported. Confidence in land resource data ranges from high (where mapping is detailed and map units are described in terms of their suitability for a full range of relevant crop types and uses) to low (where mapping is coarse and map units are described in general terms only). For some parts of the state, the only available land resource information is from the *Atlas of Australian soils*. The quality of this information is considered inadequate for the audit; therefore, those areas are shown on this map as having no data.

Mackay, Isaac and Whitsunday – Confidence in ALC data