Department of Science, Information Technology, Innovation and the Arts

Land Use Summary 1999–2012

for the Lockyer Creek sub-catchment within SEQ

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To access land use datasets it is recommended that the Queensland Government Information Service (QGIS) be used. Search for **"land use mapping"** in the type of data search after restricting your search to **"cadastral and land planning"** in the topic category field. Metadata is also available from QGIS.

Acknowledgements

We wish to acknowledge the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) who coordinate the Australian Collaborative Land Use and Management Program (ACLUMP).

The QLUMP team includes staff from DSITIA in Brisbane and four business centres of the Department of Natural Resource and Mines (DNRM) South Region. The input from the regions has been extremely valuable in respect of their mapping skills, local knowledge and capacity to engage regional experts in compiling updated land use mapping data.

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Table of contents

List of tables

List of figures

Introduction

The Queensland Land Use Mapping Program (QLUMP) is a joint initiative of the Department of Science, Information Technology, Innovation and the Arts (DSITIA) and the Department of Natural Resources and Mines (DNRM). QLUMP is part of the Australian Collaborative Land Use and Management Program (ACLUMP) coordinated by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES). ACLUMP promotes nationally consistent land use information.

Land use and land management practices have a profound impact on Queensland's natural resources, agricultural production and the environment. The availability of consistent and reliable spatial information regarding land use is critical for sustainable natural resource management by Australian, Queensland and local Governments, Natural Resource Management regional groups, industry groups, community groups and land managers.

QLUMP has updated land use mapping in the South-East Queensland (SEQ) Natural Resource Management Region to 2011 or later. Mapping has been compiled at the catchment level, with the exception of the Brisbane catchment, which has been divided into its sub-catchments (Brisbane River, Stanley River, Lockyer Creek and Bremer River) due to the size and diversity of the area. Apart from the Maroochy and Noosa catchments (2011) and the Brisbane River sub-catchment (2013), remaining catchments in SEQ were updated to 2012.

This report presents and summarises land use mapping in the Lockyer Creek sub-catchment (which accounts for 13% of SEQ total area) including:

- a revised 1999 land use dataset including improvements and corrections to the original
- 2012 land use dataset
- land use change dataset from 1999–2012
- summary statistics derived from the above spatial datasets
- results of the accuracy assessment of the 2012 land use dataset

Methodology

Mapping is performed in accordance with ACLUMP guidelines. The methodology is accurate, reliable, cost-effective, and makes best use of available databases, satellite imagery and aerial photography. QLUMP maps each catchment with the most recent suitable imagery available. The updated land use datasets for each catchment within SEQ range from 2011 to 2013.

The Australian Land Use and Management (ALUM) classification (Figure 1, page 5) shows five primary classes, identified in order of increasing levels of intervention or potential impact of land use; *water* is included separately as a sixth primary class. Within the primary classes is a three-level hierarchical structure. Primary, secondary and tertiary levels broadly describe the potential degree of modification of or impact of land use on the landscape. The secondary level in the three-level hierarchical structure is the minimum attribution level for land use mapping in Queensland.

Primary and secondary levels relate to land use (i.e. the principal use of the land in terms of the objectives of the land manager). The tertiary level includes data on commodities or infrastructure, (e.g. crops such as cereals or infrastructure such as *urban residential*). Where possible, class attribution is performed to the tertiary level. For instance, QLUMP consistently maps land use classes *sugar* and *cotton* (dryland and irrigated) to tertiary level.

The mapping scale is 1:50,000 with a minimum mapping unit of two hectares and a width of 50 metres for linear features.

The 1999 (or later where available) baseline land use dataset formed the basis for the 2012 land use dataset. The 1999 land use map was revised and improved in addition to compiling an updated land use map for 2012. This was achieved primarily by interpretation of SPOT5 satellite imagery, high-resolution orthophotography, scanned aerial photography and inclusion of expert local knowledge. An ESRI ArcSDE geodatabase replication environment was utilised to overlay land use datasets on imagery and digitise or modify areas previously omitted or incorrectly mapped in the 1999 mapping, as well as areas of actual land use change (2012). A land use change mapping product was then derived (at the secondary level of the ALUM classification) between 1999 and 2012.

Some land uses are difficult to differentiate using satellite imagery and existing databases, for example, dryland and irrigated *agriculture*. To overcome this, local expert knowledge was an important component of the mapping methodology. This was provided by regional staff in state government agencies, natural resource management groups, shires, agricultural industries and landholders. Field survey is also undertaken to verify areas of uncertainty in the land use mapping.

The land use mapping methods used by QLUMP are described in full in the ABARES handbook: Guidelines for land use mapping in Australia: principles, procedures & definitions – Edition 4

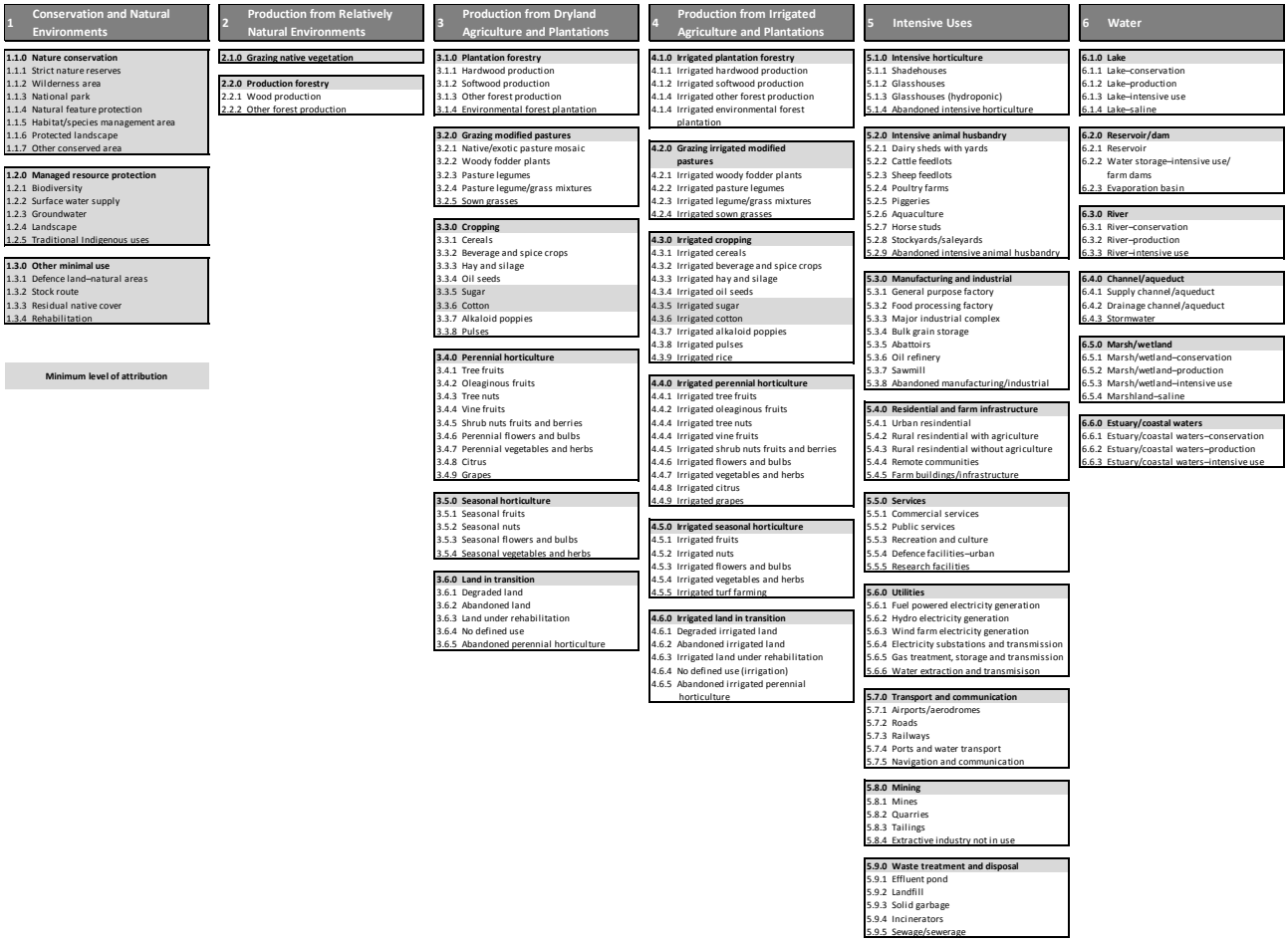

Figure 1: Australian Land Use and Management (ALUM) classification, Version 7

Data Limitations

Land use features that are linear, such as roads and railways, are not mappable at a scale of 1:50,000 with a specified minimum mapping width of 50 metres. As a result, the area estimates of these **linear features** represent only a small proportion of the actual area within this land use type in Queensland. This is of relevance to the following land use classes:

- *transport and communication*
- *utilities*
- *rivers*

Similarly, land uses that fall under the QLUMP minimum mapping area of two hectares are not explicitly mapped but aggregated into the surrounding land use class. This will have the effect of over-estimating the area of some land use classes, for example *other minimal use* and *grazing native vegetation*, whereby tracks and farm infrastructure, road reserves, drainage lines, cleared and uncleared land adjacent to rivers as well as land immediately adjacent to or between cropped paddocks are included.

Livestock grazing occurs on a range of pasture types including native and exotic as well as mixtures of both. Identifying and separating these using imagery, aerial photography and field observation is difficult and unreliable. Therefore, the ALUM secondary classes of *grazing modified pastures* and *irrigated grazing modified pastures* have not been mapped explicitly by QLUMP. Where possible (for example, with the benefit of field verification), these classes can be mapped (for example, dairy pastures and fodder crops). Areas of pasture which appeared to be harvested for fodder or grazed off were mapped as *cropping*. This may contribute an over-estimation of cropping in the region. The appearance of these can be highly variable and classification may therefore not be consistent.

The distinction between (dryland) *cropping* and *irrigated cropping* was not always evident and it is likely there is some misclassification in these classes. Proximity to water sources (watercourse or dam) as well as information from water entitlements (irrigation licences), field survey and local knowledge were used to confirm areas of irrigation as much as possible. Areas mapped as *irrigated cropping* are potentially irrigated on a supplementary basis and may not have actually been irrigated in either 1999 or 2012.

The *rural residential* land use class is a source of possible thematic error. Properties on the fringes of suburban settlements, hobby farms and subdivisions in isolated localities with comparatively small lot sizes were mapped to this class. The use of Queensland Valuation System (QVAS) (valuation information) was helpful in mapping this class, based on whether or not the land owner was classified as a primary producer. Residential features greater than 0.2 hectares and less than 16 hectares were mapped as *rural residential.* This class may be misclassified with *grazing native vegetation* and o*ther minimal use*, especially on larger properties.

A combination of the Queensland Herbarium's wetlands and regional ecosystem datasets provided the basis for mapping *marsh/wetlands*, *lakes*, *rivers* and *reservoir/dams*. The ephemeral nature of many of these water features can lead to confusion insofar as they may be present in imagery of one date and either absent or of differing extent in imagery of subsequent or previous dates. As a result, there may be errors, omissions and disagreement in the mapping of features such as farm dams, reservoirs, lakes, wetlands and other water features. Many water features, whilst exceeding the minimum mappable area requirements, do not meet the criteria for linear or uniform features.

The 1999 and 2012 land use datasets are a snapshot of what was interpreted as the primary land use in these years. However, effort was given to distinguishing between an actual land use change and a rotation. For example, an area that is usually cropped, but is not used for that particular purpose in the year of interest, was still mapped as *cropping* in the 2012 dataset even though no crop was present in that year. This was not considered an actual land use change, but rather a rotation, as the primary land use for that paddock would still be *cropping*.

Some confusion in thematic accuracy occurred in the Lockyer Creek sub-catchment between the *cropping* and *grazing native vegetation* land use classes. The point in time at which an area of *cropping* changes land use to *grazing native vegetation* (and vice versa) is subjective and varies depending on individual interpretation and additional information. Paddocks with land management practice improvements such as contour banks are particularly difficult to classify. These thematic errors are shown in the accuracy assessment (page 16).

Refer to metadata for details on the mapping of specific classes.

Products

1999 and 2012 land use datasets

Figure 2 (page 8) and Figure 3 (page 9) show the 1999 and 2012 land use datasets respectively, for the Lockyer Creek sub-catchment, presented at the secondary level of the ALUM classification (Figure 1, page 5). Table 1 (page 10) and Table 2 (page 11) provide the summary statistics for each. All statistics presenting the area of land use classes are reported in hectares (ha).

Table 2 (page 11) shows that *grazing native vegetation* (62%) and *irrigated seasonal horticulture* (9%) are the major land use classes for 2012 in the Lockyer Creek sub-catchment.

As a result of the SEQ Forest Agreement, (whereby state forests have been progressively added to the conservation reserves estates), the primary class of *conservation and natural environments* increased significantly (by 53% or 14,852ha). At the secondary level, *nature conservation* (12,129ha) and *managed resource protection* (2,913ha) were the main contributors to this increase.

Since 1999, the *production from relatively natural environments* primary land use class fell by 8% or 17,030ha. This land use change is reflected at the secondary level where the land use classes of *grazing native vegetation* and *production forestry* declined by 5% (10,608ha) and 50% (6,422ha) respectively.

The *intensive uses* primary land use class has increased by 4% or 1,140ha from 1999–2012. The majority of the growth was observed in the *residential and farm infrastructure* secondary land use class, which increased by 3% or 792ha.

Analysis of the specific land use changes from one secondary class to another for 1999–2012 is presented in the section on page 12.

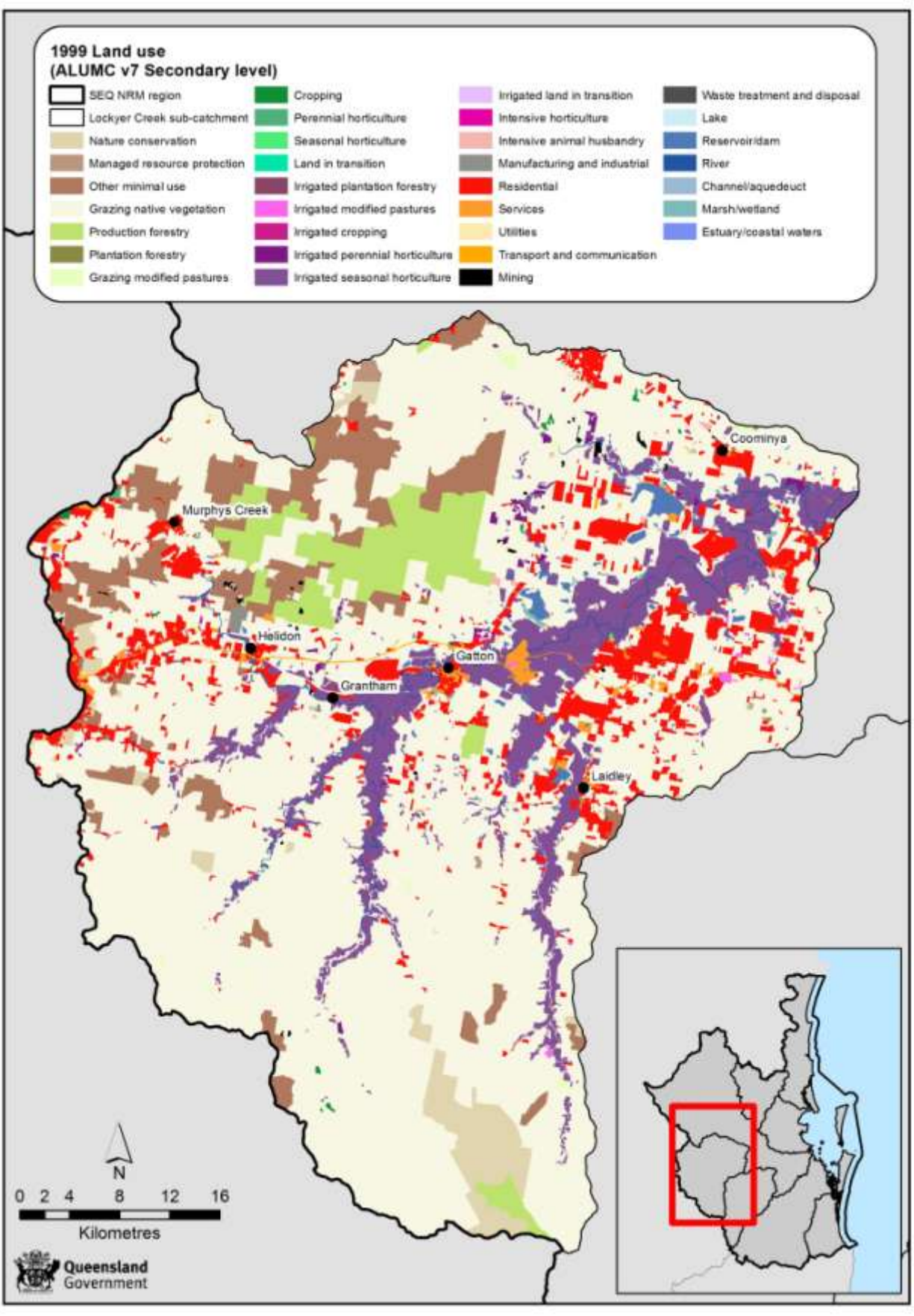

Figure 2: 1999 land use map for the Lockyer Creek sub-catchment

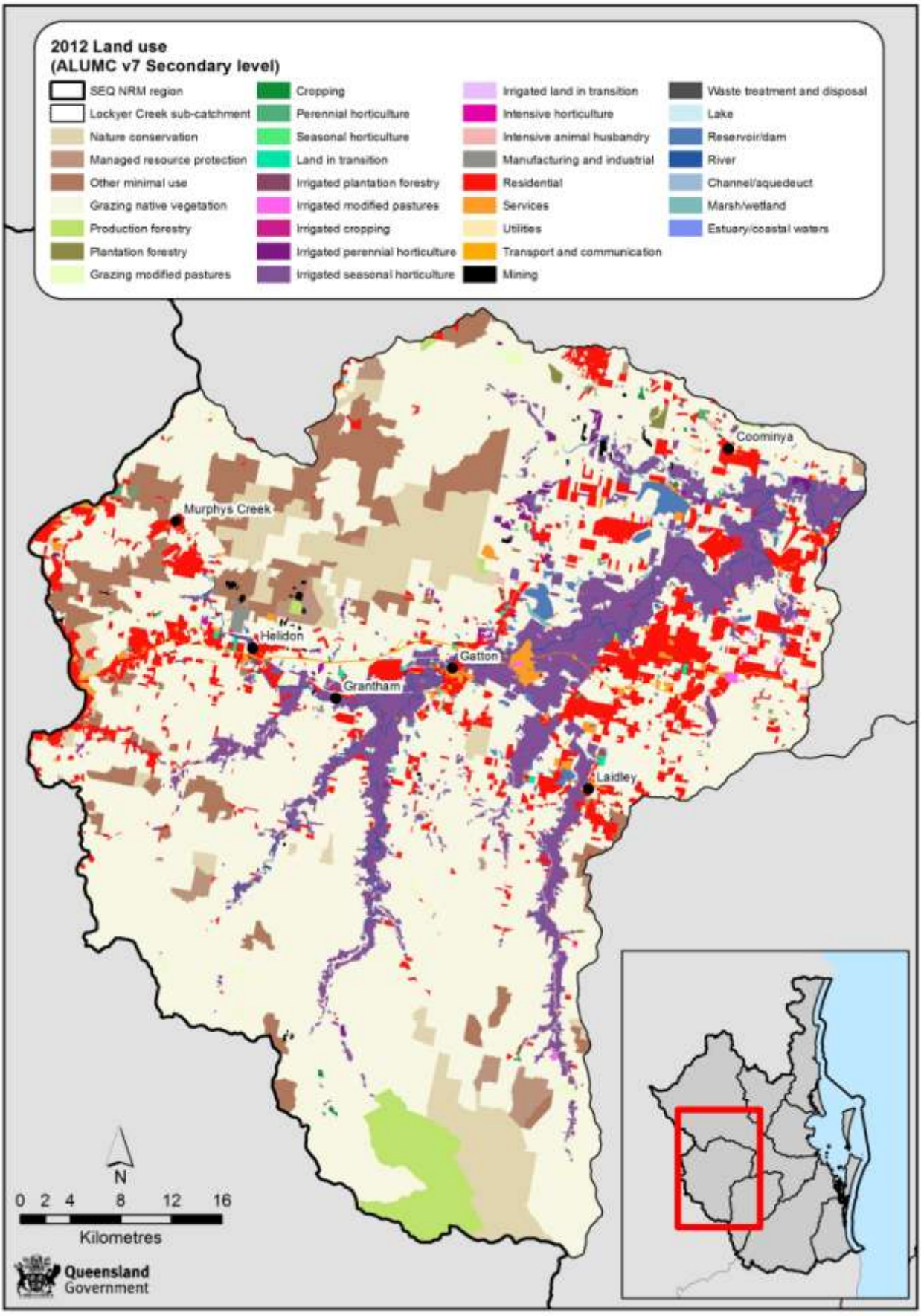

Figure 3: 2012 land use map for the Lockyer Creek sub-catchment

Table 1: Summary statistics of land use in 1999 in the Lockyer Creek sub-catchment

Land use code	Land use class	Area (ha)	Area %
1	Conservation and natural environments	27,992	9.30
1.1	Nature conservation	7,736	2.57
1.2	Managed resource protection	356	0.12
1.3	Other minimal use	19,901	6.61
2	Production from relatively natural environments	211,276	70.19
2.1	Grazing native vegetation[1]	198,369	65.91
2.2	Production forestry	12,907	4.29
3	Production from dryland agriculture and plantations	1,582	0.53
3.1	Plantation forestry	101	0.03
3.2	Grazing modified pastures[2]	1,140	0.38
3.3	Cropping	240	0.08
3.4	Perennial horticulture	92	0.03
3.5	Seasonal horticulture	10	<0.01
4	Production from irrigated agriculture and plantations	28,593	9.50
4.2	Irrigated grazing modified pastures[2]	238	0.08
4.3	Irrigated cropping	16	0.01
4.4	Irrigated perennial horticulture	1,081	0.36
4.5	Irrigated seasonal horticulture	27,258	9.06
5	Intensive uses	27,173	9.03
5.1	Intensive horticulture	69	0.02
5.2	Intensive animal husbandry	304	0.10
5.3	Manufacturing and industrial	358	0.12
5.4	Residential and farm infrastructure	23,058	7.66
5.5	Services	2,288	0.76
5.6	Utilities	27	0.01
5.7	Transport and communication	637	0.21
5.8	Mining	406	0.13
5.9	Waste treatment and disposal	27	0.01
6	Water	4,368	1.45
6.2	Reservoir/dam	2,524	0.84
6.3	River	1,506	0.50
6.4	Channel/aqueduct	83	0.03
6.5	Marsh/wetland	254	0.08
	Grand Total	**300,984**	**100.00**

[1]*grazing native vegetation* includes all pastures (modified and unmodified). No distinction is made in respect of tree cover.

[2]*grazing modified pastures* and *irrigated grazing modified pastures* are not mapped explicitly. In this case the areas mapped are generally dairy pastures.

Table 2: Summary statistics of land use in 2012 in the Lockyer Creek sub-catchment

Land use code	Land use class	Area (ha)	Area %
1	Conservation and natural environments	42,844	14.23
1.1	Nature conservation	19,865	6.60
1.2	Managed resource protection	3,269	1.09
1.3	Other minimal use	19,710	6.55
2	Production from relatively natural environments	194,246	64.54
2.1	Grazing native vegetation[1]	187,761	62.38
2.2	Production forestry	6,485	2.15
3	Production from dryland agriculture and plantations	2,548	0.85
3.1	Plantation forestry	471	0.16
3.2	Grazing modified pastures[2]	1,325	0.44
3.3	Cropping	202	0.07
3.4	Perennial horticulture	235	0.08
3.5	Seasonal horticulture	17	0.01
3.6	Land in transition	299	0.10
4	Production from irrigated agriculture and plantations	28,361	9.42
4.2	Irrigated grazing modified pastures[2]	255	0.08
4.3	Irrigated cropping	16	0.01
4.4	Irrigated perennial horticulture	1,132	0.38
4.5	Irrigated seasonal horticulture	26,954	8.96
4.6	Irrigated land in transition	4	<0.01
5	Intensive uses	28,313	9.41
5.1	Intensive horticulture	129	0.04
5.2	Intensive animal husbandry	335	0.11
5.3	Manufacturing and industrial	364	0.12
5.4	Residential and farm infrastructure	23,850	7.92
5.5	Services	2,412	0.80
5.6	Utilities	27	0.01
5.7	Transport and communication	637	0.21
5.8	Mining	533	0.18
5.9	Waste treatment and disposal	27	0.01
6	Water	4,672	1.55
6.2	Reservoir/dam	2,830	0.94
6.3	River	1,506	0.50
6.4	Channel/aqueduct	83	0.03
6.5	Marsh/wetland	252	0.08
	Grand Total	**300,984**	**100.00**

[1]*grazing native vegetation* includes all pastures (modified and unmodified). No distinction is made in respect of tree cover.

[2]*grazing modified pastures* and *irrigated grazing modified pastures* are not mapped explicitly. In this case the areas mapped are generally dairy pastures.

1999–2012 land use change dataset

Figure 4 (page 13), shows the 1999–2012 land use change dataset for the Lockyer Creek sub-catchment. The data has been presented relative to the **change in intensity** of the land use at the secondary level of the ALUM classification.

For example, change from 2.1.0 (*grazing native vegetation*) to 2.2.0 (*production forestry*) is an increase in land use intensity, whilst change from 2.1.0 (*grazing native vegetation*) to 1.1.0 (*nature conservation*) is a decrease. This is highlighted in the ALUM classification (Figure 1, page 5). Moving down and from left to right through the classification, the level of intervention or potential impact of land use increases.

The total area of land use change at the secondary level from 1999–2012 is 25,531ha. This is equivalent to 8.5% of the catchment area. Of this, 9,367ha (37% of the total change) is an increase in land use intensity, whilst 16,164ha (63%) is a decrease.

Summary statistics presenting the land use change at the secondary level for 1999–2012 are shown in Table 3 (page 14). Land use change from *production forestry* to *nature conservation* accounted for 11,968ha or 47% of the total. Figure 4 shows this (less intense) land use change east of Murphy's Creek—where the Lockyer Forest Reserve has been converted into the Lockyer National Park (gazetted in 2008). The significant decrease in the area of *production forestry* was offset in part by 6,213ha of (more intense) land use change from *grazing native vegetation* to *production forestry*—with the establishment of the Glen Rock State Forest (gazetted in 2011) in the south of the Lockyer sub-catchment.

The pattern of change from *production forestry* in 1999 to *managed resource protection* and *nature conservation* in 2012, can be attributed to the SEQ Forest Agreement, as State forests in SEQ have been progressively added to the protected area estates.

Other significant land use changes were from *grazing native vegetation* to *managed resource protection* (2,082ha or 8%), all of which was associated with the establishment of Nature Refuges throughout the Lockyer Creek sub-catchment.

Collectively the expansion of the intensive land use classes including *manufacturing and industrial, residential and farm infrastructure, services, utilities, transport and communications and waste treatment and disposal* contributed 942ha or 4% of the 1999–2012 land use change in the Lockyer Creek sub-catchment. The majority of this (805ha) was expansion in the *residential and farm infrastructure* class.

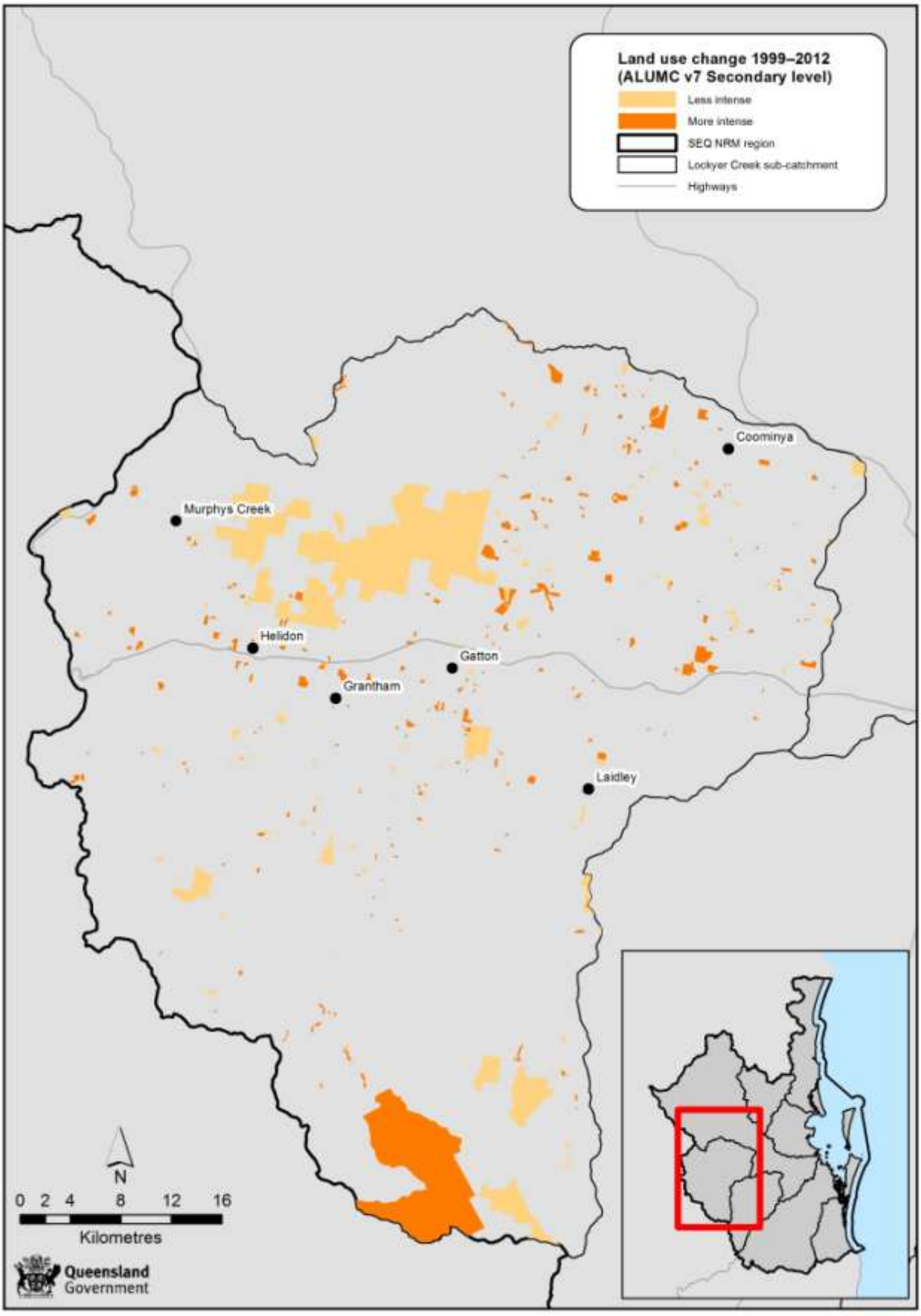

Figure 4: 1999–2012 land use change map at secondary level for the Lockyer Creek sub-catchment

Table 3: Summary statistics for land use change at secondary level for 1999–2012 in the Lockyer Creek sub-catchment (showing only the land use changes > 10ha)

Land use code 1999	Land use class 1999	Land use code 2012	Land use class 2012	Area (ha)	Area Change (%)	Total change (%)
2.2.0	Production forestry	1.1.0	Nature conservation	11,968	3.98	46.87
2.1.0	Grazing native vegetation	2.2.0	Production forestry	6,213	2.06	24.34
2.1.0	Grazing native vegetation	1.2.0	Managed resource protection	2,082	0.69	8.16
2.1.0	Grazing native vegetation	5.4.0	Residential & farm infrastructure	800	0.27	3.14
4.5.0	Irrigated seasonal horticulture	2.1.0	Grazing native vegetation	743	0.25	2.91
2.2.0	Production forestry	1.2.0	Managed resource protection	636	0.21	2.49
2.1.0	Grazing native vegetation	4.5.0	Irrigated seasonal horticulture	594	0.20	2.33
2.1.0	Grazing native vegetation	3.1.0	Plantation forestry	338	0.11	1.32
2.1.0	Grazing native vegetation	6.2.0	Reservoir/dam	285	0.09	1.12
2.1.0	Grazing native vegetation	3.6.0	Land in transition	250	0.08	0.98
1.3.0	Other minimal use	1.2.0	Managed resource protection	208	0.07	0.81
2.1.0	Grazing native vegetation	1.1.0	Nature conservation	149	0.05	0.58
2.1.0	Grazing native vegetation	3.4.0	Perennial horticulture	148	0.05	0.58
2.1.0	Grazing native vegetation	5.8.0	Mining	144	0.05	0.56
2.1.0	Grazing native vegetation	5.5.0	Services	131	0.04	0.51
2.1.0	Grazing native vegetation	4.4.0	Irrigated perennial horticulture	127	0.04	0.50
2.1.0	Grazing native vegetation	3.2.0	Grazing modified pastures	82	0.03	0.32
4.5.0	Irrigated seasonal horticulture	3.2.0	Grazing modified pastures	75	0.03	0.29
2.1.0	Grazing native vegetation	3.3.0	Cropping	71	0.02	0.28
3.3.0	Cropping	2.1.0	Grazing native vegetation	54	0.02	0.21
4.4.0	Irrigated perennial horticulture	2.1.0	Grazing native vegetation	54	0.02	0.21
3.3.0	Cropping	3.2.0	Grazing modified pastures	53	0.02	0.21
2.2.0	Production forestry	3.1.0	Plantation forestry	32	0.01	0.12
2.1.0	Grazing native vegetation	5.2.0	Intensive animal production	31	0.01	0.12
2.1.0	Grazing native vegetation	5.1.0	Intensive horticulture	30	0.01	0.12
4.5.0	Irrigated seasonal horticulture	3.6.0	Land in transition	26	0.01	0.10
3.2.0	Grazing modified pastures	2.1.0	Grazing native vegetation	26	0.01	0.10
5.8.0	Mining	1.3.0	Other minimal use	21	0.01	0.08
4.5.0	Irrigated seasonal horticulture	6.2.0	Reservoir/dam	20	0.01	0.08
4.4.0	Irrigated perennial horticulture	5.1.0	Intensive horticulture	15	0.01	0.06
4.5.0	Irrigated seasonal horticulture	5.1.0	Intensive horticulture	14	<0.01	0.06
1.2.0	Managed resource protection	1.1.0	Nature conservation	13	<0.01	0.05
2.1.0	Grazing native vegetation	4.2.0	Irrigated modified pastures	13	<0.01	0.05
4.4.0	Irrigated perennial horticulture	3.6.0	Land in transition	12	<0.01	0.05
4.5.0	Irrigated seasonal horticulture	4.2.0	Irrigated modified pastures	11	<0.01	0.05
Total				**25,531**	**8.48**	**100**

Data format and availability

Download land use datasets

To access land use datasets it is recommended that the Queensland Government Information Service (QGIS) be used. Search for **"land use mapping"** in the type of data search after restricting your search to **"cadastral and land planning"** in the topic category field. Metadata is also available from QGIS.

The dataset comprises an ESRI vector geodatabase at a nominal scale of 1:50,000. Within this are three feature classes: 1999 improved land use, 2012 updated land use and 1999–2012 land use change layer. The feature classes are polygon datasets with attributes describing land use. Land use is classified according to the Australian Land Use and Management Classification (ALUMC) Version 7, May 2010. Note that a representation showing land use at secondary level is available when working within a geodatabase.

Digital Data is supplied with a licence and by using the data you confirm that you have read the licence conditions included with the data and that you agree to be bound by its terms.

Request a land use map

Available from the QLUMP website, it is possible to request a land use map based upon a specific location (Lot on Plan, Street address or Central latitude/longitude coordinates) in Queensland. The land use maps are emailed upon request in portable document format (PDF).The maps present the most recent land use information available at the secondary level of the Australian Land Use and Management (ALUM) Classification.

View land use on the Queensland Globe

The most recent land use information available state-wide in Queensland is available for viewing on the Queensland Globe. This application allows browsing of Queensland spatial data including land use, maps and up-to-date satellite imagery.

Land use is available for viewing within the Planning and Cadastre category globe.

Appendix A Accuracy assessment

The accuracy assessment provided reference data suitable for assessing the 2012 land use map. For each of the sample points, the true land use class was independently determined (this provided the reference data) based on desktop interpretation of the same imagery and ancillary datasets available to the mapper. These points were then compared to the mapped class (map data) and the information summarised in the error matrix. The accuracy is summarised in terms of total accuracy, Kappa and user's and producer's accuracies. Each accuracy parameter is reported using a point estimate and a 95% posterior interval. Accuracy figures are provided as probabilities between 0 and 1.

Total accuracy provides an estimate of the overall accuracy of the map, and can be expressed as the probability that a point is mapped correctly. However, it should be kept in mind that total accuracy can be misleading, particularly when a dominant class exists. The Kappa statistic attempts to overcome this problem by adjusting for chance agreement. A common rule of thumb suggests a value of Kappa between 0.6 and 0.8 represents moderate agreement between the map and the ground truth, a value greater than 0.8 suggests strong agreement. Values less than 0.2 suggest the map is only marginally improved compared to a map produced by random allocation.

The user's and producer's accuracies summarise the map's accuracy on a per-class basis. User's accuracy for class A is the probability that a point mapped as A is truly in class A. If the user's accuracy of class A is estimated to be 0.84, then from a random sample of 100 points chosen from areas on the map in this class, approximately 84 would be found to be correct when checked in the field. Producer's accuracy for class B is the conditional probability that the map will show a site as class B given its true state is class B. If the producer's accuracy for class B were 0.84, then from a random sample of 100 points known to be in class B, approximately 84 would also be in class B according to the map. An accurate map should have both high user's and producer's accuracies.

The per-class estimates of accuracy are often not precise, since only part of the total sample points are used to estimate them. As a guide, if the upper bound of the interval for either user's or producer's accuracy is less than 0.5, this can indicate a true misclassification problem, rather than one due to inadequacies in sample size.

Points that differ between the map and the reference data may be due to positional or spatial errors. Inaccurate registration of datasets is an example of spatial error. Thematic errors are the incorrect labelling of an area due to difficulties in determining the true land use in that area, or by oversight or other operational errors. Spatial errors influence thematic accuracy. The purpose here is to assess the thematic accuracy of land use data. However, as described above, the separation of spatial and thematic errors can be difficult and was not undertaken. As a result, the accuracy assessment reflects properties of the land use data as a whole.

Note that the revised 1999 land use and the land use change dataset were not accuracy assessed.

2012 land use dataset

The 2012 land use dataset was accuracy assessed with 258 points based on a random sampling strategy, using the map classes (area and frequency) as the strata. The stratified estimate of total accuracy is 0.89 (0.80, 0.94) and Kappa is 0.82 (0.69, 0.90). As the lower bound of the confidence interval for total accuracy is 0.8, the mapping meets the ACLUMP specification.

Table 4 (page 18) shows the error matrix for the accuracy assessment of the 2012 land use data. For the majority of classes, the reference data agreed with the map data. For example, *grazing native vegetation* had 29 sample points identified. For 27 of those points, the map data was also *grazing native vegetation* and therefore correct. For two of the points the map data was incorrect, with one point falling onto the mapped class *other minimal use* (which includes *residual native* vegetation at the tertiary level) and one point onto *marsh/wetland*. The misclassification of these two points is likely to be related to the interpretation of 'primary land use'. Determining whether the primary land use in a vegetated or marsh/wetland area is grazing can be quite variable and problematic.

The column 'proportion' in Table 4 is the relative proportion in area of the classes that were assessed, not of the catchment as a whole. The areas of other classes that are not amenable to assessment, for example, *grazing modified pastures*, are removed from the total area before the proportions are calculated. This column will thus sum to 100%.

The error matrix shows a misclassification in the mapping—whereby a number of points were assessed as *grazing native vegetation* that were mapped as *cropping*. This type of misclassification is common in sub-catchments such as the Lockyer Creek, where it can be difficult to differentiate between the many paddocks that are managed within a rotation cycle or indeed where land management practices (contour banks) are present within each. As rotations also occur between these two classes misclassification is more likely. There was also some misclassification evident in classifying the dryland and irrigated *perennial horticulture* land use classes. The error matrix (Table 4, page 18) provides more detail on the misclassifications.

Table 5 (page 19) provides the user's and producer's accuracy for the 2012 Lockyer Creek sub-catchment land use dataset. This demonstrates that the majority of land use classes in the catchment have been mapped accurately. The largest assessable land use class in this catchment is *grazing native vegetation* which has been mapped with a very high user's and producer's accuracies of 0.911 and 0.966 respectively. The next largest class by area is *irrigated seasonal horticulture* which also returned a high user's and producer's accuracy

Accuracy estimates based on samples with fewer than two points are not considered sufficiently reliable, and are presented as NA (not available) in the table. Examples of this are *seasonal horticulture, irrigated cropping* and *utilities.*

The user's and producer's accuracy results should be interpreted individually for their respective classes. It should be noted that the classes with a small area in proportion to the total area assessed, and also a small sample size, will return a wide confidence interval. The overall accuracy shows a much tighter confidence interval as it effectively summarises the accuracy results for all the assessable classes.

Some classes with low accuracies have insufficient sample points to provide precise estimates. For example, the producer's accuracy for *other minimal use* is 0.733, however, from the 95% interval (0.345, 0.973) it can be seen that more sample points would be required to confidently determine how accurate this class is.

Table 4: Error matrix for the Lockyer Creek sub-catchment 2012 land use dataset

		Reference data																												
	2012 land use class	Nature conservation	Other conserved area	Managed resource protection	Other minimal use	Grazing native vegetation	Production forestry	Plantation forestry	Cropping	Perennial horticulture	Seasonal horticulture	Land in transition	Irrigated cropping	Irrigated perennial horticulture	Irrigated seasonal horticulture	Irrigated land in transition	Intensive horticulture	Intensive animal husbandry	Manufacturing and industrial	Residential & farm infra.	Services	Utilities	Transport & communications	Mining	Waste treatment and disposal	Reservoir/dam	River	Channel/aqueduct	Marsh/wetland	**Total**	**Proportion (%)**
Map data	Nature conservation	**13**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	6.28
	Other conserved area	0	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.32
	Managed resource protection	0	0	**10**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1.09
	Other minimal use	0	0	0	**11**	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	6.55
	Grazing native vegetation	0	0	0	1	**27**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	29	62.91
	Production forestry	0	0	0	0	0	**10**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	2.15
	Plantation forestry	0	0	0	0	0	1	**9**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.16
	Cropping	0	0	0	0	5	0	0	**5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.07
	Perennial horticulture	0	0	0	0	0	0	0	0	**5**	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	7	0.08
	Seasonal horticulture	0	0	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.01
	Land in transition	0	0	0	0	0	0	1	0	0	0	**9**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.10
	Irrigated cropping	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.01
	Irrigated perennial horticulture	0	0	0	0	1	0	0	0	3	0	0	0	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.38
	Irrigated seasonal horticulture	0	0	0	0	0	0	0	0	1	0	0	0	0	**14**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	8.96
	Irrigated land in transition	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	1	0	0	0	0	0	0	0	0	0	0	0	0	1	<0.01
	Intensive horticulture	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0	0	0	0	0	0	0	0	0	0	0	10	0.04
	Intensive animal husbandry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**10**	0	0	0	0	0	0	0	0	0	0	0	10	0.11
	Manufacturing and industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**10**	0	0	0	0	0	0	0	0	0	0	10	0.12
	Residential & farm infrastructure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**30**	0	0	0	0	0	0	0	0	0	30	7.92
	Services	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0	0	0	0	0	0	0	10	0.80
	Utilities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	1	0.01
	Transport and communications	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0	0	0	0	0	10	0.21
	Mining	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0	0	0	0	10	0.18
	Waste treatment and disposal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	1	0.01
	Reservoir/dam	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**7**	1	0	0	10	0.94
	River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	1	0.50
	Channel/aqueduct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	1	0.03
	Marsh/wetland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**10**	10	0.08
	Total	13	2	10	14	41	11	10	5	9	0	9	1	8	14	0	10	10	10	31	9	1	9	9	1	7	2	1	11	**258**	**100**

Table 5: User's and producer's accuracy for the Lockyer Creek sub-catchment 2012 land use dataset

Class	User's			Producer's		
	Estimate	95% interval		Estimate	95% interval	
Nature conservation	0.952	0.762	0.998	0.994	0.854	1.000
Other conserved area	0.721	0.166	0.988	0.833	0.123	0.997
Managed resource protection	0.936	0.692	0.998	0.960	0.439	0.999
Other minimal use	0.700	0.454	0.883	0.733	0.345	0.973
Grazing native vegetation	0.911	0.775	0.979	0.966	0.938	0.985
Production forestry	0.938	0.705	0.998	0.972	0.632	0.997
Plantation forestry	0.843	0.563	0.976	0.702	0.103	0.967
Cropping	0.459	0.195	0.745	0.390	0.022	0.978
Perennial horticulture	0.639	0.297	0.904	0.069	0.015	0.280
Seasonal horticulture	NA	NA	NA	NA	NA	NA
Land in transition	0.841	0.557	0.974	0.645	0.072	0.989
Irrigated cropping	NA	NA	NA	NA	NA	NA
Irrigated perennial horticulture	0.552	0.265	0.813	0.777	0.154	0.969
Irrigated seasonal horticulture	0.893	0.682	0.984	0.996	0.887	1.000
Irrigated land in transition	NA	NA	NA	NA	NA	NA
Intensive horticulture	0.838	0.549	0.977	0.437	0.031	0.960
Intensive animal husbandry	0.937	0.700	0.998	0.700	0.081	0.993
Manufacturing and industrial	0.938	0.696	0.998	0.716	0.083	0.993
Residential & farm infrastructure	0.978	0.889	0.999	0.994	0.863	0.999
Services	0.839	0.555	0.976	0.936	0.353	0.999
Utilities	NA	NA	NA	NA	NA	NA
Transport and communications	0.842	0.562	0.977	0.799	0.124	0.995
Mining	0.842	0.566	0.977	0.762	0.109	0.995
Waste treatment and disposal	NA	NA	NA	NA	NA	NA
Reservoir/dam	0.652	0.353	0.881	0.935	0.325	0.999
River	NA	NA	NA	NA	NA	NA
Channel/aqueduct	NA	NA	NA	NA	NA	NA
Marsh/wetland	0.936	0.700	0.998	0.044	0.010	0.396